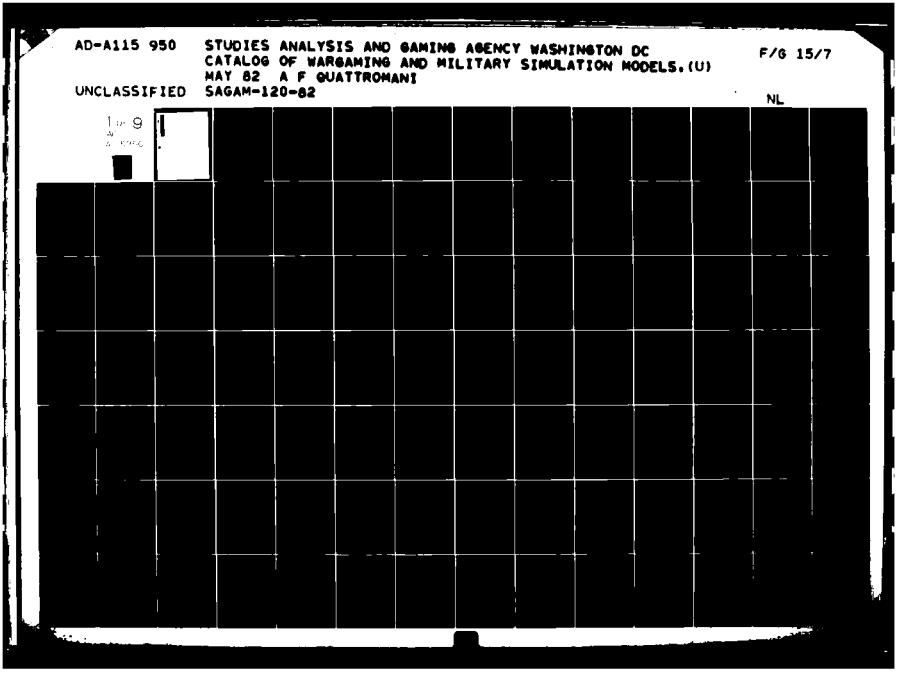
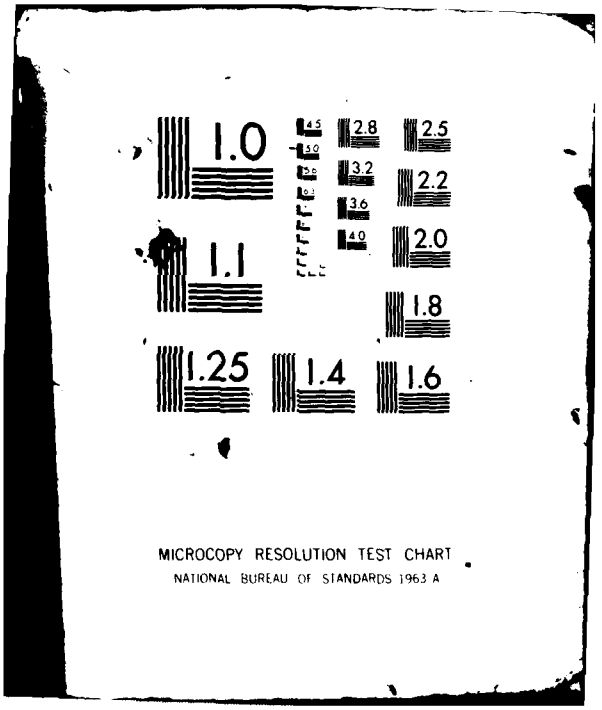
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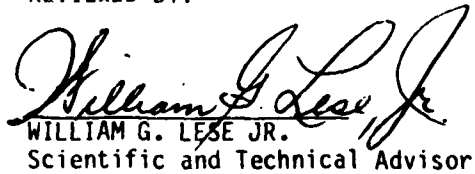
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WARGAMING AND MILITARY SIMULATION MODELS

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MAY 1982

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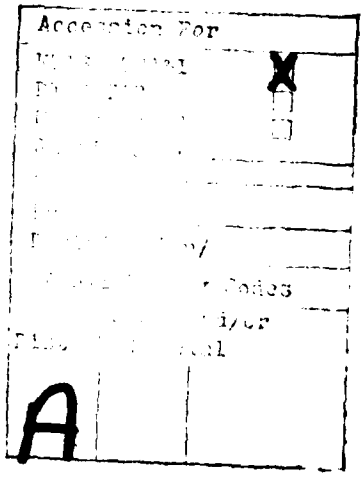
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ABSTRACT

The 9th Edition of the Catalog of Wargaming and Military Simulation Models lists the descriptions of 363 simulations, war games, exercises and models in general use throughout the Department of Defense and in the defense establishments of Australia, Canada, England, and Germany. The entries in the catalog are listed alphabetically by acronym and long title. A second index categorizes the entries by type and application. The description of each model includes: Proponent, developer, purpose, general description, input, output, limitations, hardware, software, time requirements, security classification (of the model less data), frequency of use, and point of contact for additional information. The catalog draws upon inputs from analysis agencies in the various defense establishments, independent contractors and research organizations, and similar catalogs of games and simulations. The inclusion of a specific model in the catalog was at the discretion of its proponent and does not in any way constitute endorsement of the model by the Studies, Analysis, and Gaming Agency or the Organization of the Joint Chiefs of Staff.



FOREWORD

This catalog provides the Joint Staff, the unified and specified commands, the Services, and the worldwide military operations research community with information on a number of wargaming and military simulation models currently in use or development. JCS PUB 1 defines a war game as, "a simulation, by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual, or assumed real life situation." We have taken that definition literally in publishing this catalog. It contains examples of the full range of war games from map exercises to totally automatic computer simulations.

Users of previous editions of the catalog will notice several new looks to this publication. The number of entries in the catalog has doubled since the 8th Edition, and we're still only reaching the tip of the iceberg. Secondly, we have published the catalog in loose leaf format. This will enable publication of changes and additions without the necessity of printing an entirely new catalog every two years. We also hope to publish more frequent addendums as inserts to the catalog. We have encouraged participation from other countries and you will find several entries from the defense communities of Australia, Canada, Great Britain, and Germany. Additionally, private contractors and research organizations were invited to participate. Although response from that sector was not overwhelming, we do have some entries included. The number and form of indexes have been changed in this edition, being limited to an alphabetical index and a functional index to facilitate research of particular types of war games and simulations.

In the belief that the catalog is a valuable reference tool for current military OR practitioners, we have attempted to include descriptions of a broad range of war games and simulations without deference to their degree of current use. Consequently, several entries include remarks that the war game or simulation may not be in current use. In other cases, the developers indicate the entries as being representative snap-shot descriptions of models in continuing evolutionary development. Such entries have nevertheless been included in the hope that they will prove usefull to other practitioners.

The format for each entry in the catalog has been retained from the previous edition (see Appendix B). A comment in the 8th Edition pointed out that a standard format would facilitate research and "provide a basis for rudimentary model comparison and evaluation relative to the application being considered." The format has apparently been accepted as useful as we have noted several uses of our format.

In assembling this catalog we have asked proponents of previous editions to update their entries. In order to reach other interested organizations, we advertised the catalog in several military OR newsletters. Response has been overwhelming and we appreciate everyone's participation. Realizing that wargames and simulations are ever changing and new models

are in continuing development, we encourage your continuing support in maintaining currency of the catalog. SAGA will periodically publish addendums of new entries and updates of existing descriptions. Forward such information in the format shown in Appendix B to:

Organization of the Joint Chiefs of Staff
Studies, Analysis, and Gaming Agency
Technical Support Division
The Pentagon, Room 1D 940
Washington, DC 20301

Publication of a catalog such as this involves the support of many individuals. I would like to thank each of the contributors individually. Unfortunately, that is not possible--publication of your entry is acknowledgement of my appreciation. In particular, I want to thank Joanne L. Elias, Bonnie L. Nesfeder and Marion E. Boland, of SAGA, for the endless hours of typing, editing, retyping, and collating they spent helping to prepare this catalog for the printers.



ANTHONY F. QUATTROMANI
LTC, USA
Editor

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TITLE: ABLES

PROPONENT: Directorate of Aerospace Studies, Kirtland AFB, New Mexico

DEVELOPER: Directorate of Aerospace Studies, Kirtland AFB, New Mexico

PURPOSE: ABLES is a computerized, analytical, damage assessment/ weapons effectiveness model which evaluates the system effectiveness of an airborne laser system against satellite targets. Scheduling of aircraft flight profile to maximize targets killed is the primary problem addressed, with laser performance as the secondary problem addressed.

GENERAL DESCRIPTION: ABLES is a two-sided, deterministic model involving air forces. The level of aggregation for which this model was primarily designed is one airborne laser, and the level of model exercise is one to many targets. The time step method is used as treatment of simulated time, and the primary solution techniques used are system simulation and scheduling algorithm.

INPUT:

- o Laser output
- o Aircraft performance
- o Target attack opportunities

OUTPUT:

- o Computer printout giving optimized flight profile, number of targets killed

MODEL LIMITATIONS:

- o Assumes linear target paths in attack area
- o Constant aircraft speed

HARDWARE:

- o This model is not machine dependent
- o Minimum storage required: 70K

SOFTWARE:

- o FORTRAN IV
- o Documentation in progress

TIME REQUIREMENTS:

- o 1 month required to acquire base data
- o .1 man-month to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: A. Foster Cooper
AFCMD/SAT
Kirtland AFB, NM 87117

FREQUENCY OF USE: 50 times per year

USERS:

- o Principal: AFCMD/SA
- o Other: AFWL/PG

MISCELLANEOUS:

- o This model is linked to the DETECT model, which supplies target attack opportunities

KEYWORD LISTING: Computerized; Analytic; Damage Assessment/Weapons Effectiveness; Air; Two-sided; Time Step; Deterministic

TITLE: ADAGE - Air Defense Air to Ground Engagement Simulation Model

PROPONENT: USA Air Defense School, Fort Bliss, Texas

DEVELOPER: USA Material Systems Analysis Agency, Aberdeen Proving Ground, Maryland

PURPOSE: ADAGE is a computerized, analytical, damage assessment/ weapons effectiveness model. It simulates a red air attack on a blue army division within the context of a blue vs red ground war simulated over a period of days consistent with SCORES scenario data base. ADAGE consists of the Incursion and Campaign submodels. The incursion model is a monte carlo model that determines the engagement (attrition) of one aircraft due to fire from one ground-based weapon. The campaign model uses incursion's outputs to simulate a many-on-many red aircraft vs blue army division game using deterministic methods. Air defense engagement parameters such as unmask/detection ranges and intercept data for various weapon/aircraft/ flight path combinations and level of attrition of threat aircraft and division ground forces are available as end game data.

GENERAL DESCRIPTION: ADAGE is a two-sided, mixed model which deals with land and air forces. It was primarily designed for company-sized maneuver forces and air defense fire units. Maneuver forces can be varied between platoon and battalion levels if the model and data inputs were modified somewhat; air defense fire unit resolution must be maintained. ADAGE plays for units up to army divisions (armored or mechanized infantry) and can be manipulated for other types of army divisions including infantry and airmobile. It is a time-step model which uses Monte Carlo techniques to produce proabilities employed in expected value computation.

INPUT:

- o Threat aircraft characteristics and vulnerabilities
- o ADA system characteristic (times, accuracy, lethality, reliability)
- o Aircraft flight paths
- o Scenario data (threat air and division ground forces)
- o Air-to-ground munitions effectiveness
- o Ground war loss rates
- o Material repair and refurbishment rates

OUTPUT:

- o Computer printout/punch cards with AD system effectiveness
- o Computer printout stating results of combined air/land battle showing losses to red aircraft and blue ground forces
- o Detailed output with individual effectiveness trial data and summary statistics
- o Detailed force-on-force wargame results with daily summary reports available

MODEL LIMITATIONS:

- o Incursion model is currently limited to only those ground and air defense systems analyzed in the DIVAD gun COEA and the SHORAD/ MANPADS Force Structure Study
- o Campaign model is limited to division-size scenarios using not more than ten AD weapon types or 20 target classes (primarily due to array sizes)

HARDWARE:

- o Computer: UNIVAC 1100/83
- o Minimum Storage Required: 80K (decimal)
- o Peripheral Equipment: Card reader/puncher, printer, disc storage

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: AMSAA Technical Report No. 227 Air Defense Air to Ground Engagement (ADAGE) Simulation, Volume I-IV, May 1978
- o Current model has been modified significantly to reflect more current information during recent study use

TIME REQUIREMENTS:

- o 4 months required to acquire base data
- o 3 man-months required to structure data in model input format
- o Playing time is 3-15 minutes per ADA system for incursion and 1 minute for campaign
- o CPU time per model cycle is included in playing time estimates
- o Learning time is included in time required to structure data in model input format
- o Time to analyze and evaluate results is variable

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 1000 times per year since 1977

USERS:

- o USA Air Defense School
- o USA Material System Analysis Agency
- o USA TRADOC Systems Analysis Activity

POINT OF CONTACT: John R. Armendariz
Commandant, US Army Air Defense School
ATTN: ATSA-CDX-C
AUTOVON 978-6702

MISCELLANEOUS:

- o ADAGE is linked to VISPOE, a visual detection model provided by US MICOM
- o VISPOE generates visual detection functions for acqusition of aircraft and provide data in tabular format for use by the Incursion Model
- o Anticipated improvements include reduction of core size, reduction of running time, interactive play for parametric analysis, and modification of output oriented toward increased user efficiency
- o Current improvements to ADAGE include an optional day by day percent loss campaign summary and an additional pre-processing capability to incursion to reduce the input man-hours required to produce multiple executions of the model with optimized updating capability

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Land; Air; Computerized; Two-sided; Mixed; Time Step

TITLE: ADGEM - Air Defense General Evaluation Model

PROPONENT: U.S. Army Air Defense School

DEVELOPER: RDA - R&D Associates, P.O. Box 9695, Marina Del Rey, CA, 90291

PURPOSE: The air traffic in ADGEM consists of friendly, enemy and neutral sorties executed by helicopters, fixed wing aircraft or other vehicles. These sorties perform actions (lethal acts, hostile acts, entering friendly territory, leaving friendly territory) at times specified by user. The fly-out interactin between a weapon and a sortie is modeled using two event types. The first type models the weapon firing process and computes the expected time of interception, the second computes the probability of kill, performs a Monte Carlo test, and updates the current status of the sortie based on the test results.

GENERAL DESCRIPTION: The model uses Monte Carlo techniques to determine the results of events which influence future events. Intervisibility is derived from detailed statistical analysis using digital terrain data bases.

INPUT:

- o File containing coeffficients for intervisibility obtained using digitized terrain with foliage
- o Scenario data: Air defense forces, NAPs (navigation action points), sensor data, weapon data, sortie data and communication data

OUTPUT:

- o Reports that summarize the interactions between sites and sorties
- o Reports can be printed after each replication and/or at the end of a run and presents results averaged over all replications

MODEL LIMITATIONS:

- o Maximum number of targets (sorties): 100
- o Maximum number of sites: 100
- o These numbers are to be enlarged to accommodate a larger scenario than now possible

HARDWARE:

- o Computer: UNIVAC 1100
- o Operating System: 80 series
- o Minimum storage required: 65K plus 2 BANKS of 120K decimal words each
- o Peripheral Equipment: Card reader, disk packs or tape drives and printer

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SOFTWARE:

- o Programming Language: ASCII FORTRAN
- o Documentation: Draft copies available, model in final stages of development and final publication after model implementation

TIME REQUIREMENTS:

- o 2-3 man-months to acquire data base
- o 1 man-week to structure data in model input format
- o 2 man-months to analyze output
- o 2-3 man-months player learning time
- o Scenario dependent on playing time per cycle
- o 1-12 hours CPU time per cycle (varies with scenario size)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: New model, expected continuous use upon completion

USERS: USAADS/DCD, Fort Bliss, Texas

POINTS OF CONTACT: Allen Cohen, RDA
822-1715, Ext 285 (through LA AF switch)
John R. Armendariz, USAADS
AUTOVON 978-6702
Juan Cabrales, USAADS
AUTOVON 978-6523

MISCELLANEOUS: The scenario for this model may be placed anywhere in the world, but the intevisibility coefficients must first be derived through statistical analysis using a digital terrain data base for the region of interest or a pseudo terrain data base.

KEYWORD LISTING: Analytical, Computerized, Stochastic, Two-sided, Intervisibility, Statistical, Command and Control, Communications

TITLE: Air Defense Penetration and Attack Simulation (ADPAS) Model

PURPOSE: To determine the survivability of an aerial platform against AAA, aerial interceptors and electronic warfare.

DESCRIPTION: ADPAS is a two-sided, deterministic, division-level simulation that can play up to 300 aircraft. It accounts for the C3 function and has a target acquisition capability which can be used to assess the effectiveness of sensors at the engineering level.

REALISTIC BATTLEFIELD CONDITIONS (RBC) CAPABILITIES: Model plays RED/BLUE communications jamming implicitly and RED/BLUE radar jamming explicitly. Relative to weather, the model can play rain, fog/haze, and snow/sleet. It can simulate nighttime with full moon and twilight, smoke and dust as they affect the target acquisition capability of an RPV-type device/weapon, as well as explicit terrain, specifically, site altitude. ADPAS plays all obscurants as a function of degradation to the weapon system's ability to penetrate or "see" through them. Jamming is played in the form of time delays or complete blockage. This is done by comparing power output versus receiver sensitivity and onboard jamming with both spot and broad-band jamming available for both RED and BLUE. Jammer on/off times are input parameters.

LIMITATIONS/RBC GAPS: Smoke, obscurants and communications jamming are all played in terms of degradation factors; i.e., not in detail. Cannot play both RED/BLUE AAA sites simultaneously. Does not play DF, chaff, ARMs or ECCM against communications/radar jamming, nor against incidental or deployed smoke.

INPUTS AND SOURCES:

INPUT	SOURCE
Weapon characteristics	TRADOC, FTC, DIA
Aircraft characteristics	USAF, AVRADCOM
Scenario, terrain	CAC, TRASANA
Radar characteristics	ARRADCOM
Flight profiles	TSMs
Jammer characteristics	ERADCOM, FSTC
Weather	USAF, SCORES

REQUIREMENTS: None identified.

MODEL IMPROVEMENTS: Improvements in the area of firing doctrine (SAM, AAA) are in progress and will incorporate any changes in the radar acquisition of targets from improved/postulated AAA weapons. Also the new/postulated SAM systems and their firing doctrine are being investigated for possible incorporation.

COMMENTS: ADPAS is a proprietary model, its use being controlled by Lockheed. Model was used by TRASANA through a contract with Lockheed since it was the only model that could provide the data required for an air survivability study being conducted by TRASANA on the RPV system. Lockheed is prime contractor for the RPV system.

POINT OF CONTACT: W. John Peterson
Telephone: 408/742-3179; AUTOVON (thru Moffett Field): 359-3110

STATUS: Operational

AGENCY: Lockheed Missiles and Space Co., Inc.
Tactical Systems Engineering
1111 Lockheed Way
Sunnyvale CA 94088

COMPUTER: UNIVAC

LANGUAGE: FORTRAN V

TITLE: AEM - Arsenal Exchange Model

PROPONENT: AF/SASF

DEVELOPER: AF/SASF

PURPOSE: Strategic Nuclear Exchange Analysis

GENERAL DESCRIPTION: The Arsenal Exchange Model is a two-sided expected value moderately aggregated force exchange model which uses several mathematical programming techniques to optimize weapon allocation. It can handle third country non-retaliatory targets, full force allocations, a variety of defenses, and force design problems. There are four types of scenarios: one-strike against military and value targets; a two-strike game, and two types of three-strike games with suboptimization problems of selecting a weapons reserve or selecting a value target reserve for the initiator's third strike. There are also three types of counterforce exchange options: a limited one-strike, a limited two-strike and a one-strike, all-out counterforce strike. There is also an extensive hedging capability which allows the analyst considerable control over the allocation of weapons to targets.

INPUT: AEM input describes for each side its arsenal (as a minimum for each weapon type-number to be allocated, yield, accuracy, and probability of arrival on target), target base and defenses (if any), and allocation rules.

OUTPUT:

- o AEM output data provides a summary of the nuclear exchange including static, e.g., on-line weapons, quasi-dynamic, e.g., arriving weapons and dynamic measures of effectiveness, e.g., damage expectancy
- o The user can select from a list of standard output summaries and request specific information about attack results using the model's hedging capability

MODEL LIMITATIONS:

- o Each side is restriced to 30 different weapons types, 70 different target types, and 20 hedging constraints used to control the allocation
- o Although rough weapon system range and footprinting limitations can be included in the nuclear exchange incorporating them in target base construction, AEM is not explicitly designed to handle such restrictions

HARDWARE:

- o AEM is currently operating on the AFDSC Honeywell MULTICS computer and is running on the CDC 6600, IBM 360-65, and UNICAC 1198 computers of other agencies

- o A minimum of 1500 K storage is required

SOFTWARE:

- o Programming Language: FORTRAN IV, it contains 40,000 statements, 176 subroutines and is structured into 18 overlays
- o Documentation: Four volumes of user documentation are available in the AF/SA library. The user's manual is the AEM handbook version 79, SAI-79-215-DEN, June 1979

TIME REQUIREMENTS: Typical AEM runs for a one-sided exchange on the AFDSC Honeywell MULTICS computer requires 5-10 minutes of CPU time. Preparation time for arsenal files and target bases are strictly user dependent.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 1,000 times a year

USERS:

- o Martin Marietta Corporation
- o Rockwell International, Inc.
- o Central Intelligence Agency

POINT OF CONTACT: AF/SASF (Captain Rowell)
The Pentagon
Washington, D.C. 20330
Telephone: (202) 695-2828

COMMENTS: AEM is being modified to handle 50 weapon types, 400 target types, and 40 hedging constraints. Also, improvements are being made to enhance analyst control over strategy selection and to allow the analyst wider latitude in selecting dynamic measures of effectiveness.

TITLE: AEM Hedge - Arsenal Exchange Model

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: ALM Hedge is a computerized, analytical general war model that provides a capability for quantifying strategic force analyses and allows hedging against uncertainty. The AEM model can simulate two world powers with three components: strategic forces (ICBMs, SLBMs, and bombers), non-retaliatory military resources, and non-military resources. In addition, a third power can be considered which has no retaliatory forces but may be targeted by one power having strategic forces. Area and terminal defenses of several types, with or without leakage, may be possessed by either or both sides.

An exchange may be initiated by either side. Each side may possess a variety of simultaneous objectives (which may or may not be shared or known by the opponent), including hedges against parametric uncertainties and catastrophic failures. The exchanges are sequential with the last strikes (if at least two strikes are performed), including the nonmilitary resources. Several pure counterforce exchanges may precede the last two strikes. The effects of misestimating parametric values may be evaluated following an exchange.

GENERAL DESCRIPTION: AEM Hedge is a two-sided, deterministic model involving land, air and sea forces. Simulated time is treated on an event store basis. The primary solution techniques used are LaGrange multipliers, linear programming, mixed-integer programming, game theory, and probability.

INPUT:

- Scenario variables
- Weapon variables
- Target variables
- Weapon and target hedge variables
- Forward defense variables
- Area defense variables
- Budget optimization parameters
- Optimum terminal defense deployment vehicles
- Allocation constraints
- Multi-goal objectives

OUTPUT:

- Summaries in terms of the weapon allocation and value destroyed
- Extensive summary of input data
- Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o Geography is not explicitly considered.
- o SAM and ABM defenses are highly aggregated representations.

HARDWARE:

- o Computer: IBM 360/50, IBM 360-65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370
- o Operating System: OS Release 20 (IBM); SCOPE (CDC)
- o Minimum Storage Required: 375K bytes
- o Peripheral Equipment: Standard scratch disk plus permanent disk for war file

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically. A formal training program, both in model usage and methodology, exist.

TIME REQUIREMENTS:

- o 1 day to acquire and structure base data in model input format
- o 10-30 seconds CPU time per model cycle for one-strike allocation; 1 to 10 minutes for two-strike scenario
- o 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times a year

USERS:

- o Principal: OASD(PA&E)
- o Other: ACDA, Army CAA, USAF(SA), AFSC(FID), BMDSCOM

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D.C. 20301
Telephone: OX-55587

KEYWORD LISTING: Analytical Model; General War; Land Forces, Air Forces; Sea Forces, Computerized; Two-Sided; Deterministic; Event Store; Linear Programming

TITLE: AESOPS

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: USAMSAA and Falcon Research and Development Company

PURPOSE: AESOPS is a computerized, analytic, sustained operations model that simulates the continuous operations of a company-sized helicopter unit over a period of several days of combat and introduces the impact of routine maintenance and combat damage repair on helicopter availability during such operations. The model combines the reliability, availability, and maintainability characteristics and combat damage repair of a helicopter type with the continuous operations of a helicopter unit in several days of combat. Secondarily, the model addresses the operational readiness of a helicopter unit in sustained combat. It can be used to analyze what factors influence the dynamic operational readiness of helicopters in combat and to what degree these factors influence helicopter readiness.

GENERAL DESCRIPTION: AESOPS is a two-sided, deterministic model involving air forces. It is designed to consider helicopter company sized units. Simulated time is treated on a time step basis. Solution techniques include probability theory and queuing theory which are used in an expected values approach.

INPUT:

- o Number of helicopters required for mission
- o Time (a) from receipt of mission request to take-off, (b) to fly to target, (c) between target attacks, (d) between mission requests
- o Reliabilities (a) startup, (b) mission leg, (c) return leg
- o Mission dependent probabilities for various helicopter damage states (obtained from EVADE III)
- o Repair times for each degree of helicopter combat damage and routine maintenance
- o Number of targets defeated on the mission

OUTPUT:

- o Computer printout showing number of helicoters lost
- o Targets defeated
- o Number of mission accepted over time period of interest
- o Number of helicopters: under repair, awaiting repair, in flight, operationally ready
- o Attrition for any time interval of simulation is an optional feature

MODEL LIMITATIONS:

- o Expected Value Model
- o Model can handle only one type of helicopter at a time
- o Does not generate its own damage state probabilities
- o Inputs are presently obtained from EVADE II

HARDWARE:

- o Type of Computer: CDC 6600 and BRLESC
- o Operating System: SCOPE 3.4, BRLESC
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Calcomp plotter

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Not complete

TIME REQUIREMENTS:

- o 1 man-month required to acquire data base
- o 1 man-month to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 times per year

USERS: Principal: USAMSAA
Other: Falcon Research and Development Company

POINT OF CONTACT: Commander, USAMSAA
ATTN: DRXSY-AAS (Mr. Dinsmore)
Aberdeen Proving Ground, MD 21005
Phone: AV 283-4643

MISCELLANEOUS:

- o Model linked to EVADE II
- o Uses survivability results in form of probabilities of kill as input

KEYWORD LISTING: Analysis, Sustained Operations, Air, Computerized, Two-sided, Deterministic, and Time Step.

TITLE: AFACE - Austere Field Artillery Concepts Effectiveness Model

PROPONENT: Field Artillery Coordinator's Office, BRL, APG, MD

DEVELOPER: Field Artillery Coordinator's Office, BRL, APG, MD

PURPOSE: To provide a two-sided interactive model that can address changes in tactics, organization, or equipment in a reasonably large scenario.

GENERAL DESCRIPTION: Depicts a US mechanized division defending against an armored assault. Stresses system interactions in pitting artillery, tanks, TOW, Dragon, AAH, and close air support against artillery, tanks, APCs, ZSU-23s, and HIND. Five replications of the battle are normally run sequentially and, since the model is probabilistic, the outputs are in the form of a mean and a standard deviation. About an hour of battle time is depicted in 30 seconds of computer time on a CDC 7600 system. Smoke, GSRS, and Firefinder can be included or excluded as desired.

INPUTS:

- o Red and blue force structures
- o Red and blue weapon system characteristics
- o Initial conditions (locations, speeds and directions, etc.)

OUTPUTS: Weapon systems of each type lost, battle duration, and the sources of the various kills expressed as means and standard deviations. Time spent by the artillery of each side in various missions.

MODEL LIMITATIONS:

- o Single scenario, i.e., defense against an armored assault
- o Imperfect submodels, e.g., suppression

HARDWARE: CDC 7600

SOFTWARE: Program is written in FORTRAN

TIME REQUIREMENTS:

- o Given a set of inputs, the model can be ready to run in about one day
- o The results of a single run can be obtained in about one hour
- o Depending on the problem, complete analysis can be performed in between 1/2 day and one week

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Heavy when a specific task is being addressed. Light when results are being analyzed or studies being planned.

USER: Field Artillery Coordinator's Office, BRL, APG, MD

POINT OF CONTACT: Field Artillery Coordinator's Office
BRL
Aberdeen Proving Ground, MD

MISCELLANEOUS: Program is stored in an update file on the BRL CDC 7600 computer system.

TITLE: AFSM - Artillery Force Simulation Model

PROPONENT: US Army Materiel Systems Analysis Activity (USAMSAA)

DEVELOPER: US Army Materiel Systems Analysis Activity (USAMSAA)

PURPOSE: AFSM is a computerized, analytic, damage assessment/weapons effectiveness model. AFSM is a basic force structure model that simulates an artillery battle between a Blue division, with its appropriate artillery, and a Red attacking army. It is used to determine the most effective of several competing artillery weapon/ammo force mixes in support of a "type" division. The model also keeps track of losses due to attrition and reliability and gains from float and the logistical repair system.

GENERAL DESCRIPTION: AFSM is a quasi-two-sided, deterministic model involving land forces. It was designed to consider battalion level for Blue (Red targets can be any size down to platoon) with a possible manipulation of Blue being examined at battery level. It is an event stored model. Queuing theory and probability are the primary solution techniques used.

INPUT:

- o Target scenario - description of potential targets for Blue artillery in the Red threat
- o Blue and Red artillery weapons systems characteristics (ranges, delivery errors, firing rates, etc.)
- o Blue and Red artillery rounds characteristics (lethal areas, etc.)
- o Blue and Red movement schedules and tactical rules that reflect Blue employment techniques

OUTPUT:

- o Red losses to Blue artillery (MOEs such as personnel losses, tanks destroyed, etc.)
- o Blue measures of effort such as rounds fired, battalion fire missions and Blue losses
- o Blue artillery battery losses due to Red artillery

MODEL LIMITATIONS:

- o Not dynamic
- o Red attack follows same time order no matter what losses Blue inflicts on Red

HARDWARE:

- o Computer: Digital
- o Operating System: Can be run on any with modification
- o Minimum Storage Required: 160K
- o Peripheral Equipment: Line printer, tape drive

SOFTWARE:

- o Programming Language: FORTRAN IV
- o No documentation at present

TIME REQUIREMENTS:

- o Months required depends on weapons in scenario
- o 2 man-months to structure data in model input format
- o 2-4 minutes on CDC 7600, 20 minutes on UNIVAC 1108
- o CPU time per model cycle is 2/3 of run time
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Greater than 50 times a year

USERS:

- o Principal: US Army Materiel Systems Analysis Activity
- o Other: Fort Sill, TRANSANA, Picatinny Arsenal

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-GS
Aberdeen Proving Ground, Maryland 21005
Phone: Autovon 283-4704/283-3508
(Robert Chandler)

MISCELLANEOUS:

- o Model is linked to Target Acquisition Model (TAM)
- o AFSM use TAM-generated target lists
- o Model supersedes Legal Mix IV

KEYWORD LISTING: Analysis, Damage Assessment/Weapons Effectiveness; Land Forces; Computerized, Quasi-Two-sided, Deterministic; Event Store

TITLE: AGM - Attack Generator Model

PROPONENT: Federal Preparedness Agency, General Services Administration (FPA/GSA)

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: The Attack Generator is a computerized, analytical model designed to provide a means of selecting the most effective use of a given enemy nuclear attack capability to attain specified objectives. The model assigns nuclear weapons to targets by target categories to maximize the expected contribution to the objectives. This capability assists in formulating potential enemy attacks in the study of nuclear weapons following a nuclear exchange and in devising nuclear attack patterns for sensitivity studies and exercises.

GENERAL DESCRIPTION: The Attack Generator is a one-sided, deterministic model involving air and nuclear forces. It can consider missiles and bombers on an individual basis if so desired and can aggregate up to the worldwide level. The primary solution techniques employed are probability and queuing theory.

INPUT:

- o Weapon detonation information such as yield, height of burst, probability of arrival and circular error probable is provided with the weapon inventory.
- o The necessary input pertaining to resources in potential target categories includes their location, characterization of physical vulnerability and relative measures of target value. For area targets, such as population and broad classes of industry, a system of target value aggregation is reqired to define the target for weapon assignment. The size should provide maximum aggregation within the limits of the expected effective weapons radius of the smallest weapon in the inventory.

OUTPUT:

- o A weapons list on magnetic tape suitable as input for such models as READY and RISK II is described elsewhere in this publication. The list includes weapon identification information, coordinates of the desired ground zero, and the aggregate pre-attack expected residual values for each target category. If desired, associated input information may be reported, such as detonation characteristics and the name of the target.

MODEL LIMITATIONS:

- o The precision of results is subject to the same uncertainties as pertain to predictions of weapons effects and physical vulnerability in basic nuclear damage assessment routines.
- o Potential targets which can be considered in one weapon application are limited to 4,000 in a single pass. Hence, consideration of a larger file requires consideration of the highest 4,000 in the first round with subsequent sequential runs for the remainder.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: 1100 Series Operating System
- o Minimum Storage Required: 64K
- o Peripheral Equipment: UNIVAC 9300 Card Reader and Printer, Honeywell Page Printing System

SOFTWARE:

- o Programming Language: FORTRAN V (1108)
- o Documentation: ATTACK I, Attack Pattern Generator, TR-27 Rev. 1, Office of Preparedness, GSA, October 1973

TIME REQUIREMENTS:

- o 1-2 weeks to structure the current base data in model input format for major studies
- o Approximately 1 to 2 hours' CPU time, depending on scope of study
- o Hours to days to analyze and evaluate results, depending on scope of study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Two major studies HAZARD-III, PONAST and several inhouse case studies for controlled conflict scenarios.

USER: Federal Emergency Management Agency

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS:

- The Attack Generator Model provides input for the FEMA Damage Estimation Models, READY and RISK II, in the form of a weapons input file on magnetic tape.

KEYWORD LISTING: Analytical Model, General War, Computerized, One-Sided, Deterministic, Allocation

TITLE: AGTM - Air and Ground Theatre Model

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: AGTM is a computer program simulating air and ground combat, nominally at the divisional level. The air component of the program is no longer in use at STC, and this description will be limited to the ground component. The model serves at STC as an off-the-shelf capability for the study of ground combat attheatre level.

GENERAL DESCRIPTION: AGTM is a deterministic, time stepping model based on the ground component of the ATLAS model. The model has been modified by the adoption of a more refined methodology for the calculation of attackers and defenders effectiveness. This method takes into account the composition of the opposing forces in addition to their relative strength. For each period of battle, the principal output from the model is the distance advanced by the attacker and the casualties suffered by both sides.

The model can be executed in three different modes of operation, namely game mode, simulation mode, and game/simulation mode. In game mode, orders are input by the user at the terminal when requested by the program. In simulation mode, contingency plans have to be prepared in the form of an order file before the start of the execution of the model: no user/program interaction occurs in this mode. Games/simulation is a combination of the two modes of operation already described.

INPUT:

- Sector information (terrain, prepared defences)
- Unit information (ICE-value as a matrix giving hard, medium, soft shooter's capability against hard, medium and soft targets)
- Rate-of-advance table
- Casualty curves
- Orders (if simulation run)

OUTPUT: The output consists of an end-of-period summary at the terminal giving FEBA-position and force ratio per sector. More details, such as casualties and current index of firepower potential per unit, are printed on the line printer.

LIMITATIONS: In principle, there is no limit to the number of sectors and units which AGTM can handle, although the execution time is affected by the amount of data.

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HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.3 or 3.4 and, when used interactively, INTERCOM 4
- o Minimum Storage Requirement: 60K octal words
- o Peripheral Equipment: Line printer - remote terminal

SOFTWARE:

- o Programming Language: SIMULA-67
- o Documentation: STC TM-403 "AGTM (An Air and Ground Theatre Model); User's Guide and Program Description," Jan 1974 (NU)

TIME REQUIREMENTS: Collection of the data base can be time consuming, but the preparation of the input cards should only take 1-3 weeks dependent on the number of sectors and units. Execution time: 5-10 CPU seconds/sector/time period.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not in regular use

USERS: STC with military participation

POINT OF CONTACT: SHAPE Technical Centre
P.O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Simulation; Deterministic; Time Step; Ground Forces

TITLE: AIDA - Air Base Damage Assessment

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: AIDA was developed for use in studies of conventional air attack. Damage estimates for complex targets comprised of several hundred sub-targets can be assessed for attacks involving several tens of attack passes; up to ten types of weapons may be used in single attack, and the targets may be grouped into as many as 20 vulnerability categories. Both point-impact weapons (such as general-purpose bombs and precison-guided muunitions) and area weapons can be handled.

GENERAL DESCRIPTION: In its basic mode, AIDA detemines the actual impact points by Monte Carlo procedures--i.e., by random selections from the appropriate error distributions. GP bombs and PGMs that impact within specified distances of a target are classed as hits, and the results include the total number of hits on each target and the cumulative probability of kill. For CBU munitions, the program assesses the fraction of each target covered by each pattern, and the results include the fractional coverage from all patterns and a cumulative probability of kill for each target.

The model incorporates both Monte Carlo and deterministic (expected value) modes of operation. If the user is concerned only with the expected numbers of hits with point-impact weapons and is not interested in CBU weapons or in the coverage and damage variations expected with point-impact weapons, the more efficient expected-value mode can be used.

Up to five targets may be designated as runways or taxiways suitable for aircraft operations, and the model will examine these to see if an area of specified size is available for such operations; if not, the minimum number of craters that would need to be repaired to obtain an area of that size is determined.

AIDA offers several features designed to simplify operations and to permit a series of cases to be analyzed during a single computer run.

INPUT:

- o Target location, type, and size, referenced to a rectangular coordinate system
- o Attack data including aimpoints, weapon types, delivery conditions, and delivery accuracy
- o Weapon effects data, including MAE (or Pk) for each target type--weapon type combination

OUTPUT:

- o The results include the impact points and the number of hits and level of damage for target. For runways or emergency flight surfaces, the location of hits can be displayed graphically
- o A special feature of the expected-value mode permits the user to quickly generate a hit-density grid for each attack. If not otherwise specified, hit densities are provided at 250-ft intervals over a 4000 by 4000 foot square
- o In addition to these results for each trial attack, the attack is repeated automatically for a specified number of trials to provide statistics on the average damage levels to be expected for the various targets

HARDWARE: AIDA is not machine dependent. The model was developed on a Honeywell 6060 and has since been run at Rand on IBM machines, and elsewhere on various other equipment

SOFTWARE:

- o AIDA is written in FORTRAN IV and contains approximately 2000 statements
- o Documentation: R-1872-PR, AIDA: An Airbase Damage Assessment Model, D.E. Emerson, September 1976

TIME REQUIREMENTS:

- o Core requirements for 500 targets and 50 attack passes are about 180K bytes
- o An analysis of 400+ targets hit by attacks involving 400+ GP bombs required about 3 CPU minutes for 25 trials on an IBM 370/158

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: AIDA is in regular use at The Rand Corporation and elsewhere

USERS:

- o Principal: The Rand Corporation
- o Others: AF/SAG, USAFE/DOA, PACAF/DOA
  Air Force bases: Wright-Patterson, Kirtland, Nellis, Tyndall, Lowry, Eglin
  Army Corp of Engineers, Korean AF, Japanese AF
  MITRE, McD, BAC, GD, Grumman, Sperry, BDM, RDA, SAI, GRC, SSI

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: D.E. Emerson

KEYWORD LISTING: Damage Assessment/Weapon Effectiveness; Air bases, Monte Carlo/Deterministic

TITLE: Aircraft Loader Model

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: The Aircraft Loader Model is a computerized, analytical logistics model designed to simulate aircraft loading and thereby to assist in estimating the number of airlift aircraft required to perform a stated transport mission. The model can be used in planning transport aircraft operations, in comparing numbers of aircraft loads (sorties) required for different aircraft types, and in studying alternative aircraft cargo compartment configurations.

GENERAL DESCRIPTION: The Aircraft Loader Model is a deterministic model involving air forces only. Aircraft are considered individually, in sequence. Requirements may be considered individually or else they may be grouped. Numerical analysis is the primary solution technique used.

INPUT:

- Weight allowable cabin load (WACL) for the aircraft type for the range or radius of operation
- Length, width and height of cargo-carrying space
- Number of passenger seats on the aircraft
- Allowable stacking height of bulk cargo
- Vehicle lists, including all self-propelled vehicles, weapons, prime movers, and towed loads to be loaded (detailed data are code number, item description, and number of pieces, weight, length, width, and height of each piece).
- Passenger list (number of passengers and unit weight)
- Bulk list which includes all other cargo to be loaded (code number, item description, number of boxes or pieces, weight, and cube)

OUTPUT:

- Statement of loadings for each aircraft by chalk number, consisting of a detailed listing for each aircraft of the vehicles, passengers, and bulk on each "loaded" aircraft (chalk number), the weight and floorspace of the vehicles and bulk cargo, item descriptions of these vehicle and bulk items, the number and weight of passengers loaded, and the remaining weight and floorspace of the aircraft which has not been used

- When all loading has been completed, a summary of all sorties is printed showing:

  (1) Number of sorties required;
  (2) Vehicles, passengers, and bulk not loadable (for example, items which are too large, too heavy, or passengers for whom there are no seats on the aircraft);

(3) Number, weight, and floorspace of vehicles loaded; weight and floorspace of bulk loaded;
(4) Number of passengers loaded;
(5) Total fleet weight, floorspace, and passenger seats that were available for loading.

MODEL LIMITATIONS:

- The Sortie Generator technique is not designed to produce optimal loadings in the sense that the number of sorties estimated is a minimum estimate.
- The problem of fleets of mixed aircraft types is not addressed; the routine handles a single aircraft type at a time.

HARDWARE:

- Computer: IBM 360/50; HIS 6080
- Operating System: OS/MVT for IBM; GCOS for HIS
- Minimum Storage Required: 180K bytes; 36K words;
- Peripheral Equipment: Magnetic tapes and/or disk

SOFTWARE:

- Programming Languages: COBOL and FORTRAN IV
- No documentation is available on the J-4 modified version, but the original version is covered in IDA/WSEG Research Paper P-100, "Aircraft Loading Considerations," January, 1964. Documentation is being updated.

TIME REQUIREMENTS:

- 1 month to acquire base data
- Little if any time to structure base data in model input format
- 10 minutes CPU time per model cycle
- 1 man-day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; Deterministic

TITLE: Aircraft Station Keeping Model (GPSS Version)

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: The GPSS version of the Aircraft Station Keeping Model is a computerized, analytical, logistics model that simulates operations of aircraft (such as CAP) which utilize a fixed schedule of launches and retrievals in maintaining a given number of stations. Steady-state (long term) and transient (short term) options are available. The model addresses the problem of backup estimation (that is, estimation of the number of failure prone aircraft that are required to maintain a fixed number of stations).

GENERAL DESCRIPTION: Aircraft Station Keeping Model is one-sided and stochastic, and involves air forces only. The model was designed to aggregate anywhere from 1 to 100 aircraft. Simulated time is treated on an event store basis. Discrete event simulation is the primary solution technique.

INPUT:

- o Number of aircraft, stations, repair facilities and turnaround facilities
- o Span of station occupancy per day
- o Aircraft station time
- o Transit time to station
- o Time effectively on station while on way to station
- o Minimum acceptable on-station time for unscheduled launches
- o Average time to in-flight abort
- o Turnaround time
- o Parameters for repair time distribution
- o Probabilities of down squawk, in-flight abort, and check-out failure after turnaround

OUTPUT:

- o Computer printout of the probability distribution of the number of aircraft on station and the average number on station
- o Daily statistics are output for the transient case.
- o A printout of the probability distribution of total time accumulated on station up to and including each day (for the transient case)
- o A plot of the above case
- o A printout of certain readiness statistics

MODEL LIMITATIONS:

- o Aircraft must be of a single type.
- o A schedule of launches and retrievals is set up by the model such that the span of station occupancy is divided into an equal number of shifts based on the station time supplied as an input.

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 110K octal words
- o Peripheral Equipment: Calcomp 565 plotter

SOFTWARE:

- o Programming Languages: GPSS V/6000, FORTRAN IV
- o Documentation: Basic ground rules for the model are the same as for a similar model described in Naval Air Systems Command Technical Memorandum, "Aircraft Station Keeping: A Computer Simulation Program for Backup Evaluation," Technical Memorandum No. TM-A-503-74-7, November 1974
- o User's documentation and technical documentation are incomplete.

TIME REQUIREMENTS:

- o Time required to acquire base data is variable.
- o Less than 1 man-month to structure data in model input format.
- o CPU time per model cycle is dependent upon inputs.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 projects per year

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3447

MISCELLANEOUS: While the model does not supersede the non-GPSS version, it contains several additional options. The user is cautioned, however, that use of the GPSS language results in increased CPU time per model cycle.

KEYWORD LISTING: Computerized; Analytical; Logistics; One-Sided; Stochastic; Air Forces; Event Store

TITLE: Air Defense versus Fixed Wing Simulation

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), NDHQ, Ottawa, Canada

DEVELOPER: As above

PURPOSE: This simulation was designed to give a high speed assessment of the intereactions between air defence weapons and fixed wing aircraft in research war games.

GENERAL DESCRIPTION: This simulation determines the results of the various interactions which occur between the air defense weapon sites and the aircraft in a mission. Each air defense site is assessed separately, and in the order in which it would be encountered by the aircraft as they continue down their pre-determined flight path. The results of the encounters are determined probabilistically; the probabilities being a function of the specific weapon characteristics and the Air Defense Rules used in the research war game. It is assumed that the aircraft will maneuver through and complete the flight within the five minute period involved. It is further assumed that all air defense weapons are fully loaded, providing the ammunition was available, at the start of the specific five minute period.

INPUT:

- Mission Particulars (mission type, number of aircraft, altitutde, land classification, ECM, flight path)

OUTPUT:

- A list is produced containing each air defense site which was within effective range of the flight path, and the results of each encounter (detection opportunities, detection, engagements, kills)

MODEL LIMITATIONS:

- The Flight Path is assumed to be followed regardless of the air defense resistance encountered. No evasive action can be accounted for.
- The simulation only considers air defense sites engaging enemy aircraft. No consideration is given to air defense sites engaging friendly aircraft.

HARDWARE:

- PDP 11/34 Computer

SOFTWARE:

- The simulation is programmed in FLECS and requires an acceptable data base.

TIME REQUIREMENTS:

- Preparation: Input time is approximately thirty seconds, however preparation of coding sheet takes considerably longer depending on the complexity of the mission
- Play: Running time is up to five minutes
- Analysis: Included in research war game analyses

SECURITY CLASSIFICATION: SECRET (air defense weapon characteristics taken from SECRET sources)

FREQUENCY: *Continuously during research war games.*

USERS: DLOR War Games Section

TITLE: Allen Model

PURPOSE: The Allen Model performs synthesis and analysis of electromagnetic compatibility/electromagnetic vulnerability problems.

DESCRIPTION: The model consists of 12 interconnected computer programs, each performing a distinct and special function; either utility routines, data file manipulation/processing routines, or analysis routines. In addition to these 12 programs, several other peripheral programs are used to generate input data. Examples include emission spectrum generation and frequency allocation. Model is capable of handling all emitters and receptors of electromagnetic energy in any generic category, regardless of side.

REALISTIC BATTLEFIELD CONDITIONS (RBC) CAPABILITIES: The environmental parameters represented in the model are as follows: explicit communications and radar jamming; implicit rain, fog, haze, snow and sleet; explicit land form; and implicit vegetation and cultural features. Obscurants are not addressed at all.

LIMITATIONS/RBC GAPS: Frequency hopping equipment cannot be accommodated.

INPUT: Equipment position (X, Y, Z) coordinates and netting/connectivity for all C-E equipment locations, emission spectra, transmitter power, antenna pattern, receiver RF/IF selectivity, receiver sensitivity, and receiver performance criteria.

REQUIREMENTS: Due to model being rewritten for new computer facility, data requirements are not yet defined.

POINT OF CONTACT: Paul A. Major
AUTOVON: 995-4605

AGENCY: CORADCOM

STATUS: Currently unusable at CORADCOM (see Requirements paragraph)

COMPUTER: IBM 360/65 or Interdata 8/32

LANGUAGE: FORTRAN

TITLE: ALM - Airlift Loading Model

PROPONENT: HQ USAF/SAGM

DEVELOPER: HQ USAR/SAGM

PURPOSE: The purpose of the ALM is to provide computerized analysis of the loadability of military vehicles on airlift aircraft. The model can be used to evaluate current and future aircraft designs as well as the impact of changes in military vehicles.

GENERAL DESCRIPTION: The ALM determines the number of sorties required to load a military force of any size and any level of aggregation and the amount of equipment which is not loadable. Within a unit group, it loads vehicles by width, length, and weight priority. Troops and bulk cargo can also be loaded. The ALM is a deterministic model.

INPUTS:

- Three input files are required: vehicle characteristics, unit description, and an overall input file.
- The vehicle characteristics are length, width, height, and weight (with and without secondary cargo).
- Unit descriptions include the number of personnel, weight of bulk unit equipment, and number of each type of vehicle.
- The overall input file includes aircraft descriptions, unit accompanying supply formulae, aircraft loading sequences, selection of units and input and output options.

OUTPUTS:

- All output is stored in a Multics data segment which may be printed (on paper or microfiche), examined at a terminal, or modified and extracted by utility routines.
- Output can include individual loads, distributions of loads by weight and aircraft type, loadability of vehicles, and unit and overall summaries of payload and sortie statistics.

MODEL LIMITATIONS:

- The ALM is limited to 10 aircraft types, 999 vehicle types, and 1,000 units
- Each aircraft has up to a 10 segment constant cross section, with either a straight-in (nose or tail) door or a side door
- Up to 10 groups of vehicles can be limited or excluded from an aircraft
- Special loads of a particular vehicle type can be forced onto an aircraft, but only one type per load

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HARDWARE:

- o Type Computer: Honeywell 6180
- o Operating System: Multics
- o Minimum Storage Requirements: MVS (>1,000K)
- o Peripheral Equipment: DOS

SOFTWARE:

- o Programming Language: Multics FORTRAN
- o Documentation:
  - ALM Users' Manual (1 Nov 72), AF/SAGM
  - ALM Programmers' Notes (1 Nov 72), AF/SAGM
  - Source Code - AF/SAGM

TIME REQUIREMENTS:

- o Prepare Data Base: Variable
- o CPU Time varies with size of units (Mechanized Brigade requires 45 seconds)
- o Data Output Analysis: Variable

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per month

USERS:

- o AF/SAGA is sole user of the moded as configured on AFDSC System M
- o OSD/PA&E has a similar version on AFDSC System D
- o Boeing, Douglas and Lockheed have been given the model for their use with development of new airlift aircraft

POINT OF CONTACT: AF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone: AUTOVON 224-8155
(202) 694-8155

TITLE: AMM - Strat Missiler

PROPONENT: SASM

DEVELOPER: SASM/LOGICON/TRW

PURPOSE: Analysis of total strategic ballistic missile attacks.

GENERAL DESCRIPTION: A strategic missile wargaming model for examining ICBM exchanges over a range of scenarios.

INPUTS:

- o Forces by system
- o System performance parameters
- o Installations
- o Targets
- o Population bases
- o Mobile system description
- o Defenses
- o Fratricide and nuclear effects on boosters

OUTPUTS: Computer printouts and plots of statistically analyzed data information concerning range, accessibility, footprinting, mobile base attacks, operating areas, target generation, nuclear weapon effects, weapon allocation effectiveness and efficiency, assignment effectiveness and efficiency, scheduling results, damage achieved in exchange attritioned cases, and all standard MOE's attritted by chosen factors.

MODEL LIMITATIONS: (Per attacking side)

- o 90 force elements
- o 50 mobile areas
- o 35 missile configurations
- o 60 target planning segments
- o 1,600 silo locations
- o 5,000 mobile base aimpoints
- o 9 defense types
- o 600 defense sites
- o 10,000 mobile launch locations
- o 15,000 population circles
- o 50,000 installations
- o 6,000 rural cells
- o 3,000 sorties
- o 20,000 RU's

HARDWARE:

- o Type Computer: IBM 3033
- o Operating System: MVS-2
- o Minimum Storage Requirements: 2M bytes available core
- o Peripheral Equipment: 12M bytes disk storate for data
  50M bytes disk storage for load modules

SOFTWARE:

- o Programming Language: FORTRAN and COBOL
- o Assembly Language: Rational FORTRAN
- o Documentation: Available from AF/SASM

TIME REQUIREMENTS:

- o 6 months to prepare initial data base
- o Daily for recurring data bases
- o 5 minutes to 5 hours CPU time, depending on subsystem and case
- o One hour to one month data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS:

- o AF/SASM
- o AF/ESD
- o HQ SAC
- o LOGICON for AF/BMO

POINT OF CONTACT: AF/SASM
Room 1D431, The Pentagon
Washington, D.C. 20330
Telephone: 202 695-9018

TITLE: Amphibious Warfare Model

PROPONENT: Marine Corps Operations Analysis Group, Center for Naval Analysis

DEVELOPER: Marine Corps Operations Analysis Group, Center for Naval Analysis

PURPOSE: The Amphibious Warfare Model is a computerized model of conventional amphibious operations used as an analytical tool to evaluate weapons, forces, and strategies. Since its development in 1978 the model has been used to compare alternative weapon systems, force structures, and amphibious assault concepts.

GENERAL DESCRIPTION: The Amphibious Warfare Model is a two-sided deterministic simulation of a conventional amphibious operation. The model operates without player intervention, relying instead on a series of tactical decision rules. The model is based on the VECTOR-1 theater level battle model and describes or includes the effects of the following major activities: advance force operations, cruise missile attack and defense, ship-to-shore movement, assault landing, helicopter borne operations, ground combat between maneuver units, artillery and naval gunfire support, tactical aircraft missions, and mine warfare both at sea and on land. Many of the attrition processes are modeled using Lanchester equations although a variety of other standard attrition models are used. The model was primarily designed to handle MAF-size operations although smaller scale operations could be easily accommodated. The smallest unit currently modeled is the battalion; smaller units could easily be handled. The model operates as a time step simulation using one-hour intervals for the first twelve hours and six-hour intervals thereafter.

INPUT:

- o Terrain map to include near-shore hydrography
- o Orders of battle
- o Weapons effects data (e.g., attrition rates, fractional damage, kill probabilities)
- o Supply consumption data
- o Landing plans for surface- and helicopter-borne forces
- o Landing craft and helicopter characteristics

OUTPUT:

- o Computer printout of casualties and surviving forces, both cumulative and for each model period
- o Tables of supplies consumed and remaining
- o Summary table showing FEBA movement, survivors, and force ratios

MODEL LIMITATIONS:

- o Battlefield limited to 3 sectors with 4 battalion areas each
- o Limited number of weapon types (e.g., 9 maneuver, 1 artillery, 3 surface-to-air missiles, 7 aircraft)

HARDWARE:

- o Computer: Burroughs 6700
- o Operating System: Burroughs 6700
- o Minimum Storage Required: 50,000 words
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation
  - Model overview
  - Programmer's Guide
  - Description of data base

TIME REQUIREMENTS:

- o 2-3 man-months to acquire data base
- o 1 man-month to structure data in model input format
- o 1 man-month to analyze output
- o 20-30 CPU seconds per model period (1 to 6 hours)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Average of one study per year

USERS: Marine Corps Operation Analysis Group

POINT OF CONTACT: Marine Corps Operations Analysis Group
Center for Naval Analyses
2000 N. Beauregard Street
Alexandria, Virginia 22311
AUTOVON 225-9241, Ext 3750, or
(703) 998-3750

KEYWORD LISTING: Amphibious operations, Computerized simulation, Mathematical models, Models, Simulation, War games

TITLE: AMPS - Air Movement Planning System

PROPONENT: US Army Logistics Center

DEVELOPER: US Army Logistics Center, Operations Analysis Directorate

PURPOSE: AMPS is a computerized, analytic, logistics model designed to plan, diagram and manifest individual aircraft loads of equipment and personnel for movement on C-5, C-141 and C-130 aircraft. The model develops optimum load plans to determine ability to accomplish a defined movement requirement.

GENERAL DESCRIPTION: AMPS is a deterministic model which can be used to plan movement of detachments through brigades. Specific characteristics, balance and safety constraints are considered in development of individual loads for each aircraft type.

INPUT:

- o Cargo list
- o Aircraft list

OUTPUT:

- o Schematic load plans
- o Manifests (cargo and passenger)

MODEL LIMITATIONS:

- o Cargo examined by cube, weight and center of gravity only rather than by specific item characteristics such as axle location and vehicle overhang
- o Vehicle tie down space determined on worst case basis rather than specifics

HARDWARE:

- o Computer: IBM 360 or CDC 6400/6500 UNIVAC 1100/80 Series
- o Operating Systems: OS or DOS; SCOPE; 1004
- o Minimum Storage Required: 96K
- o Peripheral Equipment: One disk

SOFTWARE:

- o Programming Language: COBOL
- o Documentation: User's documentation available

TIME REQUIREMENTS:

- o 1 man-month to prepare data base
- o 1 hour CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: US Army Logistics Center

POINT OF CONTACT: US Army Logistics Center
Operations Analysis Directorate
ATTN: ATCL-OCP (W. E. King)
Ft. Lee, VA 23801
Telephone: AUTOVON 687-4180/3403

MISCELLANEOUS: This model supersedes CAPS, Computerized Airlift Planning System and AAMS, Automated Air Movements System.

KEYWORD LISTING: Analytic; Logistics; Computerized; Aircraft Loading; Air Movement

TITLE: AMSWAG - Army Materiel Systems Analysis Activity Wargame

PROPONENT: US Army Materiel Systems Analysis Activity (USAMSAA)

DEVELOPER: US Army Materiel Systems Analysis Activity (USAMSAA)

PURPOSE: AMSWAG is a computerized, analytic, damage assessment/weapons effectiveness model which provides continuous (10-second interval) results of force-on-force (battalion versus company) engagements for the classical attack/defense situations. The model's chief focus of concern is weapon systems effectiveness within a force-on-force battle context. AMSWAG is also concerned with ammunition expenditures, expected time for one system to attrit another, detection, accuracy and dispersion, vulnerability, mobility and existence of line-of-sight.

GENERAL DESCRIPTION: AMSWAG is a two-sided, deterministic model involving land forces only. The model considers individual weapon systems, with a range of possible manipulation to include homogeneous weapons at the squad level. The largest formation AMSWAG considers is platoon, with a range of possible manipulation to include battalion. Simulated time is treated on a time step basis. The ratio of Game Time to Real Time is 60:1. AMSWAG employs differential (Lanchester) equations and probability theory as its primary solution techniques.

INPUT:

- o Scenario (terrain description, force composition and distribution, mobility, exposure, advance routes)
- o Accuracy
- o Dispersion
- o Biases
- o Size
- o Vulnerability
- o Ammunition
- o Target priorities
- o Acquisition characteristics
- o Tactics
- o Round choice
- o Reload properties

OUTPUT:

- o Computer printout stating expected outcome at 10-second intervals
- o Victim-killer score boards
- o Unit status
- o Ammunition expenditures
- o Vehicle exchange ratio
- o Time
- o Closing range
- o Plots, detailed and summary results at 10- or 60-second interval

MODEL LIMITATIONS:

- o No defender movement
- o No air forces, battalion level, pre-selected routes, pre-processed line-of-sight, pre-selected attack halt positions

HARDWARE:

- o Computer: BRLESC I and II; CDC CYBER 7600
- o Operating System: SCOPE
- o Minimum Storage Required: 200 K
- o Peripheral Equipment: Disk memory, card reader, printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: AMSAA Technical Report No. 169 by Joe H. Hawkins (July 1976)
- o User documentation available

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o .5 man-months to structure data in model input format
- o 10-20 seconds per case playing time
- o 10 percent of run time per model cycle
- o 5 months learning time for players
- o .5 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 300 times per year

USERS:

- o Principal: US Army Materiel Systems Analysis Activity - GWD - Special Projects Branch
- o Other: US Army Materiel Systems Analysis Activity - AWD, BRL-BMD

POINT OF CONTACT: US Army Materiel Systems Analysis Activity
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS: This model is linked to TRACOM and supersedes Bonder/IUA.

KEYWORD LISTING: Computerized, Analytical, Damage Assessment/Weapons Effectiveness, Two-Sided, Deterministic, Time Step

TITLE: ANSR - Analysis of SAFEGUARD Repertoire

PROPONENT: US Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: ANSR is a computerized analytical, damage assessment/weapons effectiveness model that determines the area coverage capability of the SAFEGUARD system or other midcourse intercept BMD system against either an ICBM or SLBM threat. The capability and flexibility of the program allows it to be used for the general study of effectiveness of BMD deployments having one or more batteries for area defense.

GENERAL DESCRIPTION: The model is two-sided, deterministic and was primarily designed to accommodate one battery, one target and one re-entry vehicle with a range of possible manipulation. The model was primarily designed for 12 search radars, 40 tracking radars, 30 interceptor farms, 350 ICBM or SLBM launch points, 215 target or impact points with a range of possible manipulation to include any combination of above. The ratio of game time to real time (for fully or partially manual models) is about 10 seconds of central processor time for each launch point-impact point combination.

INPUT:

- o Location and configuration of the defense radars
- o The parameters of each radar, such as maximum instrumental range, minimum elevation angle, scan penalty, and minimum signal-to-noise ratio for detection
- o The ballistic missile parameters, such as launch and impact points, re-entry vehicle and tank radar cross sections, and separation rate between the re-entry vehicle and tank
- o Interceptor flyout curves and other interceptor data, such as minimum intercept altitude, and divert rate
- o Miscellaneous information such as integration time interval, and various indicator flags

OUTPUT: The output is a listing of important offense and defense parameters or conditions existing at some significant event or time during an engagement; for example, radar parameters and interceptor and re-entry vehicle locations at intercept time. ANSR is designed so that six different analyses may be performed: (1) determine single or multiple battery coverage for a specific target list against either an SLBM or ICBM attack; (2) computer battle space; (3) generate the periphery of a footprint given an initial impact point; (4) generate a footprint given a grid of impact points; (5) output offense trajectory profiles only; and (6) generate radar tracking data only.

MODEL LIMITATIONS:

- o Maximum of 12 search radars and 40 tracking radars each having from one to four phases array faces
- o Maximum of 30 interceptor farms with no more than two types of interceptors
- o Maximum of 350 ICBM or SLBM launch points
- o Maximum of 215 target or impact points

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: 100,000 Octal

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: No formal documentation available

TIME REQUIREMENTS:

- o Acquire base data: N/A
- o Structure data in model input format: N/A
- o CPU time per model cycle: Variable depending upon option
- o 0 to 2 months learning time for players
- o 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: SRI and BMDSCOM

POINT OF CONTACT: J. O. Carroll, H. A. Lewis, J. L Dyer, J. A. Harvilla
Stanford Research Institute
Huntsville, Alabama 35804
Telephone: 205/837-3050

MISCELLANEOUS: ANSR is linked to Submarine Launch Assignment, Targeting, and Effectiveness Models (SLATEM). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC bases. It is not planned to add new capabilities to this model.

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Computerized; Two-Sided; Deterministic; Time Step

TITLE: Antiradiation Missile Flight Computer Model

PROPONENT: AFEWC

DEVELOPER: Texas Instruments, Inc.

PURPOSE: Computer simulation of SHRIKE and HARM flights

GENERAL DESCRIPTION: Models the complete flight of HARM and SHRIKE missiles from their launch by an aircraft to their impact on a ground plane. The model also computes a footprint for a given set of launch parameters.

INPUT:

Speed of launch aircraft

Az/El of launch

Altitude of launch

Estimated distance to target

Trajectory calculation increment/interval

OUTPUT: The output is a table of values for each phase of the flight profile from launch to impact at interval specified.

MODEL LIMITATIONS: Simulates dynamic characteristics only; no interactive tracking capability

HARDWARE:

Computer: UNIVAC 418-III

Operating System: RTOS-9E

Minimum Storage Required: 64,000 of 18-bit words

Peripheral Equipment: Card reader; printer; magnetic-tape drive

SOFTWARE:

Programming Language: FORTRAN

Documentation: Texas Instruments' Report entitled "Antiradiation Missile Flight Computer Model Final Report," dated 28 December 1977 (2 vols)

TIME REQUIREMENTS: Requires 1 hour to structure input data and approximately 1/2 hour CPU time per footprint requested.

SECURITY CLASSIFICATION: Model is UNCLASSIFIED; Output is SECRET

FREQUENCY OF USE: Approximately 10 times per year

USERS: AFEWC/SA and EW personnel

POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

TITLE: APAIR - MOD 2, 2.5, 2.6 - ASW Program Air Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: Ketron Corporation

PURPOSE: APAIR is a computerized analytic model which simulates interaction between an enemy submarine and one aircraft permitting study of a complete engagement through attack, reattack and kill.

GENERAL DESCRIPTION: The model is two-sided, stochastic, involving one aircraft vs one submarine; however, multiple runs can increase the number of platforms. Time is in time-step mode. The model accounts for addressees, weapons, fire control, sensors, platform noise and kinematics, environment, tactics and a user formulated scenario.

INPUT:

- o Sensor, weapon, fire control, platform and environment characteristics
- o Tactics
- o Scenario

OUTPUT:

- o Printout and plot of statistically derived quantities
- o Summary of replication history

MODEL LIMITATIONS:

- o One airplane vs one submarine
- o No counter measures
- o No false targets

HARDWARE:

- o Computer: DCC 6400, 6600, 6700, IBM 1360 and 3033
- o Minimum Storage Required: 100 to 250K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: (DTIC Numbers) SAOR 69-10 APAIR MOD 2, ASW Programs Air Engagement Model (U) Abstract (U) (AD 860 260L) Vol. 1, Part 1: User's Manual (U) (AD 860 261L) Vol. 1, Part 2: Sample Application (Conf) (AD 509 866L) Vol. 2, Part 1: Programmers Manual (U) (AD 860 262L) Vol. 2, Part 2: Program Listing (U) (AD 860 263L) SOATM 71-12 APAIR MOD 2.6 ASW Programs Air Engagement Model (U) Vol. 1: User's Manual (U) (AD 890 139L), Vol. 2; Programmers Manual (U) (ADB 006 017L)

TIME REQUIREMENTS:

- o 'ructure data base/man month
- o : time 3 seconds per replication

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 75 times per year

USERS: Manager, ASW Systems Program
NAVAIRSYSCOM

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, DC 20360
Telephone: (202) 692-9141

KEYWORD LISTING: Computerized; Analytic; ASW; Time-Step; Two-Sided

NOTE: A revision to MOD 2.6 is presently in process. Documentation will be completed and the revision incorporated by the end of FY 81.

TITLE: APM - Advanced Penetration Model

PROPONENT: AF/SASB

DEVELOPER: Boeing Computer Services, 7980 Gallows Court, Vienna, Virginia 22180

PURPOSE: To simulate the effectiveness of large strategic penetration forces.

GENERAL DESCRIPTION: The APM models the employment of bombers and tankers from launch to recovery; the response by Defensive Command and Control elements, Fighter-Interceptors and SAMs from entry to exit of the defended area. The APM logic is more detailed than most force structure models but less detailed than most end game models. The user defines the contending forces in a databank. He develops a plan for the employment of bombers and tankers using a series of modules called the Mission Planner. The Simulator module wages the air battle and determines the outcome of the thousands of encounters and interactions between offensive and defensive elements.

INPUT: BLUE and RED force descriptions; including locations; capabilities, one-on-one probabilities of detection, conversion, and kill; and degrades to these probabilities due to various countermeasures.

OUTPUT: Plots of sortie tracks, survivability and engagement reports, and output databanks of categorized information which the user can statistically analyze.

MODEL LIMITATIONS:

- o Given suitable data, the model is not geographically constrained
- o Computer run time is the only constraint on force sizes

HARDWARE:

- o The APM currently runs on the IBM 3032 with the MVS/MTAM/TSO/TCAM operation system
- o The largest module requires 600K of core
- o Important peripheral equipment includes TSO terminals with SPF, a Calcomp drum plotter, an IBM P3800 laser printer, and the capability to send output to microfiche

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Maintained by AF/SAMC

TIME REQUIREMENTS: Data base presentation is the most man-hour demanding part of the APM, requiring as much as three to five man-months to make significant force changes. Once this is accomplished, it is relatively simple to reconfigure the data base for excursions. Different modules of the APM require different amounts of CPU time. The Mission Planner modules take from 15 to 180 CPU minutes. The Simulator module generally requires 120 CPU-minutes

SECURITY CLASSIFICATION: UNCLASSIFIED (less data)

FREQUENCY OF USE: Daily

USERS: AF/SASB and SAC/SPS

POINT OF CONTACT: AF/SASB (Maj Joseph F. Smart)
The Pentagton
Washington, D.C. 20330
AUTOVON 225-4544
Telephone: (202)695-4544

COMMENTS: A review and enhancement of the Advance Penetration Model is in progress.

TITLE: APM-MEGA

PROPONENT: AF/SASB

DEVELOPER: AF/SASB

PURPOSE: To predict with acceptable reliability the output of the APM when some of the conditions are changed.

GENERAL DESCRIPTION: APM-MEGA is a quick-running expected value model which uses output from an APM base case to predict penetrator survivability for small perturbations about the base case. The output from the APM is aggregated into six parameters which describe the offense/defense force characteristics. MEGA operates on these six parameters to predict changes in penetrator survivability for user-specified changes in the offense or defense force size and/or characteristics.

INPUT: Number of penetrators, number of fighter interceptors, Fighters Assigned/Fighters Available, Fighters Vectored/Fighters Assigned, Fighters detecting and Converting/Fighters Vectored, Fighters Killing/ Fighters Detecting and Converting

OUTPUT: Probability of Survival

MODEL LIMITATIONS: Must first be alighed to fit APM Data to insure accurate predictions

HARDWARE:

- o Honeywell 6180, System M
- o IBM 3032, System J

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Documentation and Assessment of the APM-MEGA Program is available through AF/SASB

TIME REQUIREMENTS:

- o Data Base preparation is accomplished by a brief analysis of the air Battle output event notices. This yields the six necessary parameters
- o CPU time per cycle is approximately 5 seconds. Data output analysis is minimal since the model yields Ps.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times a year

USERS: AF/SASB

POINT OF CONTACT: AF/SASB
The Pentagon
Washington, D.C. 20330
AUTOVON 225-4544
TELEPHONE: (202)695-4544

TITLE: APSUB MOD 2 - ASW Program Submarine Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: Naval Weapons Laboratory/MASWSP

PURPOSE: APSUB MOD 2 is a computerized, analytical, limited war model that has been used extensively for weapon studies and for pre and postexercise analysis and exercise design. The model is primarily concerned with studying the effectiveness of ASW missions, studying in detail the interaction between opposing vehicles, and determining optimum tactics and optimum use of sensors.

GENERAL DESCRIPTION: APSUB MOD 2 is a two-sided, stochastic model involving sea forces only. It is capable of considering submarine encounters on a one-to-one basis and can aggregate up to any number of submarines on both friendly and enemy sides. Simulated time is treated on a time step basis. Probability theory and a decision logic table are the primary solution techniques used.

INPUT:

- o Tactical scenario
- o Detailed data on weapons, sensors and equipments

OUTPUT:

- o Computer printout from which analysis can be done
- o Data reduction for each replication
- o Across replications and computer plots
- o 5 options ranging from summary data to detailed battle history

MODEL LIMITATIONS: Oriented toward one-to-one encounters

HARDWARE:

- o Computer: CDC 6700, UNIVAC 1108, IBM 3260
- o Minimum Storage Required: 35K
- o Peripheral Equipment:
  - Printers
  - Plotting options exist that would require a plotter
  - 4 Tape Drives

SOFTWARE:

- o Programming Languages: FORTRAN IV
- o Both user's documentation and technical documentation (DTIC Numbers):
  - Abstract (AD 909 474L)
  - Technical Description (AD 525 118L)
  - Programmer's Manual (AD 9092546)

TIME REQUIREMENTS:

- o An extensive data base is available at the developing site for most applications
- o 30 seconds CPU time per model cycle
- o 2-3 days learning time for users
- o 20 days to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 25 times per year

USERS:

- o Principal: MASWSP
- o Other: Naval Laboratories

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, DC 20360
Telephone: (202) 692-9141

MISCELLANEOUS:

- o APSUB MOD 2 supersedes the NWL Submarine Encounter Simulation Model
- o Continual updating is planned in the areas of sonar, fire control and weapons
- o A computer-assisted version of APSUB MOD 2 has been developed

KEYWORD LISTING: Analytical Model; Limited War; Sea Forces; Computerized; Two-Sided; Stochastic; Time Step; Anti-Submarine Warfare

TITLE: APSURF MOD I & II - ASW Programs Surface Ship Engagement Model

PROPONENT: Chief of Naval Operations, OP-95

DEVELOPER: Ketron Corporation

PURPOSE: APSURF is a computerized, analytical model for the simulation of an ASW engagement between an enemy submarine and a Task Force or convoy of surface ships, including helicopters and LAMPS. Covers complete engagement from search to attack, reattack and kill.

GENERAL DESCRIPTION: The model is a two-sided, stochastic, Monte Carlo simulation, considering 25 surface ships, 25 helicopters/LAMPS, and 1 submarine. Time is covered in a time step mode. Weapons, fire control, sensors, platform noise and kinematics, environment and tactics are considered.

INPUT:

- o Sensor characteristics
- o Weapon characteristics
- o Platform characteristics
- o Fire control characteristics
- o Tactics
- o Scenario

OUTPUT: Printout and plots of all statistically derived quantities

MODEL LIMITATIONS:

- o One enemy submarine
- o No countermeasures

HARDWARE:

- o Computer: CDC 6400, 6600, 6700, IBM 360
- o Minimum Storage Required: 250K plus 4 tape drives

SOFTWARE:

- o FORTRAN IV
- o Documentation: (DTIC Numbers) Abstract AD881384L, User's Manual AD881385L, AD881386L, Programmers manual AD881387L, AD881388L

TIME REQUIREMENTS:

- o Prepare data: 1 man-month
- o CPU time: 30 seconds
- o Analyze results: 3 weeks

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 30 times per year

USERS: MANSWSP, CRUDESDEVGRU

POINT OF CONTACT: Manager, ASW Systems Project Office
Navy Department
Washington, DC 20360
Telephone: (202) 692-9141

KEYWORD LISTING: Analytical, ASW, Air and Sea, Computer Model; Two-Sided, Stochastic, Time Step, Submarine

NOTE: MOD II has been fully incorporated. The major added differences from the MOD I are:

1. Improved Helo (SH-3 type)
2. LAMPS, MK III with appropriate navigation, weapons, sensors
3. Good treatment of towed arrays, including beamforming, noise
4. Added key words for more comprehensive tactics

TITLE: APSURV MOD 1.4, 2.0 - ASW Program Surveillance Model

PROPONENT: Chief of Naval Operations (OP-95)

DEVELOPER: Tetra-Tech, Inc.

PURPOSE: APSURV is a computerized, analytical model which simulates ASW interaction between an enemy submarine and a surveillance system which detects the submarine, thereby permitting study of the search, detect, and localization process for the sensors.

GENERAL DESCRIPTION: APSURV is a two-sided, stochastic model for ASW operations involving one submarine against one sensor at a time for up to 20 sensors. Time is treated in a time-step mode.

INPUT:

- o Submarine track
- o Propagation loss
- o Ambient noise
- o Sensor characteristics
- o Submarine tactics

OUTPUT: Computer printout and plots of statistics and derived quantities

MODEL LIMITATIONS: No false targets are simulated.

HARDWARE:

- o Computer: CDC 6000, UNIVAC 1108, IBM 360
- o Minimum Storage Required: 100K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:

Mod	Defense Documentation Center Numbers
0	AD511 611L, AD511 610L
1	AD 513 177L

TIME REQUIREMENTS:

- o Structure data base: 1 month
- o CPU time: 20 seconds

SECURITY CLASSIFICATION:

- o Mod 0: SECRET
- o Mod 1: CONFIDENTIAL

FREQUENCY OF USE: 25 times/year

USERS: OP-95
OP-96
PME-124

POINT OF CONTACT: Manager, ASW Systems Project
Navy Department
Washington, DC 20360
Telephone: (202) 692-9141

KEYWORD LISTING: Analytical; ASW; Submarine; Computerized; Two-Sided; Time Step

TITLE: ARM - Ammunition Resupply Model

PROPONENT: Combined Arms Studies and Analysis Activity (CASAA), Fort Leavenworth, KS

DEVELOPER: Combined Arms Studies and Analysis Activity (CASAA), Fort Leavenworth, KS

PURPOSE: ARM is a methodology to gain insights into the effects of ammunition resupply assets contained in differing force structures and their impact upon combat effectiveness of various units within the division. ARM simulates load carring assets in a time based fashion, including transport loading/unloading.

GENERAL DESCRIPTION: ARM is an event/time sequenced computer model which simulates the various functions of ammunition resupply from corps storage areas to industrial weapons.

INPUT:

- Unit Locations
- Ammunition expenditures
- Transportation assets - type, tonnage
- Ammunition types, amounts available

OUTPUT: Computer printout detailing unit status, supply point status, transport status, which can be used directly by wargamers or analyzed into other forms.

MODEL LIMITATIONS:

- 560 transports, 6 transport types, 5 transport missions
- 75 units, 8 unit types

HARDWARE:

- Computer: DEC VAX-11/780
- Operating System: VMS
- Minimum Storage Required: 100 kb

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Ammunition Resupply Model, Vol I, Methodology and Users Manual, Vol II, Programmers Manual. DTIC ACN 36801

TIME REQUIREMENTS:

- To acquire Data Base: 1 week
- To structure Data in Model Input Format: 2 weeks
- To Analyze Output: Application dependent

- o Player Learning Tiome: 1 hour
- o Playing Time per Cycle: Game dependent
- o CPU Time per Cycle: Less than 1 minute

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5

USERS: CASSA, Fort Leavenworth, KS

POINT OF CONTACT: CASAA
Attn: ATZL-CAS-FS (Mr. Don Remen)
Fort Leavenworth., KS 66027

TITLE: ARMS II - Reliability and Maintainability Simulation II

PROPONENT: US Army Air Mobility Research and Development Laboratory, Ft Eustis, VA

DEVELOPER: RAIL Company, 21 Harrison Ave., Baltimore MD 21220

PURPOSE: Evaluate aircraft in RAM operational environment.

GENERAL DESCRIPTION: Monte Carlo simulation of up to 200 aircraft and up to 4 different types in RAM operational environment. Aircraft are a set of subsystems and components that fly missions, suffer failures and/or combat damages, and receive corrective and preventive maintenance by established maintenance crews and equipment. Plays up to 4 different levels of maintenance, including crew repairs and plays cannibalization and inventory. Differentiates between Mission and Flight essential components, and not all subsystems need to be operating during full time of mission. Simulation is up to 400 days.

INPUT:

- Failure rates
- Repair times
- Manpower
- Equipment
- Scenario: Mission profiles, Scheduled Maintenance Events, Surge Periods.
- Raw data

OUTPUT:

- Time sequenced account of failures, repairs, etc. Summary of failures, repairs, replacement parts, time etc
- Mission Reliability Availability

MODEL LIMITATIONS:

- Does not assess vulnerability. Combat damage per mission is input as probability
- Four different type aircraft can be played. Up to 200 aircraft can be played
- Aircraft are considered as set of independent subsystems and components that suffer failures and require maintenance

HARDWARE:

- IBM 360

SOFTWARE:

- FORTRAN program. Users Manual.

TIME REQUIREMENTS:

Preparation:	Dependent on availability of input - a day to months
Play:	Dependent on number of aircraft, length of time being simulated, and amount of output requested. Time from start to output printout - one hour to ten hours.
Analysis:	Dependent on level of analysis and amount of sensitivity. One hour to many days. Additional analysis programs may be written on output to shorten analysis time.

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS:

- Development Systems Analysis Division
  Plans and Analysis Directorate
  Product Assurance Directorate
  AVRADCOM
  St Louis, MO
- Army Air Mobility R&D Laboratory
  Ft Eustis, VA 23604

TITLE: ARTBASS - Army training Battle Simulator System

PROPONENT: Combined Arms Training Development Activity, Fort Leavenworth, Kansas

DEVELOPER: Combined Arms Training Development Activity

PURPOSE: Through use of a real time battle simulation and a computer graphics display system a battalion commander and staff may be exercised in the command and control realities that will be encountered on the modern integrated battlefield. Permits battalion commander to observe and evaluate ability of his staff to respond to input normally received from subordinate units on a tactical situation. Allows for alternate courses of action to be exercised and evaluated for effectiveness.

GENERAL DESCRIPTION: Lanchester theory used to drive weapons effects, unit attrition, expected values used to determine unit movement, equipment performance curve fit for determining levels of suppression probability theory in line of sight, maintenance factions, etc.

INPUT:

- o Order of battle
- o Firing rates
- o Kill probabilities
- o Mobility
- o Terrain and weather
- o Specific unit order
- o Firing commands

OUTPUT:

- o Sides display of unit locations and battlefield control information
- o Real-time CRT output reports of unit battlefield activity
- o Summary listings over time describing unit status

HARDWARE: Perkin Elmer

SOFTWARE:

- o Programming Language: FTN, some assembler
- o Documentation: Pending

TIME REQUIREMENTS: Pending

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Under development

USERS: BSD (under development)

POINT OF CONTACT: Herb Westmorland
Combined Arms Training Development Activity
Fort Leavenworth, Kansas
AUTOVON 684-4528

MISCELLANEOUS: Nuclear chemical package and logistic play

KEYWORD LISTING: Computerized, Analytical, Damage assessment, Tactical, Real-time, BN Command and Control Trainer

TITLE: Army Small Arms Requirements Study (ASARS) II Battle Model

PROPONENT: US Army Infantry School

DEVELOPER: US Army Combat Developments Command, Systems Analysis Group

PURPOSE: The model was designed to serve as an operations research tool for evaluating the comparative effectiveness and utility of small arms (pistols, rifles, automatic rifles, machineguns, and grenade launchers) and various organizations, operational concepts, and tactics of weapon employment in an operational context.

GENERAL DESCRIPTION: ASARS is a two-sided Monte Carlo simulation of dismounted combat between less than company sized units. ASARS represents a substantial portion of the factors involved in, or impacting on small infantry unit combat. Movement paths of the units are generated dynamically within the model to reflect leaders' perception of current battle conditions. The dismounted forces can be supported with artillery and mortar fires. Antipersonnel minefields are represented with options to breach, traverse, or bypass. Vehicles and direct fire weapons larger than grenade launchers are not represented. Terrain evaluations are specified at 12.5 meter intervals from map-based digitized tapes. Each of up to 150 soldiers is individually represented in up to 20 separate units. Each exposed man is individually assessed for weapon effects from individual bullets or flechettes and from fragments from each exploding munition. Probability of incapacitation is computed for each body part hit. These probabilities are translated into inability of the man to observe, move, fire, or fire and move. Suppressive effects of hits and misses are also represented.

INPUT:

- Direct and indirect fire weapons performance characteristics
- Force structure data
- Movement subobjectives, phaselines, and formations
- Terrain and vegetation

OUTPUT:

- Computer printouts showing Red and Blue losses, ammo expenditures, movement, suppression and related measures over time.
- Printouts of individual soldier conditions over time.

MODEL LIMITATIONS:

- Materiel systems not played.
- C3R not played.

HARDWARE:

- CDC 6000 or 7000 series computer

SOFTWARE:

- Programing language: FORTRAN IV

STAFF:

- 2 manmonths for input preparation;
- 2-3 manmonths for test and production runs;
- 1 manmonth for data analysis

TIME REQUIREMENTS:

- 10 minutes of CPU time per replication on a CDC 7600 computer

SECURITY CLASSIFICATION: Program UNCLASSIFIED; data base classified CONFIDENTIAL

FREQUENCY OF USE: Several months per year

USERS: US Army Infantry School/Directorate of Combat Developments

POINTS OF CONTACT: Jody Shirley
Commandant, US Army Infantry School
ATTN: ATSH-CD-CSO-OR
Ft Benning, GA 31905
AUTOVON: 835-1989

TITLE: ASWAS - ASW Air Systems Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: ASWAS is a computerized, analytical model designed to simulate search, localization, tracking, attack and reattack by a single aircraft against a single submarine. The primary focus of concern is ASW missions such as SOSUS, planning datum, barrier, and screening. In addition, it addresses the problem of developing optimum localization tactics for aircraft.

GENERAL DESCRIPTION: ASwAS is a two-sided, stochastic model involving air and sea forces. It considers an individual aircraft versus a single submarine. Sonobuoys are considered units, and the model can handle up to 31 of these. Simulated time is treated on an event store basis. Approximately 3 hours of battle are simulated in 1 second. The primary solution technique is kinematic, with probabilistic event assessment.

INPUT: ASW scenario

OUTPUT:

- o Event-by-Event history
- o Statistical analysis

MODEL LIMITATIONS:

- o No convergence zone capabilities
- o One aircraft and one submarine per replication
- o Maximum of 31 sonobuoys

HARDWARE:

- o Computer: IBM 7090/7094
- o Operating System: FORTRAN Monitor System
- o Minimum Storage Required: 70K octal

SOFTWARE:

- o Programming Language: FAP (FORTRAN Assembly Program)
- o Documentation: "ASW Air Systems Model (ASWAS)," PAG No. 19-68, OM 3360
- o The above represents complete user's and technical documentation

TIME REQUIREMENTS:

- o 1 week to prepare input (1 man-week)
- o Approximately .03 seconds CPU time per model cycle (approximately 3 minutes run time per 100 replications)
- o 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Annually

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

MISCELLANEOUS: ASWAS supplied inputs to ASGRAM in the form of tactical effectiveness of various units; probabilities of detection and probabilities of kill. ASWAS was also used in studying helo detection capabilities within towed array uncertainty areas.

KEYWORD LISTING: Analytical Model; Limited War; Damage Assessment/Weapons Effectiveness; Air Forces; Sea Forces; Computerized; Two-Sided; Stochastic; Event Store

TITLE: Area Threat Engagement Model (ATEM)

PROPONENT: Wright-Patterson AFB OH

DEVELOPER: Applications Research Corporation, Dayton OH

PURPOSE: The ATEM model simulates the many-on-many penetrator/air defense interactions to determine offensive and defensive weapon system assignments. ATEM consists of two primary modules, RADAR and C^3.

GENERAL DESCRIPTION:

RADAR MODULE:

a. ATEM simulates a flight of vehicles penetrating through an ADS network, solves the radar equations at each radar site and penetrator location, and determines signal-to-noise (S/N) and J/S ratio time histories. If jamming is not present, a detection flag is set when the S/N meets a pre-determined threshold. For jamming situations, event flags are set on the basis of J/S, radar-target range, burn-through or strobe events when a given J/S threshold is exceeded. When a range flag is set, the J/S ratio, range and range rate on all targets of opportunity within a zone of influence of the radar site would be flagged for input into the C^3 module. Also in the case of jamming, individual beams of multi-beam radars, such as height finders and certain early warning radars, are selected on the basis of the lowest J/S ratio.

b. The flight path of the penetrators thru the ADS network is generated from the initial x, y, and z coordinates of the aircraft, angular heading and velocity. Aircraft flight is simulated point-to-point with velocity adjustments for proper aircraft arrival time at the check points. Coordinates turns and pitch maneuvers are implemented so that antenna patterns and cross-section functions rotate with the aircraft. All aircraft maneuvers are presently pre-programmed.

c. For each ADS in the network, the range from the aircraft to the site is computed. A check is made to ensure that the aircraft altitude is sufficient so that the aircraft is visible above the horizon. A test is also made to determine whether or not the elevation angle is greater than the terrain masking angle at the radar site. In addition, the elevation angle must also be within the field of view of the radar. Provisions are being made to include multipath effects.

d. Three dimensional jammer and radar antenna patterns and radar cross-section lookup tables are presently employed. To increase computational speed, mathematical function approximations can replace lookup tables.

e. Jamming effects in the radar receivers are additive with appropriate adjustment for antenna patterns and range. Jamming options include noise, repeaters, saturation electronic targets, discrete electronic targets and range rings. When the penetrator ECM receiver is utilized, jammers are activated based upon radar circumstances and the discrimination logic employed in the jamming receiver. First, the radar signals at the jamming receiver must exceed a minimum detectable signal test. The strongest received radar signals are then assigned. Jamming assignments against radars will be made only if the jammer operates at the radar's operating frequency and certain discrimination criterions are met. Discrimination options that will be available include: radar PRF, radar type (for example, TWS, Con-Scan, Raster-Scan, Continuous-Scan) and polarization. Attributes are associated with each particular radar site. The jammer may be of a type that becomes duty-cycle limited. When the PRF count against jammed radar sites exceeds a predetermined limit, no additional radar sites are assigned to that jammer.

f. ATEM is currently coded to simultaneously handle 128 radar sites and 16 penetrator vehicles. The number of site/penetrator combinations can be increased by changing a dimension statement to a level commensurate with computer storage capacity and available processing time.

g. The radar module carries the simulation to the point where the penetration vehicles appear on the various radar screens above detection/situation thresholds.

C^3 MODULE

a. The C^3 (Command, Control and Communications) module simulates the communication links and nodes processing elements in the air defense net, and models the transmission and delay times associated with processing target data through the C^3 net. The process begins with the radar outstations reporting information through the air defense network. In the model, transmission paths, system delays, filtering processes, development of tracks, plotting, and assignments are simulations of actual system processes, based upon most current data. Radar outstations, consisting of Early Warning and Acquisition radars, report target information to appropriate Filter Centers. At the Filter Center, the data is processed and analyzed to develop raw penetrator track information based upon velocity-time criteria and multiple correlations from various outstations. Track data is transmitted to the appropriate air situation center for track data refinement. This information is passed to the weapon operations center where the flight path of the penetrator vehicles are predicted and assignments made to the appropriate weapon control center.

b. The C^3 module is programmed to represent the air defense system zones nodes and links, delays, and limitations. Virtually all C^3 system specifications are formatted in input parameter files, so that the module may be readily updated to represent different air defense network arrays.

c. The C^3 module is used to model either hard kills associated with defense suppression or soft kills as with electronic warfare. If targeting information is denied in the network through interruption, alternate message paths and appropriate saturation effects and delays are included. The model can simulate a C^3 system degraded to the point of autonomous operation for evaluation purposes. All appropriate vehicles and multi-netted air defense situation are present, including false crossings and ADS assignments made on the basis of those situations.

TITLE: ATLAS - A Tactical, Logistical and Air Simulation

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation

PURPOSE: ATLAS is a computerized, analytical model designed to assist the planner/analyst by simulating conventional theater level combat operations over an extended period, and to examine the overall trends, effects, and interactions of ground, air and logistic forces in conventional theater level warfare. It is basically a planner's wargame, providing the tool for examining theater level force interactions so that the planner/analyst may examine and evaluate theater contingency planning, force effectiveness and force requirements. The daily movement of a UEFA is developed as a function of firepower, terrain, posture, residual personnel strengths, and logistic support. The model is also concerned with the scheduling of reinforcements and logistic capability of lines of communication.

GENERAL DESCRIPTION: ATLAS is a two-sided, deterministic model involving land and air forces. It was primarily designed to consider division level ground forces and aircraft by mission. The model may be manipulated, however, to consider units down to brigade or battalion level, if the gamer can accept division casualty and movement "rates." The model was designed to consider combat operations by "sector." Each "sector" was designed to represent a corps level force. Up to ten sectors (corps) can be simulated in a representation of theater level combat. Time is treated on a time step basis (24-hour increments). The primary solution technique is average expected value results evaluated deterministically.

INPUT:

a. In general, inputs fall into four major categories:
   (1) Environmental inputs which structure the theater;
   (2) Ground force inputs of committed and scheduled forces and their associated characteristics;
   (3) Logistic inputs which establish supply requirements and constraints;
   (4) Air inputs which provide performance, vulnerability, and other characteristic data on aircraft, airbases, and SAM sites.

OUTPUT: Model output is in computer print out form somewhat similar to the input data format. Output is tabulated on a daily basis and reflects the current status of forces at a given time. Selective detailed and summary output is available. Output may be requested for specific days and for specific submodels (ground, air or logistics) or for a comprehensive theater summary. Retrievals of selected data items are also available using the ATLAS data conversion and retrieval programs.

MODEL LIMITATIONS: In ATLAS, the battle assessments are primarily dependent on the ratios of the opposing forces computed from firepower scores (FPS). The Index of Combat Effectiveness (ICE) values are modified by casualties or lack of supplies to form a net ICE. At the present state of gaming, weapon firepower effects are assumed to be linearly additive with no enhancement (or degradation) for training, morale, combined arms, and command and control.

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 53K words
- o Peripheral Equipment: Mass storage devices

SOFTWARE:

- o Programming Language: ASCII FORTRAN
- o Documentation (DTIC Numbers):
  - "Computerized Quickgame" RAC-TP-266 (AD 387 510), ATLAS: A Tactical, Logistical and Air Simulation: RAC-TP 338 (AD 850 355)
  - SHAPE TM 242
  - NMCC CSM *M 91-69
  - Modifications to ATLAS (ATLAS-M), CAA-TP-74-3, July 1974

TIME REQUIREMENTS:

- o 2-4 months to acquire base data, depending on Service responses
- o 1 man-month to structure data in model input format
- o 20 minutes computer time for 180 day game on UNIVAC 1100/82

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Support for 3 or 4 studies per year

USERS: US Army Concepts Analysis Agency and COMUSKOREA

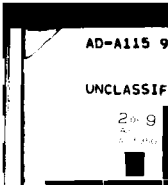
POINT OF CONTACT: UNIVAC version - Ms. P.M. Fleming
US Army Concepts Analysis Agency (CSCA-MCM)
8120 Woodmont Avenue, Bethesda, MD 20814
Telephone: (202) 295-0529

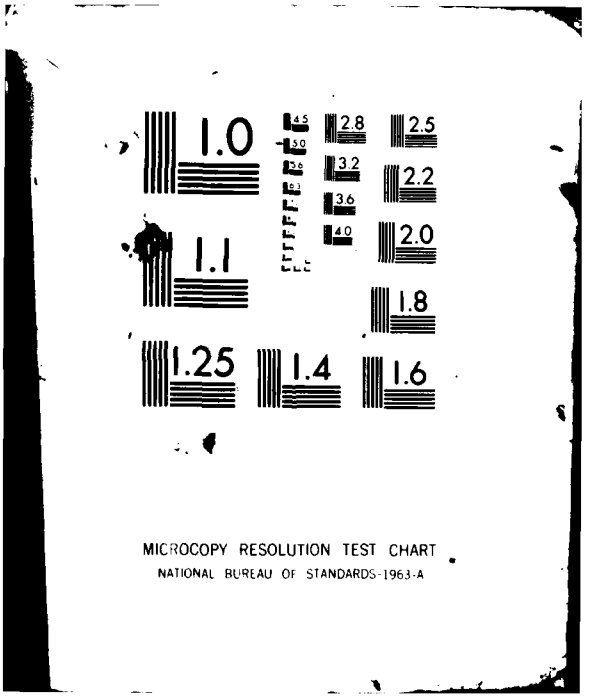
MISCELLANEOUS:

- o The user has the option of linking up to the FASTALS model in the FOREWON planning system.
- o ATLAS is an improved version of the original Research Analysis Corporation (RAC) Computerized Quickgame.

KEYWORD LISTING: Analytical Model; Limited War, Logistics, Land Forces, Air Forces, Computerized, Two-Sided, Deterministic, Time Step

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
MAY 82 A F QUATTROMANI
UNCLASSIFIED SAGAM-120-82 NL




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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TITLE: ATR - Air Transport of Radiation

PROPONENT: Defense Nuclear Agency (NATD)

DEVELOPER: Science Applications, Inc.

PURPOSE: The ATR code provides detailed descriptions of the free-field nuclear environments for all burst-target configurations in the atmosphere. The code utilizes field free input commands and performs a typical calculation in less than a computational second.

GENERAL DESCRIPTION: The ATR code contains parametric models of a comprehensive data base of air transport calculations performed by discrete ordinates techniques. The data base was generated for neutrons, secondary gamma rays, prompt gamma rays, and x-rays as a function of source energy, range, detector energy, and angle to a distance of 550 gm/cm2 of infinite homogeneous air. Results at all configurations of distance and density are obtained by integral mass scaling upon these infinite, homogeneous air results. Effects of the interface between air and ground and of non-uniform air density at high altitudes are treated as perturbation corrections.

INPUT: All input utilizes a field free mnemonic command structure.

- o Burst-target configuration
- o Source spectra and weapon yield (internal sources are available if desired)
- o Output specifications

OUTPUT: All at user option with a full complement of units (km, kft, miles, gms/cm2, cal/cm2, etc.).

- o Full energy angular dependent

  fluence — energy fluence
  current — energy current
  dose (several internal dose responses plus user specified)

- o Several convenient summary printout options
- o Constraint calculation (finds the range for a given dose)

HARDWARE:

- o Operational on UNIVAC 1108, CDC 7600/6600, IBM 360/91, GE 635, Dec 10
- o Uses no external storage devices
- o Requires approximately 60K

SOFTWARE:

- o FORTRAN IV
- o "Users Guide to Version 2 of ATR (Air Transport of Radiation)," L. Huszar, L. Nesseler, W. Woolson, DNA 3144Z (SAI-73-534-LJ), April 1973.

TIME REQUIREMENTS:

- o Less than 1 man-hour to define problem in ATR command structure
- o Less than 1 second computational time on UNIVAC 1108 for typical problems
- o Data formatted for easy interpretation

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used at several installations on a day-to-day basis.

USERS: (Representative list)

- o Ballistics Research Lab (BRL)
- o Defense Nuclear Agency (DNA)
- o Army Nuclear Agency (ANA)
- o Air Force Weapons Lab (AFWL)
- o Science Applications, Inc. (SAI)

POINT OF CONTACT: Dr. William A. Woolson
Science Aplications, Inc.
1200 Prospect Street, P. O. Box 2351
La Jolla, California 92037
Telephone: 714/459-0211

KEYWORD LISTING: Radiation transport; secondary gamma-ray; x-ray; atmosphere; computerized; neutron; prompt gamma-ray; dose; fluence.

TITLE: Automated Flagging of ELINT for Electronic Warfare (EW) (EW Flagging)

PROPONENT: EW Flagging Division, AFEWC/EWF

DEVELOPER: EW Flagging Division, AFEWC/EWF

PURPOSE: To automatically examine near real time ELINT and test that data against specific EW system logic and limits to determine whether a proper reaction should occur in the case of a radar warning receiver (RWR) or an effective countering capability is present in the case of electronic countermeasures equipment (jammers).

GENERAL DESCRIPTION: The EW Flagging Program is part of the routine processing flow for ELINT reports at selected major ELINT processing centers.

a. The program consists of three major sections:

(1) The first section is a parametric decoder which extracts the technical parameters of each ELINT intercept from the complex format. The data is then readily available for use by the second section.

(2) The second section consists of individual modules. Each module represents a specific EW system; e.g., AN/ALR-46(V)3, AN/ALQ-119. In this section, each ELINT intercept is screened against each equipment module. All or any combination of modules can be run without interrupting the processing flow. Each intercept which causes an improper response in an EW system is "flagged" as an exception.

(3) The third section compiles these exceptions. The product is a list of exceptions - the ELINT intercepts and a short statement as to why the intercept was flagged and by what equipment.

b. The following EW equipment has been modeled and is included in the program:

(1) AN/ALR-46(V)3
(2) AN/ALR-46(V)4
(3) AN/ALQ-119
(4) AN/ALQ-162 (US Navy)
(5) AN/ALR-56
(6) AN/ALQ-135

INPUT: ELINT reports in a data automated format; normally on magnetic disk or tape

OUTPUT: Screened ELINT intercepts; normally on magnetic tape or disc and then AUTODIN messages or punched cards

MODEL LIMITATIONS: One-on-one screening: screening one signal against one system at a time. The model cannot correlate signals to provide ambiguity resolution.

The modules are designed to operate on formatted ELINT data and are not simulations.

The modules are only as current as the equipment information from which it is designed. Modules are updated as new information is received.

HARDWARE:

Computer: UNIVAC 418-III; IBM 370; Honeywell 6000

Operating System: RTOS, OS, GCOS

Minimum Storage Requirement: Variable

Peripheral Equipment: Mass storage (drum or disk), printer

SOFTWARE:

Program Language: COBOL

Documentation: Available upon request

TIME REQUIREMENTS:

Time to structure input data - not applicable

CPU time - variable, based on input volume

Analysis time - variable, based on input volume

SECURITY CLASSIFICATION: SECRET NOFORN

FREQUENCY OF USE: As required

USERS: ELINT Processing Centers and AFEWC

POINT OF CONTACT: AFEWC/EWF
Lt Col Christensen
San Antonio, TX 78243
Telephone: 512/925-2021/AUTOVON: 945-2021

COMMENTS: This is not a general purpose capabilities analysis program for multiple users. It has a specific, highly structured input and a detailed output for a limited audience.

TITLE: AVAP - Airlift Vehicle Allocation Program

PROPONENT: HQ USAF/SAGM

DEVELOPER: General Research Corporation (GRC)

PURPOSE: The purpose of AVAP is to simulate daily intratheater airlift demand and allocate airlift resources to satisfy that demand.

GENERAL DESCRIPTION: The deterministic computer model allocates airlift resources until daily airlift demands are satisfied. It then returns all aircraft to home station. It has two modes - fixed fleet and force sizing. The fixed fleet mode determines the amount of cargo airlifted for a given force size. The force sizing mode determines how many additional aircraft are required to satisfy the demand. The model considers a limited scale one day demand.

INPUTS:

- o Aircraft descriptions
- o Airbase definitions
- o Initial aircraft beddown locations
- o Augmentation plans
- o Airlift demand

OUTPUTS:

- o Cruise tables
- o Takeoff and landing limits
- o Demand after allocation steps
- o Summary reports
- o Flight plans
- o Diagnostic messages

MODEL LIMITATIONS:

- o The model does not consider reliability, manintenance, or cost criteria in selection of fleet, nor does it consider base scheduling problems, differing cargo types, or changing weather conditions
- o There are also no multiple destination missions
- o The maximum range on any leg is 2,500 nautical miles
- o There can be up to 500 demands, 200 bases, and 500 total aircraft of 5 types
- o There can be 20 types of cargo

HARDWARE:

- o Type Computer: Honeywell 6180
- o Operating System: Multics
- o Minimum Storage Requirements: 54K
- o Peripheral Equipment: DOS

SOFTWARE:

- o Programming Language: FORTRAN
- o Documenttion:
  - Airlift Vehicle Allocation
  - Program - Final Report, Vol I and II (BCS-40100-1 and BCS-40100-2)
  - The Strategic and Tactical Airlift System (STAS) Final Report - 1024-01-9CR (GRC)

TIME REQUIREMENTS: Unknown (less than 20 minutes on G-635)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: This model is not currently in use by AF/SAGM. The source code is being maintained on type, but the model is not being maintained in an executable form. An advanced intratheater simulation model is currently being developed by HQ MAC, Scott AFB, ILL.

USER: AF/SAGM

POINT OF CONTACT: USAF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone (202) 694-8155
AUTOVON 224-8155

TITLE: BALFRAM - Balanced Force Requirements Analysis Methodology

PROPONENT: Commander-in-Chief, Pacific

DEVELOPER: SRI International

PURPOSE: BALFRAM is a computerized, limited war, theater-level model used as an analytical tool in support of force planning decisions. Model is compiler-like in structure; user selects nature of problem to be addressed and level of aggregation. Most commonly used in brigade or division-level scenario. This model is also concerned with naval battles involving carrier battle groups, air-to-surface misile carrying aircraft and ASW.

GENERAL DESCRIPTION: BALFRAM is a two-sided, mixed model involving land, air, sea, and paramilitary forces. This model was primarily designed for the division force equivalent level with a manipulation range of company to Army group. Level of model exercise is theater-level with a possible manipulation range of company fire-fight to theater-level conflict. Treatment of simulated time is time-step and ratio of game time to real time is user determined (not fixed; function of complexity of problem). Primary solution techniques used are Lanchester square, linear and mixed differential, plus ten other user-selected formulations of attrition.

INPUT:

- o Geography specifying battle nodes and distances
- o Orders of battle
- o Indices of Combat Effectiveness, Lanchester attrition coefficients
- o Mobility of forces, other typical force characteristics, i.e., "breakpoints"
- o Contingency logic
- o Logistics

OUTPUT:

- o Computer printout of surviving forces
- o Movement of FEBA
- o Multi-dimensional matrices of outputs as a function of parametric variations of inputs.
- o Output statistics such as mean and standard deviations as a function of randomization of inputs

MODEL LIMITATIONS:

- o Reconstitution of withdrawn or defeated units not possible
- o Limited number of geographical modes (89), logistics pipe lines (3), combat units (120), FEBA traces (3)
- o Linear degradation of force effectiveness as a function of logistics denial

HARDWARE:

- o Computer: Honeywell 6060, CDC 6400
- o Operating System: GECOS (Honeywell), KRONOS (CDC)
- o Minimum Storage Required: 55K
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN-like input language; model itself in FORTRAN
- o Documentation:
  - Users Manual (updated)
  - Program Maintenance Manual (updated)
  - Seminar Guide (updated)
- o Both User and Technical documentation complete

TIME REQUIREMENTS:

- o 2 weeks to acquire base data
- o 2 weeks to structure data in model input format
- o Several seconds to several hours CPU time per model cycle, as a function of the complexity of the problem being modeled
- o 1 week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Research and Analysis Office
CINCPAC, Box 13
Camp Smith, Hawaii 96861

FREQUENCY OF USE: 1-2 times per year

USERS:

- o Principal: CINCPAC, PACAF
- o Other: Japan Self-Defense Forces (JSDF)
  Republic of China
  Korea (USFK)
  Headquarters USMC

MISCELLANEOUS: BALFRAM model supersedes FRAM (Force Requirements Analysis Model). This model differs from the traditional "black-box" or "hard-wire" model in that the user literally constructs his own model with elements provided by the methodology.

KEYWORD LISTING: Analytical; Limited War; Land, Air, Sea; Paramilitary; Computerized; Two-Sided; Mixed, Time Step

TITLE: Barrier Air Defense Model

PROPONENT: Deputy Under Secretary of Defense for Research and Engineering (Tactical Warfare Programs)

DEVELOPER: Institute for Defense Analysis

PURPOSE: The Barrier Air Defense Model is a computerized, general war, analytical model. It evaluates engagements between offensive bombers and defensive barrier resources (interceptors, AEW aircraft, ground radars), The model analyzes the effectiveness of antiair defensive barriers maintained by land-based and/or sea-based interceptors, CAP, AEW aircraft, and ground radars, against offensive bomber forces containing passive penetrators and AES aircraft chasers.

GENERAL DESCRIPTION: The Barrier Air Defense Model is a two-sided, deterministic model involving air forces. The model was designed to operate on the level of multi-wave bomber attack (bombers in groups) versus waves of interceptors; it can be manipulated to treat all resources as individual aircraft.

INPUT:

- o Offensive Forces
  - Number
  - Composition
  - Deployment
  - Tactics of bomber groups
- o Defensive Forces
  - AEW/Ground Radar
    - -- Types
    - -- Locations
    - -- Tactics
    - -- Vulnerabilities
  - Bases
    - -- Locations
    - -- Launch Capabilities
    - -- Vulnerabilities
  - Interceptors
    - -- Locations
    - -- Performance Characteristics
    - -- Detection and weapon system capabilties

OUTPUT:

- o Computer printout giving engagement history and outcome
- o Can control level of detail of engagement summary

MODEL LIMITATIONS:

- o No communications jamming
- o Limited ECM

HARDWARE:

- o Computer: CDC 6400
- o Minimum Storage Required: 64K words
- o Peripheral Equipment: Disk

SOFTWARE:

- o Programminng Language: FORTRAN
- o Documentation: Appendix E, IDA Report R-241, "Worldwide Air Defense of Sea Lines of Communications (10)," October, 1978, SECRET
- o User's and Programmer's manuals not yet complete

TIME REQUIREMENTS:

- o 1 month required to acquire data base
- o 1 man-month required to structure data in model input format
- o CPU time is 2 minutes per engagement evaluation
- o 1 month required to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: IDA

POINT OF CONTACT: Dr. Ray Jakobovits
Institute for Defense Analyses
400 Army-Navy Drive
Arlington, VA 22202

KEYWORD LISTING: Analytical; General War; Air; Computerized; Two-sided; Deterministic; Time Step

TITLE: Basketball Court II

PROPONENT: AFEWC/SATB

DEVELOPER: AFEWC/SATB

PURPOSE: To evaluate the effective transmission range of a transmitter in the presence of jamming.

GENERAL DESCRIPTION: This program uses the free space loss form of the one way beacon equation to evaluate the effective center and radius of coverage for a transmitter in the presence of jamming

INPUTS:

Parametric data for the jammer and transmitter(s)

Scenario data for the jammer and transmitter(s)

All data entered via keyboard initially. Subsequent runs may use data previously entered

OUTPUT:

Hard Copy Unit Output: Graphical representation of scenario, and tabular data listing

MODEL LIMITATIONS: This is a small, fast model which considers only an isotropic radiator and free space loss.

a. No consideration is given to:

Atmospheric losses due to troproducting or scatter, defraction, or spectral absorption

Ground losses as functions of dielectric constant, conductivity, snow/ice, foliage, or tropospheric meterological phenomenon

Terrain masking due to hills and valleys

b. This program has no provisions for map outlines (coat lines, rivers, political boundaries, etcetera) and all computations assume input units as specified in program.

HARDWARE:

Computer: TEKTRONIX 405X series

Minimum Storage Requirement: 8,000 Bytes of "Core"

Peripheral Equipment: Hard Copy Unit, X-Y Plotter (Optional)

SOFTWARE:

Programming Language: TEKTRONIX BASIC

TIME REQUIREMENTS: Normal run time is about 60 seconds.

SECURITY CLASSIFICATION: This program is UNCLASSIFIED

FREQUENCY OF USE: As required

USERS: AFEWC/SATB

POINT OF CONTACT: AFEWC/SATB
Capt Louis P. Kelley
San Antonio, TX 78243
Telephone: 512/925-2427/AUTOVON: 945-2427

COMMENTS: The absence of atmospheric and ground loss considerations along with a smooth spherical earth provides a simplistic evaluation which is easy to interpret. This type of modeling has been and is extensively used by AFEWC.

TITLE: BATLE - Brief Adversary Threat Loss Estimator

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Sandia Laboratories

PURPOSE: BATLE was developed as an analysis tool to estimate the force losses where engagements between guards and adversaries occur in defense of a facility.

GENERAL DESCRIPTION: BATLE is a model which allows the user to select various armaments, arrival times, reload times, etc., in order to assess the results of a small-scale engagement between two hostile forces. The results include status reports, probability distribution, and steady-state results.

INPUT:

- o Force size
- o Weapon type
- o Posture
- o Delaying tactics
- o Proficiency
- o Defense/assault
- o Range
- o Illumination

OUTPUT:

- o Summary
- o Termination results
- o Status reports
- o Probability distributions
- o Time history

MODEL LIMITATIONS: Small-forces only

HARDWARE:

- o Computer: PE 3220, 7/32
- o Operating System: OS 32/MT
- o Minimum Storage: 250 KB
- o Peripheral Equipment: Graphics terminal

SOFTWARE:

- o Language: FORTRAN VII
- o Documentation: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 15-25 minutes to set up model depending on complexity
- o 1-3 minutes to run

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Mr. Ed Jacques
NSWC/G42
White Oak
Silver Spring, MD 20910
Telephone: (202) 394-2396

KEYWORD LISTING: Engagement Model

TITLE: BATTLE - Battalion Analyzer and Tactical Trainer for Local Engagements

PROPONENT: US Army TRADOC Systems Analysis Activity (TRASANA)

DEVELOPER: USA TRADOC Systems Analysis Activity

PURPOSE: BATTLE is a computer assisted "General War" battalion task force model used for training, as an analytical tool for development or evaluation of operational and organizational concepts, for evaluation of combat phenomenology not readily addressed by high resolution computer simulations such as CARMONETTE and CASTFOREM, for scenario development in support of computerized models, and for rapid screening of alternatives.

GENERAL DESCRIPTION: BATTLE is a stochastic, two sided computer assisted manual terrain board model capable of resolution simulation of all of the elements of a US combined arms task force against the first echelon of a threat motorized or tank division. Resolution is to the individual soldier. The model is capable of simulating ECM/ECCM, mines, obscurants, close air support, attack and scout helicopters, all indirect fire and direct fire systems, logistics and recovery operations, air defense artillery, and limited NBC play. The model uses teams of US and Threat players and a team of controllers. The WANG minicomputer is used to resolve all direct and indirect firing events, mine engagements, acquisition, and other combat phenomenology. It also provides a complete coroners report and analytical post-processor.

INPUT:

- o Detailed scenario and RED and BLUE operation orders
- o Specific RED and BLUE task organization
- o Probability of hit and probability of kill given a hit for all firing systems against all allowable targets for all ranges and target environments
- o Weapon basic load data
- o Platform dimensions
- o Weapon operational characteristics
- o Communications electronics operational characteristics and performance data
- o Trafficability, terrain, visibility, and weather data
- o NBC data

OUTPUT:

- o Computer printout of a complete time sequenced coroners report
- o Killer-victim scoreboard
- o Ammunition expenditures
- o Specific exchange ratio
- o Operational effectiveness ratio

MODEL LIMITATIONS:

- o Limited to 1000 dismounted infantry per side
- o Size allowable terrain is limited by the dimensions of the open area used to house the 1/3000 scale terrain boards
- o The model is manpower intensive
- o The ratio of real time to game time is approximately 60/1

HARDWARE:

- o Type of Computer: WANG 2200 Minicomputer
- o Operating System: WANG Basic II
- o Peripheral Equipment:
  Printer
  Punched/mark sense card reader
  Triple floppy disk drive
  Winchester 10 Mbyte hard disk drive

SOFTWARE:

- o Programming Language: WANG Basic II
- o Documentation:
  Users manual
  Programmers manual
  Controller manual

TIME REQUIREMENTS:

- o 6 weeks to acquire new data
- o 2 weeks to incorporate and validate new data
- o Approximately 7 days per game with dedicated minicomputer (dependent upon force size and structure)
- o 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION:

- o Model - UNCLASSIFIED
- o Data - SECRET

FREQUENCY OF USE: Continuous

POINT OF CONTACT: Director
US Army TRADOC Systems Analysis Activity
ATTN: ATAA-TDD
White Sands Missile Range, NM 88002

USERS:

- o Principal - TRASANA
- o Other
  - USAC&GSC
  - Rand Corporation
  - USAF Air Ground Operations School
  - Engineer Studies Group, Ft Belvoir, VA
  - Naval War College, Newport, RI
  - USAIS, Ft Benning, GA
  - USA Admin CTR, Ft Benjamin Harrison, IN
  - USA V Corps, FRG
  - USA AVN School, Ft Rucker, AL
  - Israeli Defense Force

KEYWORD LISTING: BATTLE, Wargame, Computer Assisted, Training, Analytical, Manual, Terrain Board

TITLE: BGM - Battalion Group Model

PROPONENT: LAI Division, DOAE, West Byfleet, Surrey, England

DEVELOPER: As above

PURPOSE: The BGM is a computer programme designed for the analysis of conventional warfare at battlegroup level and is used mainly for the assessment of direct fire weapons and their tactical use.

GENERAL DESCRIPTION: It is a deterministic model, usually used to describe a battle between a Red regiment and a Blue battlegroup. The smallest units represented are individual direct fire weapons. The suppressive effects of artillery and air bombardment are also included. The battle is divided into a number of time zones in each of which the positions of all weapons are fixed and their rates of attrition constant. The effects of terrain are taken into account by using average intervisibility (that is, the proportion of time on average for which a line of sights exists between two opposing groups) as a function of range. Large scale features like hills or ridges need to be taken into account separately by restricting fire when such features lie between the two groups. A typical run on an ICL 2900 series computer requires two or three minutes and uses less than 30 kbytes of store.

INPUT:

- o Time zones
- o Weapon characteristics (accuracy, lethality, response time)
- o Intervisibility as a function of range
- o Pinpoint data as a function of range
- o Initial deployment, movement of weapons and restrictions on their arcs of fire
- o ORBATs

OUTPUT:

- o Details of attrition rates in each time zone
- o Breakdown of who killed who for each time zone and cumulative totals
- o Times at which groups of weapons are eliminated
- o Weighted average kill powers of the two forces, for use in the TFG, NMC and Campaign Game

MODEL LIMITATIONS:

- o Absence of stochastic effects
- o Limited representation of Minefields and Barriers at present

HARDWARE: Nil

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SOFTWARE:

- o Model written in FORTRAN and run on ICL 2970
- o Adequate documentation exists at DOAE

TIME REQUIREMENTS:

- o Given a scenario, preparation of the data required takes perhaps half a day
- o The attrition caused is examined time zone by time zone and may cause tactics to be changed for the subsequent zones. The time required for this manual intervention depends on the computer turn round time but the whole process should take less than a day. (The model is not usually run on line)
- o In a study several hundred runs may be done spread over three months or so

SECURITY CLASSIFICATION:

- o Methodology: UNCLASSIFIED
- o More detailed descriptions: UK RESTRICTED
- o Database: Usually UK SECRET

FREQUENCY OF USE: Continuously

USER: LA1 and LA2 Divisions, DOAE

POINT OF CONTACT: LA1 and LA2 Divisions, DOAE
West Byfleet
Surrey, England
Telephone: Byfleet (09323) 41199

MISCELLANEOUS: Plans exist to incorporate a subroutine describing the crossing of a minefield in more detail

TITLE: BGWG - Battlegroup Level War Game

PROPONENT: MA4 Branch, RARDE, Sevenoaks, England

DEVELOPER: As above

PURPOSE: The game is designed for the analysis of conventional warfare at battlegroup level and is used mainly for the assessment of direct fire weapons and the generation of methods of tactical use. The game is manual, with all decision making by the players, with computer assistance for calculation, assessment of weapon effects, etc., and record keeping.

GENERAL DESCRIPTION: This is a two-sided game in which most events are stochastic (e.g., weapon effects, target acquisition) though some (e.g., vehicle speeds) are deterministic. It works in a time slice of 30 seconds but with a resolution of 1 second within a slice. The smallest units represented are individual AFVs, individual ATGW and infantry fire teams and the game usually examines a battle beteen a Red regiment and a Blue battlegroup. The ratio of game time to real time varies with the battle being studied, but it is usually between 1:50 and 1:150. Terrain is aggregated in 100m squares, but with specific features - buildings, woods, streams, roads - explicitly represented. The game can be played in any one of three modes:

1. Closed - with players from outside the BGWG staff playing in side rooms.
2. Open - with players from outside the BGWG staff playing on the control table with full view of both sides' pieces, and
3. "Absentee Commander" mode - with the Blue appreciation and plan being prepared by an officer outside the BGWG staff, but the subsequent gaming being played in the "open mode" with officers of the BGWG staff playing both Red and Blue.

The last is the mode most often used nowadays.

INPUT:

- o Weapon characteristics (accuracy, lethality, response time)
- o Acquisition rules
- o Movement rules
- o ORBATs
- o Scenario

OUTPUT: Raw data, with a very limited amount of manual processing. Facilities also exist for the preparation of target arrays and certain standard statistics related to exposures. Facilities can be provided in any series to collect and output data on any specific subject, appropriate to the level of the game.

MODEL LIMITATIONS:

- o A fairly crude level of command and control is now included and improvements are planned
- o The intervisibility model in use is slow and rather crude
- o The model of obscuration used is out of data and needs bringing up to date

HARDWARE: A three-dimensional terrain model has been used in the past, but nowadays the model used is usually one of the following, depending on the purpose and scale of a particular series:

- o Specially prepared, layer-tinted, large scale map
- o Large-scale aerial photographs
- o Photographically enlarged maps

SOFTWARE: The gaming programs are written in DATABUS and run on a DATAPOINT 6600. Consideration is being given to changing to BASIC. Little analysis is done as part of the game output, analysis in detail being left to the project officers of the projects in support of which the game is used.

TIME REQUIREMENTS:

- o Assuming that a scenario (provided by the project sponsor) and the necessary technical data have been provided and the necessary manual and computer "look-up" tables have been prepared, the time for one game to be set up (preparation of operational plans and deployment of pieces on the board) takes about 3-5 days.
- o Preparation of data for a new series may take 3-6 months, but this is carried out in parallel with the preceding series.
- o Play of an individual game takes 2-5 weeks and up to 8 games constitute a series, but exact timings and numbers depend on the purpose and detail of the series.
- o Detailed analysis of the results is not carried out by the game staff, but preparation of the output and delivery to project staff for analysis takes 2-4 weeks depending on the amount of detailed data collected during a series.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuously

USER: MA4 Branch, RARDE

POINT OF CONTACT: MA4 Branch, RARDE
Fort Halstead
Sevenoaks, Kent, England
Telephone: Knockholt (0959) 32222

MISCELLANEOUS: A continuous program of game enhancement and improvement is in hand, including in particular:

- Improved computer support of the gaming process, while leaving as much decisionmaking as possible to the players.
- Improved representation of the terrain used for the intervisibility calculations in the computer.
- Constant up-dating of data as fresh or more realiable data becomes available.

The description above is accurate as of 1 November 1981.

TITLE: BLOCKBUSTER

PROPONENT: Manual and Computer Supported Simulations Division, Battle Simulation Development Directorate, Combined Arms Training Developments Activity

DEVELOPER: Same as proponent

PURPOSE: Train company commanders and platoon leaders to plan and conduct combined arms combat operations in and around urbanized terrain. Capabilities of vehicles, weapon systems, and personnel in a MOUT environment.

GENERAL DESCRIPTION: A three-dimensional, manual battle simulation system designed for the purpose of conducting leader training in Military Operations on Urbanized Terrain (MOUT). Players employ miniature vehicles and dismounted units on a scaled terrain board according to an operations order and the rules of play. The rules are designed to accurately simulate the capabilities of vehicles, weapon systems and personnel. A 6-8 hour exercise will represent approximately 15-30 minutes of combat.

INPUT:

- o Order of Battle
- o Terrain and Weather

OUTPUT:

- o Combat resolutions are derived from the use of combat results tables (CRTs) based on weapon/unit employment and random number generators.
- o All reports are based upon these CRTs and are produced in accordance with units SOPs manually.

MODEL LIMITATIONS: Game time vs real time.

HARDWARE: Three-dimensional terrain board.

SOFTWARE: N/A

TIME REQUIREMENTS:

- o 3-5 hours player learning time
- o 8 hours playing time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: User determined

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USERS: Unknown

POINT OF CONTACT: Commander, Combined Arms Center
ATTN: ATZL-TDD-SM
Fort Leavenworth, Kansas 66027
AUTOVON 552-3180/3395
Commercial: (913)-684-3180/3395

TITLE: BLUE MAX - Variable Airspeed Flight Path Generator

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: Analysis

GENERAL DESCRIPTION: BLUE MAX is used to generate a variable speed flight path used in conjuction wth AAA and SAM attrition models in the study of aircraft survivability. Five types of maneuvers - (1) navigation, (2) base, (3) roll-in/dive, (4) pull-off, and (5) recovery/ link legs - are included in the model. The methodology is based on the asumptions that the pilot is able to exercise control of only three variables: pitch, roll, and power. The rate of change and magnitude of these variables is a function of the type of maneuver encountered. The model treats the aircraft as a point mass, solves for the lift, drag, and thrust to determine the three orthogonal accelerations in the body axis and then transform them into an inertial reference. These inertial accelerations are then used to update the velocity and position of the aircraft.

INPUT:

- o Requirements depend on the type maneuver desired and are requested by the computer when an appropriate maneuver is designated
- o Includes initial altitude, airspeed heading, pitch, a/c weight and drag
- o Further inputs will be required for changes in pitch, heading, "G" power constraints, and time for maneuver

OUTPUT: Computer printout listing a/c position data, speed, heading, pitch, roll, "G", throttle setting, and AOA.

MODEL LIMITATIONS:

- o Requires interactive programing to create flight path in segments with maximum of 20 segments per flight path modeled
- o Limited to a/c contained in data base

HARDWARE: Current compatible with MULTICS and IBM computers

SOFTWARE:

- o Currently written in FORTRAN
- o Documentation: Limited documentation is available in AFSAGF

TIME REQUIREMENTS: Average time to create a single flight profile is approximately thirty minutes.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Three to five times a month

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Maj Carlton L. Pannell)
The Pentagon
Washington, D.C. 20330
AUTOVON 224-4247
Telephone: (202) 694-4297

TITLE: BREACH - Battlefield Related Analysis of Concepts and Hardware

PROPONENT: SD&MD, LCWSL, ARRADCOM, Dover, NJ.

DEVELOPER: IITRI, Chicago, IL.

PURPOSE: BREACH is used to perform a variety of analyses ranging from hardware analysis to operations analysis.

GENERAL DESCRIPTION: BREACH is computer modeling language that is structured for performance analysis and evaluation of hardware in a battlefield environment. Rather then a specific model, it provides the means for modeling a wide variety of hardware with a varying degrees of resolution in many possible situations. BREACH may be played either as an interactive war game or as a stand-alone simualtion.

INPUTS:

- Weapon characteristics
- Ammunition characteristics
- Environmental description
- Combat Organization Data
- Tactics

OUTPUTS:

- User defined including:
- various levels of statistics
- computer plots

MODEL LIMITATIONS:

- Large core required limits interactive play.

HARDWARE:

- Terrain table may be used to facilitate interactive play

SOFTWARE:

- Model is written in FORTRAN and runs on a CDC 6600.

TIME REQUIREMENTS:

- This depends entirely on the scope of the problem and may range from 1 day to several months.

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: Infrequent.

USERS: SCWSL, LCWSL, ARRADCOM

TITLE: Brigade and Unit War Game Assisted Command Post Exercise

PROPONENT: War Games Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada

DEVELOPER: As above.

PURPOSE: The game is designed to exercise unit and brigade command posts dynamically in virtually all operational aspects such as appreciations and plans, orders, intelligence, fire support coordination, staff duties, radio procedures, standing operating procedures, etc. and in administrative and logistic support procedures particularly as they relate to handling and replacement of personnel and vehicle casualties, replacement on major natures of ammunition, delivery of mines, etc.

GENERAL DESCRIPTION: This is a manual, closed, two sided game, with split command levels, conducted in real time (real time/game time ratio 1:1) with a five-minute game time interval. The force being exercised is a brigade group, of various compositions, within a divisional framework against a reinforced Warsaw Pact tank or motor rifle division and other elements of combined arms army and frontal aviation. In the force being exercised, all unit command posts and the brigade command post are deployed and functioning. Lower controllers from each unit are the respective sub-unit commanders (e.g., company, platoon, detachment, squadron, troop), forward observation officers, etc., covering all sub units within the brigade. The control maps used are colour enlarged (1:10,000 or 1:12,000) and the level of detail is down to troop or platoon sized sub-units and individual equipments such as heavy anti-armor weapons, air defence weapons and helicopters. Rules, including deterministic and probabilistic, cover these areas: movement, both administrative and tactical in and out of contact; indirect fire including high explosive, illumination and smoke; detection; direct fire from tank guns, anti-tank guided weapons and machine guns; demolitions, craters and mines including the whole range of obstacle preparation and reduction, and minefield laying and breaching; air support including fixed wing reconnaissance and fighter ground attack; air defense; helicopters including observation, attack and transport operations.

INPUT:

- Scenarios approved by Mobile Command Headquarters and Director General Intelligence Services.
- Organizations and establishments approved by Mobile Command Headquarters.
- War Game rules, as above, prepared and used by War Games Section of DLOR.

OUTPUT:

- Assessment techniques are designed so that overall realistic outcomes can be arrived at quickly from which lower control intelligence and reports can be extracted relevant to the level of play. The information which lower controllers get, i.e., interaction outcomes within the dynamic battle framework, is that which the sub-unit commander, for example a company commander, would normally have available to him in actual operations and from which he would forward situation reports, states returns, situation assessments, battle damage, etc. These become the battle inputs to the exercised unit command posts for subsequent decisions and orders and also drive the logistics activities.

MODEL LIMITATIONS:

- Cannot be conducted without DLOR War Game staff controllers and supervising assessors.
- Requires large control room staff.

HARDWARE:

- 1:10,000 or 1:12,000 scale coloured maps for control board.

SOFTWARE:

- At present manual assessments. Detailed logs are maintained by all lower controllers and command posts. In future it is planned to integrate computer support for some assessments.

STAFF:

- DLOR War Game Staff of eleven Military officers, four NCOs and two scientific officers for controllers and supervising assessors. Three or four lower controllers/per unit being exercised. The brigade command post and all unit command posts within the brigade are deployed and operating.

TIME REQUIREMENTS:

- A lead time of about 6 months is required, but not full time work, commencing with scenario and setting, acquisition of maps, etc.
- Preparation: Preparations by the brigade are as for a normal command post exercise but with DLOR advice and assistance for control room set up and in operation.
  The formation or unit being exercised obtains/provides the large scale control room maps and prepares the detailed playing pieces in accordance with the force organizations.
  DLOR prepares/revises war game rules.

- Play: The War Game portion of the exercise may last up to 30 hours of continuous operation.

- Analysis: Analysis is not carried out but a post exercise critique is conducted immediately following play with the brigade commander, unit commanders, chief controller and designated other members of the war game staff. The critique report is forwarded to the headquarters of the formation or unit being exercised.

SECURITY CLASSIFICATION: Restricted overall. Rules, which remain under DLOR control, are of various classifications.

FREQUENCY OF USE: On average, one exercise annually.

USERS: Brigades of Mobile Command.

TITLE: Brigade Level Research War Game

PROPONENT: War Games Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada.

DEVELOPER: As above

PURPOSE: To study the effectiveness of current and proposed force structures for the Canadian land forces in a variety of tasks and environments. The principal areas of effectiveness focused on are plans, operations, organizations and equipments.

GENERAL DESCRIPTION: This is a closed, two-sided game with a five-minute game time interval. Detailed computer simulations are used in some assessment areas, notably direct fire, helicopter, indirect fire, target acquisition, fighter ground attack, fixed wing reconnaissance and electronic warfare, while other assessments are carried out manually. All record keeping is done by computer and most of the quantitative analysis.

The force, or parts thereof being examined, is brigade group size, of various compositions, within a divisional framework and with additional resources allocated such as fixed wing aircraft fighter ground attack and reconnaissance sorties. The opposing force, of various compositions and at the level appropriate for the phase of war, is drawn from formations and other elements of a combined arms army. The level of interaction is down to platoon/troop level and individual equipments such as heavy, medium and light anti-armor weapons, air defense weapons, helicopters, bridging equipment, etc.

INPUT:

- Scenarios approved by the sponsor (e.g., Chief of Land Doctrine and Operations) and Director General Intelligence Services.
- ORBAT as above with specific equipments and detailed or assumed technical and performance characteristics.
- Direct fire computer simulation including probabilistic line of sight, detection, acquisition and engagement rules related to terrain types, tactical status and other relevant conditions.
- Helicopter computer simulation for observation, armed and attack roles primarily in hover up mode. Run-in attacks and designations are simulated with manual input of the number of helicopter exposures and randomly selected time (in seconds) of the exposures. The simulation includes probabilistic five minute interactions between the helicopter and up to 10 homogeneous groups of similar items and weapons. The model is critical-event oriented and uses probabilistic line-of-sight, detection, acquisition and engagement rules. The result of each helicopter exposure can be monitored, if desired, and the simulation stopped when military criteria have been reached.

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- Indirect fire computer simulation for up to 10 batteries firing at up to 10 targets, unit nature and amount of ammunition, type of target, status, neutralization suppression and equipment and personnel casualties being considered.
- Air Defense versus Fixed Wing computer simulation for determination of results due to interactions between air defense weapon sites and aircraft. Each air defense weapon site is assessed individually and in chronological order. Results are determined probabilistically including field of view, line of sight, detection, engagement, and kill.
- Electronic warfare rules, chemical assessment rules, movement rules, engineer rules, fixed wing air rules and air defence rules including detailed performance parameters.

OUTPUT:

- Location and status states plus all assessment output data are inputs to bookkeeping programs from which subsequent outputs enable reconstruction of all or any part of the war game for replication or side analysis. From these data, snapshots of battle areas can be obtained as well as accountability of killer-victim specific equipments by cause against range and suppressive conditions, and ammunition expenditures by natures.
- Only the raw data from direct fire and helicopter simulations which are necessary as inputs to the bookkeeping programs are transferred. Additional raw data from these simulations are used in certain analytical programs.

MODEL LIMITATIONS:

- Inadequate electronic warfare. Slow rate of play. This is attributable for the need to manually input all location, status and assessment data for some bookkeeping programs.

HARDWARE:

- 1:10,000 or 1:12,500 scale colour enlarged map. HP 2000 Access for direct fire and helicopter simulation. A dedicated PDP 11/34 computer for Indirect Fire, FWA and Target acquisition simulations, and also administratively for all bookkeeping, data storage and analysis.

SOFTWARE:

- Direct fire and helicopter simulations are in BASIC on HP 2000 Access bookkeeping programs are in FORTRAN. Indirect fire, FWA and Target acquisition programs are in FLECS.

STAFF:

- Eleven military officers, four NCOs, three scientific officers and one computer operator. This includes control room, RED sideroom and BLUE sideroom staff. It is normal for the sponsor to provide a BLUE force commander.

TIME REQUIREMENTS:

Preparation:	Up to six months lead time is required for sponsor preparation of scenario, ORBAT, game objectives and ultimately operational plans. Given these, data base preparation and loading requires two to three weeks, and deployments two to three days.
Play:	Games usually are played to cover from about six hours to 24 hours of battle dependent upon game objectives. Real time/game time ratios vary from about 15:1 to 100:1 dependant upon the forces involved and the game objectives.
Analysis:	Approximately three to five months and, in general, much less.

SECURITY CLASSIFICATION: SECRET overall. Selected modules UNCLASSIFIED.

FREQUENCY OF USE: Continually

USERS: DLOR War Games Section

TITLE: Brigade Level War Game Assisted Command Post Exercise.

PROPONENT: War Game Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada.

DEVELOPER: As above.

PURPOSE: The game is designed to train and exercise staff college students in brigade staff work in a dynamic setting within the divisional battle.

GENERAL DESCRIPTION: This is a manual, closed, two-sided game, conducted in real time (real time/game time ratio 1:1) with a five-minute game time interval. The force being exercised is a brigade group in an assault water crossing. Two games are run concurrently with all lower controls and brigade command posts duplicated, but with a single higher control responding as division headquarters.

Brigade lower controllers represent unit commanding officers and forward observation officers. DLOR war game controllers carry out the sub-unit tactics in addition to discharging their controller duties.

Symbology, rules and assessment procedures are as for "Brigade and Unit War Game Assisted Command Post Exercise."

INPUT:

- Scenario, organizations and establishments prepared by Canadian Land Forces Command and Staff College (CLFCSC) Kingston.

OUTPUT:

- Assessment techniques are designed so that overall realistic outcomes can be arrived at quickly from lower control intelligence and reports can be extracted relevant to the level of play. The information which lower controllers get is that which a unit commander, e.g., battalion commander, normally would have available to him in actual operations and from which he would forward all operations reports and returns on the command net to the brigade command post.

MODEL LIMITATIONS:

- Cannot be conducted without DLOR war game staff controllers and supervising assessors.

HARDWARE:

- 1:12,500 scale coloured maps for control board.

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SOFTWARE:

- Nil.
- Manual assessments.
- Detailed logs are maintained by lower controllers, brigade command posts and higher controllers.

STAFF:

- DLOR War game staff of element military officers, four NCOs and one scientific officer as controllers and supervising assessors.
- Each brigade lower control cell comprises six student representing units of the brigade.
- Brigade command posts have all staff positions manned by students.

TIME REQUIREMENTS:

- Preparation: Given the scenario, preparation of operational plans by the players and realization of deployments on the control maps takes 1 - 2 days. Within this period DLOR war game staff brief and train lower controllers and assessors as necessary.
- Play: The war game portion of the exercise usually is conducted from eight to nine hours.
- Analysis: All detailed logs are retained and analyzed for staff lessons.

SECURITY CLASSIFICATION: Unclassified overall. Rules, which remain under DLOR control, are various classifications.

FREQUENCY OF USE: Until 1981 there were two exercises annually. Now game is in abeyance until CLFCSC decide to reinstitute.

USERS: CLFCSC Kingston.

MISCELLANEOUS:

- Two games are run concurrently in each exercise.
- It is intended that this war game will be mechanized under the Staff Training Tactical Simulator (STS) project. Project definition has been completed and DLOR rules and assessment procedures are being computerized now.

TITLE: BUILDUP

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The BUILDUP model determines the buildup of commodities at their destinations after they have traveled through multimodel transportation networks. It provides the analyst with a tool to determine the sensitivity of the buildup rate to changes in many parameters of the transportation system.

GENERAL DESCRIPTION: BUILDUP is a multi-sided, deterministic model involving land, sea, or air vehicles. The heart of the program is an algorithm for minimizing the time to move "packages" through multimodel transportation networks without losing the identity of the package. This algorithm selects from all feasible routes from the origin to destination that route which permits the package to arrive at its destination on the earliest day.

INPUT: Card images from detailed files generated by the Movement Requirements for Studies and Analysis (MORSA) file and updated from RAPIDSIM simulations via processing programs.

- o Number of periods being simulated
- o Number of vehicle classes
- o Onload time
- o Offload time
- o Speed, in kilometers per day, for each vehicle class

OUTPUT:

- o Output is in the form of computer listings reflecting:

  (1) The link origin
  (2) The link terminal
  (3) The mode of the link
  (4) The length of the link
  (5) The capacity of the link
  (6) The time to traverse the link in days
  (7) Vehicle limit by class
  (8) Speed in km/day for each vehicle class

MODEL LIMITATIONS:

- o Maximum number of links - 1600
- o Maximum number of nodes - 450
- o Maximum number of modes - 20
- o Maximum number of vehicles - 20
- o Maximum number of days - 40
- o Maximum number of packages - 900

HARDWARE:

- o Computers: CDC 6400; HIS 6080; IBM 360
- o Operating System: SCOPE (CDC); GCOS (HIS); OS (IBM)
- o Minimum Storage Required: 35K words (CDC); 55K words (HIS); 250Kbytes (IBM)
- o Peripheral Equipment: Tape and disk drive

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Users Manual, General Research Corporation, March 1974
- o Technical documentation is not available

TIME REQUIREMENTS:

- o 10 man-hours to structure input
- o 30 minutes CPU time per model cycle
- o 5-10 man-days to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS:

- o Principal: Organization of the Joint Chiefs of Staff (J-4)
- o Other: Director, Planning and Evaluation
  Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (20) 697-5464

MISCELLANEOUS: The BUILDUP model can be proccessed via MULTICS.

KEYWORD LISTING: Analytical Model; Computerized; Transportation; Deterministic

TITLE: BVR - Beyond Visual Range

PROPONENT: Aeronautical Systems Division (ASD/XRM) Air Force Systems Command

DEVELOPER: ASD/XRM

PURPOSE: There are two types of air-to-air combat. The first is Visual Range, or Dogfight combat. The second is Beyond Visual Range combat. The latter is becoming increasingly important in the design of aircraft and air-to-air missile systems. BVR was written in order to provide ASD/XRM with some analytical capability in this area.

GENERAL DESCRIPTION: BVR is an M on N model between two opposing forces of aircraft. Time is modeled in terms of events where an event is the firing of a missile. Outcomes of events are determined by drawing random numbers.

INPUT:

- o Number of aircraft per side
- o Probability of kill of each side's missile
- o Coordinated or uncoordinated target assignment "Fire-First Option"
- o Number of events per encounter
- o Number of encounters to be modeled

OUTPUT:

- o The detailed output option gives an event-by-event description of each encounter including:
  - Which aircraft fires at which target and whether the shot is a hit or miss.
  - The numbers of RED and BLUE aircraft that have been destroyed at the conclusion of each encounter.
  -
- o Both the detailed and non-detailed outputs give a summary which include:
  - Average numbers of BLUE and RED aircraft hit per encounter
  - Standard deviations of BLUE and RED aircraft hit per encounter
  - A table conveying how many encounters ended with 1, 2, 3, ... m aircraft being hit.

KEY LIMITATIONS:

- o No aircraft maneuvering
- o Missiles only
- o Ten aircraft per side maximum
- o Hits determined randonly, either hit or miss, No "in between" damage level

HARDWARE:

- o Operating System: Tektronix 4081
- o Minimum Storage Required Storage: under 65K
- o Peripheral Equipment: No peripheral equipment needed

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: BVR user's manual (Draft) expected date of publication - Dec 81

TIME REQUIREMENTS:

- o No data base
- o To structure data in model input format one minute
- o To analyze output 20 minutes
- o Player learning time 10 minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: ASD/XRM

POINT OF CONTACT: Mr. Gerald T. Bullmaster
ASD/XRM, Bldg 47
Wright-Patterson AFB, OH 45433
Telephone: (513, 255-6261

MISCELLANEOUS:

- o Future enhancements:
  - Long and short range missiles
  - Aircraft maneuvering
  - Aircraft limited in number of missiles
  - Missile flyout routine

KEYWORD LISTING: Computerized, Analytical; Monte-Carlo, Air-to-air, Beyond Visual Range; Simulation

TITLE: CAM-K - Combat Analysis Model, Korea

PROPONENT: Commander in Chief, Pacific

DEVELOPER: Army Materiel Systems Analysis Agency
Operations Analysis Office, Combined Forces Command, Korea
Research and Analysis Division, HQ, CINCPAC

PURPOSE: The purpose of the model is to permit the study of battalion and regimental-size battles and to determine the effectiveness of changing force mixes and weapon parameters.

GENERAL DESCRIPTION: The model is designed to determine the outcome of battalion and regimental size battles but smaller units can be studied. Each weapon and target are simulated explicitly. Game time is 8-15 times faster than real time. Human players, set up the battles and the computer program computes the losses on both sides. Each succeeding battle must be set up by human players, based on the outcomes of previous battles.

INPUT:

- o Size of the battle area, usually 3 km by 5 km
- o Terrain type, one of three classes reflecting trafficability
- o Length, width, and time to penetrate barriers and obstacles
- o Quantity and types of weapons on each side
- o Defensive position hardness
- o Effective ranges and PKs of weapons against various targets
- o Firing rates of weapons
- o Speeds of vehicles

OUTPUT: Tables showing the following:

- o Numbers of each type of weapon surviving on each side
- o Numbers of attacker's weapons killed by each defender weapon type
- o Number of defender weapons killed by each attacker weapon type

MODEL LIMITATIONS:

- o This model is limited to the study of small unit battles.
- o Attrition of artillery and close air support aircraft is not handled explicitly by the model but must be taken into account outside the model.
- o Each battle ends when the attacker is stopped or when the attacker succeeds in making contact with the defender. There is no ebb and flow of battle. That is, if the defender suddenly goes on the attack, it is necessary to set up another battle outside the computer.

HARDWARE: WANG 2200 with 32K of storage.

SOFTWARE:

- o Program Language: BASIC
- o Documentation: in draft

TIME REQUIREMENTS:

- o To acquire data base varies
- o 1-2 weeks to structure data in model input format
- o To analyze output varies
- o 1 week for player learning time
- o Playing time per cycle varies
- o 5 minutes CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Research and Analysis Division
CINCPAC, Box 15, J55
Camp H. M. Smith, HI 96861

FREQUENCY OF USE: As needed

USERS:

- o CINCPAC
- o Combined Forces Command, Korea

KEYWORD LISTING: Small Unit Battles, Ground Warfare.

TITLE: CAMMS - Computer Assisted Map Maneuver Simulation

PROPONENT: Manual and Computer Supported Simulations Division, Battle Simulations Development Directorate, Combined Arms Training Developments Activity

DEVELOPER: Same as Proponent

PURPOSE: CAMMS is designed to exercise commanders and staffs at battalion and brigade level with normal combat support and combat service support elements in a simulated non-nuclear, combined arms combat environment against appropriate enemy forces. Command and control, staff coordination in a simulated combat environment.

GENERAL DESCRIPTION: CAAMS is a computer-assisted, two-sided, mixed, land and sea training, general war model.

INPUT:

- o Order of Battle
- o Terrain and Weather

OUTPUT:

- o Computer printouts stating combat results, consumption rates, remaining status
- o Special logistic or unit status reports available by special request retreival

MODEL LIMITATIONS: Units played and logistic/admin items tracked limited to those which already exist within the data base.

HARDWARE:

- o Computer: Time share leasing with General Electric Computer Services
- o Peripheral Equipment
  - TI Silent 700 (Model 745) Data Input/Output device needed for link-up with hardware
  - Phone service to support TI 745s

SOFTWARE: N/A

TIME REQUIREMENTS:

- o 8-12 hours player learning time
- o Playing time per cycle: As desired

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 75 times per year

USERS: RC, NG, Active US Army

POINT OF CONTACT: Commander, USACAC
ATTN: ATZL-TDD-SM
Fort Leavenworth, Kansas 66027
AUTOVON 552-3180/3395
Commercial - (913) 684-3180/3395

MISCELLANEOUS: N/A

KEYWORD LISTING: N/A

TITLE: CAMP - Computer Assisted Match Program

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: CAMP is used as a tool in force structuring and in movement requirements analysis. CAMP interfaces DA force planning files (Force Accounting System), CAA's Force Analysis Simulation of Theater Administration and Logistic Support (FASTALS) theater roundout model, and various logistical data files to produce force movement requirements for input to various strategic mobility models.

GENERAL DESCRIPTION: CAMP consists of two major functions: Force Match Algorithm (FMA) and Movement Requirements Generator (MRG). FMA compares an actual or planning force with time phased type unit requirements for a specific situation and scenario. Required units are selected and assigned a destination theater and required delivery date (RDD). Notional units are created to make up shortfalls in the force. MRG develops detailed movement requirements (origin, destination, travel mode, availability date, RDD, and movement characteristics) for all deploying units, determines non-unit movement requirements (materiel resupply, personnel replacements and fillers) to support the deployed forces. Unit and non-unit movement requirements are developed in the format required for input to various strategic mobility models used at CAA and at Joint Chiefs of Staff (JCS) level. CAMP has been interfaced with the Unit Data System (UDS) to provide a generalized report generator capability.

INPUT:

- o Type unit requirements such as those provided by the FASTALS model
- o Force Accounting System (FAS) force file
- o TUCHA (Type Unit Characteristics) file
- o Geographic Location Codes
- o POMCUS and Preposition War Reserve data
- o Resupply, Consumption and Casualty Rates
- o Other service movement requirements

OUTPUT:

- o Force Accounting System file overlaid with match results
- o Army movement requirements in Mobility Requirement for Staff Analysis (MORSA) format
- o Multi-Service movement requirements in Transportation Model (TRANSMO) format

MODEL LIMITATIONS:

- o Many input files are not produced at CAA. Quality control of these files is sometimes difficult.

HARDWARE:

- o Computer: UNIVAC 1100 Series
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 60K words
- o Peripheral Equipment: Mass storage devices and tape drives

SOFTWARE:

- o Programming Language: ASCII FORTRAN and COBOL
- o Documentation: CAA-D-76-5, Computer Assisted Match Program (CAMP), August 1976

TIME REQUIREMENTS:

- o 2 weeks to acquire data base
- o 1 week to load data files
- o 2 weeks initial force match
- o 2 weeks for force modification and generation of movement requirements
- o 3 hours computer time for a two-theater force on a UNIVAC 1100/82
- o 2 weeks to analyze results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Ms. Margaret Laudin
US Army Concepts Analysis Agency (CSCA-JFJ)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-1137

KEYWORD LISTING: Model, Computer, Force Planning

TITLE: CAM-SAAB - Countering Anti-Ship Missiles - Simulated Air-to-Air Battle

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: CAM-SAAB is a computerized fleet air defense model designed to ascertain the level of attrition that defensive interceptor aircraft can inflict upon the missile-carrying aircraft of attack formations. The model determines the effect of using fleet interceptors such as F4s or F14s, with various weapon l and with varying radar configurations.

GENERAL DESCRIPTION: CAM-SAAB is a two-sided model having both deterministic and stochastic elements. Only air forces are involved. The model is designed to consider from one to one hundred individual defensive aircraft versus from one to fifty offensive groups. Offensive groups may consist of any number of aircraft from one to some practical limit of about thirty. The model can aggregate up to fifty such raid groups versus one to four aircraft carrier fleets. (Aircraft are either in the game or not. Unlike many such games, no fractional aircraft fly.) Simulated time is treated on an event-store basis. The primary solution technique used is probability. Individual aircraft maneuver and engage in three-dimensional space.

INPUT:

- o Fleet and raid makeup and position
- o Weapon characteristics
- o Radar characteristics
- o Weather conditions
- o Interceptor launch strategy
- o Interceptor/raid escort tactics

OUTPUT:

- o Summary data of raid/defensive aircraft destroyed, number of ASMs launched, etc.
- o Detailed results of individual interceptions
- o Detail and summary outputs are available for each iteration
- o Detailed step-by-step printouts are also available for each event within a selected iteration. Tape outputs are also available of the step-by-step printouts, and of the detail and summary outputs for analysis programs. Subsequent programs summarize across iterations.

MODEL LIMITATIONS:

- o The only interceptors provided for are F-4s and F-14s
- o The only missiles provided for are the Phoenix, Sparrow (E,F), and Sidewinder
- o Maximum of 6 AEW, 12 CAP, 100 DLI, and 50 raid groups
- o Maximum of 1 task group center

HARDWARE:

- o Computer: CDC 3600, CDC 3800, CDC 3400
- o Operating System: SCOPE
- o Minimum Storage Required: 32K, but 65 K is preferred
- o Peripheral Equipment: 2 scratch units (disk or drum files, or scratch tapes)

SOFTWARE:

- o Programming Language: FORTRAN, COMPASS (ASSEMBLY)
- o Documentation consists of a Model Description, Input Specifications, General Flow Description, Narrative Description of Major Routines, Radar and Geometrical Equations Used, Vectoring and Engagement Relationships. Both user's documentation and technical documentation are complete. Certain technical documents are classified CONFIDENTIAL.

TIME REQUIREMENTS:

- o 6 months to acquire base data
- o 2 man-weeks to structure data in model input format
- o 30 seconds CPU time per model cycle

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 100 per year

USERS: Center for Naval Analyses

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

MISCELLANEOUS:

- o CAM-SAAB is linked to CAM/SAM (Countering Anti-Ship Missiles - Surface to Air Missile Submodel) which deals with ASMs after launching. CAM-SAAB indicates the numbers and sources of these missiles after the air-to-air battle.
- o CAM-SAAB supersedes FAA and SAAB

KEYWORD LISTING: General War (Non-Nuclear); Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Event Store

TITLE: CAM/SAM - Countering Anti-Ship Missiles - Surface-to-Air Missile Submodel

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: CAM/SAM is a computerized model that addresses the problem of ship-based surface-to-air missiles (SAM) defense against attacking air-to-surface missiles (ASM) and surface-to-surface missiles (SSM). Assumptions in the model limit battle time to less than 1 hour (the model is primarily designed for a 20-30 minute engagement), but the model is designed for consecutive runs (provided that input data is updated) using the end of the previous engagement as the start time for the second engagement. In addition, the model addresses the following problems: (1) SAM anti-ship missile interactions; (2) interceptor engagements; (3) electronic countermeasures; (4) guns (platforms and/or missiles); (5) sensitivity studies on the vulnerability of shipboard systems simulated, including task configuration.

GENERAL DESCRIPTION: CAM/SAM is a two-sided, stochastic model designed to consider a task force (whose ships are ranked by four levels of priority) against any number of attacking ASMs or up to 60 ships (of 15 classes) with 10 radar classes, 5 jamming locations, 2 jamming power levels, 50 SAM batteries (of 10 classes) and up to 4 batteries per ship (including BPD), with 6 fire control channels and 4 launcher rails per battery. It can also consider anywhere from one attacking enemy missile to 99 ASMs launched, or up to 50 ASM launch sources, with any number of missiles being launched from any source. SAM and ASM may be nuclear, conventional or mixed. Attacking missiles are limited to 5 weapon classes. The primary solution techniques used are Monte Carlo, mechanized bookkeeping, and probability-random numbers to test survivability.

INPUT

- Detectability ranges for each radar class
- Description of radar classes
- Description of jamming sources
- Description of enemy weapon classes
- Description of SAM classes (Talos, Tarrier, etc.)
- Detection and lock-on delay distributions for each radar class
- Description of ship classes
- Ship positions
- ASM descriptions or ASM launch source descriptions
- ECM interference levels
- Miscellaneous game inputs and print options

OUTPUT: Output runs the spectrum from stop action reports on all systems and missiles to summaries of any number of iterations, including mean and standard deviations. Plots and histograms are also available. Some options are:

- o Data array sequentially printed
- o List of events stored and retrieved
- o Ship, SAM, and ASM status arrays at end of game
- o Intercept time and coordinates
- o Priority assessment event printout
- o Jamming strobe arrays
- o Reaction decision event printout
- o Lock-on/decision-to-fire event printout
- o SAM launch event
- o Intercept event
- o ASM impact event
- o Kill assessment event
- o ASM launch/detection event printout
- o Random targeting information
- o Partial input arrays
- o Targeting list
- o Intercept diagram of SAM trajectories
- o Event sequence printout for each SAM battery

MODEL LIMITATIONS:

- o See General Description (above) for maxima of ships, radars, batteries, missiles, etc.
- o Maximum duration of 99.99 minutes

HARDWARE:

- o Computer: CDC 3800
- o Operating System: SCOPE
- o Minimum Storage Required: 26.5K
- o Peripheral Equipment: Plotter (optional), load and go tape or card reader

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a set of appendices to NAVWAG Study No. 62, "Countering Anti-Ship Missile Study," CONFIDENTIAL. Appendix I of Volume 6 illustrates the computer model and describes inputs.
- o User's documentation is complete through September 1971. Technical documentation is complete through December 1970. Beyond the Appendix mentioned above, there is no complete user guide or programmer manual.

TIME REQUIREMENTS:

- o About 2 months to acquire base data
- o Up to 1 man-month to structure data in model input format
- o Approximately 1 minute CPU time for an average iteration, although this varies with the size of the game
- o Maximum of 1 month learning time for users
- o Up to 6 months to analyze and evaluate results

SECURITY CLASSIFICATION: The model is CONFIDENTIAL. Input is SECRET.

FREQUENCY OF USE: Twice annually.

USERS:

- o Principal: Center for Naval Analyses
- o Other: Carderoc, Aplied Physics Laboratory, Pentagon

POINT OF CONTACT: Center for Naval Analyses
1400 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

MISCELLANEOUS:

- o CAM/SAAB provides input to the CAM/SAM in the form of the numbers and sources of ASMs after air-to-air battle
- o CAM/SAM supersedes the FAAW-III Model
- o It is currently planned to add amore realistic nuclear game to the model, including psi effects, etc.

KE WORD LISTING: Limited War, Air Forces, Sea Forces, Computerized, Two Sided, Stochastic, Event Store

TITLE: CARMONETTE - Computer Simulation of Small Unit Combat

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation and the US Army Concepts Analysis Agency

PURPOSE: Analysis of battalion-level combat doctrine and tactics

DESCRIPTION: CARMONETTE is a computerized, Monte Carlo, event sequenced simulation of a combined arms air/ground war game, played on a terrain representation of 60 x 99 grid squares at 100 meters resolution for an hour of combat engagement. Force representation of infantrymen or various vehicles including tanks, armored personnel carriers, air defense, and helicopters at the individual-up to platoon size group in a battalion-level force. Events pertain to surveillance, movements, communication, and weapon activities. Surveillance considers the effects of battlefield obscuration including weather, aerosol smokes, and artillery dust. Probabilities of hit and kill considers the biased dispersion of weapon systems based on moving firer/targets. Output consists of displays and detailed reports including the killer/victim scoreboard.

INPUT: Troop lists; weapon lists; weapon accuracy; weapon performance data; weapon lethality; sensor performance data, vehicle mobility characteristics; vehicle vulnerability; tactical scenario; terrain characteristics.

OUTPUT: Output is in the form of computer printout listing all events assessed, with a summary of all casualty events, and summation of kills by target type and weapon types. Also available are summaries of weapon engagements (firings) shown by target type, rounds fired, personnel and vehicles killed for each of the selected range brackets.

MODEL LIMITATIONS:

- Maximum of 56 weapon types
- Maximum of 99 weapon units (each side)
- Maximum is 60 x 99 grids of selectable size (5m to 250m)
- Does not treat logistics
- Player cannot change tactics during a single game, he must write a new scenario for a new game

HARDWARE:

- Computer: UNIVAC 100 series
- Operating System: UNIVAC 110 Operating System
- Minimum Storage Required: 110K words
- Peripheral Equipment: 4 storage files

SOFTWARE:

- Programming Language: ASCII FORTRAN

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- o Documentation: CARMONETTE
  - Volume I (ADA007843) General Description, 1974
  - Volume II (ADA007844) Data Preparation, 1974
  - Volume III (ADA007845)Technical Documentation, 1974
  - Attack Helicopter Organization 1985 (ATHELO)
  - Target Acquisition Modeling, Appendix H, May 1979. CAA-SR-79-7
- o Both user's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 man-month to structure data in mode input format
- o 2-3 hours playing time for 15 replications of a 50-minute battle on a UNIVAC 1100/82
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: US Army Concepts Analysis Agency, TRASANA, MICOM, Army Aviation Systems Command

POINT OF CONTACT: Mr. E J. Rose
US Army Concepts Analysis Agency (CSCA-MCM)
Bethesda, MD 20814
Telephone: (202) 295-0163

KEYWORD LISTING: Analytical Model, Damage Assessment/Weapon Effectiveness, Land Forces, Air Forces, Computerized, Two-Sided, Stochastic, Event Store

TITLE: CARMONETTE/TRASANA (C/T)

PROPONENT: US Army TRADOC Systems Analysis Activity (TRASANA)

DEVELOPER: USA TRASANA (major modifications to version obtained from US Army Concepts Analysis Agency)

PURPOSE: C/T is a computerized simulation of conventional combat involving small unit, combined arms forces. The model is used principally in cost and operational effectiveness analyses in support of the Army's materiel acquisition process. Studies using the model typically involve the investigation of the feasibility/desirability of alternative weapon systems, sensors, and tactics over a range of scenarios.

GENERAL DESCRIPTION: C/T is a two-sided, event-sequenced, stochastic, combat simulation involving ground units ranging in size from individual antitank weapon teams to a reinforced battalion. Up to 500 individual maneuver units per side can be supported (limitation is imposed by available computer memory). Combat activities represented in the model include movement, acquisition, firing, and limited communications between units. C/T terrain is represented by grid squares, typically 100m on a side, with each square having an associated elevation, vegetation height, mobility index, and concealment index. The size of the terrain area which can be played is dependent on the computer memory available; recent uses have employed scenarios involving a 10x15 km area. Combat activities are normally controlled by a set of user-supplied orders, however individual maneuver units are allowed to react dynamically to game events such as receipt of fire and actions by friendly or enemy units. Computer time requirements vary according to the scenario, a representative example of 200 units (50 Blue, 150 Red) runs approximately in real-time on a UNIVAC 1100/82 computer.

INPUT:

- o Terrain, e.g., elevation, vegetation, mobility, concealment
- o Environment, e.g., visibility, humidity, light conditions, cloud cover
- o Weapon, e.g., accuracy, reload, lethality, vulnerability
- o Unit orders, e.g., move, stay, fire, alternative tactics
- o Sensor, e.g., naked eye, direct view optics, thermal devices
- o Organization, e.g., commanders, subordinate commanders/fighting (weapon) units

OUTPUT:

- o Intermediate results, e.g., unit locations, target acquisitions, engagement sequences
- o Terminal results, e.g., summary of survivors, non-survivors, and equipment

MODEL LIMITATIONS:

- o ECM, ECCM, and EW not explicity represented.
- o Combat support not explicitly represented.
- o RAM not explicitly represented.
- o Communications limited to that required for direct and indirect fire purpose.
- o Effects of nuclear weapons not included.

HARDWARE:

- o Type of Computer: UNIVAC 1100/82
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 200K words
- o Peripheral Equipment: Tape, disk, printer

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Series of technical notes describing major new model features

TIME REQUIREMENTS:

- o 3-10 man-months to acquire new data base (can normally use on-hand data base)
- o 6-10 man-months to develop scenario
- o 3-10 months user learning time
- o 3-12 man-months output analysis time (per study)
- o Approximately real-time on UNIVAC 1100/82

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 4-6 major studies per year

USERS: USA TRASANA

POINT OF CONTACT: USA TRASANA
Attention: ATAA-TE
WSMR, NM 88002

MISCELLANEOUS: Planned enhancements incude the addition of low energy laser weapon effects in late 1981 or early 1982.

KEYWORD LISTING: Analytical, Stochastic, Event-sequenced, Combined Arms, Computerized, Limited War, Two-sided.

TITLE: CAROM - Career Area Rotation Model

PROPONENT: Air Force Human Resources Laboratory, Manpower and Force Management Systems Branch, Decision Models Function (AFHRL/MOM)

DEVELOPER: Decision System Associates, Inc.

PURPOSE: The Career Area Rotation Model is a computerized analytic model that simulates the interaction and impact of numerous policy decisions on optimal tour rotation, manning, career progression, skill upgrading, and attrition for an occupational specialty grouping. The model assesses policy alternatives in terms of tour length, sequence of tour types, grade and skill substitution rules, attrition factors, promotion eligibility criteria, promotion rates, etc.

GENERAL DESCRIPTION: The Career Area Rotation Model is entity level and one-sided, and has both deterministic and stochastic elements. Only Air Force enlisted personnel (after initial technical training) are considered by occupational specialty or grouping of specialties. Simulation is one period (1 month or longer) at a time for up to 30 years. A modified Ford-Fulkerson assignment algorithm is used to optimally assign airmen to billets, and a Monte Carlo procedure is used to simulate random processes.

INPUT:

- Strength requirements for Grades E2 through E9 and for possible skill levels 2-9 for each of four types of tour categories
- Grade/skill-substitution policy for each tour category
- Promotion policy and rates
- Attrition factors
- Records of new accessions to the career field

OUTPUT:

- Tabular summaries of all relevant promotion, deployment, accession and attrition activities
- Output tape of personnel records, including detailed history while on board and final description

MODEL LIMITATIONS: Total manning of an occupational grouping is limited to approximately 100,000 men per simulation period.

HARDWARE:

- Computer: UNIVAC 1100/81 and CDC 6600
- Operating System: Standard
- Minimum Storage Required: CDC version - 256K bytes; UNIVAC VERSION - 79K words
- Peripheral Equipment: Tape units, card reader, printer

SOFTWARE:

- o Programming Language: CDC Extended FORTRAN and UNIVAC Assembler and FORTRAN V
- o User's Documentation: AFHRL-TR-73-49, Career Area Rotation Model
- o User's Manual: AFHRL-TR-75-51, Career Area Rotation Model; Supplemental User's Manual
- o Technical Report: AFHRL-TR-78-97, Career Area Rotation Model (CAROM): Historical Overview of Technique and Utilization

TIME REQUIREMENTS:

- o Approximately 1 week to acquire and structure data base in model input format
- o 1-25 seconds CPU time per simulation cycle
- o Less than 4 hours total computer time for most large occupational groupings

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o AFHRL for development
- o AFMPC for operational use

POINT OF CONTACT: Air Force Human Resources Laboratory
Decision Models Function
Manpower and Personnel Division
Brooks AFB, Texas 78235
Telephone: AUTOVON 240-3648
Commercial 536-3648

KEYWORD LISTING: Simulation; Computer Model; Gaming Model; Assignment; Tour Rotation; Policy Assessment

TITLE: CASSANDRA - Close Air Support Simulation and Repair Algorithm

PROPONENT: Commander in Chief, Pacific

DEVELOPER: Research and Analysis Division, CINCPAC

PURPOSE: The purpose of the model is to permit the study of the effectiveness of various types of aircraft in the close support role.

GENERAL DESCRIPTION: The model is deterministic so some fraction of the aircraft survives and some fraction of the ground targets survives. Thus, the numbers of aircraft and ground targets is not critical. The probability of surviving attacks by interceptors, SAM and AA guns is computed as the aircraft are assumed to go through the phases of search, detection, acquisition, and attack. Types of ordnance and delivery tactics can be varied as well as visibility conditions. The model computes damage to ground targets and number of aircraft killed and damaged by enemy interceptors, SAM, and AA guns. One criterion of effectiveness is number of targets killed per aircraft killed. Ground targets included tanks, personnel, and artillery.

INPUT:

- Probability of engagement defending CAP
- Probability of surviving air engagement by CAP
- Probability of surviving radar SAM and IR SAM fire
- Probability of detection and acquisition of ground targets
- For each pass made at the target, the probability of surviving AA gun fire, as a function of delivery tactics
- Probability of kill of ground targets as a function of ordnance type, target type, and delivery tactics
- Ratio of aircraft damaged to aircraft killed
- Average time required for a damaged aircraft repaired

OUTPUT:

- Tables showing numbers of aircraft damaged and numbers killed by interceptors, radar SAM, IR SAM and AA guns. These tables also show number of targets killed and ratio of targets killed to aircraft lost. These tables can be selected to show the results of an entire campaign or the results of each successive attack or wave.
- Graphs showing how above numerical results vary with campaign days
- Graphs showing number of flyable aircraft vs campaign days

MODEL LIMITATIONS: Any one run permits the study of only one ground target type and one CAS aircraft type.

HARDWARE: WANG 2200 with 32K of storage

SOFTWARE:

- o Programming Langauage: BASIC
- o Documentation: "CASSANDRA, a Mathematical Model to Simulate Close Air Support Operations"

TIME REQUIREMENTS:

- o To acquire data base: varies
- o 1 day to structure data in model input format
- o To analyze output: varies
- o 1-2 days for player learning time
- o Playing time per cycle: varies
- o 1 minute CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Research and Analysis Division
CINCPAC, Box 15, J55
Camp H. M. Smith, HI 96861

FREQUENCY OF USE: As required

USER: CINCPAC

KEYWORD LISTING: Close Air Support Effectiveness, Aircraft Effectiveness

TITLE: CASTFOREM - Combined Arms and Support Task Force Evaluation Model

PROPONENT: US Army TRADOC Systems Analysis Activity (TRASANA)

DEVELOPER: USA TRASANA

PURPOSE: CASTFOREM is intended to be the lowest echelon member of a hierarchy of models being developed as a part of the Army Model Improvement Program (AMIP). This family of models will include Battalion, Division, Corps, and Theater-level force-on-force simulations.

GENERAL DESCRIPTION: CASTFOREM is a stochastic, event-sequenced, opposing forces simulation of ground combat involving up to a BLUE battalion task force and a RED regiment. The model is written in SIMSCRIPT II.5 and is designed to be used in either batch or interactive modes with variable unit resolution down to individual weapon system level. Regardless of the level of resolution selected by a user, detections and engagements are executed at the individual weapon system level. Resolution of terrain is also variable (typically 25m grid square). Battlefield environments to be modeled include static weather, dynamic obscurants (smoke and dust), nuclear and chemical contaminants, and electronic warfare. Each organizational entity (commanders and units of resolution; e.g., tanks, infantry fighting vehicles, trucks, etc.) possesses a unique intelligence which is updated by the acquisition of information via a communication net or directly (detecting a target, encountering an obstacle, receiving fire, etc.). Delays and failures in the exchange of information over a communication net will cause each entity's intelligence to represent perceived battlefield knowledge rather than perfect knowledge. The latter can be represented by simulating perfect and instantaneous exchange of information among organizational entities. In general, all combat support and combat service support units and functions which interact with and/or directly affect the combat activities of maneuver units are represented in the model. The degree of resolution is greatest for maneuver units, less for combat support units, and least for combat service support units. CASTFOREM structure will facilitate increasing the degree of resolution with which specific vehicles, weapons, and functions are represented to satisfy study objectives. The model contains the command and control logic, in the form of decision tables, to make tactical decisions which generate orders, reports, and requests for support. These decision table outputs, in turn, control the actions of units of resolution. This logic, combined with explicit representation of a command and control structure and communication nets, serves to represent the command and control process employed by ground combat units.

INPUT:

- o Terrain description parameters
- o Environment data
- o Weapon effects data
- o Decision tables
- o Unit orders
- o Organizational structures
- o Communications data and network structures
- o CS and CSS equipment data
- o Personnel description parameters

OUTPUT: Each event is recorded for postprocessing.

MODEL LIMITATIONS:

- o RAM is not explicitly represented
- o Weather parameters hold throughout the duration of the game

HARDWARE:

- o DEC VAX 780 computer
- o VAX 780 operating system
- o Minimum storage requirements
  - oo 1 megabyte of physical memory
  - oo 16 megabyte of virtual storage
- o Peripheral equipment
  - oo Printed, disk
  - oo Graphic terminals

SOFTWARE:

- o Programming language - SIMSCRIPT II.5
- o Documentation (when model is completed)
  - oo Executive summary
  - oo User's manual
  - oo Analyst's manual

TIME REQUIREMENTS: The model is still under development, however, it is anticipated that the scenario preparation process for a CASTFOREM simulation will closely approximate the military planning process for a tactical operation in terms of both methodology used and man-hours required. This will be accomplished through the construction of sets of decision tables, for both RED and BLUE, each of which is designed for a specific type tactical operation (e.g., active defense, deliberate attack, hasty river crossing); contains doctrinal responses to a broad spectrum of tactical situations; requires user threshold inputs to trigger each doctrinal response; and permits dynamic maneuver by opposing forces.

SECURITY CLASSIFICATION:

- o UNCLASSIFIED model
- o CONFIDENTIAL/SECRET data

POINT OF CONTACT: USA TRASANA
ATTN: ATAA-TGM
White Sands Missile Range, NM 88002

FREQUENCY OF USE: To be determined

USERS:

- o TRASANA
- o US Army Training Schools and Centers

MISCELLANEOUS: CASTFOREM should be operational by November 1981.

KEYWORD LISTING: Analytical, Stochastic, Event-sequenced, Combined arms, Simulation

TITLE: Casualty Stratification Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Soldier Support Center and US Army Concepts Analysis Agency

PURPOSE: The Casualty Stratification Model is a computerized, deterministic model which provides a means of predicting (by skill category and grade) the casualties from a wartime theater scenario.

GENERAL DESCRIPTION: The Casualty Stratification Model is a one-sided, deterministic model dealing primarily with forces at a theater level. Its primary function is to take a statement of aggregate casualties on a time-phased basis (usually 10-day increments) and stratify or disaggregate those casualties into a MOS/grade statement of casualties, also time-phased. This is accomplished through the use of the overall population-at-risk, the casualty counts and a loss rates distribution table developed by the Solider Support Center.

INPUT:

- Population at-risk (time phased) by MOS/grade
- Vulnerability/loss rates for MOS/rank
- Casualties (time phased)

OUTPUT:

- Report of MOS/grade losses over time

MODEL LIMITATIONS:

- Vulnerability/loss rates are theater and scenario dependent, assume casualties include KIA and MIA only and are extremely time consuming to develop

HARDWARE:

- Computer: UNIVAC 1100/series
- Operating System: UNIVAC 1100 operating system
- Minimum Storage Required: 100K 36 bit words
- Peripheral Equipment: 1 disk drive (or 2 tape units), 1 printer

SOFTWARE:

- Programming Language: ANSI FORTRAN
- Documentation: Soldier Support Center document on model revision, July 1981

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TIME REQUIREMENTS:

- o 6 man-months to develop vulnerability/loss rates
- o 1/4 man-month required to structure data in model input format once other simulations have been completed
- o 20 minutes CPU time required per execution on UNIVAC 1100/82
- o Learning time required for this model is small
- o Only minimum time required to analyze and evaluate results
- o Model is in a post-processor position to which CEM and FASTALS provide inputs. Its requirements for data acquisitions are dependent on the main processors.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 25 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. David A. Hurd
US Army Concepts Analysis Agency (CSCA-MCM)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-1549

KEYWORD LISTING: Analytical; Computerized; One-sided; Deterministic; Time phased

TITLE: CATTS

PROPONENT: Combined Arms Training Development Activity

DEVELOPER: Combined Arms Training Development Activity

PURPOSE: Calculates intervisibility, weapon-to-target ranges and effects, status of personnel equipments, ammunition, fuel and cross-country movement. Train maneuver battalion and cavalry squadron command groups to attain and sustain ARTEP standards in the control and coordination of combined arms operations in a simulated environment against realistic enemy forces.

GENERAL DESCRIPTION: CATTS is a two-sided, time step, mixed land and air model designed for platoon/squad/brigade and battalion.

INPUT:

- o Firing rates
- o Kill probabilities
- o Mobility
- o Terrain and weather

OUTPUT: Minute-by-minute situation one line statements on CRTS. Also a TV monitor showing the map operation area with the up to date minute-by-minute locations of units, obstacles, control measures, firing lines, air missions, etc.

MODEL LIMITATIONS:

- o 100 units
- o CATTS can play in any terrain area after the input terrain files are preprocessed

HARDWARE:

- o Computer: XEROX E9
- o Operating System: 32 bit RBM
- o Minimum Storage Required: 1/2 megabyte
- o Peripheral Equipment: 270 megabyte of disk space, printer, 2 tapes and card reader

SOFTWARE:

- o Programming Language: FORTRAN, 10% Assembler
- o Documentation: Math Model Users Manual, CATTS Trainer Programming Report, CATTS

TIME REQUIREMENTS:

- o 6 months to acquire data base
- o 3 man-months to structure data in model input format
- o 3 hours to analyze output
- o 8 hours player learning time
- o 8 hours playing time per cycle
- o 60 seconds CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Ten times per month

USERS: 95 active, 33 reserve command groups have used the model.

POINT OF CONTACT: Combined Arms Training Development Activity
Fort Leavenworth, Kansas
AUTOVON 552-2073

MISCELLANEOUS: ARTBASS is a mobile version of CATTS.

KEYWORD LISTING: Computerized

TITLE: C-BASE II - Carrier-Based Air Systems Evaluation Model

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: C-BASE II is a computerized, analytic, general war model of attack carrier operations against an enemy land-based air arm and target complex. The model operations span only the opening several days of the engagement before either side can replace losses. The model's chief focus of concern is the evaluation of relative effectiveness of different mixes (of fighters, attack or multimission aircraft) for the carriers' complement of combat aircraft systems. C-BASE II is also concerned with the effect of fighter escorts on carrier force total effectiveness and variation in task force effectiveness as a function of assignment rules for multimission aircraft.

GENERAL DESCRIPTION: C-BASE II is a two-sized, mixed model involving land, air and sea forces. It was designed to aggregate fighter and attack aircraft of distinct types, with a range of possible manipulation to include: carrier: at most 4 types of attack aircraft, 2 types of fighters; enemy: 1 type each of fighter and bomber. The model was primarily designed to consider a carrier task force strike group consisting of attack aircraft and escort fighters. It can consider two carriers at most. More than two carriers are possible, but model engagement rules are not appropriate for many carrier task forces. Simulated time is treated on an event store basis. Probability theory and expected value calculations are the primary solution techniques used.

INPUT:

- Initial number of aircraft by type
- Their availability
- Kill probabilities of aircraft targets, airborne and parked on carrier deck or enemy airfields
- Enemy ground targets other than aircraft
- Carrier vulnerability
- Number of operating days
- Length of operation day
- Aircraft turnaround l time
- Mean time to repair hits on carriers
- Number of CAP stations
- Station time
- Backup factors
- Launch short probability

  Task force SAM effectiveness

OUTPUT:

- o Computer printout of number of hits on carriers
- o Aircraft kills, airborne and on ground or carrier deck
- o Number of carrier aircraft sorties to weapon release
- o Detailed daily output
- o Summary daily output

MODEL LIMITATIONS:

- o No replenishment of losses, either side
- o Enemy strike against task force not escorted
- o Effectiveness of SAM systems not degraded to reflect strike effectiveness

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 51K octal words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Naval Air Systems Command, Systems Analysis Division Technical Report "C-BASE II (Carrier-Base Air Systems Evaluation Model)," Report No. A-503-68-3, October 1969 (DDC No. AD-86463)
- o User's documentation is incomplete
- o Technical documentation is complete

TIME REQUIREMENTS:

- o The time required to acquire base data is variable
- o 1 man-month to structure data in model input format
- o 5 seconds CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 projects per year - 50 runs per project

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3443

KEYWORD LISTING: Computerized; Analytical Model; General War; Two-Sided; Mixed; Land Forces; Air Forces; Sea Forces; Event Store

TITLE: CEESS

PURPOSE: CEESS was developed to simulate the communication-electronics (C-E) environment of a deployed tactical force as a basis for electromagnetic compatibility/vulnerability analysis.

DESCRIPTION: CEESS is a static model that represents the battle action at an instant in time. It simulates a C-E environment by extracting and manipulating information contained in data base files on equipments authorized to troop units, C-E netting structure, and equipment technical characteristics. Military units are task organized, Hqs established and the entire force model concept is represented for RED and BLUE forces down to company level. Communications nets, radar emissions, missile guidance and control links, beacons, EW schemes and other operations that affect the electromagnetic spectrum are established and simulated in the deployment.

RBC CAPABILITIES: Radar/communications jamming and DF capabilities are represented explicitly for both RED and BLUE in CEESS. Terrain, in the way of land form, vegetation and cultural features are played implicitly.

LIMITATIONS/RBC GAPS: Reactive jamming and other countermeasure tactics of the dynamic environment must be treated separately in analysis programs using CEESS output. Due to CEESS being a static model, it is limited in its ability to simulate changing processes such as troop movements, CCM, and spread spectrum communications systems. Also, a large amount of manual effort and data processing time are required. Process involves a lot of time for coordination among the TRADOC, PM, INTELL Community and Development Labs for agreement on proper scenario, TOE series, and threat environment. CEESS is not an analysis tool. It develops test beds which are used as input to other analytic models and programs.

DATA INPUT/REQUIREMENTS: Equipment authorizations file

Equipment characteristics file

Equipment netting file

Equipment applications file

Antenna file

Code file

POINT OF CONTACT: Eugene Day
AUTOVON: 284-8515

AGENCY: Battlefield Electromagnetic Environment Office - TECOM
Alexandria VA

STATUS: Operational

COMPUTER: IBM 370/165

LANGUAGE: COBOL/FORTRAN

TITLE: Concepts Evaluation Model/Theater Forces Evaluation by Combat Simulation (CEM/TFECS) Model

PURPOSE: The CEM Model was developed as a tool for measuring force effectiveness in terms of combat attrition at the FEBA, personnel, equipment, and materiel losses; and FEBA movement. The TFECS modifications to the CEM reflect the results of a methodology development effort for representing the effects of communications, intelligence operations, and EW on a theater combat force, primarily in terms of impact on the command estimation and decision process.

DESCRIPTION: CEM/TFECS is a two-sided, fully automated, deterministic, theater-level combat simulation that incorporates the aggregated effects of C3I/EW. CEM uses a continuous FEBA representation and simulates combat between BLUE brigades and RED divisions over 12-hour increments. The command decision process generates estimates of the situation and decisions at each of four C2 echelons. Logistics operations, replacements, medical support, and air operations are treated as aggregated theater functions. The TFECS preprocessors generate rates of observation of battlefield activities by information collection systems, rates of attrition of these systems, probabilities of warnings of battlefield activities, probabilities of nets being jammed, and expected delays over communications means. The application of these factors, in combination with the actual number of sensors, jammers, and observables present in each brigade/division combat section across the FEBA, determines the size and content of the report stream which feeds the automated division and higher-level command estimation and decision process.

RBC CAPABILITIES: The TFECS methodology provides for representing the communications process, communications jamming, deception, ESM, collection of intelligence, and the attrition of these collection assets and jammers. The numbers and types of information-collection systems and jammers are set by the model user, as are the battlefield activities and entities, both real and deceptive. Individual equipment, messages or locations are not considered explicitly but as aggregate numbers in a given area (brigade/division). The TFECS process computes the rate at which detection, interception, jamming of communications are occurring in the area.

LIMITATIONS/RBC GAPS: CEM/TFECS is a large-scale, low-resolution model with a high level of aggregation. The model utilizes expected values in the main, and results must be viewed in that light. A typical CEM application will require 25,000 data inputs, about six technical man-months, and 6 hours of dedicated computer time per 180 day theater run. TFECS will add significant additional burdens to already lengthy input data preparation and computer run time.

INPUT: The TFECS inputs are number of sensors, jammers, and communication nets; number of observable entities and report types; terrain masking factors; mean time to detect, confirm, and report by observable/sensor combination; mean times of observable transition, number of communications systems states; damage factors for sensors; observable movement rate factors, probabilities of false detections, mean time to wait, switch means or abandon communications; equipment duty cycles, probability of loss, detection, correct and incorrect acceptance of report; types and expected duration of battlefield warning events; maximum time of report usefulness; observable types associated with the unit activities at each echelon; mean and variance of strength estimates of enemy unit type and activity; equipment deployment delay times; and jammer target priorities.

REQUIREMENTS: Data requirements for CEM, although large and time consuming, have been developed in the past. Data for TFECS in terms of future information-collection resources, and jammer and communications systems, is best characterized as unvalidated since future system data is in the form of a ROC or O&O concept or nonexistent. There is currently insufficient data in the detail required for current systems performance parameters.

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MODEL IMPROVEMENTS: Improvement plans will be formulated following test and evaluation of the new TFECS methodology.

POINT OF CONTACT: Mr. Wallace Chandler
AUTOVON 295-1686

AGENCY: Concepts Analysis Agency

STATUS: Developmental

COMPUTER: UNIVAC 1108

LANGUAGE: FORTRAN V

TITLE: CEM V - Concepts Evaluation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation and US Army Concepts Analysis Agency

PURPOSE: CEM is a computerized, analytical model designed to portray the course of theater-level, non-nuclear war in terms of FEBA location/movement, condition of opposing forces, and expenditure of resources. The primary problem addressed is that of determining the effects of force structure on force performance in theater-level warfare.

GENERAL DESCRIPTION: CEM is a two-sided, deterministic model involving theater land and air forces. It is designed to consider groupings of brigade size (up to 210 units) on the Blue side and of division size (up to 150 units) on the Red side. Command decision processes are simulated at four levels--division, corps, Army group and theater for Blue and corresponding levels for Red. Simulated time is treated on a time step basis at nested intervals of 12 hours to 4 days, depending on command level. Theater supply, replacement, maintenance, repair and hospital functions are simulated. The model uses only basic mathematical and logical operations as its primary solution techniques.

INPUT:

- o Terrain map
- o Troop lists
- o TOEs (Personnel, ammo, POL, other supplies, tanks, APCs, helicopters, antitank missiles, artillery
- o Weapon firepower indices
- o Resupply and replacement rates (Personnel, ammo, POL, other supplies and weapons)
- o Arrival schedule for resupply, reinforcing artillery Bns and maneuver units

OUTPUT: Computer printout stating (periodic) FEBA location, state of opposing forces, resources expended, and KIA, WIA, CMIA, DNBI and weapons hit, destroyed, damaged, abandoned and repaired.

MODEL LIMITATIONS:

- o Blue brigade structure cannot be changed during a war
- o Reserve units (if any) consist of exactly one of the next lower echelon unit
- o Logistic operations highly aggregated

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 operating system

- o Minimum Storage Required: 140,000 decimal words
- o Peripheral Equipment: 2 tape drives and/or disk

SOFTWARE:

- o Programming Language: ASCII FORTRAN
- o Complete user documentation: CAA-D-80-3, Part I - Technical Documentation, January 1980; Part III - User's Handbook, February 1980

TIME REQUIREMENTS:

- o 2 months to acquire base data
- o 18 man-months to structure data in model input format
- o 3 hours computer time for 180 day simulation on the UNIVAC 1100/82
- o 2 months to analyze and evaluate results

SECURITY CLASSIFICATION UNCLASSIFIED

FREQUENCY OF USE: 300 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. J.E. Shepherd
US Army Concepts Analysis Agency (CSCA-MCM)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-5244

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Land Forces; Air Forces; Computerized; Two-Sided; Deterministic; Time Step

TITLE: CHEMCAS II - Chemical Casualty Assessment Model

PROPONENT: C&S Division, Combat Developments, USACMLS

DEVELOPER: RDM Corporation and USACMLS

PURPOSE: CHEMCAS II is designed to measure the relative effectivenss of various CB defensive measures and/or the relative effectiveness of various CB weapon systems and employment techniques.

GENERAL DESCRIPTION: CHEMCAS II is as stochastic toxic environment simulation developed from the original CHEMCAS model to support the Chemical Operations Study. Resolution is controlled by input; the model is currently dimensioned for thirty major units and 900+ sub-units with resolution normally at the battalion/platoon level. CHEMCAS II consists of four main programs:

Main 0 - Target description/acquisition
Main 1 - Toxic cloud transport
Main 2 - Weapon delivery
Main 3 - Casualty assessment

Target acquisition is stochastic and is predicted on the percent of knowledge concept; weapons delivery is also stochastic and resolution is to single munitions. Cloud transport and target dynamics/casualty assessment is analytical; sampling of the target populations, however, is stochastic. Fireplanning and target description are performed manually.

INPUT: Data bases are available from USACMLS for input, with appropriate documentation, upon request.

OUTPUT:

- o Fraction and number of target population responding to lethal dose
- o Fraction and number of target population responding to incapacitating, but not lethal, dose
- o Reason for masking (alarm, impact, command)
- o Time at which masking took place
- o Average dosage on target
- o Average disposition on target
- o Target location
- o Target identifier and type
- o Protective factor (posture) of target
- o Overlay plot of targets and impacts

MODEL LIMITATIONS:

- o The model cannot quantify the extremely significant vapor hazard generated by chemical agent evaporation subsequent to its being deposited on the ground. This is particularly true in the case of Intermediate Volatility Agents (IVA) such as GD. Thus, a large fraction of chemical weapon effectiveness if not evaluated and weapon systems which now appear marginally effective may actually contribute a great deal to the outcome of a battle.
- o No mechanism exists within CHEMCAS for evaluating equipment contamination
- o CHEMCAS II has no blast/fragmentation routine. Because the blast and fragmentation effects of chemical weapons are ignored, chemical munitions cannot be directly compared with high munitions within the same model framework
- o The model cannot accurately portray different levels of contamination within the interiors of a structure. Thus, contamination within the interior of a building or vehicle is not evaluated. This makes accurate modeling of chemical attacks upon fixed installations difficult

HARDWARE: UNIVAC 1108, 1106, 1110, CALCOMP 935/936 Plotter

SOFTWARE:

- o Programming Language: UNIVAC FORTRAN V, UNIVAC Assembly Language, EXEC 8, level 33 or 36 operation system, CALCOMP proposetary plotting software
- o Documentation: Limited to descriptions in the Unit Chemical Defense Study and the Chemical Operations Study

TIME REQUIREMENTS:

- o 4 to 5 man-months for target array (size dependant)
- o 2 man-days per weapon/agent combination for cloud description
- o 3-5 man-days fireplan
- o 5 man-days for agent type toxicity and therapy data
- o 1 man-day executed fireplan

SECURITY CLASSIFICATION: UNCLASSIFIED, data bases range from UNCLASSIFIED TO CLASSIFIED

FREQUENCY OF USE: Daily during the conduct of a study or analysis.

USER: Chemical School

POINT OF CONTACT: Major Bambini
US Army Chemical School
Fort McClellan, AL
AUTOVON 865-3174

Chemical Strike Simulation

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), NDHQ, Ottawa, Ontario, Canada

DEVELOPER: As above

PURPOSE. This simulation was designed to assess the personnel casualties that would result from a chemical strike. The assessment procedure was created to specifically suit the research war game.

GENERAL DESCRIPTION:

- This simulation is based almost exclusively on the NATO document AXP-7, which lists expected casualty levels for various agents and conditions.
- The simulation is a combination of manual information gathering and computer-assisted information collection. Initially the location and size of the strike are fed into the program. This generates a list of the units affected by the strike as well as a list of the information required to assess each unit. The specific information for each unit must now be gathered manually with the aid of the War Game Controller.
- Once completed, this information along with data related to the agent and meteorological conditions are entered into the program to acquire the final results of the assessment.
- Internally the program determines a primary level of casualties related to the agent and delivery method used. This percentage is then modified several times according to all the various factors which determine the effectiveness of the agent against the personnel concerned.

INPUT:

- General inputs include the ground zero, area covered, specific agent, air stability, land classification, temperature, wind velocity and delivery system
- Unit-dependent inputs are the type of unit, situation, activity, exposure time, dress, NBC training and equipment

OUTPUT: A list is produced which contains the units' serial numbers, names, location, etc., and the personnel casualties suffered by each.

MODEL LIMITATIONS: The amount of, and time required for manual data collection is unduely excessive. This problem will be rectified when the program is rewritten for the PDP 11/34 computer

HARDWARE: IBM 1130 computer

SOFTWARE: Programmed in FORTRAN

TIME REQUIREMENTS:

- Preparation: Data collection and input time can take from several minutes to a half hour depending on the size of the strike
- Play: Running time is approximately thirty seconds
- Analysis: Included in research war game analysis

SECURITY CLASSIFICATION: NATO RESTRICTED

FREQUENCY OF USE: Depending on the type of battle being modelled, the frequency can range from never to continuously

USERS: DLOR War Games Section

TITLE: CIVIC III

PROPONENT: Defense Nuclear Agency (VLWS)

DEVELOPER: Science Applications Incorporated (modifications - CIVIC III)

PURPOSE: CIVIC III is a computerized, analytical, damage assessment/ weapons effectiveness model. It estimates civilian fatalities and casualties resulting from the prompt and fallout environments of a nuclear weapon laydown. Can also be used as a military personnel damage assessment tool with appropriate data base; i.e., ground forces arrays.

GENERAL DESCRIPTION: CIVIC III is a two-sided, deterministic model that deals with civilian forces. It was primarily designed for individual population centers. It uses probability as method for solution.

INPUT:

- o Population data base
- o Weapon laydown

OUTPUT:

- o Computer printout of population fatalities and casualties by population place (prompt only, fallout only, combined prompt and fallout) by weapon and combined due to all weapons
- o Detailed by population place and shelter category
- o Summary only by country and grand total

MODEL LIMITATIONS:

- o Fallout producing weapons limited to 1500

HARDWARE:

- o Computer: Honewell 6000, DEC 10, CDC 7600
- o Minimum Storage Required: 230-250 K to operate unoverlayed

SOFTWARE:

- o Programming Language: FORRAN IV
- o Documentation: User guide and technical description in draft form
- o User's and programmer's manual in draft form

TIME REQUIREMENTS:

- o 1-2 weeks required to acquire base data
- o Approximately 1 man-week required to structure data in model input format
- o Average 10 seconds/weapon (prompt and fallout) CPU time per model cycle
- o 1-2 weeks operational use only learning time required to players
- o 1-2 days required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED (Up to CONFIDENTIAL)

FREQUENCY OF USE: Approximately 10 times per year (SAI only)

USERS:

- o USEUCOM, SAI

POINT OF CONTACT: Eugene J. Swick
Science Applications, Inc.
1200 Prospect Street
La Jolla, Ca 92037
(714) 454-3811, Ext 2487

MISCELLANEOUS:

- o Can be linked to DCAPS code to provide an input DGZ list
- o Supersedes CIVIC

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Civilian; Computerized; Two-sided; Deterministic

TITLE: COFORKS

PROPONENT: IABG/SOP Ottobrunn, Germany

DEVELOPER: IABG/SOP Ottobrunn, Germany

PURPOSE: Limited war analysis of conventional ground combat at the division level

GENERAL DESCRIPTION: COFORKS is a computer assisted, two-sided, mixed deterministic/stockastic, time step simulation employing lanchester equations and probability theory.

INPUT: Weapon systems data

OUTPUT: Game history, chronology of events, unit status. Post-professor provides user specified game statics.

HARDWARE:

- o Computer: CDC 6500
- o Operating System: Scope 3.4
- o Minimum Storage Required: 180,000 Octal Words (COBIT)

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Available

TIME REQUIREMENTS:

- o To acquire Data Base: 1 month
- o To structure Data in Model Input Format: 1/2 month
- o Player Learning Time: 1 month
- o Playing Time: 2 months
- o CPU Time per Cycle: 400-500 CP seconds

SECURITY CLASSIFICATION: CONFIDENTIAL, RESTRICTED

POINT OF CONTACT: IABG
Arteicung SOP
Einsteinestrasse
D 8012 Ottobrunn, Germany

TITLE: COLLIDE - An Aggregated Conversion Model for Air Combat

PROPONENT: Air Force Assistant Chief of Staff, Studies and Analyses

DEVELOPER: Decision-Science Applications, Inc.

PURPOSE: COLLIDE is a computerized analytical model designed to compute airborne interceptor probability of detection and conversion to armament launch position for given target characteristics and tactics. It is used to evaluate interceptor performance under varying equipment, ECM, command and control, and geometric conditions.

GENERAL DESCRIPTION: COLLIDE is a one-sided, deterministic model which simulates a one to one airborne intercept.

INPUT:

- o Air-to-air missile launch envelopes
- o Geometry of engagement region, interceptor, and target vectors
- o Physical parameters of interceptor and target aircraft
- o Visual and radar detection parameters
- o ECM, and command and control environment

OUTPUT:

- o Probability of detection and conversion for various approach angles
- o Optimum approach angle

MODEL LIMITATIONS: Does not include capability to combine effects of simultaneous radar/IR/visual search.

HARDWARE:

- o Computer: IBM 3032
- o Operating System: TSO
- o Minimum Storage Required: 29K
- o Peripheral Equipment: TSO display terminal, printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:
  - COLLIDE--An Aggragated Conversion Model for Air Combat, 15 Dec 72
  - ECM in COLLIDE, 30 Jun 76
  - COLLIDE User's Manual, Documentation of Radar and C2 Modifications, Jun 80

TIME REQUIREMENTS:

- o 2 months to assemble data base
- o CPU time: Several seconds
- o 1 to 5 days to analyze output

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per month

USERS: USAF/SA

POINT OF CONTACT: Assistant Chief of Staff, Studies and Analyses
Hq US Air Force (AS/SASI)
Washington, D. C.
Telephone: (202) 695-3379
AUTOVON: 225-3379

KEYWORD LISTING: Computerized, Analytic, Air, Limited War, One-sided, Deterministic, Interceptor

TITLE: COMANEX - COMbat ANalysis Model EXtended

PROPONENT: TRADOC

DEVELOPER: General Research Corporation (GRC)

PURPOSE: The need for a computationally efficient model which could closely approximate the results of a slower, high-resolution combat simulation prompted the development of COMANEX. COMANEX can be used to extrapolate the results of a discrete event simulation such as CARMONETTE, and thereby predict battle outcomes for heterogeneous force mixes not explicitly simulated. The computational efficiency of COMANEX also makes it feasible for assessment of individual-unit combat engagements in the framework of a large-unit division level wargame such as DEM.

GENERAL DESCRIPTION: COMANEX comprises two subprograms: a preprocessor and an attrition model.

COMANEX Preprocessor: The preprocessor operates on a time-sequenced record of casualties (such as a CARMONETTE history tape), and uses the principles of maximum likelihood estimation to determine the attrition coefficients (kill rates) for all firer-target combinations in the battle. Acquisition probabilities are computed for each force, so that the related attrition coefficients automatically characterize an engagament as direct fire (square law), indirect fire (linear law), or some intermediate situation. Usually the battle is broken down into two, three or more distinct phases of combat, and a unique set of attrition coefficients and acquisition probabilities is computed for each interval. This procedure generally yields an excellent maximum likelihood fit to the original battle.

COMANEX Attrition Model: The attrition model numerically integrates the attrition coefficients with respect to time yield aggregate losses for each [illegible]. The battle can be stopped selectively as a function of time or according to some preset percentage-casualty-threshold for either force.

[illegible]

COMANEX Preprocessor:

- Number of replications of the high-resolution battle
- Beginning and end times of each interval (phase of combat)
- Force mix (high-resolution battle)
- Time-sequenced record of casualties, i.e., firer type, target type, time of occurrence of each casualty

COMANEX Attrition Model:

- Force mix (variable)
- Beginning and end times of each interval (phase of combat)

- Attrition coefficients (unique set for each interval)
- Acquisition probabilities (one value for each force per interval)

OUTPUT

COMANEX Preprocessor:

- Attrition coefficients (unique set for each interval)
- Acquisition probabilities (one value for each force per interval)
- Killer victim scoreboard (high-resolution battle)

COMANEX Attrition Model:

- Killer-victim scoreboard (function of input force mix)

MODEL LIMITATIONS:

COMANEX Attrition Model:

- Input force mix should not differ significantly from the force mix specified originally in the high-resolution simulation, particularly if the modified force mix would dictate revision of tactics and/or scenario when played in the high resolution simulation.

HARDWARE:

- Computer: Digital
- Operating System: Any with some modifications
- Storage Required: Preprocessor - 29K
  Attrition Model - 13K
- Peripheral Equipment: Line printer, tape drive

SOFTWARE:

- Programing Language: FORTRAN IV
- Documentation Dissertation, Ohio State University, 1969

TIME REQUIREMENTS:

- 1 to 2 weeks initially to structure COMANEX Preprocessor for non-CARMONETTE input data format.
- Execution Time: Preprocessor - typically 8 to 12 minutes (UNIVAC 1108)
  Attrition Model - typically 15 to 60 seconds (UNIVAC 1108)

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 50 to 75 times per study

USERS:

- CAA
- TRASANA

POINT OF CONTACT: Director
US Army TRADOC Systems Analysis Activity
ATTN: ATAA-TGD
White Sands Missile Range, NM 88002
Phone: AUTOVON 258-3149 (Mr. Brenton C. Graham)

MISCELLANEOUS:

- COMANEX is undergoing revision to account for ammunition expenditure and to improve the quality of its predictability for varying force mixes.

TITLE: COMBAT - Simulation of Encounters Between a Platoon and a Section

PROPONENT: DOA Army, G-1-24, Dept of Defence, Russell Offices, ACT, 2600, Australia

DEVELOPER: As above.

PURPOSE: The purpose of the simulation is to access the influence of rifle firing parameters, such as time to aim and accuracy, on the outcome of an encounter between an attacking platoon and a defending section. The simulation has been used to evaluate the effect of varying recruit training standards for the Army.

GENERAL DESCRIPTION: The model is a simple Monte-Carlo simulation in which speed of advance, detectability, vegetation and hit probability are determined from various probability distributions. The simulation is started at a predetermined separation between the two groups and is terminated when one of the groups has suffered a selected percentage loss of soldiers. The program is to be extended to include a variety of hand weapons, such as machine guns, grenades and anti-personnel mines.

INPUT:

- Soldiers grouping ability, start separation, means and standard deviations for the distributions of hit probability, visibility, speed and direction of advance, time taken to aim and fire a round.

OUTPUT:

- Outcome of encounter, distance at which the encounter was terminated. The losses on both sides.

SOFTWARE:

- The program is written in HPL suitable for a Hewlett Packard HP9825 desk top computer. Documentation is not yet available.

STAFF AND TIME REQUIREMENTS:

- Negligible

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Periodically

USERS: DOA-Army

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TITLE: COMBAT II

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: The BDM Corporation

PURPOSE: COMBAT II is a computerized model of simultaneous air/ground combat at the theater level with the capability to play conventional, nuclear, or mixed interactions. It is an aggregate model designed to provide an overview of theater level mixed combat exchanges and to determine what is driving the battle outcome.

GENERAL DESCRIPTION: COMBAT II is a differential equations model. Detailed time histories of the combat systems are obtained by numerically integrating a coupled system of nearly a hundred ordinary differential equations. Time histories include the number of remaining units at various locations, targets of every type killed within the system, supply flows, deployments, and attritions due to each enemy source. Systems considered in COMBAT II are ground force units (with a proportionate share of conventional artillery), nuclear artillery, tactical missiles, aircraft, supplies, and nuclear warheads. Model equations are symmetrical for red and blue. Asymmetries are dealt with through data input.

INPUT:

- o Allocation factors
- o Acquisition factors
- o Kill factors
- o Maximum expenditure rates

OUTPUT: The time history of nearly eleven hundred parameters are output on tape. The COMBAT II output tape is input to a post processor program to produce any of the following:

- o Computer printout and plot of the time history of any parameter.
- o Conservation table for any combat system. The conservation table gives a rigorous accounting at each location throughout the battle of units remaining, losses from each enemy source, expenditures against each enemy target, resupply, etc.
- o Decomposition table summarizing throughout the battle the contributions of each combat system to the outcome. The decomposition table and conservation tables enable the analyst to see the contribution of each factor and to identify driving parameters at any point of the battle.

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MODEL LIMITATIONS:

- o FEBA movement is considered in three segments (fronts) only
- o Terrain, weather, day, and night effects on target acquisition, and movement rates are not calculated explicitly. Provisions are made for accounting for these effects by manual inputs.
- o There are no provisions to represent local breakthrough, overrun, encirclement, and capture.

HARDWARE:

- o Computer: CDC 6000-7000 system
- o Operating System: Local or remote job entry
- o Storage Required: 100K andtwo on-line files (disk or tape)
- o Peripheral Equipment: Card reader or RJE terminal, printer.

SOFTWARE:

- o Programming Language: FORTRAN (CDC extended)

TIME REQUIREMENTS:

- o Preparation time for a completely new problem is approximately 3 man-days.
- o Preparation time for a minor excursion on an existing problem is as little as 1/2 hour.
- o Typical run time for a 10-day war (including post processor time) is under 2 CPU minutes (run time is somewhat data dependent).
- o Analysis time for output to a completely new problem is less than 1 day.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used extensively for on-going theater force balance studies.

USERS: The BDM Corporation for DNA

POINT OF CONTACT: Mr. John R. Bode
The BDM Corporation
1920 Aline Avenue
Vienna, VA 22180
Telephone: 703/893-0750

KEYWORD LISTING: Differential Equation; Analytical; Conventional-Nuclear; Ground/Air Forces; Time-Histories; Sensitivity Analysis

TITLE: Combined Arms Combat Developments Activity Jiffy War Game

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Combat Operations Analysis Directorate

PURPOSE: The CACDA Jiffy War Game is a computer-assisted, analytical, general war model which simulates ground combat by computing rates of advance and assessing combat losses due to indirect fire, armor-antiarmor engagements, infantry combat, air defense/armed helicopter engagements and minefields. The model's chief focus of concern is scenario development and analysis of combat force structures at division level and above.

GENERAL DESCRIPTION: Jiffy War Game is two-sided and deterministic and involves both land and air forces. The level of aggregation for which the model was designed is Blue company, Red battalion, with a range of possible manipulation up to corps level. Simulated time is treated on a time-step basis. Ratio of Game Time to Real Time is 4:1 (generally). Interactive wargaming using non-linear assessment equations for combat losses determination is the primary solution technique.

INPUT:

- o Force file (3-level hierarchy)
- o Dynamic interactive game decisions
- o Environmental descriptors

OUTPUT:

- o Interactive feedback (CRT and/or hardcopy)
- o Unit-status file (printed output only)
- Battle statistics summary (printed output only)
- o Force effectiveness (optional at selected gaming intervals)
- o Unit weapons output (optional at selected gaming intervals)
- o Sector of battle (optional at selected gaming intervals)
- o Opposing weapons array (optional at selected gaming intervals)

LIMITATIONS:

- o No synergistic weapons effects
- o No specific unit geometry

KNOWN:

- o Computer: CDC 6400/6500
- Operating System: SCOPE 4.2
- o Minimum Storage Required: 65K
- o Peripheral Equipment: Remote interactive terminal (secure), line printer

SOFTWARE:

- o Programming Language: FORTRAN Extended
- o Documentation: 3 Manuals: Technical Manual - 2 volumes: methodology; classified data; appendices; Programmers Manual; User's Manual
- o Both user's and technical documentation are complete. All documents submitted for publication May 1977. Estimated date of availability for published documents is June 1977.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 3 man-months to structure data in model input format
- o 1 week for each day of corps level battle
- o 2 minutes CPU time per model cycle
- o 6 months learning time for players
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Continual

USERS:

- o Principal: Scenario Oriented Recurring Evaluation System (SCORES)
- o Other: CACDA, COA

POINT OF CONTACT: Dr. Robert Schwabauer
Combat Operations Analysis Directorate
ATTN: ATCA-CAT
USA Combined Arms Combat Developments Activity
Fort Leavenworth, Kansas 66027
Telephone: AUTOVON 552-3193

MISCELLANEOUS: This model supersedes SCORES Jiffy War Game, Manual Jiffy War Game.

KEYWORD LISTING: Computer-assisted; Analytical; General War; Two-sided; Deterministic; Land Forces; Air Forces; Time-Step

TITLE: COMJAM.BAS (Communications Jamming Effectiveness Graphs)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Draw a graphical representation of effective jammer or transmitter range for communications transmitter-receiver links

GENERAL DESCRIPTION: The program determines effective radius of transmitter range for given parametric values. It assumes a flat earth with only standard $1/R^2$ losses and is based on the classical jam equation.

INPUT:

Communications receiver bandwidth

Frequency

Transmit power

Transmit antenna gain

Distance of transmitter to receiver

Peak power of jammer

Jammer antenna gain

Jammer to receiver distance

OUTPUT:

Effective transmitter radius

Effective jammer results

MODEL LIMITATIONS:

No atmospheric or terrain propagation losses

Assumes flat earth

No terrain

Assumes Ø dB J/S necessary for 50% intelligibility

HARDWARE:

Computer: PDP 11-35

Operating System: TEKTRONIX SPS

Minimum Storage: 36,000 words

Peripheral Equipment: TEKTRONIX 4010 or 4014 console; TEK 4610 hardcopy

SOFTWARE:

Program Language: SPS BASIC

Documentation: Comments within code

TIME REQUIREMENTS:

Time to structure input data: Time to gather parametric data on jammers/transmitter

CPU Time: five seconds

Analysis Time: None

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Two times each month

USERS: AFEWC/EWTR

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

COMMENTS: This is the original version of the communications jamming effectiveness program. Revisions and additional options resulted in later versions of this program (COMJAM 1.BAS, COMJAM 2.BAS, COMJAM 3.BAS).

TITLE: COMMBAS (Communications Jamming Effectiveness Graphs)

COMPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Calculates and graphs J/S versus jammer-to-receiver range for various communications transmitter-receiver link distances

GENERAL DESCRIPTION: Program uses standard jam equation to determine J/S ratio at target receiver for various jammer-to-receiver ranges with transmitter-to-receiver links of 1, 5, 10, and 20 nautical miles (NM). Program generates X-Y graph with J/S on Y axis and jam to-receiver range on X axis.

INPUT:

Peak Jammer Power

Jammer antenna gain in direction of receiver

Transmitter power

Transmitter gain in direction of receiver

Communication receiver bandwidth

Jammer bandwidth

OUTPUT:

Plots a chart of jamming/signal ratio against jammer to receiver range (0-150 NM) for separations of transmitter and receiver of 1, 5, 10, 20 KM.

LIMITATIONS: Program uses only standard $1/R^2$ losses and assumes no atmospheric or terrain propagation losses.

HARDWARE:

Computer: PDP-11

Operating System: RT-11

Minimum Storage Requirement: 28,000 of memory

Peripheral Equipment: RX01 floppy disk driver, TEKTRONIX 4014 or 4010 terminal

SOFTWARE:

Programming Language: RT-11 BASIC

Documentation: Within program

TIME REQUIREMENTS: Total run time is 45 seconds.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Six times a year

USERS: AFEWC/EWTR and EWTA

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

KEYWORD LISTING: J/S Jamming

COMMENTS: See comments in COMJAM.BAS

TITLE: COMJ2.BAS (Communications Jamming Effectiveness Graphs)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Same as COMJ1.BAS with option to compare theoretical results of program to measured or other calculated data

GENERAL DESCRIPTION: Program has option for user to enter measured (or calculated) data for specific jammer-receiver, transmitter-receiver ranges and jammer effectiveness. These user entered points are then plotted on the same graph generated by the program for a direct comparison.

INPUT:

Peak jammer power

Jammer antenna gain in direction of receiver

Transmitter power

Transmitter gain in direction of receiver

Communication receiver bandwidth

Jammer bandwidth

J/S ratio

Jammer to receiver range

Transmitter minus receiver distance -- Optional

Jammer effectiveness -- Optional

OUTPUT:

Plots an X-Y graph of jamming/signal ratio (Y Axis) against jammer to receiver range (0-150 NM) (X Axis) for separations of transmitter and receiver of 1, 5, 10, 20, 30, 40, 50, 60 NM

Option: Plots user entered values on same graph generated by program for comparison purposes

MODEL LIMITATIONS: Assumes standard $1/A^2$ loss with no atmospheric or terrain attenuation.

HARDWARE:

Computer: PDP-11

Operating System: RT-11

Minimum Storage Requirement: 28,000 of memory

Peripheral Equipment: RX01 floppy disk, TEKTRONIX 4010 or 4014 terminal

SOFTWARE:

Programming Language: RT-11 BASIC

TIME REQUIREMENT: Total run time 60 seconds

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: One time per year.

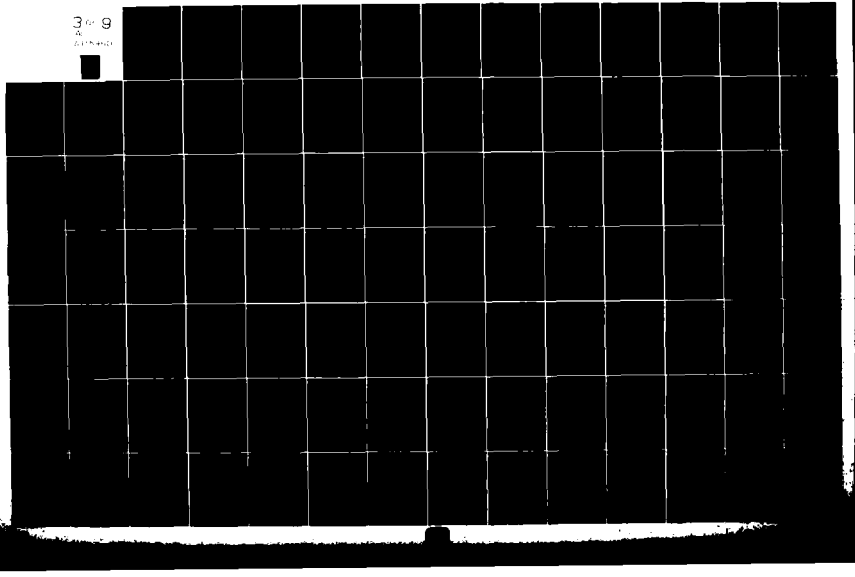
USERS: AFEWC/EWTR

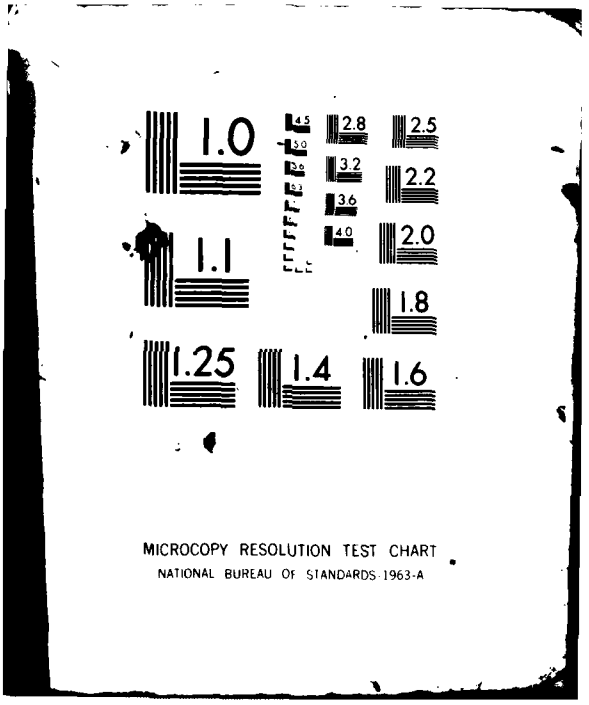
POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925/2567/AUTOVON: 945-2567

KEYWORD LISTING: J/S Jamming

COMMENTS: See comments in COMJAM.BAS.

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
MAY 82 A F QUATTROMANI
UNCLASSIFIED SAGAM-120-82 NL




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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TITLE: COMJ3.BAS (Communications Jamming Effectiveness Graphs)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Generates X-Y graph of user entered values of jammer-receiver and transmitter-receiver ranges and measured effectiveness

GENERAL DESCRIPTION: Same as COMJS.BAS except no theoretical J/S curves are generated. Only user enter points are plotted in X-Y format with J/S along Y axis and jammer-to-receiver range along X axis.

INPUT:

Jammer to signal ratio (J/S)

Jammer to receiver distance

Transmitter minus receiver distance

Jammer Effectiveness (Effective/Not Effective)

OUTPUT:

Graph displaying the input points. Y axis is the J/S
X axis is the jammer to receiver range

MODEL LIMITATIONS: Standard $1/R^2$ propagation only. No atmospheric or terrain attenuation considered.

HARDWARE:

Computer: PDP-11

Operating System: RT-11

Minimum Storage Requirements: 20,000

Peripheral Equipment: RX01 floppy disk, TEKTRONIX 4010 or 4014 terminal

SOFTWARE:

Programming Language: BASIC

TIME REQUIREMENTS: Total time is 2 minutes.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Once a year

USERS: AFEWC/EWTR

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

COMMENTS: See comments in COMJAM.BAS.

TITLE: COMMAND Guided Missile Model (COMMAND)

PROPONENT: Wright-Patterson AFB Ohio

DEVELOPER: Applications Research Corporation, Dayton Ohio

PURPOSE: COMMAND models the engagement between a penetrating aircraft and a command guided missile

GENERAL DESCRIPTION:

a. COMMAND simulates the missile flyout against specific targets in the penetrator force as assigned by ATEM. COMMAND simulates the missile launch over the gamut of range conditions and flies the missile to the target using missile design parameters and guidance algorithms; e.g., three point (for ECM) and lead angle (when target range is available). The aircraft and missile modules developed in HOME are employed in COMMAND. COMMAND includes the following additional functions: the acquisition process, the simulation of up-down communication links, application of the appropriate radar equations and guidance laws. If jamming occurs during the acquisition phase, a correlation must be made in the weapon fire control between the azimuth and elevation radar channels to establish target track position. Correlation can be determined based upon range, target burnthrough, electro-optical, or auxiliary radar adjuncts. COMMAND simulates operator target selection, track cursors placement, and a tracking mode selection. Tracking options within COMMAND include: automatic and manual radar track, and optical track. Tracking performance is based upon J/S or S/N, and is empirically derived.

b. COMMAND can simulate penetrators carrying warning systems and employing ECM against both target track and command guidance links. A radar fuze option with ECM is also available. The same data outputs are available in COMMAND as in HOME.

TITLE: Tactical Air-Land Operations Model (COMMANDER)

PROPONENT: TACLO, Fort Leavenworth, Kansas 66027

DEVELOPERS: USAF Tactical Fighter Weapons Center

U.S. Army Combined Arms Combat Development Activity

C.A.C.I. Inc. - Federal

PURPOSE: COMMANDER is an analysis tool for quantifying the effect of various combinations of tactical air weapons and support systems on the outcome of a dynamic, corps-level combined arms battle.

DESCRIPTION: COMMANDER consists of:

Tactical ground operations for both offensive and defensive units, including armor, mechanized, and artillery

Tactical air operations, including CAS, interdiction, and defense suppression

Tactical reconnaissance, including targeting, sensor configuration, and recce fusion

Air defense operations, including target acquisition, TEL allocation, missile and equipment availability, and damage assessment

Graphic battlefield displays of combat measures: location, momentum, and position certainty

Calculation routines for generating/updating measures of unit mass momentum and battlefield stress

User control over forces, including the capability to change tactical plans during the course of a game

COMMANDER was developed to provide a tool for joint studies of the total tactical air and ground environment. Two assumptions are fundamental to COMMANDER:

Major Army and Air Force combat (and combat-related) systems must be integrated into a single simulation to permit a satisfactory examination of any one (or combination) of them within a total tactical environment.

It is not currently possible to model the COMMANDER's tactical decision-making process.

Thus, COMMANDER is a dynamic, interactive model of combined air/ground operations in which both the initial planning and the control of forces during the battle are reserved to human gamers.

Two developments, possibly unique to COMMANDER, permit the achievement of this objective:

Creation of simple combat measures that quickly convey what is occurring on the battlefield, and

Development of a user/program interface that permits gamer control of the combat units during the battle.

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Each mission in COMMANDER is independent in that it can be made the focus of a study with its own parameters varied over a range of values while the others are held relatively stable. Thus, a reconnaissance study may investigate differences between "perceived" enemy locations and "ground truth" for various levels of reconnaissance effort and aircraft/sensor combinations. A close air support study may vary tactical air allocation rules as well as the numbers and types of aircraft. Studies of ground combat can focus on the effects of various tactics for fixed resources or the effects of variations in force mixes or force levels.

The operations interact in that the results of each form part of the input to the others. The disposition of the ground forces in simulated combat forms a realistic test bed for reconnaissance operations as well as targets for tactical air strikes. The tactical air allocation and strike operations, on the other hand, provide air support to the ground forces that is credible in both level and timing, while reconnaissance missions provide a "perceived" picture of the battlefield for ground and air tactical planning. The entire process is superimposed on a realistic communications model linking command and control centers with ground and air units.

COMMANDER is an extension of the hand-played war game philosophy. Tactical decisions are left to the players; bookkeeping and computational chores are given to the computer. The area of tactical decision-making belongs entirely to the players, and tactical planning for a COMMANDER game in many aspects parallels real world operational planning.

INPUT: Input requirements are extensive and consist of items such as scenario, system characteristics/effectiveness, air-order-of-battle, weather, and terrain. Because COMMANDER is written to allow deselection of mission areas, data input requirements vary with the study being performed.

OUTPUT: Complete time history with summaries for major mission areas such as air strike results, air defense effectiveness, and ground unit status. Interactively generated graphical results as desired.

LIMITATIONS: Ground Combat. The combat zones controlled by the ground combat units are represented by circles. Close combat occurs when opposing units overlap. There is no directional effect; at the level of individual units, an attack from the rear has the same effect as a frontal or side attack. There are, of course, ways in which the analyst may simulate the effects of frontal versus rear attacks (for example, by type changes, to allow the units to acquire new values for attrition rates and break points), but the effect is not automatically present for each engagement.

There is no distance effect. The killing rates do not depend on the relative positions of the units nor on the degree of penentration as represented by the size of the overlapping area. Thus, microtactics (that is, the movements of men and equipment within the area occupied by the basic game unit) cannot be simulated.

The appropriate level for the basic unit played in a given game depends, of course, on the study objective of the game. However, because attrition is deterministic and uniform across a ground unit, the model is probably not suitable for basic units smaller than companies, and the model's best use is at the battalion to division level. While it could handle units larger than the division, its treatment of individual air attacks and specific environment features would be wasted (that is, unnecessarily detailed). Other operations related to real warfare but not modeled explicitly in COMMANDER include:

Logistics (maintenance, resupply, stockpiling)

C3

Intelligence operations, espionage, deception

Special warfare (irregular, urban, CB, nuclear)

Political, psychological aspects

Air Attacks: Weather effects may change the target detection probabilities. There is no weather effect on the aircraft flight path nor on the survival probability computed for the aircraft. Other operations crucial to air strikes not included explicitly in COMMANDER are:

Air-air combat

Logistics, resupply of fuel and weapons

Airfield attacks

Reconnaissance: Reconnaissance flights are simulated in detail, with the recce aircraft flying along prespecified path legs, at designated altitudes, and with sensor on-off conditions specified by the players. The aircraft are assumed to travel so fast, relative to the ground units, that no movement of ground units takes place during the flight. This does not mean, of course, that moving ground units are perceived as stationary. Any moving ground unit is potentially detectable by the appropriate sensors. A recce flight may be designated as having a data-link and, if destroyed, is assumed to have transmitted its information to the ground for all flight legs up to the one on which it was lost. All information is lost from a destroyed recce aircraft if no data-link is present.

HARDWARE: Computer: CDC Cyber 74, VAX 11/780 (early CY 1982).

Operating System: NOS/BE.

Minimum Storage: Approximately 200,000 octal words. Varies with the scenario and modules used.

Pheripheral Equipment: Tektronix 4014 (if graphics desired).

SOFTWARE: Programming Language: SIMSCRIPT II.5

Documentation: Extensive user and programmer documentation available.

TIME REQUIREMENTS: General estimates of study timing and manpower requirements are difficult because both are especially sensitive to each study's scope and objectives. Rough guidelines for study planning are given below:

	MAJOR STUDY EFFORT	MINOR STUDY EFFORT
Personnel:		
Study Director	1	1
Computer Program Operators/Data Entry Clerks	2-3	1-2
Analysts	4-6	2-4
Programmers	2-4	0
Timing:		
Initial Data Preparation	2 months	0
Program Runs	3-4 months	1-2 months
Data Analysis	3-4 months	1-2 months

A major study effort is one for which the entire database must be developed. Interactive runs are used for:

Inputting the reconnaissance missions (which are stored permanently for later program runs)

Inputting the air strike missions

Checking the ground war operations for consistency and "reasonableness."

When the combat results for the case are acceptable, then batch runs with parameter variations required by the study are submitted. Obtaining the runs and analyzing the results can proceed simultaneously during the 2-6 months allotted for the study.

In addition to the development of a complete data base, a major study effort may call for program modifications, requiring two to four programmers during the study period.

A minor study is one that may use a data base already developed in the course of another study and will not require program changes. A team of two to four analysts can obtain and analyze results over a two- to four-month period.

These numbers are obviously intended to be representative only, since the actual requirements of any given study are highly sensitive to the study's particular characteristics as well as to the resources available for it.

SECURITY CLASSIFICATION: COMMANDER is unclassified. Data bases are normally SECRET.

POINT OF CONTACT: TACLO
1Lt Meyer
Ft Leavenworth, KS 66027

C.A.C.I. Inc. - Federal
2727 Camino Del Rio S.
Suite 319
San Diego, CA 92108
Telephone: 714/299-0960

TITLE: COMM/EW Evaluation System

PROPONENT: DARCOM CM/CCM Directorate, Adelphi, MD

DEVELOPER: Department of Defense, Electromagnetic Compatability Analysis Center, Annapolis, MD

PURPOSE: The system is intended for use in conjunction with existing wargames in order to allow players of these wargames to incorporate communications/electronic warfare into the wargames. The system is being designed modularly to allow the incorporation of Comm/EW modules directly into wargames being developed or modified.

GENERAL DESCRIPTION: This system is an interactive two-sided game in which events are deterministic. The system models units to the level of individual pieces of equipment (e.g., communications radio, jammer, direction finder, etc.). The performance characteristics of each piece of equipment may either be specified by the players or be drawn from a data base of existing equipment. The location of each piece of equipment is specified using universal coordinates, and actual terrain is modeled using a computerized topographic data base. The system may be either time or event driven, with changes in equipment types, characteristics or location being allowed by each player between events or time slices. The system then evaluates the status (i.e., operation, effects of jamming, effects of interception) of each communication link being played. The status of each link may be displayed in either abbreviated form (GO/NO GO) or full form (jamming-to-signal ratio, signal-to-noise ratio, etc.).

INPUT:

- o Equipment characteristics (if not in standard equipment data files)
- o Equipment locations/scenario
- o Communications links/nets to be analyzed

OUTPUT:

- o Link/net status
- o Link/net communications characteristics (J/S, S/N, etc.)

MODEL LIMITATIONS: Equipment location/characteristics changes must be transferred from wargame to this system between plays

HARDWARE: PDP11 (can be easily adapted to other similar minicomputer as well as most main frame computers)

SOFTWARE: FORTRAN

TIME REQUIREMENTS:

- o Preparation: Set up of initial scenario may require about a half day
- o Play: Interactive, proceeds along with wargame (each Commo/EW play may require several minutes of computer time on PDP 11)
- o Analysis: Performed interactively between plays

SECURITY CLASSIFICATION:

- o System software UNCLASSIFIED
- o Equipment scenario may be CONFIDENTIAL
- o Equipment Characteristics - depending on types of equipment being analyzed, the characteristics may be classified

FREQUENCY OF USE: As required

USER: DARCOM CM/CCM Directorate, DOD ECAC, wargamers

POINT OF CONTACT: Mr. James Sczepanski
ATTN: DRDEL-CM/CCM
Adelphi, MD 20783
Telephone: (202) 394-3160

MISCELLANEOUS: Current simulation addresses conventional communication and interception techniques. Follow-on work in process will address spread spectrum modulation techniques.

TITLE: COMO III - Computer Model

PROPONENT: Systems Analysis Division, Plans & Analysis Directorate, US Army Missile Command, Redstone Arsenal, AL 35809

DEVELOPER: SHAPE Technical Center/US Army Agencies

PURPOSE: COMO III is a computerized, analytical, damage assessment/ weapons effectiveness model. It is used to evaluate the operational effectiveness of air defense weapon systems in a realistic tactical scenario. Model results can be used for comparative evaluations of alternative systems. It contains a detail threat model to include the ECM environment. A many-on-many or a few-on-few if desired. It also deals with damage assessment of ground targets from air attack.

GENERAL DESCRIPTION: COMO III is a two-sided, stochastic model which deals with land and air forces. It was designed for an individual fire unit and may be manipulated up to a total air defense weapons mix. May be used for a field army level of exercise. It is an event-store model which has a ratio of game time to real time of 5:1 and uses engagement logic, probability, statistics, and Monte Carlo techniques as methods of solution.

INPUT:

- o Technical Chharacteristics
- o Performance Data
- o Operational Data
- o Decision Rules
- o Weapons Quantity
- o Deployment Layout

OUTPUT: Computer Printout

MODEL LIMITATIONS:

- o Threat flight paths contain no detailed effects due to "G" limits
- o No digitized terrain data base
- o Many-on-many requires large number of CPU time

HARDWARE:

- o Computer: CDC 7600/CDC 6000 Series
- o Operating System: Scope
- o Minimum Storage Required: 125K octal

SOFTWARE:

- o Programming Language: FORTRAN
- o User's manual complete
- o Programmer's manual not complete

TIME REQUIREMENTS:

- o 2 months required to acquire base data
- o 1 man-month required to structure data in model input format
- o 1 hour playing time required
- o 10-60 minutes CPU time required per model cycle
- o 1/2 months required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS:

- o US Army Air Defense Community
- o TRADOC System Analysis Activity

POINT OF CONTACT: Charles E. Covin
US Army Missile Command
ATTN: DRDMMI-DS
Redstone Arsenal, AL 35809
(205) 876-2626; AUTOVON 746-2926

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Land; Air; Computerized; Two-sided; Stochastic; Event Store

TITLE: COMO III - Computer Modelling System for Air Defense Applications

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: COMO III is a general-purpose critical event modelling system designed to speed the writing of air defense simulations. Already programmed within its framework are many of the features that are common to air defense simulations (aircraft flightpath representation, terrain screening, radar detection, etc.), together with a means of time-ordering the critical events that occur in the simulation. In addition, a special input language (COMIL) and a flexible data retrieval system are provided. The user develops his own model of each particular air defense weapon system in FORTRAN IV, which is combined with the COMO III framework to produce an air defense simulation model.

GENERAL DESCRIPTION: The COMO III software system consists of four parts:

- o The COMO III frame source program;
- o A library of weapon system models (normally written by the user in FORTRAN IV, utilizing COMO III frame subroutines;
- o The COMO Runtape Assembly Program (CRAP);
- o The COMO Input Language (COMIL)

The purpose of the CRAP program is to add a selected set of weapon system models to the COMO framework, thus producing a COMO III simulation model. A COMO III model is a critical event model, and therefore in the combat simulation process, a subroutine must be programmed for every discontinuity occurring. A form of time-stepping is also adopted to simulate a unit "waiting" for something to occur, for example a unit trying to detect a target.

The COMIL input language allows games of varying size and detail to be simulated, e.g., one weapon versus one target, up to theatre level conflict involving numerous weapons and aerial targets (current limit is 4096 combat units in the game simultaneously). The total number of combat units in the game can be considerably higher than the number input, because combat units may be created dynamically.

INPUT: Data are input in the form of COMIL program which consists of a list of specially named COMIL STATEMENTS. In general, the type of data input by means of these statements can be grouped into two classes: Game Control Data and Combat Unit Data, as described below.

(1) Game Control Data

- o Number of each type of land-based and airborne combat units in the game
- o Size of the geographic area in which the game is played and resolution required
- o Combat unit geometry and game entry/exit conditions (x,y,z coordinates, game entry and exit times (if known), initial speed, planned changes in x, y, z and speed during the game)
- o Accuracy and units of measurement to be used
- o Number of parametric variations required, and parameter value
- o Number of replications of each game
- o Type of output required (graphics display, history of each critical event, summary of number of times a articular event executed, etc.)

(2) Combat Unit Data. The amount of input data required to describe a particular combat unit depends upon the complexity of the combat model unit which has been added to the COMO frame. The data requirement is thus fully controlled by the user.

Weapon system models currently programmed in COMO require the following type of input data:

- o Missile/shell characteristics (time of flight versus range, lethality, intercept boundary versus target speed, drag coefficient, thrust history, maximum lateral acceleration as a function of speed and altitude)
- o Interceptor characteristics (drag coefficient, lift coefficient, thrust as a function of throttle setting, speed and altitude)
- o Detection/Acquisition curves (visual/radar/IR probability versus range, or fixed boundary or individual radar characteristics)
- o Reliability (probability of losing target track, missile in-flight failure, incorrect operation by gunner)
- o Logistics (missile/shell stockpile, reload capability)
- o System time delays (times to react, assess target for engage-ability, reloads, and time frequency of repetitive operations such as glimpse time, radar scan time)
- o Assessment criteria (firing boundaries, range and/or speed estimation statistics)
- o Type of inter-weapon coordination
- o Visibility data (meteorological visibility, terrain screening patterns, search sectors)
- o Airborne and ground based jammer characteristics (e.g., power, directivity, frequency, bandwidth)

OUTPUT:

- Computer printout of the number, frequency and distribution of the results occurring at each decision point in the simulation (e.g., number of detections, assessments, target kills, missile failures).
- The mean and standard deviations of each 'result count' for the number of replications used.
- A 'TRACE' printout (used for debugging) which causes some or all of the critical events to be listed in time order with the values of weapon system variables at the time each event occurs.
- More complex scenarios, especially with the interceptor operations model, can be run interactively with a graphical representation of aircraft tracks on a display, and additional printout, if required.

LIMITATIONS:

- Initial set-up of game requires expertise as a special input language is used (however, once expertise is acquired, the use of special input language can be considered an advantage over other models).

HARDWARE:

- Computer: CDC 3600, CDC 6400, CDC 6600 and UNIVAC
- Operating System: For CDC 6400: SCOPE 3.4
- Minimum Storage Required: 100K octal words or greater according to weapon system and scenario
- Peripheral Equipment: For CDC: Disc and/or tapes

SOFTWARE:

- Programming Language: FORTRAN IV, Assembler
- Documentation:
  - *STC TM-162 "COMIL Input Definition Language for COMO III" May 1967 (NU)
  - *STC TM-232 "The Addition of Weapon Systems to the COMO Framework" February 1970 (NU)
  - *STC TM-554 "The COMO III Air Battle Model Program Description" 1977 (NU)

*Currently under revision

TIME REQUIREMENTS: The definition of a weapon system model for use in the COMO framework can take a number of weeks to design and debug, depending upon familiarity with the model. Thereafter simple runs can be set up in a few minutes if the programmer has a working knowledge of the COMIL input language. More complex simulations should take no more than a day to prepare. The results can be interpreted in a few minutes, although the analysis and evaluation can take up to 1 man-week if a lot of parametric or output options are requested.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used daily at SHAPE Technical Centre

USERS: SHAPE Technical Centre; General Research Corporation (GRC); Concepts Analysis Agency (CAA); Army Missile Command (MICOM); Redstone Arsenal, Selenia Italy; British Aircraft Corporation (BAC); IABG Munich Germany, Thomson CSF France, Fort Leavenworth, Kansas, USA; Army Air Defense School (USAADS), Fort Bliss, Texas; TRADOC System Analysis Activity (USA-ATAA); White Sands Missile Range, New Mexico.

POINT OF CONTACT: SHAPE Technical Centre
P.O. Box 174
The Hague
Netherlands
APO New York 09159

MISCELLANEOUS:

- o A noise jamming package has been added to the COMO frame. This package allows the user to add noise jamming units or radar units to any combat unit in the game, and assesses whether a particular jammer or set of jammers can influence the detection of a target by a radar. This facility, although completed, is not yet fully debugged.
- o A facility to enable the user to interact with the program during a run is also under development.

KEYWORD LISTING: Simulation; Monte-Carlo; Critical Event; Air Defense; Modelling System; Missile System, Gun System; Interceptor Operations

TITLE: COMO III - USAADS/UNIVAC Version

PROPONENT: Directorate of Combat Developments, US Army air Defense School, Fort Bliss, Texas

DEVELOPER: CDC/UNIVAC Frame Conversion - TRW Defense and Space Systems Group, Huntsville, Alabama

PURPOSE: COMO III is a computerized two-sided analytical damage assessment/weapon effectiveness model that can be used to simulate one-on-one engagements to theater force-level air defense war games

GENERAL DESCRIPTION: COMO III is a framework for the construction of system-level simulations of tactical and strategic weapon systems in an inherently modular and mutually compatible form. The COMO frame, when assembled with FORTRAN weapon decks whch describe the dynamically interacting systems, form the critical event stepped Monte Carlo simulation which is flexible to game size and input/output format and is extremely efficient in the use of memory. The COMO III software was developed by the SHAPE Technical Centre, The Hague, Netherlands. It consists of: (1) a simulation framework (discrete event simulation executive and dynamic memory manager), an input language (COMIL) to facilitate input of system performance and deployment scenario characteristics, and (3) the Computer Run Tape Assembly Program (CRAP) which facilitates the integration of the weapon decks with the frame. The COMO III program has been extensively modified by TRW to run on the CDC 7600 computer. Weapon decks are used to model weapon system engagement logic. The fidelity of such a model is limited only by the program objectives and the resources applied to model development. Representative weapon decks are listed below:

PATRIOT	CHAPARRAL
I HAWK	STINGER
ROLAND	RED AIRCRAFT

INPUT:

- o Threat aircraft characteristics and vulnerabilities
- o ADA system characteristics
- o Aircraft flight paths and profiles
- o Scenario data (flight path timing and ground deployments)
- o Threat munition characteristics
- o ECM jamming levels

OUTPUT:

- o Computer/Microfiche printout with input data, kill summary, and specialized statistics on a per site/per aircrat basis
- o Data tape for extensive post-processing for additional data at a later time

MODEL LIMITATIONS:

- o Model detail can increase CPU run time
- o Model is partially written in COMPASS which requires conversion efforts to fit other machines
- o Model is currently manpower intensive in set-up time and output data reduction. (Plans exist to reduce manpower requirements via computer assisted input generation and data reduction
- o Model run time increases non-linearly with the number of threat aircraft in the scenario

HARDWARE:

- o Computer: CDC 6400/6600/7600 (Current)
  UNIVAC 1100 Series (Planned 1st Qtr, FY 83)
- o Minimum Storage Required: HIMAD Study - 230K SCM 450K LCM
- o Peripheral Equipment: Card reader/puncher, printer, tape drive, disc storage

SOFTWARE:

- o Programming Language: CDC - Compass and extended FORTRAN IV and FORTRAN 77
- o Documentation:
  CDC: COMO III Program Description, Volumes 1 and 3, SHAPE Technical Centre Manuals (STC TM-554), November 1978
  COMIL: The COMO III Input Language, SHAPE Technical Centre Manual (STC-TM-595) March 1979
  The Generation of COMO III Models, STC TM-594, March 1979
  Numerous weapon deck manuals have been written for the US Army Missile Command and the Patriot Project Office under the control of the respective project managers
  UNIVAC: No current documentation. Will be published on or about 15 September 1982

TIME REQUIREMENTS:

- o One man-year to understand the frame and weapon decks to allow the proper generation of input data. At least three man-years required to understand weapon decks fully and the linkages between the decks and the frame
- o 3-6 man-months to generate a full corps and rear area scenario given prior experience
- o Playing time per replication for a case with 36 Patriot fire units, 72 Roland, and 1000 airplanes can run up to 1 hour. Shorter times can be achieved at the expense of model fidelity
- o Time to analyze and evaluate the results is vaiable based on experience and the amount of fidelity required from the simulation

SECURITY CLASSIFICATION:

- o Frame: UNCLASSIFIED
- o Weapon Decks: UNCLASSIFIED, but restricted limited distribution
- o Input Data: CONFIDENTIAL to SECRET. Unclassified input data does not exist at this time
- o Output: CONFIDENTIAL to SECRET

FREQUENCY OF USE:

- o CDC Version: Used in Project Successor, ROLAND COEA, HIMAD Study and several other classified studies
- o UNIVAC Version: Use projected beginning FY 83
- o USA Air Defense School

POINT OF CONTACT: John R. Armendariz
Commandant, US Army Air Defense School
ATTN: ATSA-CDX-C
Fort Bliss, Texas 79916
AUTOVON 978-6702

KEYWORD LISTING: Simulation, COMO, Event-Stepped, Monte Carlo, Air, Air Defense, Weapon effectiveness

TITLE: COMWTH II - Combat Worthiness

PROPONENT: US Army Mobility Research and Development Command

DEVELOPER: The BDM Corporation

PURPOSE: COMWTH II is a computerized, damage assessment/weapons effectiveness and target acquisition, analytical model. It simulates sensor/target interactions, intelligence assessments, target analysis, weapons allocation and weapons employment. It accommodates all types of air and ground sensors and both nuclear and conventional munitions. COMWTH II was developed to incorporate the full range of operational and technical details that interact to affect the damage actually inflicted on tactical targets. The object of COMWTH II is to provide analysts with a tool that allowed them to assess the effect on target damage of the complex sensor employment tactics interaction between sensor capabilities, environment, force deployment, target mobility, camouflage, target location error, munition lethality, delivery system accuracy, system response time, and weapon employment doctrine.

GENERAL DESCRIPTION: COMWTH II is a one-sided, deterministic model which employs land, air and civilian forces. It was designed to be used primarily for individual target elements such as tanks, trucks, and people but can also be used up to the battalion level. The largest unit that COMWTH II can accommodate is a division and it can be manipulated from a company through a corps using selected units. It is an event step model which is based on probablistic dependent and independent events to generate an expected value type outcome.

INPUT:

- Target array
- Sensor performance and deployment data
- Weapon system performance and deployment data
- Sensor and weapon system employment doctrine and description of environment

OUTPUT:

- Detected Target List - Identifies each unit that is detected and describes what the unit is assumed to be, and where it is considered to be located. The sensors which detected each target are also identified.
- Target Analysis File - Results of nuclear or conventional target analyses against each detected target are provided for each delivery unit/warhead deployed against the target array.

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- o Attack Plan - The delivery unit/warhead selected for use against each detected target is documented. Supplemental data such as expected results, selection criteria, etc. are also printed out.
- o Attack Plan Summary - Summarizes the anticipated cumulative damage to the array of detected targets and the total number of warhead/delivery systems of each kind that are required to attack the array.
- o Target Damage Assessment - Tabulates how much damage was actually inflicted on each real target as a result of the attack against the assumed target.
- o Engagement Summary - Summarizes what happended to each unit in the array of "real" targets. It tells if a unit was detected, if so, by what sensors it was detected, what the unit was identified as being and how much damage was inflicted on the unit.
- o Automatic analysis of results on the basis of user selected evaluation criterion.
- o Suppression on all unneeded output formats.

MODEL LIMITATIONS:

- o The time span of an individual simulation should not exceed approximately 24 hours because the scenario requires periodic manual revision to account for losses.

HARDWARE:

- o Computer: CDC 6600 or similar
- o Operating System: Scope 3.4 or NOS/BE
- o Minimum Storage Required: 100 K8 words memorandum execution
- o Peripheral Equipment: Disk Data Base: 40,000 words random access; 5000 words sequenctial, scratch files: 20 sequential; 5 random access

SOFTWARE:

- o Programming Language: FORTRAN IV Extended
- o Documentation: Application guide has been published
- o User's and programmer's manuals are pending.

TIME REQUIREMENTS:

- o CPU time is 100 per model cycle
- o No analysis time--automatic analysis by model

SECURITY CLASSIFICATION: UNCLASSIFIED

TITLE: COPE - Combat Operational Performance Estimates

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: The first model in the COPE family was designed to simulate a Copperhead fire mission under battlefield conditions taking into account such degrading effects as weather, terrain, smoke, dust, enemy artillery, prep fires, enemy direct fire, communication failures, and target location error as well as factors affecting Copperheads ability to track, hit, and kill a target. Later derivatives of the model played other weapons besides Coppernead (e.g. Tanks, Tow, Hellfire, SADARM, etc.)

GENERAL DESCRIPTION: The model is a primarily one-sided, stochastic, discrete event simulation of a single weapon vs a single target unit. It is suitable for a wide variety of surface-to-surface and air-to-surface weapon systems.

INPUT:

- o Probabilities of engagement, hit and kill
- o Mobility data for target
- o Terrain line of sight distributions and acquisition ranges are used weather data (cloud ceilings, visibility limits, and effects on smoke) are used.

OUTPUT: Output consists of a report of how many potential fire missions by the given weapon system were successful (resulted in a kill) and how many failed for various reasons (bad weather, smoke, dust, target, out-of-range, LOS lost, etc.)

MODEL LIMITATIONS:

- o Only 1 target unit which may have an arbitrary number of target elements (vehicles of some type).
- o Smoke is played statically.

HARDWARE:

- o Computer: Control Data Corporation CYBER 76
- o Operating System: SCOPE, NOS, or NOS/BE (has also been run or CYBER 173, 174
- o Minimum Storage Required: About 24K of 60 bit words
- o Peripheral Equipment: Printer, disk drives (about 160K of 60 bit words for data base file)

SOFTWARE:

- o Programming Language: FORTRAN 4 (Control Data Extended Version)
- o Documentation: AMSSA TR-318: Copperhead Operational Performance Evaluation (COPE): Computer Program User and Analyst Manual, March 1981.

TIME REQUIREMENTS:

- o To acquire Data Base: 2-4 weeks for new systems.
- o To Structure Data in Model Input Format depends on quantity, but 1 week seems adequate.
- o To Analyze Output: 1 hour per case.
- o User Learning Time: 1 week.
- o CPU Time per Cycle: 2-3 seconds.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Extremely variable depending on studies performed. Ranges from zero to several hundred runs per month.

USERS: USAMSAA, USAFAS, LCWSL, TRASANA

POINT OF CONTACT: USAMSAA - GWD - SWAB
Director, USAMSAA
DRXSY-GS (ATTN: Mr. Sandmeyer)
APG, MD 21001
Telephone: (301) 278-3810
AUTOVON 283-3810

MISCELLANEOUS: The original Copperhead version of COPE spawned a number of derivative models which play Tanks, TOW's, Hellfire, SADARM, etc. Copperhead COPE uses the PAM (probability of Engagement and Maneuver) model as a preprocesser.

KEYWORD LISTING: Computerized, damage-assessment, artillery, weapons effectiveness, laser-guided, smart-weapons, operational-performances, item-level-performance, (and, of course, the names of the particular weapons systems for which it has been used: (Copperhead, TOW, Tanks, SADARM, Hellfire).

TITLE: CORDIVEM - Corps/Division Evaluation Model

PROPONENT: Combined Arms Studies and Analysis Activity, Fort Leavenworth, KS

DEVELOPER: Combined Arms Studies and Analysis Activity, Fort Leavenworth, KS

PURPOSE: CORDIVEM is a computerized division/corps level multi-purpose model. As a systemic simulation model it may be used as an analytical tool in the design/evaluation of force structure tradeoff analysis and other combat development problems. As a gamer-assisted interctive war game it will be used to develop TRADOC standard scenarios. In addition a training model will evolve from the interactive version to support the Command and General Staff College at Fort Leavenworth.

GENERAL DESCRIPTION: CORDIVEM is a two-sided deterministic model involving joint Army-Air Force operations on the air/land battlefield. Its flexibility of use allows for a systemic simulation mode for addressing combat development problems and as a gamer-assisted computerized wargame. This model is primarily designed for division/corps level application with a manipulation range of company through Army. Level of model unit resolution is normally a maneuver battalion with a manipulation range of company through regiment. CORDIVEM is an event sequenced model which will be capable of executing at or near real time, dependent upon model application and unit resolution. Primary solution techniques include COMANEW utilizing Lanchester equations along with probabilistic algorithms. The CORDIVEM modeling effort is currently in a developmental stage. It represents part of a DA directed hierarchial model development plan instituted in 1980 and to be completed in 1984. CORDIVEM is expected to be ready for limited production application in mid 1982.

INPUT:

- o Unit TOE and Echelonment
- o Terrain, weather
- o Leathality data
- o Command & Control data
- o Mobility
- o Firing rates
- o Item level performance characteristics

OUTPUT: CORDIVEM output is a combination of graphical displays and computer printout in the form of specialized reports tailored to provide detailed information on military functions and processes modled. Reports include:

- o Unit Status
- o Intelligence & Sensor Reports
- o Killer/Victim Matrices
- o Comprehensive Artillery Reports
- o Reports on Movement, Resupply, Air Missions, etc

MODEL LIMITATIONS:

- o Currently not available for use
- o Undocumented
- o Hardware specific, not easily transportable

HARDWARE:

- o Computer: DEC VAX-11/780
- o Operating System: VMS
- o Minimum Storage Required: 2mb memoray, 200mb disk
- o Peripheral Equipment: RAMTEK 9300

SOFTWARE:

- o Programming Language: FORTRAN IV, SIMSCRIPT
- o Documentation: TBP

TIME REQUIREMENTS:

- o To acquire Data Base: 3 man-months
- o To structure Data in Model Input Format: 2 weeks
- o To Analyze Output: 1 man-month
- o Player Learning Time: 2 weeks
- o Playing Time per Cycle: 8 hours
- o CPU Time per Cycle: 2 hours

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continual

USERS: CASAA, Fort Leavenworth, KS

POINT OF CONTACT: CASAA (ATZL-CAR-MD)
Attn: Mr. T. Bailey
Fort Leavenworth, KS 66027
Telephone: (913) 684-5176

MISCELLANEOUS: CORDIVEM will be linked to CASTFOREM in a battalion level model and to FORCEM, a theater level model. The linkage will consist of passing scenario descriptive information up to FORCEM and receiving detailed direct fire attrition data from the higher resolution model, CASTFOREM.

KEYWORD LISTING: Computerized, Analytical, Simulation

TITLE: COSAGE - Combat Sample Generator

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: COSAGE is a computerized, combat assessment/weapon effectiveness model. The model develops information on losses of personnel and equipment, and ammunition expenditures during a 24-hour period of ground combat. COSAGE is applied mainly in the forecasting of personnel, ammunition, and equipment requirements.

GENERAL DESCRIPTION: COSAGE is a closed-form, two-sided, stochastic model which deals with land forces. It was designed to deal mainly with forces at the division level with battalion unit resolution. It can be employed from the platoon-battalion level to brigade-corps level. COSAGE is event-store and uses computer simulation as the method of solution.

INPUT:

- o Strength and weapons
- o Orders for each maneuver unit
- o Weapons data (single shot probability of kill, lethal area)
- o Sensor capabilities
- o Terrain data
- o Movement rates

OUTPUT:

- o Killer-victim scoreboard
- o Personnel losses
- o Ammunition expenditures
- o Materiel losses

MODEL LIMITATIONS:

- o Capabilities not represented:
  - Electronic warfare
  - Chemical warfare
  - Tactical nuclear effects
  - Military operations in built-up areas

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 200K words for model and data
- o Peripheral Equipment: Data entry, device, line printer

SOFTWARE:

- o Programming Language: SIMSCRIPT II.5
- o Documentation:
  - Code Listing
  - Data Requirements Document
  - Hierarchical Function Charts
  - User's and programer's documents not complete. Final completion expected in Oct 82

TIME REQUIREMENTS:

- o 6 man-months required to acquire base data
- o 3 man-months required to structure data in model input format
- o 60 minutes CPU time per model replication
- o 1 month (estimated) required learning time for basic model operation
- o 1 month (estimated) required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Support for 1 to 3 studies a year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: CPT James S. Kramer
US Army Concepts Analysis Agency (CSCA-RQR)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-5263

MISCELLANEOUS:

- o COSAGE provides output which is used as input to other models
- o Linked to:
  - CEM (Concepts Evaluation Model)
  - WARF (Wartime Replacement Factors)
  - APP (Ammunition Postprocessor)
- o COSAGE is an integrated model replacement for the multi-model AMMORATES system
- o Capabilities currently under development
  - Attack helicopters
  - Minefields
  - Battlefield obscuration
  - Tactical Air
  - Air Defense

KEYWORD LISTING: Analytical; Damage Assessment/Weapon Effectiveness; Land, Computerized; Two-sided, Stochastic; Event Steps; Simulation

TITLE: COUNTERCOM

PROPONENT: US Army Mobility Equipment Research and Development Command

DEVELOPER: BDM Corporation

PURPOSE: COUNTERCOM was developed to realistically model, at a very high level of resolution (i.e., individual weapon systems), tank/anti-tank combat; air-to-surface and surface-to-air engagements; the effects of indirect artillery and mortar fire (including obscuration and suppression); tactical maneuver and fire plans; the direct and indirect effect of landmines and other obstacles; and countermine/counterobstacle systems. Besides the applications of mobility/countermobility research and development activities, COUNTERCOM can also be used to assess tactics and employment doctrine of mobility/countermobility systems within the framework of the modern, integrated battlefield.

GENERAL DESCRIPTION: COUNTERCOM is a totally automated, high resolution, two-sided Monte Carlo combat engagement simulation model designed to evaluate the performance and military worth of integrated air-land combat systems at the company and battalion level on the modern battlefield.

INPUT:

- o Sensor Characteristics
- o Blue and Red Force Characteristics
- o Scenario and Mine Related Data
- o Doctrine Inputs
- o Intervisibilities of Defender-Attack Paths Pairs

OUTPUT:

- o Printed Graph, Survivors vs Time
- o Table of Average Survivors, M-Kills, K-Kills
- o Average Length of Battle

MODEL LIMITATIONS:

- o Stationary Defenders
- o Fixed Attack Paths

HARDWARE:

- o Computer: CDC CYBER 6000
- o Operating System: NOS/BE
- o Minimum Storage: 75K
- o Peripheral Equipment: Batch or interactive terminal

SOFTWARE:

- o Programming Language: FORTRAN 4 Extended
  COMPASS 3
- o Documentation: 2 Volume set: An Applications Guide and the Program Documentation and User's Manual, 30 Jun 81

TIME REQUIREMENTS:

- o 6 man-months to acquire new data base (if needed)
- o 1 man-week to structure imput for execution
- o 400 Octal seconds for complete run
- o 1 man-week to design experiment, execute, and evaluate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: One a month

USERS:

- o Primary: Systems Employment Branch, Countermine Laboratory, MERADCOM
- o Others: USAES, Fort Belvoir

POINT OF CONTACT: Commander
US Army Mobility Equipment Research and Development Command (MERADCOM)
Attn: DRDME-NES (Mr. Mark S. Adams)
Countermine Laboratory, Bldg 399
Fort Belvoir, VA 22060
Telephone: AUTOVON 354-4498

KEYWORD LISTING: Mine; Countermine; Mobility; Countermobility; Company; Force-on-Force; Simulation; Monte Carlo

TITLE: CREST - Computer Routine for Evaluation of Simulated Tactics

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: CREST is a computerized, analytical model that evaluates the effectiveness of one unit successfully evading one or more adversaries. Although the simulation is presented in terms of a CVA maneuvering to evade a number of nuclear and/or conventional submarines, the model is adaptable to many encounter-evasion situations. The game is designed to examine the survival of a CVA with SONAR screen against a force of submarines. The CVA mission may be to transit through an area or to maneuver in the area. The CVA and the submarines in the model may be given detection and speed parameters similar to other units; for example, merchant ships and surface raiders may be simulated.

GENERAL DESCRIPTION: CREST is a two-sided, stochastic model involving sea forces only. It is capable of considering one CVA versus a maximum of 120 SS/SSNs. Outcomes are assessed semi-rigidly. Simulated time is treated on a time step basis. A 30-hour (100 trials) real time simulation requires approximately 2 minutes of computer time. The primary solution techniques used are Monte Carlo simulation of decision processes and kinematics for unit motion.

INPUT:

- o CVA normal and evasion speeds
- o SS/SSN patrol and attack speeds
- o Detection ranges
- o Kill probability and weapon firing range for SS/SSN vs. CVA

OUTPUT: Time-step battle history, or various levels of summary output are available.

MODEL LIMITATIONS:

- o Maximum of 120 SS/SSNs
- o The CVA and SONAR screen or escorts cannot kill submarines.
- o CVA speed must exceed submarine speed.

HARDWARE:

- o Computer: IBM 360/91, IBM 7090/7094
- o Operating System: OS 360 (360/91); IBSYS (7090/7094)
- o Minimum Storage Required: 32K
- o Peripheral Equipment: Card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Computer Routine for Evaluation of Simulated Tactics (CREST), "Command Manual, User's Manual, Listings, PAG No. 17-68, CM 3350
- o Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o 3 days to prepare input
- o Approximately 1 second CPU per model cycle (3 minutes run time for 100 trials)
- o 3 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Time-Step

TITLE: C3 Model - A Strategic Communication Simulation Tool

PROPONENT: Joint Strategic Target Planning Staff (JSTPS/JPS)

(Note: The C3 model is a derivative of the AF Studies and Analyses - developed STRAT command methodology.)

DEVELOPER: Air Force Studies and Analysis, Science Applications, Inc., JSTPS, and SAC/ADW.

PURPOSE: This computerized model simulates the one-way flow of Emergency Action messages from the NCA to strategic forces. The model determines the time-varying availability of nodes and radio links in benign, nuclear, and/or jamming environments, and simulates one-way propagation of an EAM through this degraded network to a variety of force elements.

GENERAL DESCRIPTION: The C3 model is general in nature, such that any desired communications network can be examined. The model was primarily designed for strategic forces (bombers, SSBNs, ICBM Launch Control Centers) and uses a stochastic time-step Monte-Carlo technique with a shortest path network algorithm to determine probabilities of message receipt as a function of time at special nodes. A scenario of hours duration can be run in minutes of CPU time.

INPUT:

- o Network topology (nodes and links from initiator to force elements).
- o Description of attack (nuclear weapons and radio jammers).
- o Node processing times and link delays.
- o Node group data.
- o Run parameters (number of Monte-Carlo replications, game time, etc.)

OUTPUT:

- o Node probabilities of survival and link availabilities (as a function of time).
- o Computer printout which includes probability of message receipt as a function of time.
- o Detailed output at the end of each Monte-Carlo cycle is available at the user's option. This data includes node dead times, node alive times, order of nodes receiving message, and message arrival times at each intermediate and destination node.

MODEL LIMITATIONS:

- o Computer storage capability.
- o Selected nuclear effects.

HARDWARE:

- o Type of Computer: IBM 370/3033, IBM 4341
- o Operating System: DOS
- o Storage Required: Varies according to network and attack size
- o Peripheral Equipment: Discs or tapes can be used for input/output data storage

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: User's Manual and Programmer's Manual available.

TIME REQUIREMENTS:

- o Time required to acquire base data and structure data in model input format varies from hours to days, depending on size and complexity of network to be modeled.
- o CPU time per model cycle is 5-10 Minutes (after link and node availabilities have been computed) for moderate-sized network.
- o Several weeks learning time for new users.
- o Hours-days to analyze and evaluate results.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: 100-200 times per year

USERS:

- o Principal: JSTPS/JPS and AF/SASC (STRAT Command version), JSCS/JCA
- o Other: NSA

POINT OF CONTACT: Joint Strategic Target Planning Staff/JPS
Attention: Maj Paul
Building 501, Room U131A
Offutt Air Force Base, NE 68113
Telephone: 294-5836

KEYWORD LISTING: Analysis; C3; EAM Distribution Networks; Communications Network Topology; Connectivity.

MISCELLANEOUS: The C3 model consists of two major components. The Network Status Model (NSM) computes time-varying node and link availabilities of a network subjected to a nuclear and/or jamming attack, while the Dynamic Network Simulator (DNS) simulates message propagation through the degraded network. The size of network and attack establish the storage and run time rquirements of the C3 model. For example, a simulation of network of 900 nodes, 3700 links, 5000 wpns and 500 iterations on an IBM 3033 requires 5 megabytes storage and 5 hours CPU time for the NSM and 6 megabytes storage and 5 minutes CPU time for the DNS. Several DNS runs can utilize a set of NSM output data if the network topology and the attack does not change.

NAME: DACOMP - Damage Assessment Computer Program

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Engineering Systems Division, Stanford Research Institute

PURPOSE: DACOMP was developed to apply the SEER III single-weapon fallout model to the analysis of full-scale strategic nuclear attacks. The program was designed to determine the radiological fallout effects on population centers and to assess damage in terms of fatalities and casualties. DACOMP has been used in a damage assessment exercise involving an attack of 1,261 nuclear weapons against 3,615 population resource points in the United States. The program was run for three different attack dates. Although the computer program was designed for strategic nuclear studies at the national level, it can be applied to tactical nuclear studies over a more limited area.

GENERAL DESCRIPTION: DACOMP is a dynamic simulation model using the falling rates of representative particles and the winds aloft over the study area to determine the transport and final deposition of radioactive debris from nuclear bursts. The program accepts wind data from up to 100 weather observation stations and generates the wind field over the entire area of study for four observation times. The fallout dose received at each resource center from all weapons is determined, and, using the distribution of population with various shelter protection factors, the program computes the expected number of fatalities and casualties.

INPUT:

- o Population resource data
- o Weapon laydown
- o Wind data
- o Shelter protection factors

OUTPUT:

- o Outside dose for each resource center
- o Number of fatalities and casualties for each resource center
- o Number of fatalities and casualties for each state
- o Total number of fatalities and casualties nationwide

MODEL LIMITATIONS:

- o 10 shelter distributions
- o 4 wind observation times
- o 12 wind levels
- o 10 weapon types

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Storage Required: 45K
- o Peripheral Equipment: 1 tape file for resource data is required, a second tape file for weapon data is optional, three scratch files

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Computer Routine for Evaluation of Simulated Tactics (CREST)," Command Manual, Users Manual, Listings, PAG No. 17-68, CM 3350.
- o Both user's and technical documentation are complete.

TIME REQUIREMENTS:

- o 3 days to prepare input
- o Approximately 1 second CPU per model cycle (3 minutes run time for 100 trials).
- o 3 days to analyze and evaluate results.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: OP-96

POINT OF CONTACT: Mr. Charles G. Frankhauser
Planning Analysis Group
John Hopkins University
Applied Physics Laboratory
8612 Georgia Avenue
Silver Spring, Maryland 20910
Telephone: 589-7700

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Sea Forces; Computerized; Two-Sided; Stochastic; Time-Step.

TITLE: DADENS-C2 - Divisional Air Defense Engagement Simulation - Command and Control

PROPONENT: US Army Air Defense School/Directorate of Combat Developments (USAADS/DCD)

DEVELOPER: BDM Services Company

PURPOSE: DADENS-C2 is computerized, analytical, general war and damage assessment/weapons effectiveness model designed to simulate either one-sided or two-sided war games. It investigates the effectiveness of offensive and defensive force command and control systems. The focus of this model is command and control. Elements are included to provide either a realistic battlefield environment within which the command control systems must operate, or a means of measuring the effectiveness of alternative command and control systems. Weapon systems are represented in sufficient detail to realistically represent their operation and to make significant changes in their characteristics meaningful in the outcome of results.

GENERAL DESCRIPTION: DADENS C2 is a two-sided, stochastic model involving land, air, sea, or paramilitary forces. The level of aggregation for this model is one on one (one fire unit - one threat vehicle). It can simulate the operation of alternative air defense command and control systems, and investigate in detail complex situations involving the interaction between: (1) offensive and defensive forces; (2) offensive forces and the environment; (3) defensive forces and the environment; (4) command and control and the environement; (5) command and control of defensive forces. The level of model exercise is one numbered UTM grid zone. The model was primarily designed for 444 defense entities, 28,665 offensive objects, and 2,047 communication lines with a range of possible manipulation to include any combination of offensive and defensive systems. Simulated time is treated on an event store basis. The DADENS-C2 is a fully rigid computerized war game. The model is event-stepped and uses Monte Carlo techniques to determine the results of events which influence future events.

INPUT: The analyst prepares the attack plan by inputting specific aspects such as:

- Threats identifiers
- Launch times
- Hostile burst times and locations
- Turn points
- Velocities
- Nodes representing command and control center, relay station, switches, etc.

OUTPUT:

- A history of all defensive and offensive actions and the results of all defensive and offensive interactions are recorded. Two generic types of output are produced: (1) summary reports, and (2) sorted lists of messages. The analyst can obtain a few concise summaries of results, or complete list of each action with any level of detail.

MODEL LIMITATIONS:

- Area of play - on UTM grid zone
- Defense - 63 (444 per defense)
- Offensive cells - 4,095 (7 objects per cell)
- SAM system types - 63
- FI types - 7
- FI base types - 63
- Sensor types - 63
- ABM system types - 63
- Threat types - 31

HARDWARE:

- Type of Computer: CDC 6000 Series
- Operating System: SCOPE 3.4 Compiler
- Minimum Storage Required: 147K words of octal storage
- Peripheral Equipment: Disks, magnetic tapes and internal system packs

SOFTWARE:

- Programing Languages: FORTRAN and ASSEMBLER
- Documentation: BDM's version of FORTRAN. This is converted to FORTRAN and ASSEMBLER by BDM's SST translator. No documentation on translator.
- Documentation is not complete. User's documentation is incomplete, and technical documentation is partially documented.
- This model is still in its testing stages and has not been used to support a study.

TIME REQUIREMENTS:

- 4 months to acquire base data
- 2 man-months to structure data in model input format
- 1 to 4 hours of CPU time per model cycle, depending on detail of scenario
- Learning time is variable as to player's responsibility
- 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Still in test

USERS: US Army Air Defense School/Directorate of Combat Developments - SW

POINT OF CONTACT: Pete Bogue, BDM 821-5241 (through Washington Switch)
John R. Armendariz, USAADS, AUTOVON 978-6702
Juan Cabrales, USAADS, AUTOVON 978-6523

TITLE: DAMSEL - Transportation Network Analysis (Interactive Data Management and Selection)

PROPONENT: US Army Logistics Center

DEVELOPER: The BDM Corporation

PURPOSE: The Data Management and Selection (DAMSEL) Data Base Management System is an automated system for transportation network analysis. This interactive, use-oriented system provides the capability for analysts to rapidly conduct shortest path analyses for the routing of personnel, equipment, and supplies. The analyst also has the capability to evaluate the effectiveness of various interdiction policies by blocking links in the network and determining the resulting transportation delays and alternative routings. The DAMSEL system was designed to support simulation models of the Army Worldwide Logistics System (MAWLOGS) family, including LOGATAK I, LOGATAK II, AND MACATAK. DAMSEL supports these models by automatically providing regionalized subsets of transportation network data which can be input directly to the models.

GENERAL DESCRIPTION: DAMSEL is a computerized, interactive or batch, transportation network analysis methodology. The transportation network is stored in a Data Base Management System (DBMS) for ease of access and change, and to preserve the data for multiple users and applications. The DAMSEL network is also presented in a multi-volume set of Data Base Atlas'. Each Atlas volume includes a complete set of maps with overlays delineating the existing DAMSEL network elements on each page and a computer print out of the DAMSEL data values on the facing page. The DAMSEL data base currently encompasses most of the Central European transportation network, Mideast and the Northeast Asia regions.

INPUT:

- o Selection:
  - Quadrant
  - Sectors desired
  - Modes desired (highway, rail, sea, air, inland waterway, pipeline, transshipment)
  - Model input format desired
- o Interactive Analyses:
  - Origin
  - Destination
  - Shipment size
  - Mode restrictions
  - Network blockage
- o Data Base Expansion:
  - Terminal Number
  - Link numbers
  - Quadrant

- Mode
- City
- Country
- Location
- Capacity
- Docks
- Vulnerability
- Rebuild time
- Type of link
- Route number
- Length
- Rate of travel
- Location of vulnerable points

OUTPUT:

- o Selection:
  - MAWLOGS tape file with all data base elements for region
  - MAWLOGS report for transportation network selected
- o Interactive Analysis:
  - Routing for shipment by terminal and link numbers
  - Travel time
- o Data Base Expansion:
  - Report of data elements altered or added

MODEL LIMITATIONS: Transportation network analysis limited to regions contained in the data base management system. Dynamic, time phased traffic interactions can only be represented by linking DAMSEL to one of the family of MAWLOGS simulation models specified above.

HARDWARE:

- o Computer: CDC 6000, CDC CYBER 176
- o Operating System: NOS/BE, NOS
- o Minimum Storage Required: 120K (Octal)

SOFTWARE:

- o Programming Language: FORTRAN, System 2000 DBMS
- o Documentation:
  - DAMSEL DBMS User's Guide
  - DAMSEL Programmer's Guide
  - DAMSEL Transporation Network Atlas, The BDM Corporation, 1981 User's and Programmer's manuals, including interface with MAWLOGS models documentation, are complete.

TIME REQUIREMENTS:

- o 3 months to expand data base to new region of the world
- o 1 day to structure data in model input format
- o Interactive response for playing time
- o 1-5 days required learning time for players
- o Minutes to hours to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED program code and data base

FREQUENCY OF USE: 50 times yearly

USERS:
- o US Army Logistics Center
- o The BDM Corporation
- o Defense Nuclear Agency

POINT OF CONTACT: Mr. Sherm Cockrell
Simulations Division, OAD
US Army Logistics Center
Ft Lee, VA 23801

MISCELLANEOUS: Models to which the DAMSEL system interfaces include: MAWLOGS, LOGATAK I, LOGATAK II, PETRONET, and MACATAK.

KEYWORD LISTING: Analytical, Logistical, Land; Air, Sea, Computerized; Transportation, Nodes; Throughput

TITLE: DBM - Division Battle Model

PROPONENT: TRADOC

DEVELOPER: General Research Corporation (GRC)

GENERAL DESCRIPTION: DBM is a computer assisted, manual wargame designed to support studies of the performance of weapons, organization, and tactics of a division-size force. The model permits the play of tactical aircraft, airmobile operation, and general support artillery as well as ground combat operations. The manual portion consists of decisionmaking, determination of events, and time sequencing while the computer provides attrition assessment, reports battle results, and keeps records. The game is played on a tactical map with unit resolution to the company/ battalion level. Play may be in open, semi-closed or closed modes.

INPUT:

- o Weapon effects data
- o Unit organization
- o Tactical decisions

OUTPUT: Combat attrition

MODEL LIMITATIONS:

- o Requires tactically proficient gamers
- o Requires an extensive library of high resolution simulations for ground combat attrition calculation

HARDWARE:

- o Computer: Digital
- o Operating system: Any with some modification
- o Storage 55K
- o Peripheral Equipment: Line printer, tape drive

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Limited documentation is available.

TIME REQUIREMENTS:

- o Set up time dependent on high resolution history availability - approximately two man-months minimum.
- o Game play: 1/2 to 1/8 real time, depending on gamer skill. Two to four games may be played simultaneously
- o Computer Time: Six minutes per two hours of combat play (UNIVAC 1108)

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SECURITY CLASSIFICATION: Dependent on input weapon effects data. Basic model is UNCLASSIFIED.

FREQUENCY OF USE: Approximately 100 times per study.

USERS:

- o TRASANA
- o CAA

POINT OF CONTACT: Director
US Army TRADOC Systems Analysis Activity
ATTN: ATTA-TGD (Mr. Keith THorp)
White Sands Missile Range, NM, 88002
Phone: AUTOVON 258-1881/3149

MISCELLANEOUS: Model is linked through COMANEX to a high resolution simulation such as CARMONETTE.

TITLE: DCAPS - Dual Criteria Aimpoint Selection Program

PROPONENT: Defense Nuclear Agency (NATD)

DEVELOPER: Science Applications, Inc.

PURPOSE: DCAPS is a computer program used to select single weapon aimpoints. It simultaneously maximizes the damage to targets and minimizes damage to designated non-targets. It can also be used to evaluate target/non-target damage from an input aimpoint (DCZ) data base. A necessary condition for aimpoint selection is that the damage specifications on the primary target be met. In all cases, the aimpoint which kills the target and minimizes damage to nearby non-targets is given. In many cases, alternative aimpoints are also given which maximize damage to nearby secondary targets while simultaneously killing the primary target and limiting damage to non-targets.

GENERAL DESCRIPTION: DCAPS is a deterministic model using standard target damage evaluation procedures. It determines a lethal aimpoint region (LAIR) within which the primary target kill criteria are met. It then searches this region for desirable aimpoints based on user supplied damage criteria. Several alternatives are available for damage specification. Up to 500 targets/non-targets can be processed as a group. Up to 50 weapon types (combinations of yield, accuracy, and height-of-burst) can be considered.

INPUT:

- o Weapon list (yield, accuracy, height-of-burst)
- o Target kill requirements
- o Non-target survival requirements
- o Program control options
- o Target/non-target data base
- o Optional strike file data base
- o Optional secondary weapon list

OUTPUT:

- o Selected aimpoints
- o Damage to targets
- o Damage to non-targets
- o Damage to other installations

MODEL LIMITATIONS:

- o Fixed targets
- o 500 installations
- o 50 weapon types
- o Single weapon aimpoints

HARDWARE:

- o Computer: IBM 360, Honeywell 6060, UNIVAC 1108, and DEC 10 systems
- o Storage Required: 50K words decimal
- o Peripheral Equipment: Hard copy device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: DCAPS Program Final Report, July 1975

TIME REQUIREMENTS:

- o Data Base: A few minutes if data files are available
- o CPU Time: About 15-20 seconds per aimpoint on UNIVAC 1108
- o Data Output Analysis: User dependent

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Used extensively at SAI and other DOD organizations

USERS: USEUCOM, SHAPE, CCTC, USAFE

POINT OF CONTACT: Headquarters, Defense Nuclear Agency (NATD)
Washington, D. C. 20050
Phone: (703) 325-7403

KEYWORD LISTING: Dual Criteria, Analytic, Damage Evaluation, New Guidance, Fixed installations, Targets, Non-targets, Evaluation, Aimpoint Selection, Designated Ground Zero

TITLE: DELIVLR

PROPONENT: HQ USAF/SAGM

DEVELOPER: HQ USAF/SAGM

PURPOSE: To estimate the time required to deliver a given military force by airlift. It provides computerized analysis of sortie output from the Airlift Loading Model (ALM).

GENERAL DESCRIPTION: This model is a deterministic computation of the time to deliver a set of military units (described in terms of sorties required by various aircraft types to move the entire unit) by an airlift force of a mix of aircraft types. The force can vary in size and aircraft utilization rates during the deployment. Aircraft capability is measured in sorties per day. Resupply requirements are decremented from the existing capability.

INPUTS: Include the sorties required to move a given unit by different aircraft types, as well as the number of sorties still required by the most capable type following a less capable type, the number of each aircraft type, its utilization rate and its round trip flying time.

OUTPUTS: Completion times of various cargo types within units and of the entire unit and, if requested, the sorties available.

MODEL LIMITATIONS:

- o The model can accept a maximum of six aircraft types, three of which can be outsize cargo capable, up to 10 increments of utilization rate or fleet size changes, and up to 100 units
- o The model does not actually load or fly the aircraft, but depends upon sorties determined by the ALM and uses average sorties per day calculations

HARDWARE:

- o Type Computer: Honeywell 6180
- o Operating System: Multics
- o Minimum Storage Requirements: <20K
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: Multics FORTRAN
- o Documentation: Source code and instructions in HQ USAF/SAGM

TIME REQUIREMENTS:

- o Prepare data base: Variable
- o 3 seconds CPU time per cycle
- o Data Output Analysis: Variable

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 250 times per month

USER: AF/SAGM

POINT OF CONTACT: AF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone (202 694-8155
AUTOVON 224-8155

TITLE: Dynamic Electromagnetic Signal Environment Model, Second Version (DESEM2)

PROPONENT: AFEWC (tasking by ASD or AFSC)

DEVELOPER: AFEWC

PURPOSE: An analysis tool to assist the PELLS SPO in predicting and specifying the data handling rates for receiver and data processing equipment operating in a dense electromagnetic environment.

GENERAL DESCRIPTION: The model simulates the operation of threat radars by simulating antenna scans, RF agility and pulse repetition frequency (PRF) agility. It calculates time of arrival for each pulse at each aircraft as the three aircraft are moved along the FEBA.

INPUT:

Warsaw Pact Wartime Scenario by electronic order of battle (EOB) location with equipment parameters.

Limited to sequentially processing 300 radars at a time from the environment frequency and time windows.

OUTPUT: Sequential listing of pulse emission to estimated time-of-arrival at each aircraft for subsequent computer processing to determine emitter locations

MODEL LIMITATIONS: Three aircraft, microsecond time-of-arrival accuracy

HARDWARE:

Computer: UNIVAC 418

Operating System: RTOS 9E

Minimum Storage Requirement: 64,000

Peripheral Equipment: Tape drives, drum, printer, etcetera

SOFTWARE:

Programming Language: FORTRAN

Documentation: No documentation except program listing

TIME REQUIREMENTS: Dependent upon frequency and time windows chosen

SECURITY CLASSIFICATION: SECRET NOFORN

FREQUENCY OF USE: Seldom

USERS: Contractor for ASD, AFSC

POINT OF CONTACT: AFEWC/SAA
Mr Dave Crawford
Kelly AFB
San Antonio TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

TITLE: DEWCOM - Divisional Electronic Warfare Combat Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: CACI, Inc

PURPOSE: The DEWCOM Model is a computerized, analytical, general war battle model designed to assess the impact of communications and electronic warfare on the outcome of combat.

GENERAL DESCRIPTION: The DEWCOM Model is a two-sided, stochastic, event-driven model of land warfare. Tactical communications and electromagnetic intelligence/threat acquisition systems and electronic warfare against these systems are simulated. The model is driven by a conventional tactical engagement with ground and close air support forces that include maneuver units, artillery units, EW units, and support units. The finest resolution accommodated is maneuver (platoon), artillery (battery), EW (section), and support (section). A typical simulation would involve a Blue Division against a Red Army.

INPUT:

- o Terrain
- o Combat organization
- o Weapon, communications and electronic warfare systems characteristics
- o Message characteristics

OUTPUT: Individual events can be recorded for later analysis

MODEL LIMITATIONS: Does not include logistics or the effects of the integrated battlefield.

HARDWARE:

- o Computers: UNIVAC 1100 series, IBM 370/148
- o Operating System: UNIVAC 1100 Operating System, OS 370
- o Minimum Storage Required: 200K words
- o Peripheral Equipment: Printer, disk, tape drive

SOFTWARE:

- o Programming Language: SIMSCRIPT II.5
- o Documentation: Divisional Electronic Warfare Combat DEWCOM Model - Executive Summary (CAA-D-80-4), User Manual (CAA-D-80-5), System General (CAA-D-80-6), Programmer Manual (CAA-D-80-7)

TIME REQUIREMENTS:

- o Data base acquisition: Up to 12 man-months
- o Data structured for input: Up to 3 man-months

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- o Run times: 5 minutes computer time for each hour simulated, on a UNIVAC 1100/82
- o Output analysis: Estimated to be 3 man-months

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Support for several studies per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. M.L. Dwarkin
US Army Concepts Analysis Agency (CSCA-SMS)
8120 Woodmont Avenue
Bethseda, MD 20814
Telephone: (202) 295-1645

MISCELLANEOUS: The DEWCOM Model supersedes the COMMEL III Model. Planned enhancements include nuclear weapons effects (EMP, blackout) and more realistic command and control logic.

KEYWORD LISTING: Communications; Electronic Warfare, Simulation; Electronic Countermeasures; Intelligence, Command Control, Radar

TITLE: DGEM - Dynamic General Equilibrium Model

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency (Contracted)

PURPOSE: DGEM is a computerized econometric simulation system for economic and industry analysis. The model can be used to evaluate national economic and industrial conditions during industrial mobilizations, general war, limited war or other emergencies. The primary problems addressable with DGEM are:

- To measure the economic impacts of major emergencies or economic disruptions on the growth to GNP and its components and on industry input-output relationships.

- To measure the economic impact of disruptions of basic materials and energy products on industrial outputs, prices, and growth in GNP and its components.

- To measure the economic impacts of increased war mobilization requirements on economic growth, industry output and equilibrium requirements for basic materials and energy products.

- To measure the substitutability among basic materials and products and among industrial outputs in achieving war mobilization goals.

- To measure the requirements and evaluate goals for stockpiled strategic materials, energy, and industrial capacity in the event of war or mobilization for war.

- Where possible, to measure the effects of catastrophic economic disruptions such as nuclear war and evaluate economic activity and growth following such catastrophes.

- To measure the economic impacts and effectiveness of policies such as to mitigate wartime and peacetime emergency shortages of energy products, basic materials or industrial outputs and the effects of prices and policies on demands for energy, basic materials and industrial outputs.

GENERAL DESCRIPTION: The DGEM employs an econometric approach to consider emergency economic and industrial activity and growth in the United States. Simulations of the model are deterministic. The model is driven in an event store mode by means of expected responses to changes in relative prices. The price changes include changes in production by industries; substitutions of raw materials, energy, intermediate goods, and finished products; investment, employment;

technology, wealth, and economic growth. Price changes in the model can be imposed through changes in taxes, population, capital stock and supplies of raw materials, intermediate goods, finished goods and energy.

DGEM considers 36 separate industrial sectors as well as households and governments in modeling the US economy. The sector configurations were devised to optimize the detail of the manufacturing and energy sectors while limiting the econometric relationships in the model to around 4,000. The number of econometric relationships grows geometrically with the number of sectors. The sector detail could be expanded to as many as 500 sectors by using DGEM to drive more detailed input-output models using a modular approach.

The model has been successfully tested for convergence under drastic changes in population, capital stocks and supplies of resources. As such, it shows considerable promise for simulating economic strategies for nuclear warfare and recovery from nuclear attack.

The model simulates annual economic growth based on changes in capital stock, population and private wealth from year to year. The model can be simulated for several years with one or two days of analytical preparation. The simulation software employs Newton's method for solving a system of nonlinear simultaneous equations.

INPUT: Inputs to simulations can include economic policy variables such as a variety of tax rates and government expenditures as well as relative prices of inputs or outputs, supplies of inputs or outputs, and primary inputs such as capacity, labor or energy.

OUTPUT: Equilibrium production, prices, input requirements, investment, consumption, tax revenues, etc., are printed out for each year of the simulation. A variety of outputs are available covering the 4,000 or so economic values evaluated by the model in each simulation year.

MODEL LIMITATIONS:

- o DGEM needs a monetary/financial sector to improve its usefulness in economic stabilization matters
- o The limited sectoring requires disaggregation for many emergency purposes
- o The general equilibrium structure restricts simulations to long-run analysis
- o DGEM is national-level only--no regional, state or local capabilities
- o Data and econometric model parameters soon will need updating
- o Not yet operational

HARDWARE: The DGEM is available on the UNIVAC 1108 computer. Its present configuation requires 60,000 words of main memory to execute the simulation program.

SOFTWARE: The simulation software is written in FORTRAN. It is a flexible nonlinear simultaneous equation solver which is based on Newton's method and designed specifically for DGEM.

TIME REQUIREMENTS: The data development for the DGEM cost approximately $500,000 in contract funds and required 2.5 staff years and 115 hours of computer time in addition. The model development also cost $500,000 in contract funds and required 2.0 staff years and 1,800 hours of computer time. Single year model simulations may require one or more days of staff preparation but typically less than a minute of computer time. Staff preparation per annual simulation declines as the number of annual periods considered for a given scenario increases. Computer time expressed as standard units of processing increases approximately linearly with the numbers of annual periods to be simulated. The model was designed to facilitate analysis by skilled econometricians, not as a gaming device requiring a low skill level of execution. Decisionmakers could be educated in the use of model results in a relatively short period of time.

SECURITY CLASSIFICATION: The DGEM and its basic data are unclassified. Specifications of some national security simulations would require exercising the model in secure mode.

FREQUENCY OF USE: The long-range simulation capability of the DGEM is still being developed and tested. This work will be completed early in 1982. The model is not being used other than for test purposes.

USERS:

The DGEM effort was initiated with the primary purpose of improving FEMA's strategic raw materials stockpile analysis capability. Secondarily, its purpose was to enhance FEMA's capabilities in realistically planning for war mobilization. DGEM's future role in these critical analytical efforts is now unclear. If used, it likely couuld significantly contribute to analytical efforts in these areas.

The Department of Energy is planning to rely heavily on DGEM in its long-range analysis of potential energy disruptions. Energy contributed funding to both the data and modeling development efforts. The emergency economic stabilization activities both of FEMA and the Department of the Treasury are highly interested in making use of the DGEM. DGEM has also attracted interest from the more general economic community as one of the few contemporary economic models with extensive structure pertaining to supply side issues.

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resources Management and Administration
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS: A long-range simulation capability should be completed for DGEM early in 1982. Detail on monetary and financial sectors needs to be added. The Department of Energy plans to expand the coverage of energy products in DGEM.

KEYWORD LISTING: Econometric, Interindustry, Equilibrium, Dynamic, Simulation, Substitution, Technology, Model, and Economic

TITLE: Direct Fire Simulation (BRONZE SCEPTRE I Version)

PROPONENT: War Games Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada.

DEVELOPER: As above.

PURPOSE: Assessment of the interaction between direct fire weapons in research war games.

GENERAL DESCRIPTION: The program models interactions between up to eight defending and eight attacking groups, each group comprising up to nine similar items. The logic is rather abstracted in that probabilistic line of sight and detection are treated as group vs group phenomena which persist for the full five minutes. The model proceeds in two sections representing an opening engagement and the remainder of the five minutes. Line of sight and detection status are determined in section one. In each section, groups are chosen one at a time and awarded a certain number of "tries" which they then expend against opposing groups. A "try" may be converted into a firing or lost for various reasons such as suppression or low acquisition probability.

INPUT:

- General information required consists of engagement type, ambient light, met visibility range, an advantage code which affects the randomness of order in which groups are chosen to act and a fire-on-signature policy.
- For each group, the inputs required are grid location, item type, weapon type, search and acquisition device types, light level, contrast, smoke, movement, tactical position, ready rounds, personnel, suppression factor and suppression type (reflexive or not).
- In any given run a large amount of the input required may be derived from default values or previously stored data.

OUTPUT:

- This consists of the line-of-sight and detection status, number of firings and kills between each pair of groups and number of personnel casualties to each group.

MODEL LIMITATIONS:

- The model is too abstracted to be used with any confidence in weapon comparison studies. For example it is not entirely clear what detection in the model corresponds to in real life. As a war game assessment tool the models justification lies in the plausible outcomes generated by it and its simplicity of use.
- Run time is slow on the HP 9830 typically 10-15 minutes exlusive of input. This will be reduced greatly by new equipment.

HARDWARE:

- HP 9830 mini-computer with disk drive.

SOFTWARE:

- Programmed in BASIC.

STAFF:

- Operator. War Game controller provides input data.

TIME REQUIREMENTS:

- Preparation: Input time typically 5 minutes.
- Play: Running time typically another 10-15 minutes.
- Analysis: Included in research war game analyses.

SECURITY CLASSIFICATION: UNCLASSIFIED.

FREQUENCY OF USE: Continuously during research war games.

USERS: DLOR War Games Section.

MISCELLANEOUS:

- To be converted to either HP 2000 Access or PDP 11/34 in near future.
- A run time exclusive of i/o of approximately one minute is to be expected.

TITLE: Division Level War Game Assisted Command Post Exercise.

PROPONENT: War Game Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada.

DEVELOPER: As above.

PURPOSE: The game is designed to train and exercise staff college students in brigade and divisional staff work in a dynamic setting within the corps battle.

GENERAL DESCRIPTION: This is a manual, closed, two-sided game, with split command levels, conducted in real time (real time/game time ratio 1:1) with a five-minute game time interval. The force being exercised is a division within a corps framework in mobile defense against a combined arms army. Division HQ and three brigade HQ command posts are established with students filling all appointments.

Brigade lower controllers represent unit commanding officers and forward observation officers. DLOR war game controllers carry out the sub-unit tactics in addition to discharging their controller duties.

Symbology, rules and assessment procedures are as for "Brigade and Unit War Game Assisted Command Post Exercise".

INPUT:

- Scenarios, organizations and establishments prepared by Canadian Land Forces Command and Staff College (CLFCSC) Kingston and Canadian Forces Command and Staff College (CFCSC) Toronto.
- War Game Rules and assessment procedures prepared and used by War Game Section of DLOR.

OUTPUT:

- Assessment techniques are designed so that overall realistic outcomes can be arrived at quickly from which lower control intelligence and reports can be extracted relevant to the level of play. The information which lower controllers get is that which a unit commander, e.g, battalion commander, would normally have available to him in actual operations and from which he would forward all operations reports and returns on the command post. Similarly, artillery nets function between forward observation officers, regimental command posts and divisional artillery staffs. The logistics activities are driven as a result of battle activity and interactions.

MODEL LIMITATIONS:

- Cannot be conducted without DLOR War Game staff controllers and supervising assessors.
- Required additional augmentation for some higher control staff positions.
- Large control room staff.

HARDWARE:

- 1:12,500 scale colored maps for control board.

SOFTWARE:

- Nil. Manual assessments. Detailed logs are maintained by all lower controllers, higher controllers and command posts.

STAFF:

- DLOR war game staff of eleven military officers, four NCOs and two scientific officers as controllers and supervising assessors.
- Each brigade lower control cell comprises six students representing units of the brigade.
- Higher control is manned by a mix of Directing Staff, students and augmentees.
- Brigade and division command posts have all staff positions manned by students.

TIME REQUIREMENTS:

- Preparation: Given the scenario, preparation of operational plans by the players and realization of deployments on the control map takes two to three days. Within this period DLOR war game staff brief and train lower controllers and assessors as necessary.
- Play: The war game portion of the exercise usually is conducted for three days.
- Analysis: All detailed logs are retained and analyzed for staff lessons within the Staff College.

SECURITY CLASSIFICATION: UNCLASSIFIED overall. Rules, which remain under DLOR control, are of various classifications.

FREQUENCY OF USE: Two exercises annually.

USERS: CLFCSC Toronto.

TITLE: DIVLEV - Division Level Wargame Model

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: The DIVLEV model is used to determine the relative merit of various weapon and support system mixes and of various tactics in a realistic combat environment. The merit of each variation is based on how well the total ground force performs, and not solely on the performance of the particular system being varied.

GENERAL DESCRIPTION: DIVLEV is two-sided, expected value, time-step, combined arms land combat model, that includes the effects of air on the ground battle. The model is designed to play a defending division size force against a suitable attacking force. The defending force can be as large as a corps with a corresponding larger attacking force. The manipulated units can vary from company/battery level to battalion.

INPUT:

- o Tactical scenario to include initial situation and unit objectives
- o Weapon data to include range, rate of fire, crew size, weight of ammunition, and range dependent kill rates
- o Terrain statistics
- o Unit data to include position, equipment strength and maneuver instructions
- o Vehicle speeds
- o Fixed wing aircraft/sorties, mission
- o Reliability and repair times for weapons and vehicles

OUTPUT:

- o Plots showing unit positions
- o Unit data to include position, strength, and interaction with opposing units
- o Killer- - victim scoreboard
- o The time interval for any of the output can be specified by input codes

MODEL LIMITATIONS:

- o Digitized terrain is not included
- o Logistics are kept on the unit level and not by the individual system

HARDWARE:

- o Computer: CDC-7600
- o Operating System: Batch
- o Minimum Storage Required: 125K
- o Peripheral Equipment: Disc storage, CALCOMP Plotter

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Model description, users and technical documentation are complete and available from the developer

TIME REQUIREMENTS:

- o 3 man-months to acquire base data
- o 1 man-month to structure data in model input format
- o Overall game play: 1:8 game time to play time
- o Computer time: 5:1 game time to computer time
- o 5-6 hours learning time for players
- o Most analysis can be done concurrently with game play

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 1-2 games per year (50-100 runs per year)

USERS: US Army Materiel Systems Analysis Activity

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-T (Tony Rouse)
Aberdeen Proving Ground, Maryland 21005
Telephone: AUTOVON 283-2900
301-278-2900

MISCELLANEOUS: This model can be used as a simulation once the player input decisions have been developed through war gaming the desired tactical situation. This reduces the manpower and time required to play variations.

KEYWORD LISTING Computer-Assisted; Analytic; General War; Two-Sided, Deterministic, Land Forces; Time-Step

TITLE: DIVWAG - Division War Game Model

PROPONENT: Combined Arms Combat Developments Activity

DEVELOPER: Combat Developments Research Office, Computer Sciences Corporation

PURPOSE: DIVWAG is a player-assisted, analytical, general war model. Based upon game order to the units, the model performs the firepower, mobility, target acquisition, and combat service support functions. The chief focus of concern is the evaluation of a division-sized force at a level of resolution which will permit determination of the impact on force effectiveness of changes in mixes of weapons and other systems. In addition, the model considers available logistical support and other combat and combat service support functions, to include Army and Air Force air support.

GENERAL DESCRIPTION: DIVWAC is a two-sided model having both deterministic and stochastic features. Land and air forces are simulated. The model is primarily designed to consider units ranging in size from a maneuver battalion task force to a division. The lower limit of this range may be manipulated to consider a maneuver company team. Simulated time is treated on an event store basis. The ratio of game time to real time is 1:3. Probability and analytical algorithms are the primary solution techniques used.

INPUT:

- o Terrain and weather data
- o Weapons and equipment characteristics
- o Weapon effects data
- o Decision tables for establishing priorities for fires and levels of attack
- o Consumption rates
- o Unit TO&Es
- o Task organization

OUTPUT:

- o For each period: A set of computer printout reports which provide the information essential for accomplishing the period turnaround
- o For a game: Raw data requiring analysis in summary, tabular form

MODEL LIMITATIONS:

- o Does not portray dismounted riflemen in ground combat
- o Communications are not simulated
- o Total number of units for both sides is 1,000
- o 200 items of equipment are played for each side

HARDWARE:

- o Computer: CDC 6500
- o Operating System: SCOPE 3.4.2
- o Minimum Storage Required: 3 million words
- o Peripheral Equipment: 1 disc drive, 3 tape drives, card reader and printer

SOFTWARE:

- o Programming Language: FORTRAN and COMPASS
- o Documentation published on 15 August 1972. An updated version is available dated April 1973. A User's Manual, Technical Manual and a Programmer's Manual are provided with the documentation

TIME REQUIREMENTS:

- o 3 months to acquire base data
- o 15 man-months to structure data in model input format
- o 60 calendar days playing time for 48 hours of continuous combat
- o 1.7 hours CPU time per two hours of combat
- o 6 months learning time for players

SECURITY CLASSIFICATION: CLASSIFIED

FREQUENCY OF USE: Two times a year

USERS: Not applicable

POINT OF CONTACT: COL Stephen G. Friend
Chief, Scenario and War Games Division
USA CACDA, ATCA-SW
Fort Leavenworth, KS 66027
Telephone: 913 684-3957
AUTOVON 552-3957

MISCELLANEOUS: DIVWAG superseded DIVTAG II

TITLE: DUNN-KEMPF

PROPONENT: Manual and Computer Supported Simulations Division, Battle Simulations Development Directorate, Combined Arms Training Developments Activity

DEVELOPER: Same as Proponent

PURPOSE: Train company/team level leaders in the planning and conduct of combined arms combat operations in a simulated combat environment. Evaluation of and training in internal unit SOPs.

GENERAL DESCRIPTION: A three-dimensional, manual battle simulation designed to train leaders in combined arms operations. Players employ scaled miniatures on a terrain board in accordance with unit orders and SOPs.

INPUT:

- o Order of Battle
- o Firing Rates
- o Terrain and Weather

OUTPUT: Combat resolution derived from CRTs manually and oral reports rendered by players to training elements.

MODEL LIMITATIONS: Game time versus real time ratio.

HARDWARE: Training Device 17-98 (DUNN-KEMPF)

SOFTWARE: N/A

TIME REQUIREMENTS:

- o 2-3 hours player learning time
- o 8 hours playing time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As desired by unit.

USERS: Unknown.

POINT OF CONTACT: Commander, USACAC
ATTN: ATZL-TDD-SM
Ft Leavenwoth, Kansas 66027
AUTOVON 552-3180/3395
Commercial: (913)-684-3180/3395

MISCELLANEOUS: Rules update published in October 1981

TITLE: DRAGON - Digital Simulation of the DRAGON Antitank Missile

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: US Army Materiel Systems Analysis Activity (AMSAA)

PURPOSE: The digital simulation of the DRAGON missile is designed to be used an analytical tool in various studies concerning the effectiveness of the weapon.

GENERAL DESCRIPTION: The simulation is based on a full six degree of freedom mathematical model. It simulates the flight of the DRAGON missile from launch to target (encompassing human tracking error, weather, manufacturing tolerances, etc.). The time-varying, nonlinear differential equations are solved via the Runga Kutta fourth order integration algorithm. The simulation is most ofter used in a Monte Carlo fashion as a means of generating predictions of some aspect of missile performance.

INPUT:

- o Time history of gunner tracking error in azimuth and elevation
- o Time history of target position in three dimensions (i.e., in XYZ coordinates)
- o Initial target coordinates
- o Launcher coordinates

OUTPUT:

- o Computer printout (at each time step) of:
  - Missile lateral and vertical displacement from the target line in launch coordinates
  - Missile center-of-gravity displacement from the x-axis in launch coordinates
  - Missile range
  - Missile velocity
  - Number of pairs of side thrusters fired
- o Printer trajectory plots vs time of:
  - Missile lateral and vertical displacement from the target line in launch coordinates
  - Missile center-of-gravity displacement from the x-axis in launch coordinates

MODEL LIMITATIONS: Single infantryman vs single target

HARDWARE:

- o Computer: CDC Cyber 70 Model 76
- o Operating System: SCOPE
- o Minimum Storage Required: 6K words
- o Peripheral Equipment Requied: Line printer

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SOFTWARE: The simulation is programmed primarily in the Advanced Continuous Simulation Language (ACSL), although several subroutines are written in FORTRAN. The program source listing contains many comments, and the simulation is further documented in AMSAA Technical Report #334, "Digital Simulation of the DRAGON Missile" (expected publication October 1981).

TIME REQUIREMENTS:

- o To structure data in model input format - 2 hours
- o To analyze output - 1 hour
- o CPU time per cycle - 15 seconds

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Depends on needs (of other agencies, e.g.) Ballpark average equals 300 runs/year

USERS: US Army Materiel Systems Analysis Activity (AMSAA)

POINT OF CONTACT: Mr. Patrick J. O'Neill
US Army Materiel Systems Analysis Activity
Combat Support Division
Attn: DRXSY-CS
Aberdeen Proving Ground, MD 21005
Telephone: AUTOVON 283-2611

KEYWORD LISTING: DRAGON missile; ACSL language; digital simulation; engineering model; validation; flight simulation; Runga Kutta fourth order integration algorithm

TITLE: DWG - Divisional War Game

PROPONENT: MA2 Branch, RARDE, Sevenoaks, Kent

DEVELOPER: RARDE with support from LOGICA Ltd

PURPOSE: Manual, computer-assisted War Game for Land Warfare Studies

GENERAL DESCRIPTION: Closed, two-sided with split command levels. Terrain aggregated in 500m squares. Units in general aggregated at Platoon (Blue), Company (Red) with important units down to single vehicles. Event sequenced. Flow of orders and information simulated in Command/Control/Communications model with appropriate delays.

INPUT: Scenarios for Combat Development and Defence Intelligence Staffs. Equipment performance data from MOD R&D Estabs. Unit performance data - from analysis. Terrain data - from maps.

OUTPUT:

- Battle historic and tactical impressions - from military players and control staff
- Game occurrence diary with all events recorded
- Analytical data is then extracted from the occurrence diary using special purpose software

MODEL LIMITATIONS: Numbers of individual units less than 1500 each side. Rate of play typically 6-12 minutes real time to 1 minute game time.

HARDWARE:

- Type computer: VAX 11/780
- Operating System: VMS
- Minimum storage required: 1 1/2 Mbytes MOS; 3 x 67 Mbytes discs
- Peripheral equipment: 8 VDU; 8 printers; 1 line printer; 2 x Magnetic tape drives

SOFTWARE:

- Programming Language: VAX FORTRAN (PLUS)
- Documentation Availability: Users Guide and Programmers' Manual

STAFF:

- Control: 3 Military officers
- Players: 2 Military officers (permanent Red and Blue commanders) 12 Military officers (visitors - variable depending on on staff functions explicitly played)
- Support Staff: 6 clerks; 4 map markers
- Analysts: Variable depending on projects under evaluation

TIME REQUIREMENTS: Prepare Data Base: 5 days

SECURITY CLASSIFICATION: Up to SECRET

FREQUENCY OF USE: Continuous. Six games each of four weeks duration per year. These games are independent but any number can be run sequentially to giv ntinuous combat simulation.

USERS: RARDE

POINT OF CONTACT: S/MA2, RARDE, Sevenoaks - Knockholt (0959) 32222 Ext 2370

MISCELLANEOUS: Transfer to new dedicated computer in 1979. This sheet updated November 1981.

TITLE: DYNCOM - Dynamic Combat Model

PROPONENT: Systems Analysis Division, Plans & Analysis Directorate, US Army Missile Command, Redstone Arsenal, AL 35809

DEVELOPER: Ohio State University and US Army Missile Command

PURPOSE: DYNCOM is a computerized, analytical, damage assessment/ weapon effectiveness model. It predicts combat unit performance as a function of weapon system characteristics, tactical deployment doctrine, and real terrain interactions. DYNCOM is a high-resolution close support land combat model developed to predict the effect of missile performance characteristics on the effectiveness of tactical units in engagements with enemy forces. It also assesses the effectiveness of other weapons (i.e., armor, aerial platform, air defense, artillery) on engagements with enemy forces.

GENERAL DESCRIPTION: DYNCOM is a two-sided, stochastic model which deals with land and air forces. It was designed for a company size unit up to battalion level and may be manipulated from a single element to multiple battalions. It is a time-step model which uses stochastic processes, event sequenced occurrences as methods of solution.

INPUT:

- o Actual terrain description
- o Scenario representation
- o Tactical doctrine
- o Weapon system performances characteristics
- o Military characteristics (vehicles deployed)

OUTPUT:

- o Complete battle history as a function of time steps per single or multiple replications
- o Individual single even outcomes
- o Summary outcomes as a function of battle time (variable)

MODEL LIMITATIONS:

- o Operational modes of laser guided missile systems are represented separately
- o ECM not explicity represented
- o Weather and environmental conditions not represented explicitly

HARDWARE:

- o Computer: IBM Computers (360-370 series)
- o Operating System: HASP
- o Minimum Sorage Required: 700K bytes
- o Peripheral Equipment: Disk

SOFTWARE:

- o Programming Language: FORTRAN IV
- o User's and programmer's manuals complete

TIME REQUIREMENTS:

- o 2 months required to acquire base data
- o 1 man-month required to structure data in model input format
- o Function of computer type, scenario size and type determines CPU time required per model cycle
- o Learning time for players is variable
- o Statistical output program available to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Variable

USER: US Army

POINT OF CONTACT: US Army Missile Command
Redstone Arsenal, AL 35809
(205) 876-3633 AUTOVON 746-3633

MISCELLANEOUS:

- o Linked to statistical output program
  - Tape developed during DYNCOM execution containing significant events serves as input to the statistical program
- o Supersedes DYNTACS (Dynamic Tactical Simulation)
- o Degraded battlefield environmental conditions and new acquisition methodology (non-visable) capabilities plan to be added

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Land, Air, Computerized, Two-sided, Stochastic, Time Step

TITLE: DYNEVAL - Dynamic Economic Values Model

PROPONENT: U.S. Arms Control and Disarmament Agency

DEVELOPER: Decision-Science Applications Inc.

PURPOSE: DYNEVAL, a national economic model in which the underlying decision processes are governed by a dynamic balance of value considerations, is a fundamental analysis tool for assessing the theoretical adaptability of the economy to severe disruptions.

GENERAL DESCRIPTION: DYNEVAL uses Lagrange Dynamic Programming to chart through time the optimal trajectory of an economy which has either been disrupted in some way, or in which the value structure has been changed.

INPUT:

- o Input-output data aggregated into current activity levels to include investment, production, trade, and consumption activities. (Data bases available for 95 sector Soviet and 465 sector USA; Model limited to 1000 production activities.)
- o Capital resource inventories
- o Capital gestation times, depreciation rates, discount rates, and growth rates for all capital resources
- o A direct requirements matrix
- o A rental array giving current mix of capital and labor for each production activity
- o Utility functions for consumption activities
- o Fraction of each capital resource which survived disruption (recovery problem)
- o Minimum consumption activity level
- o Ratios of utility coefficients
- o Translog elasticity parameters for capital/labor trade-offs, and if two types of capital are required, the effective capital calculations
- o Population growth

OUTPUT:

- o Activity levels for each production and consumption sector for each year for both current economy and study economy
- o Summaries of major macro-economic indicators or both current and study economies

MODEL LIMITATIONS: Adequacy and reliability of I-O data

HARDWARE:

- o Computer: DEC 2060
- o Operating System: TOPS 20
- o Minimum Storage Required: 3.6 mega bytes
- o Peripheral Equipment: Tektronix Graphic Terminal

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Draft copies available from ACDA/OA

TIME REQUIREMENTS:

- o Prepare inputs: Dependent upon degree of aggregation of data
- o CPU time per cycle: 1-30 minutes depending upon complexity

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: ACDA, DOD/ISA

POINT OF CONTACT: Office of Operations Analysis
U.S. Arms Control and Disarmament Agency
320 21st Street, NW
Washington, D.C. 20451

KEYWORD LISTING: Economic Analysis, Recover, I-O, Military Expenditures, Equilibrium Analysis

TITLE: EDSPOP - Event Driven Simulation of Personnel Operational Performance

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Mission Research Corp.

PURPOSE: EDSPOP is a tool used to assess the performance of the guard response force in a physical security system.

GENERAL DESCRIPTION: EDSPOP is a model which allows the user to describe a situation where the expected performance of a guard is desired. By describing the situation the model will compute the probability of detection, time of performance, etc., for the task being performed.

INPUT:

- o Physical condition
- o Dedication
- o Willingness
- o Training
- o Scenario

OUTPUT:

- o Event sequence
- o Probability of detection
- o Time
- o Success

MODEL LIMITATIONS: Scenario complexity

HARDWARE:

- o Computer: PºE 3220, 7/32
- o Operating System: OS 32/MT
- o Minimum Storage: 600 KB Memory, 10 MD Disk
- o Peripheral Equipment: Graphics terminal, Digitizer

SOFTWARE:

- o Language: FORTRAN VII
- o Documentation: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 6-15 hours to set up model depending on complexity
- o 20 minutes to run

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Mr. Ed Jacques
NSWC/G42
White Oak
Silver Spring, MD 20910
Telephone: (202) 394-2396

KEYWORD LISTING: Human Performance Model

TITLE: Electromagnetic Interference Effects Model (EIEM)

PROPONENT: U.S. Army Electronic Proving Ground

Aberdeen Proving Ground, Maryland 21005

PURPOSE: The Electromagnetic Interference Effects Model is used to assist in the conduct of compatibility and vulnerability analyses of communications and electronic equipment and systems in tactical deployments of any force model to include Army in the field with opposing forces. The output of the model may be used to make decisions on overall concepts of operation, and the equipment and systems to support the operational concept.

DESCRIPTION: This model takes deployment data concerning the location, terrain, and linking of all communications-electronics equipment deployed in a U.S. Corps; samples a required number of links; and based upon equipment parameters and scoring data, determines the communicability probability for the link without interference. The model then computes the propagation loss for each interfering transmitter. Based on the previously measured susceptibility of the intended receiver to interference from that particular interferer at the computed signal to interference ratio (scoring), the model then computes the probability of correct information transfer for the desired link under consideration. Vulnerability is determined similarly with the jammer considered as an interferer.

INPUT: Deployment data

Equipment parameters data

Propagation

Scoring data

OUTPUT: In addition to intermediate printouts, scores are provided at the single-link level as a probability of satisfactory operation (PSO) and at the system or group level as system effectiveness (SE). Scores at both levels are provided for various interference situations including no interference (communicability), interference from communications-electronics (C-E) only (compatibility), interference from all sources including jamming (vulnerability), interference from individual deployment groups in isolation (such as field army C-E only, or enemy electronic warfare (EW) unintentional effects only), and for individual equipment types only. System effectiveness scores are calculated for any system, or link grouping required by the test design, with breakouts typically based upon such parameters as net type, deployment group, equipment type, deployment area, and link of jammer distance.

HARDWARE: Computer: CYBER 172, CDC 6400, 6500, and 6600

Operating System:

Minimum Storage Requirements: 150,000 octal words, 60 byte words

Peripheral Equipment: Optimum number varies, but three tape drives and a disk capacity of at least one billion bytes are desirable.

SOFTWARE: Programming Language: FORTRAN and COMPASS

Documentation: Documentation of current model is complete.

TIME REQUIREMENTS: Preparation of Data Base: The preparation of the data base is entirely dependent on the specific problem being addressed. The time typically varies from weeks to months.

CPU Time Per Cycle: There really is no cycle per se, the CPU requirements are on the order of tens of hours with the longest run of record being 250 hours.

Data Output Analysis: Here, again, the requirement is problem dependent, but typically is on the order of weeks.

FREQUENCY OF USE: Monthly

SECURITY CLASSIFICATION: Unclassified

USERS: The Electromagnetic Environmental Test Facility

POINT OF CONTACT: The Electromagnetic Environmental Test Facility
U.S. Army Electronic Proving Ground
Fort Huachuca AZ 85613
AUTOVON: 879-6284

COMMENTS: Operational, but being expanded.

TITLE: Electronic Warfare Simulation

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE) Ottawa, Ontario, Canada.

DEVELOPER: As above.

PURPOSE: This simulation was developed to assess Electronic Warfare activities in the BRONZE TALON series of Research War Games.

GENERAL DESCRIPTION: The simulation specifically addresses four areas of electronic warfare:

a. Ground Communications Intercept
b. Ground Communications Direction Finding
c. Non-Communications Intercept and DF of Radars
d. Ground Communications Jamming.

Intercept activity of a radio net begins with the determination, in a general sense, of the existance of a detectable radio path from the median location of the net nodes to the intercept radio. Rather than consider the exact terrain-threshold signal to noise ratio for each intercept, the simulation utilizes a probability distribution based on radio band and transmitter power. Once a target is deemed detectable, the possibility that the net is acquired is then assessed stochastically based upon the usage of the net frequency by the nodes on the network and the general level of radio traffic in the sampled band.

Direction finding is accomplished through triangulation, either by determining differences in the direction of signal arrival or the time of arrival. Each DF station is treated independently. Radio paths, station intercepts, and accuracy of location determination are ascertained probabilistically.

The intercept and DF of radars contains many elements parallel to the intercept and DF of radio traffic. Activity begins with the determination of radar line of sight between the radar and the intercept receiver. This is a function of frequency, power of the radar, and intervening terrain. Once the interceptable path has been established, the acquisition of the radar is attempted. If acquired, an attempt to identify and locate it is made.

Spot and Barrage jamming of ground communications are evaluated by the simulation. Spot jamming is the allocation of jamming power against a limited number of radio frequencies, while allowing all other frequencies uninterrupted transmission. Barrage jamming attempts to deny communication to all frequencies over a specific frequency band.

INPUT:

- All messages and their generating units are required on a period by period basis. (Note: A generating unit has a prescribed (fixed) network over which it transmits so that the potential recipients are present.) As well all operating radars are needed.

OUTPUT:

- A list of which messages have been lost or intercepted and which generating units have been located is produced. As well a listing of the radars which have been intercepted and located is printed, and the results of any jamming activities is given.

MODEL LIMITATIONS:

- All aspects of electronic warfare activities are modelled stochastically. Probabilities are based on somewhat scant and debatable information. As better sources of data become available this deficiency will be corrected.

HARDWARE:

- PDP 11/34 computer.

SOFTWARE:

- Programmed in FLECS (an extension of Fortran).

STAFF:

- One computer operator is required to input data and run the program.

TIME REQUIREMENTS:

- Preparation: Data collection and input consumes approximately one half hour for each five minutes of game play.
- Play: Running time can be up to fifteen minutes depending on the size of the data base.
- Analysis: Included in research war game analysis.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Used continuously throughout the BRONZE TALON War Game series.

USERS: DLOR War Games Section.

TITLE: Empirical Propagation Model 73 (EPM 73)

PROPONENT: AFEWC/SATB

DEVELOPER: Electromagnetic Compatibility Analysis Center (ECAC)

PURPOSE: To evaluate radio frequency (RF) propagation loss due to atmospheric and terrestial losses

GENERAL DESCRIPTION: This model is the same as that described in "IEEE Transactions on Electromagnetic Compatibility," Vol I, EMC 19, Nov 3, Aug 77 pp 301, 309. This model provides an estimate of mean basic transmission loss in dB. It has been compared with measured values over a frequency range of approximately 20 to 10,000 MHz, and it provides results comparable to those achieved using more sophisticated models.

INPUT: Inputs are by Keyboard

Height of transmitting and receiving antennas in feet

Frequency in MHz

Link Distance (nautical mile (NM))

Terrain type (select one of five types)

OUTPUT: A single number which is the propagation loss in dB

MODEL LIMITATIONS:

Frequency range 20 to 10,000 MHz

Antenna Heights $\leq$ 3000 meters

HARDWARE:

Computer: TEKTRONIX 4051

SOFTWARE:

Programming Language: BASIC TEKTRONIX

Documentation: See General Description above

TIME REQUIREMENTS: 60 seconds each run

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Seldom used as a stand alone program. Frequently used as a subroutine in support of other programs.

USERS: AFEWC/SATB and EWTR

POINT OF CONTACT: AFEWC/SATB
Capt Louis P. Kelley
San Antonio, TX 78243
Telephone: 512/925-2427/AUTOVON: 945-2427

COMMENTS: Program is available from ECAC or AFEWC/SATB for the Hewlett-Packard HP-65 calculator.

TITLE: ESCAP/6

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Systems Command (AIR-503)

PURPOSE: ESCAP/6 is a computerized, analytical, general war model which evaluates the joint effectiveness of several fighter systems (aircraft, radar, missile) in coordinated operations in strike escort or beachhead CAP. The model is concerned with the performance of the fighter group in detecting the threat and, once the threat is detected, the effectiveness of the fighter group in air-to-air combat. The two sections of the program may be run separately.

GENERAL DESCRIPTION: ESCAP/6 is a two-sided, mixed model which involves air forces only. It aggregates fighter and threat aircraft, each of a distinct type, with a range of possible manipulation to include up to 10 fighter aircraft. Simulated time is treated on an event-store basis. Monte Carlo simulation (detection performance) and Markov chain computations (combat effectiveness) are the primary solution techniques used.

INPUT:

- o Weapon system type
- o Radar scan pattern
- o Fighter aircraft flight pattern
- o Threat aircraft radar cross section
- o Altitude and speed of escort and threat
- o Escort aircraft grouping
- o Number of missiles for each fighter and threat aircraft
- o Missile launch sequence

OUTPUT:

- o Strike escort: radar detection contour map, survive/kill probabilities, probability distribution of number of unexpended missiles on survivors
- o CAP: Joint radar detection performance, number of missile launches by the first CAP making a detection
- o A summary output for the detection portion of the program is available which gives mean detection range and standard deviation.

MODEL LIMITATIONS: For the strike escort case in the detection portion of the model, the speed of the threat aircraft cannot exceed that of the strike group.

HARDWARE:

- o Computer: CDC 6600
- o Operating System: NOS/BE 1.0
- o Minimum Storage Required: 100K octal words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: A short description of the program and a list of inputs are available.
- o Both user's documentation and technica' documentation are not complete.

TIME REQUIREMENTS:

- o Less than 1 month to acquire base data
- o Less than 1 man-month to structure data in model input format
- o CPU time per model cycle: 101-5 minutes per 100 iterations for detection; 5 minutes for combat effectiveness

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 projects per year

USERS:

- o Principal: Naval Air Systems Command

POINT OF CONTACT: Naval Air Systems Command
Systems Analysis Division (AIR-503)
Washington, D. C. 20361
Telephone: Autovon 222-3490

MISCELLANEOUS: This model supersedes ESCAP/5

KEYWORD LISTING: Computerized; Analytical Model; General War; Air Forces; Two-Sided; Mixed; Event Store

TITLE: EVADE II

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: EVADE II is a computerized, analytic, damage assessment/weapons effectiveness model. The model simulates engagements between an aircraft force and a ground array of gun and missile positions and calculates relative survivability of candidate aircraft types in various threat environments. This program is also useful as a means of obtaining a first order estimate of the practicality of flight paths, adequacy of weapon deployments or as a relative survivability indicator when investigating tactics, techniques, equipments, environmental variations, and other systematic variations of input parameters to the engagement problem.

GENERAL DESCRIPTION: EVADE II is a two-sided, deterministic, time-step model. Systematic sampling is used in the modeling gun error sources.

INPUT:

- o Aircraft: Vulnerable area data, flight profile, time-position-velocity history, terrain masking history to ground weapon sites
- o Ground Weapons: Number of rounds fired each burst, time pause between bursts, magazine capacity, time to reload, trajectory table data, fire control smoothing constant

OUTPUT:

- o Expected number of attrited aircraft
- o Expected number of ground targets destroyed
- o Event histories list key events for each participant
- o Unmasking
- o Detection
- o Entering effective range
- o Firing
- o Receival of fire

MODEL LIMITATIONS:

- o Not dynamic, flight profiles must be preplanned
- o No ground vs ground interactions
- o No air versus air interactions

HARDWARE:

- o Computer: CDC 7600, CDC 6600, IBM 360
- o Operating System: NOS 1.4 - 531
- o Minimum Storage Required: 80K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: EVADE II, Evaluation of Air Defense Effectiveness, revised December 1974. VOL I User Manual; VOL II Analyst Manual, Book 1 and 2. (DDC 909-345L, - 347L)

TIME REQUIREMENTS:

- o 1 week to acquire data base
- o 1 week to structure data in model input format
- o 1 hour to analyze output
- o 30 seconds CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS:

- o Principal: US Army Materiel Systems Analysis Activity
- o Other: AVARADCOM, NAD, FALCON R&E and ASI

POINT OF CONTACT: R. Baldwin and W. Paris
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-AAS
Aberdeen Proving Ground, Maryland 21005
AUTOVON 283-4643

MISCELLANEOUS: EVADE II is linked to MASKPAS which generates flight paths and intervisibility history for input. AESOPS uses EVADE output for sustained operations. MASKPAS output can be used for EVADE input. EVADE output can be used for AESOPS input. EVADE II supersedes EVADE I.

KEYWORD LISTING: Analysis; Damage Assessment/Weapon Effectiveness; Land, Air, Computerized; Two-Sided; Deterministic; Time Step

TITLE: EWS - Electronic Warfare Simulation

AVAILABILITY: WAP Branch, RARDE, Sevenoaks, Kent, England

DEVELOPER: RARDE with support from LOGICA Ltd.

PURPOSE: Manual computer-assisted wargame to examine effects of EW on the land battle.

GENERAL DESCRIPTION: Closed, two-sided game with models of communications and EW equipments permitting interactions to be explored between opposing elements in the context of an all-arms, non-nuclear battle.

INPUT: Same as DWG

OUTPUT: Same as DWG with facilities to replicate portions of battle with alternative parameters

MODEL LIMITATIONS: EWS recently upgraded to run on VAX 11/780. Statement on limitations awaits results of tests.

HARDWARE:

- Type Computer: VAX 11/780
- Operating System: VMS
- Minimum Storage Required: 512K bytes MOS
  2 x 67 Mbytes discs
- Peripheral equipment: 6 VDUs
  2 keyboard printers
  1 line printer
  1 magnetic drive

SOFTWARE:

- Programming Language: VAX FORTRAN IV (plus)
- Documentation: User's Guide, System Description and Programmer's Manual

TIME REQUIREMENTS: 5 days to prepare data base

SECURITY CLASSIFICATION: CLASSIFIED

FREQUENCY OF USE: As required

USERS:

- RARDE
- TRANSANA

POINT OF CONTACT: S/MA2, RARDE
Sevenoaks, Kent, [illegible]
Knockholt (0959) 32222, ext 2370

TITLE: Exercise "Barossa Pearl"

PROPONENT: Central Studies Establishment

DEVELOPER: As above

PURPOSE: Exercise Barossa Pearl is a tactical training war-game designed to exercise students in the application of the principles of tactics and staff work for the four phases of war at Bn/TF level.

GENERAL DESCRIPTION: Barossa Pearl is a closed two-sided game designed for training at TF/Bn HQ level and for Tactical special to Corps and general courses. It may be played as a HQ game with emphasis placed on staff work and planning or as a series of separate games played simultaneously employing small player groups in the order of three to four players. The game can cater for free play with general training objectives or be played in discreet steps designed to place emphasis on special aspects of training. The game can be played in real time with discrete time jumps at periods of low activity. Game resolution is down to platoon level. When the game is played to such settings that demand specialist weapons such as TOW etc., the relationship between play time and real time can be less than real time.

INPUT: An operational Plan, Planning Data are provided in the handbook.

OUTPUT: Consequence of players actions

LIMITATIONS: Adjudication rules have to be simplified to cater for quick manual adjudications.

HARDWARE: Game handbook

SOFTWARE: Manual war-game

STAFF:

- Control 3 officers and 3 NCOs
- Player teams
  - As a HQ game, key personnel on a Bn/TF HQ in the order of 12-18 persons per team
  - In the multi-play mode 3-4 players per tea

TIME REQUIREMENTS:

- Preparation: Three hours required for preparation of the HQ and familiarization of handbook
- Play: Two and a half days, one day being equal to 10 hours
- Analysis: For 30 hours of game play about three hours

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 plays per year

[illegible] BEING FILMED

USERS: Training Gps, TF HQ and Infantry Centre. (The settings are changed to suit each of the above establishments.)

MISCELLANEOUS: As game play is increased and the experience based is enlarged more involved adjudication rules covering a broader spectrum of events will be introduced into game play. Two more games of similar characteristics have been developed; they are EX "KOKODA" and EX "DISTANT DRUM". The above games have similar training characteristics but incorporate different settings and types of ORBATs.

TITLE: Exercise Batman - Battle Management and Strike Effectiveness War Game

PROPONENT: Central Studies Establishment

DEVELOPER: Central Studies Establishment

PURPOSE: Exercise Batman is a manual war game that may be assisted by a small desk computer. The game is designed to assist joint training of Army and Air Force personnel in battle management techniques and the effectiveness of air-to-surface and surface-to-air weapons.

GENERAL DESCRIPTION: Batman is a two-sided, free play war game designed to demonstrate the effectiveness of surface-to-air to surface weapons in the context of an air ground battle. The game provides a facility for training exercise participants in the management of resources during an air ground battle, the flow of information of battle tactics at both inter and intra service levels, testing existing doctrine and the examination of new concepts of operations.

INPUT: A concept of operations plans for both air and ground force, planning data are provided in the handbook.

OUTPUT: Consequence of players action.

MODEL LIMITATIONS: When used in computer assisted mode the game is depencent on a computer (Hewlett-Packard 9825A) and its support staff. When used in manual mode rules have to be simplified to cater for quick manual adjudication.

HARDWARE: Game handbook

SOFTWARE: Hewlett-Packard 982A Program

TIME REQUIREMENTS: Approximately four and a half full working days should be allowed for the running of the exercise.

- o 1/2 day for briefing and exercise preparation
- o Demonstration play - 1/2 day
- o 3 days for play
- o 1 day = 8 hours
- o Game play will be in real time with a game time jump when appropriate

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Has not been played for two years.

USER: Joint Services Air Defense Course; RAAF Staff College

MISCELLANEOUS: As the game play is increased and the experience base is enlarged, the game will be expanded to cater for more operational staff work.

TITLE: Exercise 'MOBILE STORE'.

PROPONENT: Central Studies Establishment

DEVELOPER: Central Studies Establishment

PURPOSE: Exercise MOBILE STORE is an administrative war game designed to exercise students in the conduct of road transport tasks at Division level and when used in CPX mode to train Troop Squadron and Regimental HQ.

GENERAL DESCRIPTION: Exercise MOBILE STORE is a one sided war game designed to aid instruction in road transport operation at transport training centres and when played in CPX mode provides HQ training for road transport units. The game considers the following aspects of road transport, the distribution of combat supplies, the interface between Division and Corps transport responsibilities, and unitisation of cargo loads, the location of transport unit and the size of vehicles to be used. The game is usually played in real time when played in CPX mode. When played at training establishment, 24 hours of exercise time equals six hours of game time.

INPUT:

- A series of five 24 hour operational situation maps.

OUTPUT:

- Consequence of players actions

LIMITATIONS:

- Adjudication rules have to be simplified to cater for quick manual adjudications.

HARDWARE:

- Game Handbook

SOFTWARE:

- Manual war game

STAFF:

- Control - three officers and three NCOs
- Player teams:
  - As a CPX HQ game.
    Sqn HQ - 5 to 7 pers Regt HQ - 3 to 5 pers.
  - In small team play mode three to four players per HQs played

TIME REQUIREMENTS:

- Preparation: Three hours required for players to prepare their HQ and familiarisation of handbook.
- Play: Two to three days with between eight to 10 hours of play per day.
- Analysis: For 30 hours of game play about three hours.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Three plays per year.

USERS: Transport Sqns, Army School of Transport.

MISCELLANEOUS: As game play is increased and the experience base is enlarged, more involved adjudication rules covering a broader spectrum of events will be introduced into game play, together with some computer assistance, in particular, in such areas as road movement control. Work has commenced on the development of road transport war games at Corps, COMM Z and Support Area levels.

TITLE: Exercise NEW PIN

PROPONENT: Central Studies Establishment

DEVELOPER: Central Studies Establishment

PURPOSE: Exercise NEW PIN represents a movements war game designed to assist instruction in critical areas of transportation. These areas involve the movement of supplies, terminal facilities and modes of transport. The requirement of the game is to supply 5000 tons per day of civil aid to an island, named Ruritania, which is located to the north-east of Australia.

GENERAL DESCRIPTION: This game is an open one-sided game with a game play to real time equaling one hour of game play to 24 hours of real time (actual movement time).

Exercise NEW PIN was developed as a movement war game to produce a form of training that exposes player teams to the type of problems that occur at random in various locations of the supply line.

The players must recognize the type of problems presented in the supply line by the occurrence of these problems, initiate a correction, know when to apply that correction and know the level at which the correction is to be initiated. It is these characteristics that illustrate the essential difference between NEW PIN as a one-sided movements war game and the conventional TEWT.

In playing NEW PIN, player teams will be made aware of the type of problems that are encountered in obtaining the best throughput of supplies depending upon the relationship between the type of containers (20 ft ISO, BMSS or Pallets), the type of material handling equipment (fork-lifts, cranes, etc.) and the mode of transport employed (sea, air, rail, road, and inland waterway).

Player teams will encounter problems which they will have to solve. To do so, they will have to perform the following tasks: decide whether the problem involves their location directly or indirectly; study the problem; identify how it affects the plan; decide whether resources are available immediately to solve the problem; if not, demand those resources; and decide how the solution will affect other plans involving the total supply system. Having decided on a course of action a SITREP must then be sent to all other levels of command in the supply system. The other player groups on receiving the SITREP must carry out the necessary staff activities by either concurring with the action taken or by providing an alternative course of action. Each action can be accepted or vetoed at higher levels of command.

Exercise NEW PIN in the form described above is designed to cover the principles of movements only and does not consider the type of detail that would be required at unit level.

INPUT:

- o Exercise NEW PIN is played to a set of plans. These plans are:
  - a defence maintenance plan
  - a defence movement plan
  - a local movement plan for Australia
  - a local movement plan for Ruritania

OUTPUT:

- o Any shortcoming in the above plans and deficiencies in the supply rate.
- o Lack of resolution down to unit level, considers gross tonnage and not individual items

HARDWARE: Magnetic board and symbols, diagram of transport modes and distances and handbook.

SOFTWARE: A computerized version of NEW PIN has been developed on a HP 9845.

TIME REQUIREMENTS:

- o Preparation: Depending on the level of play a lead time of between two and eight weeks would be required between notifying the participants and actual game play
- o Two and a half days to play. One day being equal to eight hours
- o Analysis. Depending on the resolution of play, between 3-24 hours

SECURITY CLASSIFICATION: UNCLASSIFIED

USER: DMOVI-A, RACT

POINT OF CONTACT: Central Studies Establishment

MISCELLANEOUS: Exercise NEW PIN is being further developed to cater for:

- o terminal operations
- o employment of a full military ORBAT
- o deployment and supporting of a TF to the Island
- o employment of financial constraints

TITLE: FACITS - Fleet Air Combat Interactive Tactical Simulation

PROPONENT: NSWC, Dahlgren, Virginia/G22

DEVELOPER: NSWC, Dahlgren, Virginia/G22

PURPOSE: The Fleet Air Combat Interactive Tactical Simulation, FACITS, was developed to help analyze outer perimeter defense scenarios and tactics, including the effects of hostile ECM and changes in own force weapon capabilities

GENERAL DESCRIPTION: FACITS is an interactive outer air battle simulation designed for maximum flexibility in blue force tactics. A color CRT provides the user with a geometric representation of the ongoing battle which includes information concerning jam strobes, radar/IR detections and integrity of communication links. The user is responsible for establishing and updating all blue force tactics as the battle progresses. This is easily accomplished with the aid of subroutines that interact conversationally with the user and with the use of a joystick that allows the user to indicate directions and points on the graphics screen. Two auxiliary programs are available to help with the creation of a new friendly or hostile scenario which may be added to the main scenario library (any friendly scenario may be exercised against any hostile scenario). A third auxiliary program will display battle results in both tabular and graphic formats.

INPUT:

- o Friendly and hostile scenario names
- o Hostile noise jamming intensity
- o Number of AAMs per interceptor
- o AAM speed, range, and kill probability
- o Long range, SAM max range and kill probability
- o Update rate and time late for ocean surveillance data
- o IR maximum detection range

OUTPUT:

- o Cover page which lists scenarios used, date of run, parameter values, and user supplied comments
- o A 35mm camera may be used to make color slides of the graphics display
- o A hard copy unit may be used to obtain a running account of the blue force tactics
- o AAM data:
  - Launch platform
  - Target
  - Time of launch
  - Time of intercept
  - Range of intercept
  - Result of intercept

- o LRSAM data:
  - Target
  - Time of launch
  - Time of intercept
  - Range of intercept
  - Result of intercept
- o Initial detection data:
  - Hostile detected
  - Friendly making detection
  - Means of detection (IR or radar)
  - Time of detection
  - Range of hostile from task force center at time of detection
- o Interceptor final state:
  - Fuel remaining
  - Number of AAM's remaining
- o Map of AAM kills which differentiates between incoming and outgoing targets

MODEL LIMITATIONS:

- o Enemy tactics are pre-programmed
- o Two dimensional model
- o May take several hours to run an entire battle

HARDWARE:

- o Computer - Tektronix 4052
- o Peripheral equipment - RAMTEK color graphics and joystick, disk drive unit, hard copy unit (optional), plotter (optional)

SOFTWARE:

- o Language - Tektronix graphic system BASIC
- o Documentation - Technical report to be published

TIME REQUIREMENTS: Several hours to run a battle

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Jim Terrell/Dave Clawson
NSWC/G22
Dahlgren, Virginia 22448
(703) 663-8558

KEYWORD LISTING: AAW, Fleet Air Defense, Interactive simulation

TITLE: FASTALS - Force Analysis of Theater Administrative and Logistics Support

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: General Research Corporation and US Army Concepts Analysis Agency

PURPOSE: FASTALS is a computerized, analytical model that provides an automated force roundout methodology for the Army Staff. The model simulates the workloads which would be generated under combat conditions in order to identify the support units needed to make the theater force self-supporting, taking into account constraints imposed by the player. The model may be used to assess the effects of different user constraints and supply policies in accomplishing the logistics functions.

GENERAL DESCRIPTION: FASTALS is a one-sided, deterministic model involving land forces only. It is designed to consider groupings at the company or battalion level, although units as small as a team or as large as a division can be considered. The model normally operates in fixed time-steps, usually 10- or 30-day increments. Network analysis and table look-up are the primary solution techniques used, though the process can be characterized roughly as an integerized, time phased, input-output model.

INPUT:

- o Logistic network description for the theater of operations
- o Time phased list of combat units, and their combat intensities
- o Logistics tables of stockage, consumption, construction, medical factors, etc.
- o Logistics rules

OUTPUT: Computer printout of time-phased troop deployments, workloads generated, and supply consumption/stockage by time period. Supplemental programs can be invoked to:

- o Provide a detailed description of the flow of supplies through the transportation network
- o Produce multi-item plots of capabilities versus requirements for some logistics activities
- o Compare the troop lists generated by several runs
- o Summarize the troop list in various ways

MODEL LIMITATIONS:

- o Typically, only US Forces are modeled
- o Data base preparation is detailed and extensive

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 operating system
- o Minimum Storage Required: 150K 36 bit words
- o One disc drive or three tape drives

SOFTWARE:

- o Programming Language: FORTRAN V
- o User Documentation: RAC-R-86, Appendix C, provides a description of the program and provides guidance for the preparation of input data. Users guide prepared under contract for US Army Logistics Center by Computer Sciences Corporation (in April 1980) provides a more complete documentation of changes made between 1972 and 1980. Subsequent modifications/expansion of the model are being incorporated into this document.

TIME REQUIREMENTS:

- o 3-6 months to acquire data base
- o 6 man-weeks to structure data in model input format
- o 25 minutes computer time per 180 day simulation on a UNIVAC 1100/82

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 500 runs per year

USERS: US Army Concepts Analysis Agency, US Army Logistics Center

POINT OF CONTACT: Mr. H.G. Whitley
US Army Concepts Analysis Agency (CSCA-FAF)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (20) 295-1585

MISCELLANEOUS: ATLAS, CLM or other theater level war game model provides combat data for input. CAMP examines the feasibility of the FASTALS generated deployment list. SIGMALOG may be used to evaluate the detailed logistics function. Semi-automated interfaces exist or are being built for these models.

KEYWORD LISTING: Analytical Model, General War, Land Forces, Computerized, One-Sided, Deterministic, Time Phased

TITLE: FASTGEN II

PROPONENT: Aeronautical Systems Division (ASD/XRM, Air Force Systems Command

DEVELOPER: JTCG/AS - ASD/ADDP & ASD/XRM

PURPOSE: FASTGEN II is a model for describing the geometry and internal components of aircraft for use in nonnuclear vulnerability assessments.

GENERAL DESCRIPTION: FASTGEN II is a program to model aircraft skin, structure, and internal component geometrics in the computer. The output of the program is files of shotline data containing components intercepted, obliquities, and thicknesses. The data is stored for later use in vulnerability computation programs for projectile, fragment, and laser threats.

INPUT:

- o Aircraft skin, structure
- o Aircraft internal components

OUTPUT: Shotlines through the aircraft at any desired orientation

MODEL LIMITATIONS: One target at a time

HARDWARE

- o Computer: CDC CYBER 74 & 750
- o Operating System: NOS/BE Level 451
- o Minimum Storage Required: 65K (Octal)

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: ASD-TR-77-24 (JTCG/AS-79-V-002) FASTGEN II Target Description Computer Program

TIME REQUIREMENTS: Time to prepare a target model ranged from 2 weeks to 10 months depending on level of detail

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times a year

USERS: NWC, AFATL, NNSC/DL, ASD, AFWAL

POINT OF CONTACT: Mr. Roy Hilbrand (ASD/ADDP) AV 785-5807
Mr. Gerald Bennett (ASD/XRM) AV 785-6545
Wright-Patterson AFB, OH 45433

KEYWORD LISTING: Vulnerability, vulnerable areas, target description

TITLE: FCIS - Force Cost Information System

PROPONENT: Headquarters, DA Army, Office of the Comptroller

DEVELOPER: US Army Management Systems Support Agency (USAMSSA)

PURPOSE: FCIS is a computerized, analytical, politico-military model that provides rapid cost estimates, for planning purposes, for various Army forces, force postures, and changes in force postures. The model provides costs for actual and hypothetical TOE units and for force structures such as theater forces, division force equivalents, to include division, non-division combat and tactical support increments. A capability has been added to this model to provide cost estimates of future weapon system force units (e.g., AAH, XM-1, AN/TPQ36).

GENERAL DESCRIPTION: FCIS is a one-sided, deterministic model involving land forces only. It is designed to consider units ranging in size from a team to a force. Simulation time is treated in a time-step basis. Arithmetic is the primary solution technique used.

INPUT: Input consists of the Standard Requirements Codes (SRCs), Force Unit Identification Codes (FUICs) for actual force units. Hypothetical structures are presently costed by modifying actual SRCs or FUICs or creating pseudo SRCs identifying equipment by UN items and personnel by MOS and GRADE.

OUTPUT:

- Output in variable formats is available in hard copy.
- Data for a selection of SRCs is published in the Army Force Planning Cost Handbook (AFPCH), a by-product of the FCIS.
- Data for costing future weapon system force units is published as an annex to the AFPCH, entitled, "Future Systems and Organizations."
- A conversational capability, via a cathode-ray tube (CRT) display device, allows Army staff analysts direct access to FCIS, making possible rapid response on questions such as the aggregate costs of force structures.
- Detailed and summary retrievals are available for any unit, actual or pseudo, in the data bank. Selective report summations via hard-copy and CRT output are available on request.

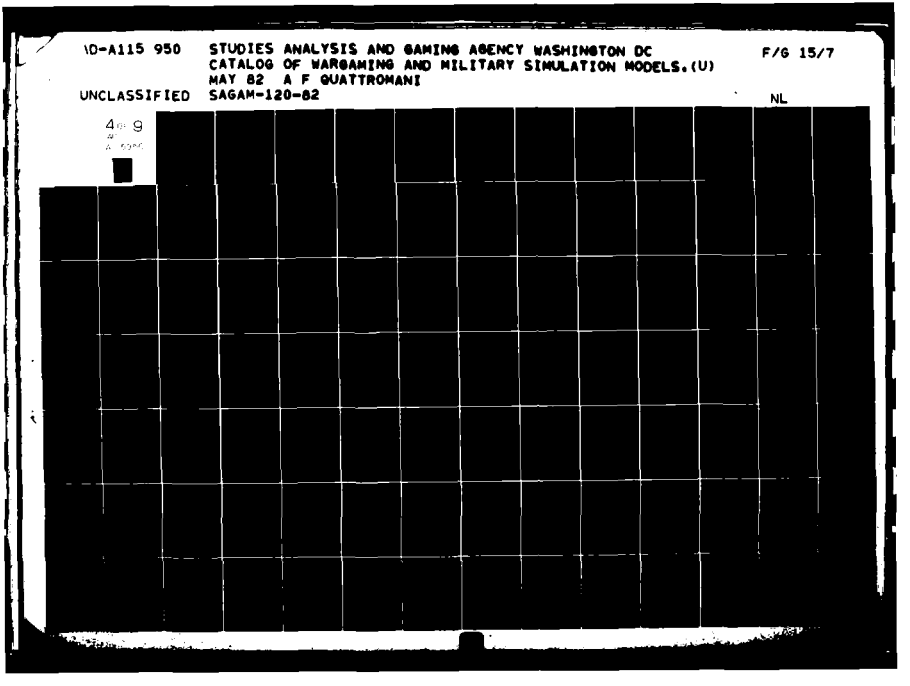
MODEL LIMITATIONS: The model depends upon the specification of the force units. Pseudo units, when modified by UN, MOS, and GRADE, also be costed in standard FCIS format.

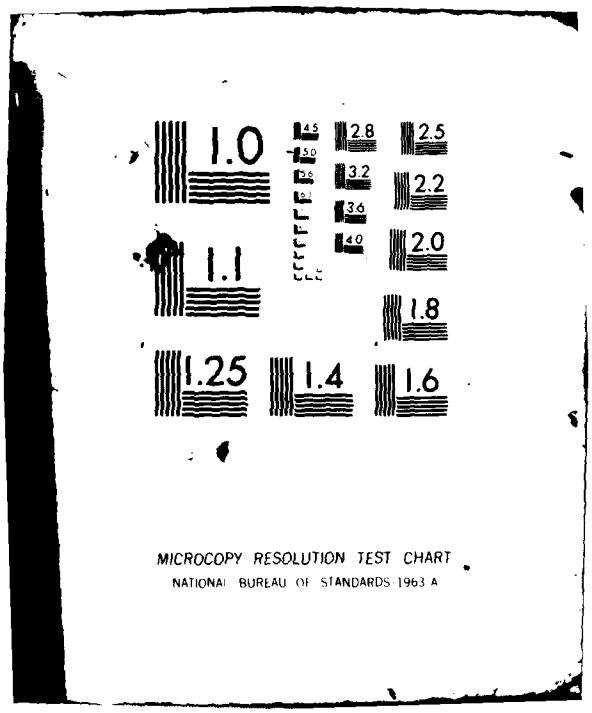
HARDWARE:

- Computer: IBM 370/168
- Operating System: O.S. MVS
- Minimum Storage Requirements: 1M
- Peripherals Required: Disk drive, tape drive, printer (IBM 3211), Printer, and card reader

/bls

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
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5.6
6.3
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

SOFTWARE:

- o Programming Language: FORTRAN IV, COBOL
- o User's technical documentation is not complete, due to the fact that expansion and refinement of the FCIS is going on continuously. However, brief general descriptions and programmer documentation are available.

TIME REQUIREMENTS:

- o 3 months or less to acquire base data
- o 1 month or less to structure data base
- o 5 minutes or less CPU time per model cycle

SECURITY CLASSIFICATION: Model algorithms are UNCLASSIFIED.

FREQUENCY OF USE: Weekly

USERS:

- o Principal: Department of the Army
- o Other: Contractors, Office of the Secretary of Defense, and allied nations

POINT OF CONTACT: Headquarters US Army
Office of the Comptroller
ATTN: DACA-CAF, Rm 2B679
Washington, D. C. 20310
Telephone: OX5-2065/6
Autovon 225-0265/6

MISCELLANEOUS:

- o The FCIS provides input to the Force Stratification System, the Battalion Slice Model, and a variety of Army Staff exercises. The FCIS also uses some data from the Force Planning Information System (FPIS).
- o FCIS supersedes the Army Operating Cost Information System (AOCIS) and COSTALS.
- o Additional efforts include modification for correlation with Army budgetary factors and costs, and incorporation of a capability for sensitivity analysis, and CRT display of costs.

KEYWORD LISTING: Analytical Model, Politico-Military, Land Forces, Computerized, One-Sided, Deterministic, Time Step

TITLE: FCLDO - Cloud Forecast Simulation Model

PROPONENT: United States Air Force Environmental Technical Applications Center (USAFETAC)

DEVELOPER: USAFETAC

PURPOSE: FCLDO is a computerized, weather simulation model used as an analytical tool in support of combat doctrine, strategy and tactics development simulations, force mix studies, war games, and other user applications.

GENERAL DESCRIPTION: FCLDO generates a two dimensional gridded field of synthetic 3-hr forecasts of total cloud cover. The model uses an input "verifying" observation field and stochastically generates a forecast field in such a manner as to preserve desired forecast-verifying observation skill and the spatial correlation characteristics of the forecast fields. FCLDO was originally designed to be used on a limited geographical subgrid but may be expanded to nemispherical or global scale. Primary solution techniques used are a sawtooth wave submodel and a skill matrix adjustment submodel. The wave generator produces a gridded field of spatially correlated psuedo-random normal numbers and the skill matrix adjustment performs an inverse normalizing transformation on the spatially correlated random normal number field to produce synthetic values of forcast cloud cover at each grid point. These forecasts are based on the input verifying cloud cover observation for each point.

INPUT:

- o A categorical forecast skills matrix (forecast verification contingency table) specifying the skill or forecast "goodness" that the ouput synthetic cloud cover forecaster must have. Normally a different matrix for each geographic area and time of year.
- o Observation fields from which the synthetic forecast will be generated.
- o Various controlling parameters to detemine input and output format.

OUTPUT:

- o Gridded fields of consistent spatially correlated synthetic total cloud cover forecasts.
- o Diagnostic statistics, such as conditional and joint distributions of forecasts and observations, to verify model credibility.

MODEL LIMITATIONS:

- o Model is CPU intensive
- o Large scale models (global, nemispherical, etc.) require large portions of core.

- o The Ornstein-Uhlenbeck process is a first-order Markov, but this is not too restrictive for weather.
- o Only one spatial correlation function can be designated for the entire forecast grid.

HARDWARE:

- o Computer: IBM 360, 370, 4341; DEC System 10, PDP 11/45, easily adaptable to others.
- o Operating Systems: IBM VM/370 DOS; TENEX; RSX-11M
- o Minimum Storage Required: Depends on scale of model. The developmental version of this model for a 97 x 80 subgrid with full diagnostic package required 100 K words.

SOFTWARE:

- o Programming Language: FORTRAN IV less all vendor-unique features.
- o Documentation: USAFETAC Technical Note, to be published 1981.

TIME REQUIREMENTS:

- o Depends greatly on the nature of the problem posed, the size of the desired forecast grid, and the availability and suitability of input data.
- o 4 months to acquire base data
- o 6 months to structure model for desired input and output
- o 0.05-0.1 milliseconds CPU time to generate a synthetic forecast for each desired grid point.
- o Output forecast fields are not analyzed in their own right, but are played directly into the user's simulation, game, or study.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required by the end user, in that the weather model is executed every time the user's model or simulation is run.

USERS: HQ Air Weather Service

POINT OF CONTACT: Maj Roger C. Whiton
USAFETAC/DNS
Scott AFB, IL 6335
Telephone: AUTOVON 638-5412
Commerical (618) 256-5412

MISCELLANEOUS: Application of the basic framework of FCLDO is not limited to cloud cover forcasts. Two dimensional grids or networks of many different types of weather variables can be generated. USAFETAC will adapt this model to meet the user's specific needs, making such

changes in the FORTRAN code as are necessary to satisfy the user's specific requirements regarding variables and locations to be simulated, inputs/outputs/interfaces desired, computer environment restrictions to be met, etc.

KEYWORD LISTING: Two-dimensional, sawtooth wave, grid network, forecast, cloud forecast, spatial correlation, bivariate normal, stochastic process, computerized, meterology, environmental simulation, weather, weather forecast

TITLE: FIOS - FEMA Input-Output System

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: The 1967 FEMA Input-Output System (FIOS) was developed for both computerized and computer assisted analysis of economic and interindustry relationships. This model has been used to evaluate requirements for industrial production, energy, skilled workforce and raw materials to support mobilization for and execution of non-nuclear war.

GENERAL DESCRIPTION: FIOS focuses on industrial capabilities of the United States and requirements for manpower, war materiel and resources required for production. The 1967 FIOS has served as the central model in a modular system of models which has had primary application in the mobilization planning and strategic materials stockpiling areas. FIOS partitions the US economy into 178 industrial sectors but can consider as few as 110 industrial sectors. The greatest detail is in durable goods manufacturing and construction sectors. Chance events are treated deterministically. The model employs fixed co-efficient input-output techniques which allow no changes in relative prices and technology and no substitution of inputs or outputs. From that standpoint, it presents a worst-case simulation of capabilities for industrial mobilization. The model simulates an instantaneous adjustment to general economic equilibrium. Time is treated as an event storage phenomenon during economic simulations. Several successive annual simulations can be simulated in an elapsed time of one hour. The primary solution technique is linear algebra.

INPUT: The driving inputs are civilian and defense expenditures on goods, services, war materiel, etc.

OUTPUT: The model evaluates requirements for intermediate and finished goods, raw materials, manpower and energy. Computer printouts provide estimates of each type of economic variable for each industry sector.

MODEL LIMITATIONS: The fixed co-efficient input-output structure inhibits analysis of economic changes such as prices and taxes, substitutions of inputs or outputs, inventory adjustments and capacity limitations. As a result, the model simulates only a type of worst-case. As configured, the model is demand driven and cannot analyze supply disruptions or bottlenecks. The 1967 data on interindustry relationships are obsolete in 1981, especially on imports, production, prices and use of energy. There is no geographic detail in the model other than national. The system is being updated to 1972. FIOS will be updated to 1977 when the data are available.

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HARDWARE: The 1967 FIOS is resident on the FEMA UNIVAC 1108 computer

SOFTWARE: The software for the 1967 FIOS is Matrix Arithmetic Programming System (MAPS), a FORTRAN-based macro-language. FIOS and its input data are undocumented.

TIME REQUIREMENTS: Four staff years of effort were expended to develop the 1967 FIOS over a five year period. Assimilation of data and development of computer software accounted for three staff years Maintenance and updating of the demand data bases required one staff year. A similar level of effort is required for the forthcoming 1972 system. Individual input-output simulations may require less than a day of staff time. A simulation will require only a few minutes of CPU time.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: When the data were less obsolete, frequency of use was several times per month. Now the model is used only 2 or 3 times a year because of obsolescence.

USERS: The primary users of this system have been within FEMA (FPA) programs. Other Federal Agencies including the Departments of Commerce, Labor, and Energy have used the model during tests, exercises, and planning efforts.

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS: Historically, the FIOS Systems (previously called DITT systems) formed the foundation of many FEMA analytical systems. Today FIOS forms the heart of INFERS and STOCKPILE Systems presented later in this catalog.

KEYWORD LISTING: Interindustry, Input-Output, Requirements Material, Workforce, Energy, Output, Production, Intermediate

TITLE: FIRST BATTLE

PROPONENT: Manual and Computer Supported Simulations Division, Battle Simulation Development Directorate, Combined Arms Training Development Activity

DEVELOPER: Same as Proponent

PURPOSE: A division level manual, scenario and terrain independent battle simulation designed to exercise division command groups, coordinating staff along with brigade command groups and selected battalions in a simulated combat environment against a free play opposing force. Internal SOPs can be evaluated under simulated combat conditions.

GENERAL DESCRIPTION: A manual, scenario and terrain independent battle simulation which models complete resolution at company/terrain level and is designed to exercise the division command group while also being capable of exercising selected battalions, brigade staffs and commanders and including the corps assets.

INPUT:

- o Order of Battle
- o Firing Rates
- o Terrain and Weather

OUTPUT:

- o Combat results generated manually using combat results tables
- o Reports rendered manually to player elements by player/controller personnel

MODEL LIMITATIONS: Player controller personnel costs.

HARDWARE: GTA 71-2-3

SOFTWARE: N/A

TIME REQUIREMENTS:

- o 2-3 days player learning time
- o Playing time per cycle - Unit Desires

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: When the unit desires

USERS: N/A

POINT OF CONTACT: Commander, USA CAC
ATTN: ATZL-TDD-SM
Fort Leavenworth, Kansas 66027
AUTOVON 552-3180/3395
Commercial: (913)-682-3180/3395

MISCELLANEOUS: Field Observations Booklet available.

KEYWORD LISTING: N/A

TITLE: FLOATS - Force Level Operational Analysis and Tactical Simulation

PROPONENT: Chief of Naval Operations (OP-35)

DEVELOPER: Applied Physics Laboratory/Johns Hopkins University

PURPOSE: FLOATS is a computerized, engagement model for naval surface AAW. It is used to evaluate the effectiveness of Navy SAM systems against air threats (only ASCMs are engaged). It is also used to evaluate the effectiveness of Point Defense Systems in the context of a task force AAW battle.

GENERAL DESCRIPTION: FLOATS is a one-sided, mixed model which deals with air and sea forces. It was designed to deal mainly with Battle Group - Ship - SAM Combat Systems and can simulate from one SAM Combat System to a Battle Group of 40 ships. It was primarily designed to simulate single formation of ships and size of formation can vary from 10 to 40 ships. This model is event-store and uses Monte Carlo simulation of a Battle Group as method of solution. Detection ranges in jamming may be computed internally or by a preprocessor (PREFLT).

INPUT:

- o Performance Characteristics
  - Ship Radars
  - SAM and Point Defense Systems
  - Unit Positions
  - Threat Vehicles and Raid Tracks
  - Jamming Parameters and/or Ranges
  - Doctrine Controls

OUTPUT:

- o Computer Printout stating probable outcome of battle
- o Detailed and Summary Results

MODEL LIMITATIONS: Model limited to surface to air missile engagements

HARDWARE:

- o Computer: IBM 360/91, 370/3033
- o Minimum Storage Required: 225K - 1000K Bytes

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: JHU/APL Internal Memorandum CAF-007 to CAF-010 (FLOATS), FSE-367 (PREFLT), INPUT data sheet documentation in preparation
- o User's manual

TIME REQUIREMENTS:

- o 4 to 6 months required to acquire base data
- o 1 month required to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20 times per year

USERS: JHU/APL for various Navy offices

POINT OF CONTACT: Mr. J.W. Farrell
Applied Physics Laboratory
John Hopkins University

KEYWORD LISTING: SAM, AAW, Navy, Computerized, One-sided, Mixed, Event Store

TITLE: Force Mix Model

PROPONENT: Chief of Naval Operations (OP-654)

DEVELOPER: Chief of Naval Operations (OP-654)

PURPOSE: To calculate an optimum mix of US strategic forces to satisfy targeting objectives within a variety of targeting and other constraints such as SALT limits, cost limits, and nuclear material limits. Model can also be used to evaluate targeting.

GENERAL DESCRIPTION: The model has classified target bases built into the model. It optimally allocates any list of weapons against any combination of the built in target bases. It is a one-sided model of US capability against Red targets but can be made to represent a two-sided exchange, where the first strike is a counterforce strike against the US, by calculating US force survivability externally to the force mix model. Collateral damage to targets not in the objective set, for example, collateral damage to population when targeting military targets, is not accounted for.

INPUT:

- o Weapon characteristics, yield, R/Vs per booster, CEP reliabilities, alert rates, pre-launch survivability
- o Weapon system costs, R&D, procurement and operating cost per unit
- o Constraints, SNDV limits, MIRV SNDV limits, TRIAD damage requirement, etc.
- o Targeting requirements, required damage levels against specific target sets

OUTPUT: Optimum mix of US strategic forces to meet a set of targeting objectives

HARDWARE:

- o Computer: CDC CYBER 175
- o Minimum Storage Required: Variable to 32K words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o CDC APEX linear programming package

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: As Required

USER: Chief of Naval Operations, OP-654

POINT OF CONTACT: Chief of Naval Operations (OP-654C)
Telephone: 697-0907

KEYWORD LISTING: Strategic, Counterforce, Targeting, Cost, Nuclear Materials

TITLE: FOURCE - Command, Control, Communications, and Combat Effectiveness

PROPONENT: TRASANA

DEVELOPER: TRASANA

PURPOSE: The Command, Control, Communications, and Combat Effectiveness Model (FOURCE) is a division level force-on-force combat model with resolution to battalion which places particular emphasis on the simulation of staff performance and combat information/intelligence flow in order to measure the relative combat effectiveness of command and control and intelligence system alternatives.

GENERAL DESCRIPTION: FOURCE is a two-sided, deterministic, mathematical model which executes without player intervention. Execution time varies as a function of output selected and total simulation time. Nominal simulation to execution time is 16:1. Primary solution techniques include differential equations, probability and queuing theory.

INPUT:

General Staff
Organization
Performance - processing criteria, message routing criteria, message generation criteria, processing delay times

Communications
RED EW - jammer performance, mission, composition

Artillery Staff
Organization
Performance
Communications
Decision Thresholds

Tactical Decision Rules
Mission and Roles
Posture, Zones
Thresholds
Initial Resource Allocations

Battlefield Environment
Terrain - minefields and rivers, bridges, vegetation, relief type
Locations - destination of units
Strengths
Operational Status
Smoke types, characteristics

Movement
Degradation Factors and Thresholds
Linkages

Target Acquisition
Sensor Coverage
Sensor Performance
Duty cycle times and thresholds
Line of sight as a function of range, vegetation, relief type
Sensor characteristics

Combat Support
Artillery Characteristics
Artillery Effects - damage, suppression, smoke
Minefield Characteristics
CAS and Helicopter Characteristics

Direct Fire
Unit Characteristics - deployment, etc., posture factors, thresholds
Line-of-Sight
Acquisition Rates
Priorities
Kill Rates, Firing Times
Weapon Characteristics

OUTPUT: User Controlled Periodic Printout:

Listing of maneuver units, artillery unit weapon inventories
Printer-plot of true situation
Artillery effectiveness table and ammunition consumption
Unit location
Staff processing statistics
Communications utilization

Program controlled periodic printout:

Resource allocation and missions and roles
Time relative combat effectiveness
True and perceived relative combat power ratio
BLUE artillery target list
BLUE artillery organization and status
Propagation results for BLUE commo
RED jammer status

Event driven printout:

Number of rounds impacting on CP locations
Smoke missions
Commitment of 2d echelon units
Lateral movement event
Main thrust prediction
Positioning of units arriving at counter thrust sector
Arrival and departure of units
Allocation of resources

Output files include:

Messages processed, routed, rejected, discaraded
Sensor detections (optimal)
Killer victim table (optimal)
Transaction log
Staff processing
Engagement summary table
RED unit mission and role
BLUE status
BLUE orders, status, resources request

An extensive set of post reduction programs provide analysis capability in each functional area for the model.

MODEL LIMITATIONS:

- o No weather
- o No Air defense
- o No nuclear/chemical
- o No night
- o Limited Attack - no flanking, no BLUE attacks
- o No route selection
- o No CP destruction
- o One minute time resolution
- o No explicit RED commo

HARDWARE:

UNIVAC 1100/82, UNIVAC 1100 series EXEC8
185K memory, 6-8 M mass storage disk, one 9 TRK Tape Unit

SOFTWARE:

ASCII FORTRAN (250 FORTRAN, 2 assembly I/O routines)

Revised program to be published in August 1981

TRASANA TECHNICAL MEMORANDUM 3-78, COMMAND, CONTROL, COMMUNICATIONS, AND COMBAT EFFECTIVENESS MODEL DOCUMENTATION

TIME REQUIREMENTS:

- o 9 man-months to acquire data base
- o 5 man-months to structure data in model input format
- o 1 man-month to analyze output
- o 1 minute playing time per cycle
- o 1/32 minute CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 120 times per year

USERS: TRASANA, CACDA

POINT OF CONTACT: USA TRASAANA
WSMR, NM 88002
Mr. Charles Todd, ATAA-TCA

MISCELLANEOUS: Different scenario - update to tactical decision rules, improve maneuver incorporation of air war, upgrade RED staff and BLUE EW.

KEYWORD LISTING: Command and Control; Staff Performance, Combat Effectiveness, Intelligence, Combat Simulation; Automated Data Processing, Division Level Model

TITLE: FOZ - Footprints by OZ

PROPONENT: Chief of Naval Operations (OP-654)

DEVELOPER: Academy for Inter-Science Methodology

PURPOSE: A computerized, analytical system for creating optimal allocation of MIRV'd SLBMs within capability of delivery vehicle.

GENERAL DESCRIPTION: The model allocates MIRV weapons to targets to maximize target coverage subject to the constraint that the utility (number of missiles targeted) from each SSBN and/or missile field must be equalized to the maximum extent possible. The model is designed and structured to achieve fast run time and to provide a complete analysis of the given MIRV problem. Input missile performance parameter requirements are such that detailed missile design and performance parameters are not required. FOZ consists of two major programs.

a. FOZAUX. FOZAUX reduces the number of missile combinations that must be analyzed by the model and reduces computer core storage requirements. This reduction is realized by aggregating, or combining, targets into groups that can be represented by a single geographic position for each group.

b. FOZ. The FOZ program analyzes the target and missile location data to determine feasible combinations of targets which might be grouped into footprints. FOZ forms footprints by targeting missiles from the more difficult-to-target patrol areas first and performs an analysis to provide information relating to feasible alternative patrol area - footprint matchups. FOZ also deaggregates the aimpoint data and formats the various printed reports available from the model.

INPUT:

- o Target base (DGZs)
- o MIRV characteristics
- o Footprint size
- o Booster range
- o Launch areas

OUTPUT: Computer printout assigning weapons to targets

HARDWARE:

- o Computer: CDC 6600
- o Minimum Storage Required: 300K storage

SOFTWARE:

- o Computer: FORTRAN IV

Ref: MIRV Footprint Theory Study (U), OP-604, 1 June 1974

TIML REQUIREMENTS:

- 2000 DGZs Footprinted from 15 potential SSBN patrol areas in about 20 minutes CP time.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 300 runs per year

USERS: Chief of Naval Operations, OP-654

POINT OF CONTACT: Chief of Naval Operations (OP-654C)
Telephone: 697-5743

MISCELLANEOUS: SIRNEM provides DGZs and assesses damage.

KEYWORD LISTING: Analytical; Strategic; Footprint; Computerized; Missile

TITLE: FRAM - Fleet Requirements Analysis Model

PROPONENT: Naval Surface Weapons Center/White Oak Lab/Code N13

DEVELOPER: Naval Surface Weapons Center/White Oak Lab/Code N13

PURPOSE: The Fleet Requirements Analysis Model (FRAM), was developed as a tool to analyze the effectiveness of US naval surface combatants in potential threat scenarios and to evaluate improvements in fleet capability due to improvements in combat subsystems.

GENERAL DESCRIPTION: FRAM is a Monte Carlo model which time steps through a user-input scenario and predicts US response to an enemy air, surface, and subsurface attack. Analytical sensor models, reaction time models for CIC functions, hand off times, and weapon envelope and Pk data are used to predict major combat system performance. Environment, both natural and man made, are considered in the sensor models. Inter ship data link delays are predicted based on number of tracks reported on each link.

INPUT:

- o Platform types, position, and velocity
- o Warfare areas to be engaged by own fleet
- o Natural environment: Weather, sea state, sound velocity profiles, land masses
- o Jamming and clutter (chaff) regions
- o Types of data links in own fleet
- o Sector coverage (optional) for own fleet platforms
- o Time step and launch time for enemy cruise missile carriers

OUTPUT:

- o Description of engagements scheduled by own fleet including intercept time and resources allocated
- o Enemy cruise missile launches
- o Enemy cruise missile hits on own fleet
- o Hits on enemy platforms
- o Vectoring of own fleet platforms at enemy platforms
- o Considerable more detail is readily available at user option

MODEL LIMITATIONS:

- o Up to 220 platforms
- o Combat system description, platform degradation, cruise missile trajectories must be preprogrammed or model is considerably more difficult to run
- o Enemy tactics preprogrammed

HARDWARE:

- o Type of Computer: CDC 6500
- o Operating System: KRONOS
- o Minimum Storage Required: 70K
- o Peripheral Equipment: Printer and plotter

SOFTWARE:

- o Language: FORTRAN IV
- o Documentation: User's/Programmer's Manual available

TIME REQUIREMENTS:

- o A few hours to set up model if all platforms types preprogrammed, 1 or 2 days to add platform type
- o Approximately two secs per platform per Monte Carlo loop for scenario involving 100 time steps

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Ten times per year

POINT OF CONTACT: Bob Lucas
NSWC/N13
White Oak, Silver Spring, MD 20910
Offutt Air Force Base, NE 68113
Telephone: 301-394-1246

KEYWORD LISTING: ASuW, AAW, ASW, Combat System Analysis, Time Step, Monte Carlo

TITLE: FYT - Force Year Totals

PROPONENT: AF/SASF

DEVELOPER: AF/SASF and Science Applications, Inc.

PURPOSE: Static Measure of Effectiveness Analysis of Nuclear Arsenals

GENERAL DESCRIPTION: FYT is an automated method of calculating and displaying various static and quasi-dynamic measures of effectiveness (MOEs) as a means of evaluating the overall effectiveness of a strategic arsenal. It is intended for use as an aid in evaluating alternative force structures, the capabilities of projected arsenals, and the current and projected strategic balance of forces. The forces projected for an arsenal may include grey-area and theater systems, as necessary to the analysis. Area and terminal defenses are represented only by the probability of a system's penetration to target. These projections include number of systems as well as system characteristics and weapon loadings. Weapon systems may be identified and separately counted as strategic, grey area, forward based, Nth country, defensive interceptors, SAM sites or radars. Evaluation of arsenals can be done for TAI, US, alert, surviving and on-target conditions. FYT will automatically build files containing those calculated static and quasi-dynamic measures of effectiveness for automated graphics.

INPUT: Weapon system projections for the years of interest along with loading and characteristics of the systems.

OUTPUT: Three page printout for each year of interest that includes summaries of the following measures of effectiveness for each weapon type and for each Triad element:

- o Strategic Nuclear Delivery vehicles (SNDVs)
- o Multiple Independently Targetable Reentry Vehicles (MIRVs)
- o Weapons or Reentry Vehicles (RVs)
- o Equivalent Megatons (EMTs)
- o Economic EMT (EEMT)
- o Counter-Military Potential (CMP)
- o Throwweight (TW)
- o Hard-target Kill Potential (HTK)
- o Soft-target Kill Potential (STK)
- o User defined MOE

MODEL LIMITATIONS: A maximum of 100 systems projected over thirty years may be input into FYT.

HARDWARE: Honeywell MULTICS computer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: None

TIME REQUIREMENTS:

- o 4-8 hours (depending on the number of years in the data base)
- o 10 seconds per year analyzed CPU time
- o Variable data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times a year

USERS:

- o HQ USAF/SASF, Foreign Technology Division
- o Science Application, Inc. (Denver Office)

POINT OF CONTACT: AF/SASF (Major Boykin)
The Pentagon
Washington, D.C. 20330
Telephone: (202)695-2828

TITLE: GAINER

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Applications, Inc (POST)

PURPOSE: GAINER is a computerized model that evaluates the implication of Command, Control and Comunication connectivity for US nuclear forces. It was developed to illuminate the implications of US nuclear weapons policy and to explore sensitivities to alternative programs, policy and plans. It maintains range sensitivity and can have flexible damage objectives and wave structure.

GENERAL DESCRIPTION: GAINER was created to increase the level of control and analyst interface when analyzing strategic systems or policy. It is capable of looking at the global cummulative damage expectancy plane in the analytical model.

HARDWARE: MULTICS

SOFTWARE: Programming language-ANSI FORTRAN (MULTICS)

TIME REQUIREMENTS: 10 to 30 minutes.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: A standard has not been established due to the recent development of the model.

USERS: OD (PA&E)

POINT OF CONTACT: OD(PA&E)
Stragtegic Programs
The Pentagon, Washington, DC 20301
Telephone: (202) 695-5587

KEYWORD LISTING: Linear Programming, Computerized, Command, Control and Communication, Allocation.

TITLE GFE-III - Gross Feasibility Estimator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Command and Control Technical Center (CCTC)

PURPOSE: GFE-III is a computerized, analytical logistics model designed as a rapid deployment planning tool to produce quick estimates of closure dates for cargo and personnel at multiple destinations. The model will simulate the deployment of movement requirements to various destinations under various time and facility constraints with varying levels of air and sea transportation resources. Thus, it may be used to assist in examining the feasibility of deployment plans and the effectiveness of transportation resources in support of such plans. The model produces day-by-day totals of cargo and personnel arrivals at the various discharge points with the number of days required to deliver each cargo category within each movement requirement. The model attempts to move requirements as fast as possible and does not honor required delivery dates.

GENERAL DESCRIPTION: GFE-III is a one-sided, deterministic model that simulates individual vehicles and individual requirements. However, both vehicles and requirements may be grouped to suit the user's needs, and these groupings can vary in size at the user's option. Numerical analysis is the primary solution technique used. Simulated time is treated on an event-store basis.

INPUT:

- o Movement requirements
- o Ship resources
- o Airlift resources
- o Attrition of shipping
- o Planning factors (land speed from origin of movement to POE, ship speeds, and convoying factors if applicable)
- o Link distances in the transportation network

OUTPUT:

- o Listings of input data
- o Intermediate listings showing the daily status of movement requirements
- o Optional output data specified by the user from nine options which are essentially summations of selected portions of the intermediate output
- o The foregoing include such data as the utilization of ships and aircraft, air, and sea channel movements summaries, airfield utilization (sorties per day), tonnage handled at ports of embarkation and debarkation, and graphic presentations showing the cumulative closure of each movement requirement priority group by mode of transportation.

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MODEL LIMITATIONS:

- o 64 movement channels within the configurations of 8 origins
- o 8 each sea and aerial ports of embarkation and debarkation
- o 8 each convoy marshalling areas and convoy dispersal areas
- o 100 ship groups
- o 15 convoy escort groups
- o 30 aircraft types
- o 40 movement requirements per priority group which are unlimited. The latter consist of personnel and cargo categorized as bulk, outsize and nonair-transportable.

HARDWARE:

- o Computers: IBM 360/65; HIS 6080
- o Operating System: OS/MVT (IBM); GCOS (HIS)
- o Minimum Storage Required: 320K bytes (IBM); 97K words (HIS)
- o Peripheral Equipment: Tape and disk drives

SOFTWARE:

- o Programming Languages: FORTRAN IV (IBM); FORTRAN Y (HIS)
- o Documentation: (1) General description: CSM-GD 37A-72; (2) User's Manual: CSM-UM 37A-72
- o The above two documents constitute complete user's documentation and are being updated and republished. There is no technical documentation.

TIME REQUIREMENTS:

- o 1 man-week to structure input data in model input format
- o 1 hour CPU time per model cycle
- o 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times annually

USERS:

- o Principal: Organization of the Joint Chiefs of Staff (J-4)
- o Other: CINCPAC, USCINCEUR, CINCLANT

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-5464

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Sea Forces; Computerized; One-Sided; Deterministic; Event Store

TITLE: Glide Bomb Flight Model

PROPONENT: AFEWC/EW

DEVELOPER: AFEWC/SAA

PURPOSE: To analyze ECM effects on the command and control link from control aircraft to glide bomb and on the glide bomb to aircraft video link for relay of target image.

GENERAL DESCRIPTION: The program iterates the bomb position on actual altitude/speed information from test data and periodically calculates J/S ratios for the correct az/el positions of the transmit and receive antennas in the two data links.

INPUT:

Initial relative locations and speeds for launch and control aircraft

Flight profile for bomb

OUTPUT: Tables of predicted J/S ratios at each bomb flight path point

MODEL LIMITATIONS: Model limited to available flight profile data and available information on complete antenna patterns measured on the vehicles.

HARDWARE:

Computer: UNIVAC 418-III

Operating System: RTOS-9E

Minimum Storage Requirement: 40,000

Peripheral Equipment: Card reader, printer

SOFTWARE:

Programming Language: FORTRAN

Documentation: No documentation except listing

TIME REQUIREMENTS: Requires 8 hours to structure pattern data and 1 minute CPU time

SECURITY CLASSIFICATION: Program UNCLASSIFIED

FREQUENCY OF USE: As required

USERS: AFEWC/EWT

POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

COMMENTS: Present program was developed for GBU-15 analysis but could be adapted for other glide bomb applications.

TITLE: GROSA-Grand Offspring of Super Ace

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Application, Inc (POST)

PURPOSE: GROSA estimates residual forces by evaluating weapon allocations. It is most often used to estimate residual ICBM forces resulting from countersilo attacks. It allows for mapping of surviving and remaining forces into PACER files for retention and analysis.

GENERAL DESCRIPTION: GROSA evaluates the effectiveness of strategic countercentral forces (particularly ICBM's) to inflict specified damage levels on an opponent's nuclear forces. It is capable of sequentially attacking a set of targets.

INPUT:

- o Arsenal data
- o Target data
- o Allocation controls
- o Budget controls

OUTPUT:

- o Summary of surviving and remaining forces
- o Expected value destroyed in target set

MODEL LIMITATIONS: Ignores range considerations.

HARDWARE: MULTICS

SOFTWARE:

- o Programming language-ANSI FORTRAN
- o Documentation is available

TIME REQUIREMENTS: 10 to 40 seconds.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times a year.

USERS: OD(PA&E)

POINT OF CONTACT: OD(PA&E)
Strategic Programs
The Pentagon, Washington DC 20301
Telephone: (202) 695-5537

KEYWORD LISTING: Linear programming, computerized, analytical model, allocation, strategic.

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TITLE: Antiaircraft Artillery Model (GUN)

PROPONENT: Wright-Patterson AFB Ohio

DEVELOPER: Application Research Corporation, Dayton Ohio

PURPOSE: The GUN computer program provides a key element of the Situation Modeling capability: the simulation of a one-on-one engagement of a penetrator aircraft with an anti-aircraft artillery (AAA) battery. The types of weapons which may be addressed by GUN are the radar, optical and electro-optically directed crew-served weapon systems, which contribute significantly to tactical aircraft vulnerability. The engagement methodology adopted for use in this program is closely analogous to that of HOME. The simulation begins at the detection/acquisition point and continued to a point where cumulative effects may be assessed. This is usually at the time of last round impact or closest approach to the target.

GENERAL DESCRIPTION:

a. The program is designed to be used in the basic stand-alone mode described. This mode is most commonly employed to investigate scenarios involving the battery firing N bursts of variable length at a target which is at some point on a preprogrammed flight path. A single pass through the simulation results in the accumulation of the number of rounds that come within a specified lethal radius of the target. In addition to a single pass, the necessary looping structures have been included to permit sequential engagements. With incremental changes in the battery's initial location with respect to the target aircraft, vulnerability footprints for the simulated gun system/generator engagement can be generated. This capability allows GUN to generate firing opportunity and probability of hit data for input into SURVIVE so that simulated engagements can be performed with C^3 and acquisition effects included.

b. The GUN model develops data on AAA weapon system effectiveness in the context of one-on-one and many-on-many engagements. To realize this capability, the following key scenario parameters are considered within the program: ECM effects, target kinematics, slew rates, firing rates, dispersion, warhead size, fuzing options, ballistic performance, firing criteria, and tracker characteristics. The ECM effects are modeled in the same manner as the other models; that is, on a J/S effects basis. Each of these parameters is located in an appropriate file to maintain the generic form of the model. Parametric variations can be examined with and without the presence of ECM to determine system performance variations. Outputs from the GUN program include both probability of hit and probability of kill contour plots, and expected number of projectile impacts, as a function of time.

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TITLE: GUNVAL V

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: The GUNVAL V model evaluates effectiveness of fighter aircraft gun systems in air-to-air combat.

GENERAL DESCRIPTION: GUNVAL II was developed for SAGF by the General Electric Company to include the correlation effects of high firing rate guns in a terminal effectiveness model. The GUNVAL II model was then extensively modified by SAGF to include the effects of gun acceleration, reliability, projectile lethality, target maneuver bias, and tracking error.

The GUNVAL V model was specifically designed to integrate a multitude of gun and projectile performance parameters into a single measure of effectiveness: Kill probability. The TAC AVENGER air combat simulation produces a file of gun-firing opportunities which is used as an input for the GUNVAL V model. The firing opportunity file describes the positions of the attacker and the target during the burst and gives a realistic distribution of the firing conditions expected in a duel of two airplanes for which no combat exchange data are available.

INPUT: A TAC AVENGER generated gun firing opportunities file.

OUTPUT: Range time of flight, velocity, burst length, rounds fired, and kill probability of each burst.

MODEL LIMITATIONS: Unknown

HARDWARE: GUNVAL V is executed on the Honeywell G635 computer. The model utilizes the GCOS III operating system, and 3200 words of core.

SOFTWARE:

- o The GUNVAL V model is written in FORTRAN IV language, contains 16 subroutines, and 1800 source statements.
- o Documentation: The following documentation is maintained at SAGF:
  - Terry, E.R., "Air-to-Air Gunnery Model and Associated Computer Program Logic for USAF/SA TAC AVENGER (GUNVAL II), "Contract F44620-73-C-0030, General Electric, Aircraft Equipment Division, Armament Systems Division, Burlington, VT, 12 Apr 73.
  - Rankine, R.R., "GUNVAL V Gun System Effectiveness Model," 17 Jun 7.

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TIME REQUIREMENTS: 10 seconds per gun burst

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Unknown

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Lt Col Mottern)
Pentagon
Washington, DC 20330
Telephone: (202) 697-5677

TITLE: HALL

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Aplications, Inc. (SAI)

PURPOSE: HALL is a computerized, analytical model which allows quick analysis of the survivability of aircraft fleeing an SLBM attack. The model allows multiple aircraft types, multiple SLBM warhead types and trajectories, and a large variety of basing schemes.

GENERAL DESCRIPTION: HALL is an expected value model which sacrifices detail for more rapid analysis and allows examination of all parameters of interest through its various input options. The model uses a set of aircraft bases either defined by input or internally computed, assigns an aircraft bed-down, and generates an attack plan against those bases and the aircraft escaping from those bases. The primary solution techniques used are LaGrange multipliers, linear programming, and probability.

INPUT:

- o SLBM weapon variables
- o Target (aircraft) variables
- o Basing variables
- o SSBN variables
- o Attack preference variables

OUTPUT:

- o Summaries of the assumptions made in the run and the survivability results
- o Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o Expected value calculations are performed
- o Pure weapon strategies are computed
- o No complexing of the target structure due to aircraft altitude variations

HARDWARE:

- o Computer: Honeywell 6080
- o Operating System: MULTICS (MIT)
- o Minimum Storage Required: N/A
- o Peripheral Equipment: Standard scratch disk plus permanent disk

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available

TIME REQUIREMENTS:

- o 1 minute or less to structure base data in model input format
- o 5-10 seconds CPU time per model cycle
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times per year

USERS:

- o Principal: OASD(PA&E)
- o Others: CIA, AFWL, GRC

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: 695-9180

KEYWORD LISTING: Aircraft, Survivability, SLBM Attack, Strategic Analysis, Operations Research, Models, Linear Programming, HALL

TITLE: HARLOT

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Applications, Inc (POST)

PURPOSE: HARLOT stands for: Height of Burst; Altitude of Targets; Resources; Location; Objectives; and Time. It measures the percentage of aircraft surviving a counterforce attack from the time of initiation until all of the attacking weapons are used. It was developed to examine aircraft pre-launch survivability. It considers SSBN threats, strategic airborne forces and scenarios for force interaction. HARLOT looks at the defenders uncertainty for aircraft vulnerability and height of burst, and the attackers uncertainty to aircraft location and altitude for lethal area calculations and escape.

GENERAL DESCRIPTION: HARLOT is a computer program that addresses problems and possible solutions to pre-launch survivability. It can evaluate changes in the US warning capabilities, basing requirements and system characteristics for candidate future systems and the impact of Soviet SSBN forces on bomber pre-launch survivability.

INPUT:

- o Aircraft base files
- o Target data files
- o Arsenal data files
- o Trajectory
- o Scenario

OUTPUT: Expected number of aircraft destroyed for all attack strategies, bases and aircraft types.

MODEL LIMITATIONS: Operational flight profiles are not considered. Only aircraft vulunerability to overpressure is considered.

HARDWARE: MULTICS

SOFTWARE: Programming language-ANSI FORTRAN.

TIME REQUIREMENTS: 5 to 10 minutes.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times per year.

USERS: OD(PA&E)

POINT OF CONTACT: OD(PA&E)
Strategic Programs
The Pentagon, Washington, DC 20301
Telephone: (202) 695-5587

KEYWORD LISTING: Computerized, analytical model, nuclear weapons, tactical, theater, allocation

TITLE: HELICOPTER Simulation

PROPONENT: War Games Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (OREA), Ottawa, Canada

DEVELOPER: As Above

PURPOSE: This simulation was designed for assessment of helicopter operations in research war games. It has also been used for comparison of performance of various types of armed or attack helicopters in a battle framework.

GENERAL DESCRIPTION: This simulation permits complex detailed assessments between single helicopters and up to 10 homogeneous groups of ground target elements in a five-minute interval. It addresses helicopters in observation, armed, or attack roles with multiple hovers from different locations. The model uses probabilistic line of sight and is of critical event type. Detection and acquisition times as well as some other times (e.g., time between hovers) are randomized. Times of flight of projectiles are deterministic. Tactical status of each item in the ground array, and additional ground weapon firings if involved in a direct fire battle are taken into account.

INPUT: Detection, acquisition, weapon performance and vulnerability modules are embodied in the program. Inputs incldue:

- o Area data such as light conditions and meteorological visibility
- o Helicopter data such as type, search device, weapon, attack position, and fire policy
- o Ground target data for each unit and element within it including location, type of target, deployment status, degree of smoke and/or obscuration, sighting devices, weapons and fire control systems

OUTPUT: All detections, engagements, kills by the helicopter and ground weapons by weapon type, range and suppressive condition, and ammunition expenditures.

MODEL LIMITATIONS:

- o Only one helicopter is permitted in each run so that it cannot handle a hunter/killer team. The capacity for targets is ten groups, each with up to nine like items.

HARDWARE: HP 2000 ACCESS with disk drive.

SOFTWARE: Programmed in BASIC.

TIME REQUIREMENTS:

- o Preparation: Input time is three minutes. No preparation time required unless new helicopter, vehicle or weapon parameters are to be included
- o Running time up to three minutes. Used for helicopter assessments as required during research war games.
- o Analysis: Included in research war game analyses.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuously during research war games.

USER: DLOR War Games Section

POINT OF CONTACT: War Games Section, Directorate of Land Operational Reserch (DLOR)
Operational Research and Analysis Establishment (OREA)
Ottawa, Canada

MISCELLANEOUS: The helicopter simulation is primarily in hover-up mode. Run-in attacks and designations are simulated with manual input of the number of helicopter exposures and randomly selected time (in seconds) of the exposures. The result of each helicopter exposure can be monitored, if desired, and the simulation stopped when military criteria have been reached. The computer program is being expanded to include five minutes interactive simulation for up to 12 helicopters against the ground array, and it is being converted for use on a PDP 11-34.

TITLE: HELMATES II - Helicopter Launched Missile Antitank Effectiveness Simulation

PROPONENT: AMSAA

DEVELOPER: AMSAA and Falcon R&D Company

PURPOSE: HELMATES II is designed to assess the effects on system performance of characteristics such as reliabilities, hit probabilities, etc.

GENERAL DESCRIPTION: HELMATES II provides measures of effectiveness for the attack helicopter platoon in the antitank role. Large ground threat arrays can be played which include air defense guns and missiles.

OUTPUT: Primary output is kills and kill rates for each firer and each target for each kill category.

MODEL LIMITATIONS: Blue ground versus Red ground is not played

HARDWARE: Computer: CDC 7600

SOFTWARE: Program Language: FORTRAN V

TIME REQUIREMENTS:

- To acquire Data Base: 2 months
- To Structure Data in Model Input Format: 3 weeks
- To Analyze Output: 1 day
- CPU Time per Cycle: 13 minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Once per year

USERS: AMSAA at the request of TRADOC

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-AAM
Aberdeen Proving Ground, MD 21005
Telephone: AUTOVON 283-4202

MISCELLANEOUS: Model is being interfaced with Battlefield Environment, Laser Designator/Weapon System Simulation (a MICOM simulation of HELLFIRE probability of hit)

KEYWORD LISTING: HELLFIRE; AH-46; Missiles, Attack Helicopters; Scout Helicopters; Antitank, TOW

TITLE: Homing Missile Model (HOME)

PROPONENT: Aeronautical Systems Division (ASD), Wright-Patterson AFB, OH

DEVELOPER: Applications Research Corporation, Dayton, OH

PURPOSE/GENERAL DESCRIPTION:

a. The Homing (HOME) Missile Model Simulation was developed by the Applications Research Corporation (ARC) of Dayton, Ohio, in 1974. HOME is a generic missile simulation for air-to-air, surface-to-air, and air-to-surface technically guided weapons. The model is designed to simulate very large numbers of individual missile shots so that comprehensive descriptions of countermeasure effectiveness can be achieved with minimum of set-up time and computer execution time. The model has been used by the Air Force Wright Aeronautical Laboratories (AFWAL), ASD, and AFEWC for studies involving aircraft vulnerability, countermeasures effectiveness, flare strategy development, and tail warning system development. Both infrared and microwave variations of HOME exist.

b. AFEWC uses HOME 02 which is the infrared missile seeker version. The radiance pattern of the aircraft is modeled versus the field of view and gimbal limits of the IR seeker. Flare decoys versus both air-to-air and SAM threats are also modeled.

(The following data pertains to AFEWC use of HOME 02.)

INPUT. Operator interactive, that is, data is entered by CRT prompts and answers. This permits generation of many very long runs by selectively implementing various operational parameters for repeat simulated engagements.

OUTPUT: A series of matrices which define miss distance versus azimuth and elevation of the aircraft. Statistics of average miss distances and percent kills are also computed.

LIMITATIONS: Run time is the main constraint, experience has shown that each missile shot takes 30 to 45 minutes of computer time on a shared computer system.

HARDWARE: Model is operational on the CDC CYBER 73 located on Kelly AFB. Operating system is NOS. Minimum storage required is 52,000, 60-bit words. Peripheral equipment is CRT and printer.

SOFTWARE: Model is programmed in FORTRAN IV.

Documentation may be available from the developer, Applications Research Corporation, Dayton, OH.

TIME REQUIREMENTS: Data base updated annually (approximately 8-12 hours) CPU time is approximately 500 CP seconds per shot. Output analysis time is approximately 1 hour per run.

CLASSIFICATION: Unclassified.

FREQUENCY OF USE: 250 simulated shots per year at AFEWC.

POINT OF CONTACT: AFEWC/SATA
1Lt Frank DiBartolomeo
San Antonio TX 78243
Telephone: 512/925-2391/AUTOVON: 945-2391

ASD/XRE
Mr. Stan Tate
Wright-Patterson AFB, OH 45433
AUTOVON: 785-7401

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COMMENT: At AFEWC, this model is being converted to PDP 11-70 since CYBER 73 time is no longer available.

TITLE: HOPE - Helifire Operational Performance Estimation

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: US Army Materiel Systems Analysis Activity (AMSAA)

PURPOSE: HOPE provides measures of performance, such as number of targets acquired, number of launches, number of hits and number of kills. It also displays event times for critical events and failure modes. The results can be used to rank alternative missile system performance and explain why one system is better than another.

GENERAL DESCRIPTION: HOPE is a one-sided model that presents measures of performance for one attack helicopter, such as number of targets acquired, launches, hits and kills. It also displays event times and causes for failures. It can be used to evaluate missile alternatives for a variety of environmental conditions.

INPUT:

- o Firing rates
- o Kill probabilities
- o Terrain and weather

OUTPUT: Results are displayed in tables designed to summarize success rates, failures, summaries of performance, etc.

MODEL LIMITATIONS: Model is one-sided (targets do not fire). Plays only one attack helicopter.

HARDWARE: CDC 7600

SOFTWARE: FORTRAN IV

TIME REQUIREMENTS:

- o 4 weeks to acquire data base
- o 2 weeks to structure data in model input format
- o 2 days to analyze output
- o 5 seconds CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuous for the past year

USERS: AMSAA

POINT OF CONTACT: Director, AMSAA
US Army Materiel Systems Analysis Activity
ATTN: DRXSY-AAM
Aberdeen Proving Ground, Maryland 21005
AUTOVON 283-4202

MISCELLANEOUS: Model will be modified to simul te new missile concepts and target acquisition devices.

KEYWORD LISTING: Hellfire, Target acquisition, Detection, Recognition, Missiles

TITLE: Hospital Model (Medical)

PROPONENT: Director, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

DEVELOPER: Director, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

PURPOSE: The Hospital Model is a computerized, analytical, resource utilization model that simulates a hospital (up to 600 beds) with the purpose of estimating optimum capabilities, modifying TOEs and examining hospitalization requirements in a combat zone more effectively. The model deals exclusively with the operation of a combat zone hospital. It is primarily interested in examining (and pointing out) the critical parameters in a given theater situation. Some specific problems addressed are: (1) optimum evacuation policy for given patient workload; (2) utilization of treaters in different hospital areas; (3) number of X-rays and lab tests given to a patient mix; (4) number of beds necessary for given evacuation policy.

GENERAL DESCRIPTION: The Hospital Model is a stochastic model involving land forces only. It is primarily designed to consider theater level forces, but can handle almost any small group of men. Simulated time is treated on a time step basis. Fifteen days of real time are simulated in 1/2 hour of computer time. The primary solution techniques used are queuing theory (used throughout the system) and probability (used extensively in referencing patient class data such as recovery times, death rates, etc).

INPUT:

- o Patient class related information (i.e., probability of occurrence, recovery time, treatment time, death rate, etc)
- o Staffing levels in different areas and wards
- o Number of beds, evacuation policy, etc

OUTPUT:

- o Utilization of treaters
- o Equipment levels (i.e., X-ray plates, et
- o Totals for admissions, evacuations, returns to duty, divisions, beds filled, etc
- o Options available are limited to interim printouts, end-of-replication printout (for 15 days), and average of several replications printout

MODEL LIMITATIONS:

- o Maximum of 280 patients in process at one time (ward patients are not included in this limit). This limit may be expanded with extended core
- o Beds classified as belonging to the medical section do not become available to the surgical section when they are needed there
- o Patients are diverted if treater is not available
- o Only 15 different treaters can be considered in each treatment area
- o Maximum of 600 beds

HARDWARE:

- o Computer: Control Data 6500
- o Operating System: SCOPE NOS/BE
- o Minimum Storage Required: 145K octal
- o Peripheral Equipment: 8 tape units (or combination of 8 disk/tape files)

SOFTWARE:

- o Programming Language: FORTRAN
- o User's documentation is complete; technical documentation is sketchy.
- o Formats for input data are complete. Some routines are flow-charted.
- o Each routine has a one page outline

TIME REQUIREMENTS:

- o 2 man-months to acquire base data
- o 9 man-days to structure data in model input format
- o 20-30 minutes CPU time per mode cycle
- o 2 man-weeks learning time for users
- o 2 man-weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Director, Combat Developments and Health Care Studies

POINT OF CONTACT: Director, Combat Developments and
Health Care Studies (HSA-CSD)
Academy of Health Sciences, US Army
Fort Sam Houston, Texas 78234
Telephone: Autovon 471-6430

MISCELLANEOUS: The Hospital Model can be used by itself or it can accept input directly from the patient workload model.

KEYWORD LISTING: Analytical Model, Health Care Delivery, Land Forces, Computerized, Stochastic, Time Step

TITLE: ICOR - Integrated Corps Model

PROPONENT: Defense Nuclear Agency

DEVELOPER: The BDM Corporation

PURPOSE: ICOR is a computerized, general war, corps-level model used as an analytical tool in support of issues relating to force structure, weapons effectiveness and mission area analysis. ICOR utilizes a top-down structured modeling approach. Its modular characteristic allows the user to adopt the model to meet specific requirements. The most commonly used level of aggregation is battalion unit level with terrain representation to a resolution of 3.5 km. The model is concerned with ground and air-ground combat involving aircraft, tanks, infantry fighting vehicles, artillery equipment, anti-tank guided missiles and various other assets.

GENERAL DESCRIPTION: The ICOR model is a two-sided, corps-level computerized war game of air and ground combat operations. It plays the movement of individual ground combat units in a two dimensional sense in that units are not restricted to artifical corridors, as is the case with sector models, but can maneuver as the situation dictates constrained only by terrain, opposing forces, and orders. It also does not require the user to impose an artificial partition on the battlefield.

All elements of a combined arms operation are included. Maneuver and fire support units are represented as explicit entities with inherent decisionmaking capabilities. Within each of the individual combat units, each major weapon type is explicity represented. There is no aggregation of weapons. Indirect fire weapons engage by firing battery, platoon, or any user defined volleys against acquired targets. Aircraft, including attack helicopters, acquire and engage targets, utilizing expected kills per sortie for precision munitions, or fractional damage for area munitions. Explicit representation of individual air defense systems, with relatively detailed ground-to-air engagements, provide the source of aircraft attrition. It plays explicit intelligence collection by imaging and passive electronic warfare systems, and it has explicit representation of the effects of terrain and weather on unit fire and maneuver. A key capability of the model is its "man-in-the-loop" (MITL) feature, which allows actual battle staff gamers to interact with the model and make command decisions.

INPUT:

- o Order of Battle
- o Firing Rates
- o Kill Probabilities
- o Weapon System Characteristics
- o Mobility
- o Operational Doctrine, Behavior, and Transitions

- o Terrain, Weather
- o Artillery Tasking
- o EW System Tasking
- o Air Support Tasking

OUTPUT:

- o Position and Status Reports
- o Strength-Loss Reports
- o Air Attack Results
- o Air Defense Kills
- o Direct Fire Weapon Kills
- o Sensor Status
- o Intel Reports
- o Line of Contact Reports
- o Artillery Statistics
- o Mass/Momentum
- o Full graphics output is available: Terrain, unit displays, hex grid, SIGINT displays, mass momentum vectors, line of combat displays

MODEL LIMITATIONS: Requires higher level (corps level) command decisionmaking provided manually.

HARDWARE:

- o ICOR-I
  CDC CYBER 176 requiring 220K octal 60 bit words
  NOS/BE or NOS operating system
  VAX 11/780 VMS operating system
- o ICOR-II
  CDC CYBER 176, NOS/BE or NOS operating system. Generally the perhipherals needed are: A card reader or alphanumeric input terminal, a line printer, and for graphics output a Tektronix 4014 terminal or equivalent.

SOFTWARE: Both ICOR models are written in FORTRAN with data structures implemented using a precompiler developed by BDM, called MIDAS.

- o ICOR Program Design Language
- o ICOR User's Manual

TIME REQUIREMENTS:

- o Data Base: ICOR-I currently has available a European scenario involving a US Corps area in West Germany.
- o ICOR-II currently has available a Korean scenario involving a Republic of Korea Corps.
- o To develop an entirely new data base generally requires 6 man months of effort. This includes data collection, preparation and structuring the data in model input format.

- o Analyze output: The model can be set to generate detailed output user defined time periods usually between 2-6 hours of combat. Depending on the degree of detail, output can be analyzed in 1-2 hours or to increasing levels of detail, 2-3 days.
- o Playing time per cycle: Can be set by the user in any increment from 1-6 hours.
- o CPU time per cycle: Several seconds to several hours CPU time per model cycle.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used for studies 2-3 times per year.

USERS: CACDA, DNA, US Army Field Artillery School and Center, TCATA

POINT OF CONTACT: F.J. Lunch
The BDM Corporation
7915 Jone Branch Dr.
McLean, VA 22010
Telephone: (703) 827-7928

KEYWORD LISTING: Corps Level; Conventional, Nuclear, Ground, Air-Ground Combat; Computerized; Two-Sided

TITLE: IDACASE (Task Force Air Defense)

PROPONENT: Deputy Under Secretary of Defense for Research and Engineering (Tactical Warfare Programs)

DEVELOPER: Institute for Defense Analyses

PURPOSE: IDACASE is a computerized, general war, analytical model. It deals with one raid of ASMs versus a task force of several ships. This model addresses itself to the cost effectiveness problems related to radars, SAMs and guns that compose the area and self-defense of ships in a task force. It also deals with the assessment of outcomes of ASM raids against task forces.

GENERAL DESCRIPTION: IDACASE is a two-sided, mixed model which deals with sea forces. It was designed to handle individual ASMs, individual ships (with their radars), individual SAM and gun systems on these ships. IDACASE can model the area and self defenses (or just the Ship Self Defenses) on one ship being attacked by ASMs. This model is designed to handle one task force with one carrier and one to six escorts; the capability to model larger sized task forces (i.e. more ships) is expected to be added. The radar/ECM portion of the model is Time Step, and the remainder is Event Store. The model is based on Monte Carlo simulation.

INPUT:

- o Composition of task force
- o Weapon effectiveness parameters

OUTPUT:

- o Raw game data
- o Probable outcomes
- o From levels of detail are available (from very summarized outputs to very detailed outputs)

MODEL LIMITATIONS:

- o ASW not modeled
- o Interceptors are not directly modeled
- o Some other model must be used to determine the effect of interceptors on the rapid, this effect can then be input to IDACASE

HARDWARE:

- o Computer: CDC 6400 or larger
- o Minimum Storage Required: 50,000 (base 10)

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SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "IDA Coordinated Area-Air-Defense Ship-Self-Defense Evaluation Model (IDACASE)," Institute for Defense Analyses, Arlington, VA, forthcoming
- o User's and Programmer's manuals are complete

TIME REQUIREMENTS:

- o 2 to 3 months required to acquire base data
- o 1 man-month required to structure data in model input format
- o 8 seconds of CPU time per Monte Carlo trial after a 70 second initialization
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202
(703) 558-1652

MISCELLANEOUS:

- o IDACASE is linked to weapon effectiveness inputs which must come from other, more detailed models
- o Attrition caused by interceptors must come from another model of comparable aggregation
- o This model supersedes FLOATS, IDA's Ship-Self-Defense Model
- o The capability to model larger sized task forces (i.e. more ships) is expected to be added

KEYWORD LISTING: Analytical, General War, Sea, Computerized, Two-sided, Mixed, Event Store

TITLE: IDAGAM IIA - IDA Ground Air Model, version IIA

PROPONENT: Organization of the Joint Chiefs of Staff, Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Jointly by OJCS/SAGA and the Command and Control Technical Center (DCA/CCTC). Initial version of the model was developed by the Institute for Defense Analyses (IDA).

PURPOSE: IDAGAM IIA is an interactive model designed for computer assisted manual wargaming of ground and air conventional combat, and used for force capability assessments.

GENERAL DESCRIPTION: IDAGAM IIA is a deterministic, interactive model of ground and air conventional combat between two opposing sides. The model is parameterized to allow building/sizing the model for a specific study (and its objectives) and for a specific region (and its level of detail).

The geographical structure of the model consists of a series of nonintersecting sectors, each sector consisting of intervals, each of which have a type terrain and combat posture assigned to them by the user. A region consists of one or more sectors, and is split into two depths behind the sectors. A communications zone for each side is located to the rear of the regions.

IDAGAM IIA has a fixed time step of one day. At the end of each day the user provides decisions and directions for the next day. These directions may include adjustments to the model geographical structure (distances, terrain, combat posture for any sector), engage/disengage forces, aircraft mission/sortie allocation and loadings, force movement, movement of supplies, etc.

The key compile-time parameters currently in IDAGAM IIA are:

- Up to 75 sectors and 15 regions can be defined, subject to computer memory constraints.
- Within each sector, up to 50 intervals may be specified.
- Each interval is described by one of three types of terrain (slow, medium, or fast movement) and one of five combat postures (meeting engagement, prepared defense, breakthrough, constructed terrain, and urban warfare) for Blue/Red on attack matched with Red/Blue on defense.
- Up to 200 ground combat units can be played per side. Each unit has three types of personnel (combat, combat support and combat service support) and 12 types of weapon systems, including AAA and SAMs. Quantities are recorded each day.
- Up to 22 aircraft types per side can be played. Airbases played are notional, with each side having a forward and rear airbase in each region and one in the COMMZ. Eleven types of air missions are defined in the model.

- o Up to 26 types of supplies can be tracked by the model. The movement through the theater and consumption of these supplies are recorded. These supplies include up to 13 ground munitions and 10 air munitions. A switchable option in the model allows supply shortfalls to affect battle results.

IDAGAM IIA does not use firepower scores - an antipotential potential method is used to calculate the value of opposing weapon systems. Attrition by weapon type is calculated using the opposing weapons densities, capabilities, and allocation of fire.

INPUT: The model needs some 600 input variables and arrays. All input data are uniquely identified for input into a base case set of data files. Preprocessor programs operating in time-share mode are used for data entry and for format and variable verification.

OUTPUT: All output is in the form of computer printouts of user selected summaries or data records formated as input to postprocessor programs.

- o Detailed Report (Used for debugging)
- o Daily Selected Summary Tables
- o Selected Summary Report
- o Time - t record of input decision implementation and of model operation.
- o Postprocessor programs operating in batch mode are used for specialized reports and data reduction.

MODEL LIMITATIONS:

- o IDAGAM IIA may not be operated as a computer simulation model.
- o Logistic aspects of the model are very aggregated.
- o Model is expected value vice Monte Carlo.
- o Conventional warfare only

HARDWARE:

- o Computer: HIS 6080
- o Minimum Storage Required: Depends on array limits desired - 162K words required in nominal case

SOFTWARE: Programming Language: FORTRAN V

TIME REQUIREMENTS: 20 to 25 CPU minutes per 15 day game, not including postprocessor batch reports.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 400-500 times per year

USER: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Organization of the Joint Chiefs of Staff (OJCS)
Studies, Analysis, and Gaming Agency (SAGA)
The Pentagon
Washington, DC 20301
Telephone: (202) 695-9003

KEYWORD LISTING: Ground-Air; Deterministic Computer Model; Theater-Level; Region-Level; Conventional Combat

TITLE: IDAHEX

PROPONENT: Office of the Secretary of Defense

DEVELOPER: Institute for Defense Analyses

PURPOSE: IDAHEX is a computer-assisted, limited war, analytical and training model. This model is a computer program that acts as bookkeeper and controller in a two-sided wargame. IDAHEX allows units to move and attack in six directions; the model represents maneuver and its consequences, including nonintegral FEBAs and encirclements. The model is also concerned with weapon-on-weapon attrition, supporting fire, close air support and air interdiction, engineer activities and logistics.

GENERAL DESCRIPTION: IDAHEX is a two-sided, deterministic model which deploys land forces. The model was designed to deal mainly with brigade or division-level units but can be manipulated from battalion level to army level. It is intended to consider theater level combinations of units and can be manipulated to corps sectors. IDAHEX uses both time step and event-store time simulation with a game time to real time ratio of about 1:12 in theater-level gamming.

INPUT:

- o Ground orders of battle
  - Unit locations
  - Terrain
  - Road and rail nets
  - Movement rates
  - Weapon-on-weapon attrition rates
  - Air-to-ground weapon effectiveness
  - Engineer capabilities
  - Supplies consumption rates

OUTPUT:

- o Informs the players at their computer terminals as important events occur
- o Files a detailed history for high-speed printing or retention on tape
- o Level of detail in terminal output can be varied widely by setting one parameter

MODEL LIMITATIONS:

- o Bottlenecks in road and rail lines cannot be represented

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HARDWARE:

- o Computer: Any
- o Operating System: Interactive mode
- o Minimum Storage Required: 50,000 words
- o Peripheral Equipment: 1 or 2 terminals

SOFTWARE:

- o Programming Language: FORTRAN and PL/I
- o Documentation: IDAHEX: A Maneuver-Oriented Model of Conventional Land Warfare, Version 3.0, 3 Vols
- o User's and programmer's manuals are complete

TIME REQUIREMENTS:

- o 3 months required to acquire base data
- o 1/2 man-month required to structure data in model input format
- o Playing time is 2 hours for 1 day of war, depending on level of resolution
- o Approximately 2 minutes CPU time per model cycle
- o 1 day of learning time for players
- o 1/4 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2 times per year

USERS: OASD (PA&E)

POINT OF CONTACT: Dr. Paul Olsen
OASD (PA&E)
Washington, DC 20301

KEYWORD LISTING: Analytical, Training, Limited War, Land, Computer-assisted, Two-sided, Deterministic, Time Step, Event Store

TITLE: IDA Range (Strategic Vehicle Performance)

PROPONENT: Under Secretary of Defense for Research and Engineering (Strategic and Space Systems)

DEVELOPER: Institute for Defense Analyses

PURPOSE: IDA Range is a computerized, damage assessment/weapon effectiveness, analytical model. It determines the flight performance of rocket and airbreathing missiles, reentry vehicles and gliding aircraft. This model is primarily addressed to trajectory analysis of air and space vehicles, as well as the analysis of the flight environment to specify stresses on a missile.

GENERAL DESCRIPTION. IDA Range is a one-sided, deterministic model which deals with air and space forces. This model was designed to consider a single vehicle for a one-to-one engagement. This is the only case it can consider. IDA Range is a time step model which uses Range-Kutta integration of equations of motion as its primary means of solution.

INPUT:

- o Vehicle Configuration
- o Vehicle Weight
- o Propulsion system characteristics

OUTPUT:

- o Time dependence of:
  - Position
  - Velocity
  - Acceleration
  - Forces
  - Attitude
  - Temperature
- o Orbit elements
- o Impact point
- o Influence of variations in atmosphere
- o Reference ideal peformance
- o Integrated impulse

MODEL LIMITATIONS:

- o Three degree of freedom point-mass calculation with programmed pitch
- o Yaw and roll angles

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE
- o Minimum Storage Required: 42 K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Any 1963 memo (general description), IDA P-427 (lifting reentry spacecraft), IDA P-506 (ballistic reentry vehicles), IDA N-595 (R) (aerodynamic force model)
- o User's and programmer's manuals are not complete

TIME REQUIREMENTS: CPU time per model cycle varies

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As many as 100 per year

USER: IDA

POINT OF CONTACT: R.G. Finke
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202

MISCELLANEOUS:

- o Linked to Exoatmospheric interceptors model
- o Output of IDA Range supplies input to Exoatmospheric interceptors model
- o Addition of calculation of peformance of scramjet-powered missiles expected

KEYWORD LISTING: Analytical, Damage Assessment/weapon effectiveness, Air, Space, Computerized, One-sided, Deterministic, Time Step

TITLE: IDASNEM - IDA Strategic Nuclear Exchange Model

PROPONENT: Organization of the Joint Chiefs of Staff; Studies Analysis, and Gaming Agency OJCS/SAGA

DEVELOPER: Institute for Defense Analyses (IDA)

PURPOSE: IDASNEM is a computerized, analytical, damage assessment/ weapons effectiveness model that evaluates results of two-strike strategic nuclear war. The model evaluates the results of two-strike exchange based on a globally optimal division of the first strike's strategic weapons between counter force and counter value missions. Objective function is value damage difference.

GENERAL DESCRIPTION: IDASNEM is a two-sided, deterministic model involving land, air, and sea forces. Primary solution technique used is nonconvex programming via branch and bound.

INPUT:

- o Strategic weapon numbers and parameters
- o Values and hardness information for value targets

OUTPUT:

- o Optimal allocation for the first strikes
- o Resulting damage to value targets by category
- o Surviving retaliatory weapons by type

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE
- o Minimum Storage Required: 64K words

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: WSEG Report 101, IDA Strategic Nuclear Exchange Model (IDASNEM), December 1976
- o Both User and Technical documentation complete

TIME REQUIREMENTS:

- o Less than 1 month required to acquire base data
- o Less than 1 man-month to structure data in model input format
- o Approximately 100 seconds CPU time per model cycle required
- o Less than 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Dr. Jeffrey H. Grotte
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202

KEYWORD LISTING: Analytical; Damage Assesment/Weapons Effectiveness; Land; Air; Sea; Computerized; Two-sided; Deterministic

TITLE: IDASTRAT (Strategic Conflict Analysis)

PROPONENT: Deputy Under Secretary of Defense Research and Engineering

DEVELOPER: Institute for Defense Analyses

PURPOSE: IDASTRAT is a manual, analytical, general war model. The model simulates two-sided exchanges including USSR Balistic Missile Defense options. First and second strikes can be performed for either side. IDASTRAT performs two-sided strategic encounters and derives their outcome for various sets of assumptions of the user's choosing, quickly and anlytically without resort to a large computer code. The model assesses the effects of various types of ballistic missile defense of the outputs.

GENERAL DESCRIPTION: IDASTRAT is a two-sided, deterministic model which uses land, air and sea forces. The model can consider individual ballistic missiles and defense batteries and can be manipulated for this same range. IDASTRAT is designed for formations up to the level of national strategic forces and can be manipulated for that level or less. This model simulates time by use of event storing and solves using algebra.

INPUT:

- o Weapons performance descriptor (e.g. yield, CEP) for each weapon played
- o Defense battery descriptors

OUTPUT:

- o Fraction of the first strike's population killed by the other side's retaliatory strike
- o Number of missiles surviving various types and levels of attacks with and without hard site defense

MODEL LIMITATIONS:

- o Output in fraction of population killed
- o Industrial base can be assumed to be proportional but no industrial base data was used to build the model
- o Actual weapon assignments to specific targets are not used, that process is handled analytically

HARDWARE: None

SOFTWARE:

- Documentation: Journal of Defense Research, Series A: Strategic Warfare, Fall of 1969, Volume IA, Number 3, "A Manual Model for Strategic Conflict Analyses (U)," William J. Schultis and IDA Paper P-493; "A Manual Model for Strategic Conflict Analysis," William J. Schultis, July 1969
- User's manual is complete

TIME REQUIREMENTS:

- Playing Time: Depends on how quickly the player can go through the manual

SECURITY CLASSIFICATION: SECRET

USERS: DR&E (SALT)

POINT OF CONTACT: William J. Schultis
Science & Technology Division
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202

KEYWORD LISTING: Analytical, General War, Land, Air, Sea; Manual, Two-sided, Event Store

TITLE: IDATAM (Tactical Air War)

PROPONENT: Deputy Under Secretary of Defense for Research and Engineering

DEVELOPER: Institute for Defense Analyses

PURPOSE: IDATAM is a computerized, general war, analytical model. It deals with theater-level conventional air campaigns and all air missions on both sides of the FEBA for many days of combat; no ground combat is played. IDATAM was developed to allow the consideration of various types of aircraft, ground-air-weapons and related resources in net assessment and cost-effectiveness studies. The model also addresses itself to effectiveness-only studies, sensitivity analyses and studies involving the integration of results from more detailed and more specialized models.

GENERAL DESCRIPTION: IDATAM is a two-sided, deterministic, model which considers air forces and land forces; the land forces are used for air defense only. The model was designed for use at the theater or ATAF level and can be manipulated through this range. IDATAM can handle combinations of unit up to the theater level and can be specialized to the ATAF level. It is a time step model which uses deterministic simulation as its primary solution technique.

INPUT:

- Aircraft, SAMs and relating resources on both sides by type and base or location
- Effectiveness parameters for all resources
- Allocation values for assigning aircraft to missions

OUTPUT:

- Raw data and aggregated measures of effectiveness (such as blue minus red air ordnance delivered in support of ground operations)
- Detailed outputs
- Summary "daily" outputs

MODEL LIMITATIONS:

- C3 is not extensively played
- Flights of aircraft are modeled in groups, not individually by specific flight path and tail number

HARDWARE:

- Computer: CDC 6400 or larger
- Minimum Storage Required: 50,000 words (base 10)

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Documentation of the IDA Tactical Air Model (IDATAM) Computer Program," IDA Paper P-1409, Institute for Defense Analyses, Arlington, Virginia, February 1979
- o Documentation consists of a 15 page overview and about 100 pages of programmer documentation

TIME REQUIREMENTS:

- o 3 to 6 man-months required to acquire base data
- o 1 man-month required to structure data in model input format
- o 6 seconds of C/U time required after a 30 second initialization
- o 1 month required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 250 runs per year since 1976

USERS:

- o L. B. Anderson (IDA)
- o S. Deitchman (IDA)

POINT OF CONTACT: Lowell Bruce Anderson
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202
(703) 558-1877

MISCELLANEOUS:

- o IDATAM is linked to RADE, FIMOD, SORTIE GENERATION MODEL, OPTSA
- o Inputs for IDATAM were partially constructed from outputs from these models
- o This model superseded the air combat portion of IDAGAM

KEYWORD LISTING: Analytical, General War, Land, Air, Computerized, Two-sided, Deterministic, Time Step

TITLE: IDES - Installation Damage Expectancy Summary

PROPONENT: Defense Nuclear Agency (NATO)

PURPOSE: IDES is a computerized, analytical, damage assessment/ weapons effectiveness model. It calculates probability of damage, damage expectancy and compound damage expectancy from multiple weapon nuclear strikes. Also shows installation damage by country and type of installation. It primarily calculates compounded prompt damages against all installations from major war plans. It also addresses the kind of damage on a country-by-country and city-by-city basis.

GENERAL DESCRIPTION: IDES is a one-sided model which deals with land, air, and sea forces.

INPUT:

- o Extensive installation data base (like TDI)
- o Strike file of weapons (aimpoints, probabilities of arrival, kill requirements, etc)

OUTPUT:

- o Summary of damage by installation, city, major groupings, and country

MODEL LIMITATIONS:

- o Does not handle fallout

HARDWARE:

- o Computer: Major mainframe
- o Operating System: Any
- o Minimum Storage Required: 40 K 32-bit words

SOFTWARE:

- o Programming Language: FORTRAN
- o User's manual completed
- o Programmer's manual not completed

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS:

- o SHAPE
- o USAFE
- o AAFCE
- o USEUCOM
- o CCTC

POINT OF CONTACT: Defense Nuclear Agency
ATTN: NATD
Washington, DC 20305
(703) 325-7403

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Land, Air, Sea, Computerized, One-sided

TITLE: IEM - Helicopter Individual Engagement Model

PROPONENT: US Army Combined Arms Combat Developments Activity

DEVELOPER: US Army Combined Arms Combat Developments Activity

PURPOSE: IEM is a computerized, analytical, damage assessment/weapon effectiveness model used to assess the effectiveness and vulnerability of attack and scout helicopters versus a threat armor and air defense force. IEM was designed as a tool for comparing the effectiveness and survivability of alternative heliborne antiarmor weapons versus an armor battalion with air defense.

GENERAL DESCRIPTION: IEM is two-sided and deterministic, involving both land and air forces. The level of aggregation considers individual attack helicopter (AH) and/or scout helicopters versus individual target weapon. The largest formation the model considers is multiple AH teams versus armor-mechanized threat battalion. IEM portrays line of force contact. Larger forces may violate model assumptions. Simulated time is treated on an event-store basis. IEM constructs player weapon event timeliness and estimates convoluted response times to compute event occurrence probabilities.

INPUT:

- o Terrain
- o Visibility
- o Threat target density
- o Engagement ranges
- o Player tactics and responsiveness
- o Munitions lethality
- o Helicopter mission abort criteria

OUTPUT:

- o Probabilities of event occurrences
- o Summary of player weapon losses
- o Output may be listed as a function of engagement range increments or aggregated within a predefined engagement range distribution

MODEL LIMITATIONS:

- o Helicopters always employ pop-up hover tactic
- o Threat approach velocity is constant
- o Uniform distribution of threat elements
- o Player weapon events are independent

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE
- o Minimum Storage Required: 65K octal words
- o Peripheral Equipment: Card reader, printer, CRT terminal for interactive play

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Published as an appendix to the AH-IS/ITV Force Structure Analysis (AFSA) Technical discussion of ILM appears in HELLFIRE Cost and Operational Effectiveness Analysis Addendum (U), Volume II, Appendix O, 1 Nov 1975

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 month to structure data in model input format
- o Less than 10 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Source Code UNCLASSIFIED

FREQUENCY OF USE: 5-10 times per year

USER: US Army Combined Arms Combat Developments Activity

POINT OF CONTACT: Combat Operations Analysis Directorate
(ATTN: ATCA-CAT)
US Army Combined Arms Combat Developments Activity
Fort Leavenworth, Kansas 66027
Telephone: Autovon 552-5140

MISCELLANEOUS: ILM probabilities and expected time results provide input to the Sortie Effectiveness Model. IEM output summary directly input to SLM.

KEYWORD LISTING: Computerized, Analytical, Damage Assessment/Weapon Effectiveness, Two-Sided, Deterministic, Land Forces, Air Forces, Event Store

TITLE: INCAM - Integrated Nuclear-Communications Assessment Model

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: BDM Corporation

PURPOSE: INCAM is a computerized, analytical, damage assessment/ weapons effectiveness model which will assess the damage to facilities and disruption to the propagation medial resulting from nuclear weapons detonations. The primary problem addressed is C3 degradation due to nuclear weapons effects.

GENERAL DESCRIPTION: INCAM is a one-sided, mixed, event store model involving land, air and sea forces and designed for theater level C3 systems. Nodes can vary from one to 2047. It is an event store model using network analysis for its primary solution technique.

INPUT:

- o C3 system description
- o Nuclear weapons yield
- o Height of burst
- o Targets

OUTPUT:

- o Event listings
- o Drawdown curves
- o Map overlays
- o Sorts on the event listings

MODEL LIMITATIONS: Purely static model, can only look at snapshots, makes assumptions in modeling the propagation degradation.

HARDWARE:

- o Type of Computer: IBM 370/255
- o Operating System: Any recent mission of OS
- o Minimum Storage Required: 550K bytes
- o Peripheral Equipment: Disc and printer

SOFTWARE:

- o Programming Language: FORTRAN (90%) Machine Language (10)
- o Documentation: MEECN System Simulation. Documentation is not complete.

TIME REQUIREMENTS:

- o Variable months to acquire base data
- o 1 man-month to structure data in model input format
- o 10 minutes CPU time per model cycle
- o Variable months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: Principal: Defense Nuclear Agency

POINT OF CONTACT: Defense Nuclear Agency (STRA)
Washington, DC 20305
Telephone: 325-7067

MISCELLANEOUS: Model is not linked to any other model. New capabilities will include the logic associated with C2 functions.

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Land, Air, Sea, Computerized, One-Sided, Mixed, Event Store

TITLE: Indirect Fire Computer Program

PROPONENT: US Army Armament Materiel Readiness Command (ARRCOM)

DEVELOPER: ARRCOM Program Analysis and Evaluation Directorate

PURPOSE: To conduct trade-off analyses and to assess the benefits of hypothetical changes to weapons and ammunition.

GENERAL DESCRIPTION: The model computes effort and effectiveness measures of a friendly artillery force in an open, one-party war game situation. The principle measures of effort are the cost and weight of ammunition expended against a list of various area targets. Effectiveness is evaluated by computing the number of casualties inflicted and the amount of material damage inflicted, and by summarizing military worth points scored. The game is played in a time ordered sequence of 15 minute intervals.

INPUT:

- o A Target List derived from a war game and subsequent target acquisition analysis. Each target is described by various data elements (location, time of acquisition, duration time, number of tactical elements: personnel, tanks, trucks, etc.)
- o Target Frequency (allows 4 levels of battle intensity)
- o Military Worth (based on expert opinion)
- o Target Posture Mix (12 basic mixes)

OUTPUT: For each weapon system there is a report of total cost and weight of ammunition expended; number of personnel, tanks, trucks, etc., defeated; plus of grand total for the systems and summary of military worth points scored.

HARDWARE: IBM 360 computer with 300K bytes

SOFTWARE: FORTRAN IV

TIME REQUIREMENTS:

- o One man month to prepare
- o Six to seven minutes running time for a typical case to play
- o One man-month to analyze a typical study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: One study a year

USER: ARRCOM

MISCELLANEOUS: Revision of AMSAA Legal Mix IV Model

TITLE: Indirect Fire Simulation

PROPONENT: War Games Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE) Ottawa, Canada

DEVELOPER: As above.

PURPOSE: This simulation was designed for assessment of indirect fire engagement in research war games.

GENERAL DESCRIPTION: This simulation permits interactions between up to 10 fire units firing at up to 10 targets each. The shoot can be either adjusted or predicted, with up to seven levels on how the target was obtained. The target in turn can be in 13 different categories, and the shoot can be assessed against equipment or personnel. The suppression/neutralization/casualty figures are determined by the weight of fire (number of rounds by gun type) and the category of the target.

INPUT:

- Weapon performance, miss distance and offset distance are embodied in the program. Inputs include the target being fired at; battery doing the firing to include number and nature of rounds; adjusted or predicted; how target obtained, target key and whether the shot is against equipment or personnel.

OUTPUT:

- Complete status on the target to include calculated suppression, neutralization and casualties. Also complete status on the actor (Battery firing) to include rounds fired by weapon type, and range between target and actor.

MODEL LIMITATIONS:

- The weight of the rounds on the target in accordance with the range is not considered through lack of data. This problem is presently being addressed.

HARDWARE:

- PDP 11/34 computer.

SOFTWARE:

- Programmed in FLECS/FORTRAN.

Information Canada Publication Library

STAFF:

- Operator. War Game Artillery Assessor provides the input data.

TIME REQUIREMENTS:

- Preparation: Input time - less than one minute.
- Play: Running time - 1 min 30 seconds.
- Analysis: Included in research war game analysis.

SECURITY CLASSIFICATION: UNCLASSIFIED.

FREQUENCY OF USE: Continually during research war game.

USERS: DLOR War Game Section.

TITLE: INFERS - Interindustry National Feasible Economic Recovery System

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: INFERS is a computer oriented input-output system for assisting in the analysis of plans for economic recovery from a major national disaster. Its design was initiated by the need for use in formulating the plan for recovery from a nuclear attack in general war. The chief focus of concern is to select those final demand requirements for the economy which can be feasibly handled by the surviving production capacities, and at the same time best serve national recovery objectives.

GENERAL DESCRIPTION: INFERS is a one-sided, deterministic model that simulates the US economy through its interindustry relationships either as a whole or in terms of individual economic sectors. The model considers 178 economic sectors using the national interindustry input-output table (FIOS). A maximum of 12 priority final demand components can be processed in any single run of the system. Simulated time is treated on an event-store basis. The model employs the economic interindustry input-output analysis techniques and attempts to satisfy initial estimates of final demand requirements according to a designated priority sequence. This attempt is subjected to the constraint of available surviving production capabilities. When the total capacities required to satisfy a priority final demand exceeds the available capacities, the adjustments that must be made to the priority final demand is computed. If the user wishes to know the distribution of the output of any specified sectors among the 178 purchasing industries, this information can be provided.

INPUT: The model requires an initial estimation of each of the priority final demand requirements and of the total production capacities at the 178 I-O sector level of the system.

OUTPUT: The system produces the following five edited tables through the standard printer: (a) initial final demand requirements, (b) capacity utilization for each priority final demand, (c) initial gross estimates of adjustments to final demand, (d) total requirements of the output of specified sectors relating to final demand, and (e) distribution of the output of specified sectors relating to total production requirements. Options are available to produce only needed tables.

MODEL LIMITATIONS:

- o The system is based on the concepts and techniques of economic input-output analysis. Consequently, its limitations are the same as those of input-output analysis itself.
- o The system presently uses the year 1967, 178-sector level FEMA Input-Output System (FIOS). This table is obsolete.
- o Maximum of 12 priority final demand components can be considered.
- o The system could be used more appropriately for emergency situations of a less severe nature than nuclear attack.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VI'I
- o Maximum Storage Required: 60K
- o Peripheral Equipment: Data Matrix Tape, UNIVAC 9300 Card Reader and Printer, Honeywell Page Printing System

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: The Interindustry National Feasible Economic Recovery System (INFERS), TM-257, April 1977

TIME REQUIREMENTS:

- o Time required for initial estimation of priority final demands and surviving capacities depends on user's knowledge and experience in the area
- o Less than 1 minute of CPU time per run should be adequate
- o Time required to analyze the results depends on the user's knowledge of input-output analysis and its inherent weaknesses and strengths

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Infrequently

USERS:

- o Principal: Federal Emergency Management Agency (FEMA)
- o Other: Federal non-Defense departments and agencies with emergency repsonsibilities

POINT OF CONTACT: Dr. William T. Felhberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS:

- o Initial estimation of final demands or surviving capacities must be made through other models (e.g., READY, FIOS, etc.)
- o INFERS supersedes POST
- o The YEAR 1977 input-output table is being prepared to be used by this system, and the table will be at a 257 sectors.

KEYWORD LISTING: Analytical Model, General War, Damage Assessment/ Weapon Effectiveness, Civilian Population, Computerized, One-sided, Deterministic, Economic Recovery

TITLE: Interceptor War Game Model

PROPONENT: Headquarters, NORAD, Aerospace Defense Command (ADCOM/XPYA)

DEVELOPER: Headquarters, NORAD, Aerospace Defense Command (ADCOM/XPYA)

PURPOSE: The Interceptor War Game Model is a computerized analytical general war model designed to determine the most probable results to be obtained by a postulated manned interceptor defense system versus a plausible manned bombed raid threat. It is used to determine proposals for optimum interceptor force sizing and basing. The model contains the five functions basic to a bomber raid and interceptor defense: (1) Move a number of raids of arbitrary size over defined penetration routes; (2) calculate the intersections of the penetration routes with selected radar coverage; (3) search eligible interceptor bases and commit flights against the raids at the earliest possible time; (4) compute the probability of kill results of the successful intercepts by a combination of Monte Carlo and deterministic methods; and (5) return the interceptor flights to the nearest recovery base for turnaround.

GENERAL DESCRIPTION: The Interceptor War Game Model is a one-sided model having a mixture of deterministic and stochastic elements. Only air forces are involved. It is designed to consider bombers, interceptors, bases and radars on an individual basis if desired and can aggregate each up to a maximum of one hundred. Simulated time is treated on an event-store basis. Monte Carlo is the primary solution technique used.

INPUT:

- o Radar data: Location and altitude and range capabilities
- o Fighter/interceptor (F/I) bases data: Location, type and numbers of F/Is on the base
- o Interceptor aircraft data: Maximum allowable time to intercept, speeds, turnaround time, fire control system, armament, probabilities of kill for various altitudes and speeds, reliabilities and commitment policies
- o Raid information data: Number of penetrators in each raid, timing and raid path

OUTPUT:

- o Input parameter listings which establish initial conditions for the run
- o Chronological events list giving time of events in minutes and hundredths of minutes from simulation time zero, raid number, raid size, and penetrator velocity; or the number and type of interceptors, their commitment and/or recovery base, the event, results of the event, location and simulation time.
- o Summary reports: (1) Interceptor summaries; (2) total kill summaries; (3) kill summaries by raid; (4) summaries of activities by raid; (5) summary of interceptor data by raid

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MODEL LIMITATIONS:

- o Bases, types of interceptor aircraft, total penetrator aircraft, raids, and legs per raid path are limited only by memory and time available
- o The command-and-control decision to commit a flight is assumed positive in all cases
- o North latitude and west longitude are assumed

HARDWARE:

- o Computer: Honeywell 6060 - 6080
- o Operating System: GCOS
- o Minimum Storage Required: 50K

SOFTWARE:

- o Programming Language: SIMSCRIPT II.5
- o Documentation: Both user's documentation and technical documentation are in preparation.

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 man-week to structure data in model input format
- o 5 minutes CPU time per case
- o 1 man-week to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuous

USERS: ADCOM/XPY

POINT OF CONTACT: Mr. W.R. Fischer
Headquarters, NORAD/J5YA
Peterson AFB, CO 80914
Telephone: AUTOVON 692-3717
Commerical (303) 635-8911, Ext 3717

KEYWORD LISTING: Analytical Model; General War; Air Forces; Computerized; One-sided; Mixed Deterministic/Stochastic; Event Store

TITLE: INWARS - Integrated Nuclear and Conventional Theater Warfare Simulation

PROPONENT: Deputy Under Secretary of the Army for Operations Research

DEVELOPER: The BDM Corporation

PURPOSE: INWARS is a computerized fully automated simulation for analysis of a general war situation. It was developed to allow examination of doctrine and issues in decisionmaking in a theater nuclear, chemical, and conventional context. Of particular interest are the reactions of C2 elements to perceived enemy preparations, defensive measures, and other actions influencing nuclear warfare decisions. Emphasis is on decisionmaking processes of ground C2I elements at echelons above division.

GENERAL DESCRIPTION: INWARS is a two-sided deterministic unit-centered model of the land theater battle. It represents units down to brigade and regimental level with spatial resolution of 9.5 km. Combat and CSS units, airfields, air missions, and special weapons packages are fundamental entitles. Direct and indirect fire combat, air warfare, air defense, and the use of nuclear and chemical weapons are represented. Repair, supply, and intelligence collection are also included.

The emphasis in the model is on decisionmakeing with each headquarters at corps level and above represented by an entity which makes decisions and plans. This is accomplished using a knowledge based technique known as "frames," which provide a context for maintaining an "Understanding of the Situation (UOS)." These headquarters units make plans for ground operations, (e.g., envelopments), develop targeting plans, monitor the performance of subordinates, and react to contingencies.

Simulator consists of the two primary modules, one for the combat interations, which is a time stepped unit capable of running stand alone with initial unit orders, and the C3I module which is event stepped. Interfaces between the two are implemented as messages.

INPUT:

- o Order of Battle
- o Weapon/Asset description parameters, including weapon effects
- o Terrain data
- o Operation decision tables (division, brigade, air, etc.)
- o SOPs
- o Operation descriptors, defining various operation types
- o Operation concepts (for corps and above)
- o Decision criteria
- o Information collection parameters
- o Understanding of the situation-fundamental knowledge

OUTPUT: Summary of situation at predetermined times, including unit locations, state information. Summary of individual understanding of the situation.

MODEL LIMITATIONS: Currently designed to handle a situation of approximately:

- o 1000 km x 1000 km area
- o 50 Corps and above headquarters
- o 2000 units, with about 6 assests each

The above limits can be expanded with major modification.

HARDWARE:

o UNIVAC 1108	200K words
o CONTROL DATA CYBER 176	200K (octal) words, SCM, 40K (decimal) words ECS

SOFTWARE:

- o Programming Language: FORTRAN with MIDAL data structure preprocessor
- o Documentation: Integrated Nuclear and Conventional Theater Warfare Simulation (INWARS) Documentation, (3 parts, 12 volumes). The BDM Corporation, Feb 8, 1980
- o Size:

Combat Interactions Module	10K lines source
C3I module	30K lines source
Data inputs, typical	3K lines

TIME REQUIREMENTS:

o To acquire data base:	7 man-months
o To structure data in model input format:	3 man-months
o To analyze output:	2 man-months
o Analyst learning time:	6 months
o CPU time per replication:	8-1 simulated/real time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not yet used in study.

USERS: US Army Concepts Analysis Agency
The BDM Corporation

POINT OF CONTACT: Mr. Louis W. Schlipper
Director, C3I Systems Analysis
The BDM Corporation
7915 Jones Branch Drive
McLean, VA 22102

MISCELLANEOUS: A stand alone interactive testbed for C2 data development is planned.

KEYWORD LISTING: INWARS, Theater, Nuclear/Chemical Warfare, Integrated Battlefield, Decisionmaking, C2I, C3I, Knowledge Based, Simulation Combat Simulation

TITLE: ISDM - Interactive Strategic Deployment Model

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The Interactive Strategic Deployment Model is a computerized, analytical, logistics scheduling model. Deployments of military forces and resupply are simulated to overseas destinations with scarce resources. On a daily basis, the model schedules cargo according to a predetermined priority ranking.

GENERAL DESCRIPTION: ISDM is the one of a series of mobility models developed to provide a tool for evaluating strategic mobility programs and making trade-offs between them. The overall deployment objective is achieved by the maximum utilization of available transportation resources. A heuristic scheduling algorithm takes into account both the priorities of the cargos and the desirability of making maximum use of the transportaton resources.

INPUT:

- o Scenario file containing all data relating to the geography of the scenario and land movement of forces and supplies
- o Force requirements data file containing all of the data on the forces to be processed
- o Ships data file containing all of the data on individual ship characteristics and availability

OUTPUT:

- o Detailed descriptions of the movements of each of the cargo requirements
- o Cargo assigned to each ship and aircraft
- o The activities of aircraft categories and individual ships throughout the deployment
- o The movements of major Army units at the division and brigade levels
- o The tons of cargo and firepower of various categories of equipment which buildup at a selected location or set of locations
- o The types of Air Force squadrons with numbers of aircraft arriving at their destination and the arrival date
- o Graphics displays which display user designated measures
- o The ratio of support to combat forces tonnage in a theater

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 695-3156

TITLE: ISEM-P - Integrated Simulation Evaluation Model Prototype

PROPONENT: Air Force Human Resources Laboratory, Manpower and Force Management Systems Branch, Decision Models Function (AFHRL/MOM)

DEVELOPER: CONSAD Research Corporation, Pittsburgh, PA

PURPOSE: To simulate the interrelated effects of various policy changes on the operation of the Air Force Manpower and Personnel System (AFMPS) and its subordinate functions. The prototype was developed as a scaled-down version of the total ISEM to determine the feasibility of constructing a large, comprehensive, detailed computer-based representation of the AFMPS.

GENERAL DESCRIPTION: ISEM-P deterministically simulates the activities of the AFMPS as it responds to personnel and manpower policy parameter changes. It performs simulation on aggregrate groups of people across some 91 officer and airman career fields, 17 Air Force bases, including training functions, and nine weapon systems. The model has an aggregrate planning cycle which translates FYDP and other congressional and DOD constraints on the force into force progression and projection information. This data is then input to the detailed assignment and training modules which carry out the aggregrate planning orders with actual training, assignment, separation, and functioning of the officer and enlisted force by Air Force speciality base, years of service and numerous other definable variables.

INPUT: The model is input data dependent. It requires a large amount of information to structure the force and the base weapon system configuration. Data includes force levels, number of bases, types of weapons, manpower standards for bases, base support, and weapon system support, training system throughput and standards, personnel action information (promotion rates, separation rates, etc.). A scenario is then constructed to use these standard data as a baseline and investigate the changes in the AFMPS that various manpower and personnel policy changes would make.

OUTPUT: Standard reports are produced on grade and skill structure of the force as well as movement and training information. As the model produces a vast amount of information on the AFMPS, the user is free to construct output reports tailored to his individual management needs.

MODEL LIMITATIONS: The only limitations on the functioning of the model are the data required to simulate greater levels of force disaggregation, length of run on computer time, and formulation of meaningful output reports.

HARDWARE:

- o Computer: UNIVAC 1100/81
- o Operating System: Standard

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- o Minimum Storage Required: 100K words
- o Peripheral Equipment: Tape units, card reader (if card input), disk, printer

SOFTWARE:

- o Programming Language: Simscript II.5
- o User's Documentation: Available from AFHRL
- o User's Manual: Available from AFHRL
- o Other Documentation: AFHRL-TR81-15. Integrated Simulation Evaluation Model - Prototype (ISEM-P): Overview and Sensitivity Analysis

TIME REQUIREMENTS:

- o Approximately one month to collect all data and construct scenario
- o 1-2 minutes per simulation cycle (one month basis)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required (still in test mode as prototype)

USERS:

- o AFHRL for development
- o AFMPC and Air Staff for operational use

POINT OF CONTACT: Air Force Human Resources Laboratory
Decision Models Function
Manpower and Personnel Division
Brooks AFB, Texas 78235
Telephone: AUTOVON 240-3648
Commercial 536-3648

KEYWORD LISTING: Simulation, Computer Model, Gaming Model, Policy Model, Decision Model, Force and Personnel Simulation

TITLE: IREM Aircraft Model

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: AMSAA, Aberdeen Proving Ground (APG), MD 21005

PURPOSE: IREM (Incorporation of Readiness into Effectiveness Modeling) is an AMSAA project whose purpose is to analyze the influence of combat damage and failure repair and maintenance upon the results of weapons effectiveness models. The IREM Aircraft Model takes into account shotline damage and failures that generate a workload for aircraft maintenance shops, and factors including maintenance manpower and spare parts stockage that restore aircraft to operational readiness. The output of the IREM Aircraft Model indicates, for a particular scenario, which spare parts should be stocked in greater quantities, and which could be stocked at lower levels without harming operational effectiveness.

GENERAL DESCRIPTION: The IREM Aircraft Model is a discrete-event, computerized, Monte Carlo simulation involving up to 50 aircraft. During simulated combat missions, aircraft failures and enemy fire cause attritions, forced landings, mission aborts, or other damage. Simulated maintenance takes place at AVUM (aviation unit maintenance) or AVIM (aviation intermediate maintenance) shops, using men of up to 25 military occupational specialties and spare parts of up to 700 different line items.

INPUT:

- o Scenario, describing the number and length of the legs of the missions, the threats to be encountered, and the aircraft requirements and frequency of occurrence for each mission
- o Mission essential spare parts list, by National Stock Number or manufacture's part number, with costs, weights, and volumes
- o A computerized target description of the aircraft
- o A vulnerability data base, showing (a) what components will be damaged, (b) which MOS's and repair times will be required, (c) the probabilities of attrition, forced landing, and mission abort, for each threat and projectile or fragment velocity along each shotline to be considered
- o A failure data base, showing, for each failure mode, (a) its frequency per flying hour, (b) the consequences to the aircraft, (c) the MOS's, parts and times required to repair the failure
- o A description of the maintenance support, including (a) number of each MOS at AVUM and AVIM, (b) Authorized Stockage List (ASL) at AVIM and Prescribed Load List (PLL) at AVUM, (c) delay times for ordering of parts and movement of aircraft, (d) rules for cannibalization, (e) size of maintenance float, if any, and (f) scheduled maintenance requirements

OUTPUT:

- o Printer plot of surviving aircraft and available aircraft versus time
- o Number of missions of each type flown and scrubbed
- o Failures occurring in flight or detected on the ground, grouped according to the consequences to the aircraft
- o For each spare component line item, the numbers that were required, on hand when needed, not in stock when needed, ordered from next higher maintenance level, orderd from depot, reordered for inventory, actually arrived after order or reorder, obtained through cannibalization, sent down to lower maintenance levels, and actually used to repair aircraft.

MODEL LIMITATIONS:

- o Monte Carlo simulation
- o Limits on number of aircraft and line items
- o Vulnerability data base depends on COVART, with a Ballistics Research Laboratory-APG (BRL) that computes MOS requirements and elapsed repair times
- o Does not simulate the repair of unserviceable Line Replaceable Units
- o Simulates cannibalization, but not direct exchange
- o Aircraft must be fully mission capable to take off on a mission

HARDWARE:

- o Type of Computer: CDC CYBER 76
- o Operating System: SCOPE 2.1
- o Storage requirement: 56K SCM + 52K LCM

SOFTWARE:

- o Programming Language: FORTRAN Extended
- o Proprietary Package Used: GASP IV Simulation Language
- o Documentation: Not complete. See AMSAA CSD Interim Note C-97 (Sep 80) and AMSAA AWD Interim Note A-170 (Apr 81) for more detailed descriptions of inputs, program logic, and outputs

TIME REQUIREMENTS:

- o 3 man-months to prepare inputs, given the target description
- o 2 man-months to run the model and analyze outputs

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 analyses per year, with 20-40 different cases run per analysis

USERS: AMSAA

POINT OF CONTACT: Director, US AMSAA
Attn: DRXSY-CR (Mr. Matt Rosenblatt)
Aberdeen Proving Ground, MD 21005
Telephone: AUTOVON 283-4210

MISCELLANEOUS:

- o Plans to expand model to simulate three AVUM shops instead of one
- o Shotline data from COVART required as input

KEYWORD LISTING: Analysis; Aircraft; Maintenance; Spare Parts; Inventor; Computerized; Simulation; Monte Carlo; Combat Damage

TITLE: JANUS

PROPONENT: Lawrence Livermore National Laboratory

DEVELOPER: Lawrence Livermore National Laboratory

PURPOSE: JANUS is a computerized interactive ground combat simulation model utilizing dynamic graphics representation. The JANUS code provides a neutral battlefield environment with detailed treatment of nuclear, chemical, and conventional military systems and digitized terrain. Players, in a competitive near real time simulated battle, make tactics and system employment decisions using interactive graphics based upon continuous presentation of a map-like display and on-call status reports. The model is used to evaluate nuclear weapon concepts and the interaction of the principal maneuver elements under conventional/chemical/nuclear conditions. The model provides insights useful in analysis or training.

GENERAL DESCRIPTION: JANUS is a two-sided stochastic ground force model designed for conflict at up to Blue Brigade versus Red Division force levels. The model focuses on individual fire line system engagements and assessments, with aggregation capability up to company size elements. The JANUS code is event sequenced, runs in near real time, and uses probabilistic solution technique within an overall Monte Carlo simulation approach.

INPUT:

- o Numbers and types of units
- o Number of nuclear rounds
- o Weapon systems/specific system characteristics (including basic loads, ranges, reload rates, movement speeds, ordnance velocity and system size)
- o Terrain (digitized tapes)
- o Engineer obstacle availability
- o Visibility assumptions
- o Combat objectives
- o Interactively (during simuulation); unit movement orders and indirect fire targeting

OUTPUT:

- o Continuous color display of units, weapons effects and individual weapon engagements
- o Unit status reports - on-call from terminal scope or in hard copy at preset intervals:
  - Attrition by unit
  - Unit locations
  - Unit ammunition status

- Nuclear incapacitation and other effects
- Unit speed and direction
- Summary of attrition by side - unit systems killed vs weapons causing kills

o Vidotape, 35mm slide, 16mm movie (optional)

MODEL LIMITATIONS:

- o Air support not modeled
- o Logistics limited to basic loads
- o Forces not able to dismount
- o Scope currently limited to Blue Brigade (+) vs Red Div (+)
- o C31 not explicitly modeled
- o Sensors limited to visual acquisition
- o Static engineer obstacles only

HARDWARE:

- o Computer: Current - Varian V73/75
  Aydin Color Graphics
  Supporting equipment (graph tablets, medium resolution monitors, function box, terminals)
  FY 1982: VAX 11/780
  Ramtek 9400
  Supporting equipment (graph tablets, high resolution monitors, function box, terminals)

TIME REQUIREMENTS:

- o To acquire Data Base: 1 man-day - 1 man-month, depending on data
- o To Structure Data in Model Input Format: 1-7 man days in general
- o To Analyze Output: Less than 1 day
- o Player Learning Time: 1-2 days
- o Playing Time per Cycle: 4-6 hours per battle

SECURITY CLASSIFICATION: SECRET - RESTRICTED DATA

FREQUENCY OF USE: Daily

USERS: Lawrence Livermore National Laboratory, US Army, US Air Force

POINT OF CONTACT: Donald Blumenthal, L-7 (415) 422-6519
Cal Buzzell, L-7 (415) 422-6569
Lawrence LIVERMORE National Laboratory
P.O. Box 808
Livermore, CA 94550

MISCELLANEOUS: Planned Ennancements:

- o Use of a distributed network with multiple player stations to model Corps level conflict, including Corps, Division and multiple Brigade Headquarters with C3I.
- o Air support and ammunition logistics resupply explicitly modeled and controlled by players

KEYWORD LISTING: Air-land Battle; Analytical; Brigade Model; Competitive; Computerized Division Air-land Battle; Graphics Displayed Battle; Integrated Battlefield; Interactive; Nuclear; Real-time; Stocnastic;

TITLE: JANUS - Battalion-Level Version

PROPONENT: US Army TRADOC Systems Analysis Activity (TRASANA)

DEVELOPER: Lawrence Livermore National Laboratory (LLNL)

PURPOSE: "Battalion" JANUS is a two-sided, interactive, near real time wargame developed to explore the relationships of combat and tactical processes. Players interactively make decisions of doctrine and tactics, deploying forces, determining unit objectives, planning and executing artillery fires, and planning the use of nuclear weapons. JANUS has been used to compare RED vs BLUE combined (nuclear and conventional) tactics and determine the effectiveness of artillery fired atomic projectiles.

GENERAL DESCRIPTION: "Battalion" JANUS supports studies of one maneuver battalion versus one regiment each with supporting nuclear capable weapon systems. Size of digitized terrain is selectable. Resolution is down to the weapon system. Conventional direct fire is automatic and dependent upon line-of-sight, probability or acquisition, reload rates, range, and postures. Nuclear effects include thermal, blast, and prompt and delayed radiation.

INPUT:

- o Order of battle
- o Basic ammunition loads
- o Firing rates
- o Kill probabilities
- o Mobility
- o Terrain, weather
- o Nuclear weapon yields
- o Transmission factors for equipment
- o Blast vulnerability for equipment
- o Thermal vulnerability for personnel
- o Radiation levels for personnel

OUTPUT: Summary status reports for each side are available during the game.

MODEL LIMITATIONS: "Battalion" JANUS does not include chemical weapons or effects and does not model the following nuclear effects: Dazzel, induced radiation, fallout, pre-initiation, and EMP.

HARDWARE:

- o LLNL
  - VARIAN V77
  - VORTEX and CSL
  - 128K words
  - Aydin Graphics

THIS PAGE IS BEST QUALITY PRACTICABLE

- o TRASANA
  - UNIVAC 1100/82
  - EXEC - 8 and CGF
  - 76K words
  - VARIAN V73 - RAMTEK 9300 graphics

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation for government users only is available from:

  Lawrence Livermore National Laboratory
  Tactical Analysis Group L-7
  University of California
  P.O. Box 808
  Livermore, CA 94550

TIME REQUIREMENTS:

- o Player learning time - 1 hour
- o Playing time per cycle - less than 8 hours per game

SECURITY CLASSIFICATION: SECRET RESTRICTED DATA

FREQUENCY OF USE: Once per month

USERS:

- o Lawrence Livermore National Laboratory
- o TRADOC Systems Analysis Activity

POINT OF CONTACT: USA TRASANA
Attention: ATAA-TGI
White Sands Missile Range, NM 88002
AUTOVON: 258-3359/3735
Commercial: 505-678-3359/3735

MISCELLANEOUS: A "Brigade" JANUS is operational at LLNL and is being reprogrammed for a VAX 11-780 minicomputer coupled with RAMTEK 9400 graphics. TRASANA will acquire this version in FY 1982.

KEYWORD LISTING: Computerized, simulation, wargame, warfare, nuclear weapons, weapons effects.

TITLE. J/SCIR.Vol (Communications Jamming Effectiveness Graphs)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Plots effectiveness circles for transmitters based on jammer range, power, and gain. Various J/S levels at receiver are equated to a percentage of intelligibility.

GENERAL DESCRIPTION: Program uses standard jamming equation to plot those areas around transmitter in which a receiver can expect a specified intelligibility percentage. Program uses a predetermined scale for J/S versus intelligibility based on J/S 0 = 50% intelligibility.

INPUT:

Transmitter power

Transmitter antenna gain

Jammer antenna gain

Communications receiver bandwidth

Jammer bandwidth

Transmitter to jammer distance

OUTPUT: Intelligibility and the associated distance range from 0% to 80%

MODEL LIMITATIONS: Receiver antenna gain assumed to be Ø dB.

Standard $1/R^2$ propagation

No atmospheric/terrain attenuation

Assumes 0 dB J/S equates to 50% intelligibility

HARDWARE:

Computer: PDP-11

Operating System: TEKTRONIX WDI

Minimum Storage Requirement: 28,000

Peripheral Equipment: TEKTRONIX 4010 or 4014 terminal, CP100 cassette

SOFTWARE:

Programming Language: BASIC

TIME REQUIREMENTS: Requires approximately 1 hour for input data collection and formating 1 and approximately 15 seconds run time.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Twice a year

USERS: EWT

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

KEYWORD LISTING: Jamming, Burnthru, Communications

TITLE: J/S.V01 (J/S Ratio for Communications Jamming)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Calculates the jammer to signal (J/S) ratio for communications jamming.

GENERAL DESCRIPTION: Program uses standard jamming equation to calculate the J/S ratio at the receiver antenna based on transmitter/receiver range, jammer/receiver range and characteristics of transmitter and jammer.

INPUT:

Transmitter power

Peak jammer power

Transmitter antenna gain

Jammer antenna gain

Receiver bandwidth

Jammer bandwidth

Transmitter to Receiver distance

Jammer to receiver distance

OUTPUT: J/S ratio

MODEL LIMITATIONS: Receiver antenna gain assumed to be Ø dB

Assumes $1/R^2$ propagation

No atmospheric/terrain attentuation

HARDWARE:

Computer: PDP-11

Operating System: TEKTRONIX WDI

Minimum Storage Requirement: 28,000

Peripheral Equipment: TEKTRONIX 4010 or 4014 Terminal, CP100 cassette driver

SOFTWARE: Programming Language: BASIC

TIME REQUIREMENTS: Requires approximately 20 minutes input data collection and formating and approximately 10 seconds run time.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: One or two times per year

USERS: AFEWC/EWTR

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

TITLE: K-MABS - Keen-Mixed Air Battle Simulator

PROPONENT: Commander in Chief, Pacific

DEVELOPER: SRI International
Research and Analysis Division, CINCPAC

PURPOSE: The purpose of this model is to permit the study of factors that affect the effectiveness of air defense systems. The model permits varying the numbers, locations, and characteristics of: radars, SAM sites, AA guns, short range SAM, interceptors, bombers, ordnance, and noise jamming equipment. Effectiveness is judged by the ability of the air defense system to inflict damage on the enemy and prevent damage to itself.

GENERAL DESCRIPTION: The model is designed to simulate individual radars, missiles, bombers, and aircraft, but several Red aircraft can be grouped into one raid point and several short range SAM can be grouped into one fire unit. It can be used to study air defense in a small area, say, 50 by 50 miles, or a larger area, say, 2,000 by 2,000 miles.

INPUT:

- o Quantities of radars, SAM systems, interceptors, and bombers of each type
- o Effective ranges and Pk for weapons such as SAM, AA guns, and air-to-air missiles
- o Radar ranges or a listing of so-called "Detect/Leave" events generated outside this model (See MPRES model)
- o Terrain masking in terms of range to and height of nearest obstacle
- o Speeds and ranges of bombers
- o Speeds and fuel consumption rates of interceptors
- o Bomb damage potential as a function of number of bombs, type of target, and expected CEP
- o IFF characteristics in terms of probability of correct identification and probability of misidentification
- o Fire control delays and failure factors

OUTPUT: For each of the successive Red attacks:

- o Tables summarizing damage to each type of aircraft in terms of number killed or damaged by various ground-to-air and air-to-air weapon systems
- o Tables summarizing damage to ground targets in terms of fraction of each ground target surviving
- o Summary of damage by each SAM system type
- o Table showing quantities and types of bombers surviving and used in each computer-generated Red attack wave
- o Graphs showing numbers of interceptors on the ground, assigned, in maintenance, attack rig, and returning to base versus time for all attack waves

MODEL LIMITATIONS:

- The model does not handle ECM explicitly so the MPRES model has been used to generate the detect/leave events under noise jamming conditions.
- It does not handle damage to ground targets and collateral damage in a sophisticated manner so JMEM methods have been used to determine potential damage to ground targets to arrive at Pk and damage factors to put into the model.
- The model is deficient in handling the outcome of the air-to-air battle. Tables were added to the model which permit determining the outcomes of engagements between several different types and quantities of aircraft.

HARDWARE:

- Computer: Honeywell 6060
- Operating System: GECOS
- Minimum Storage Required: 80K
- Peripheral Equipment: Printer

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: SRI Manual (1972)
  CINCPAC (1979)

TIME REQUIREMENTS:

- To acquire data base varies
- 2-3 man-weeks to structure data in model input format
- To analyze output varies
- 2-3 weeks for player learning time
- Playing time per cycle varies
- 2-60 minutes CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Research and Analysis Division
CINCPAC, Box 15, J55
Camp H. M. Smith, HI 96861

FREQUENCY OF USE: As needed

USERS:

- CINCPAC
- U.S. Forces Japan
- Combined Forces Command, Korea
- Japan Self Defense Forces

KEYWORD LISTING: Air Defense Model, Air Defense Effectiveness.

TITLE: KORA

PROPONENT: IABG/SOP Ottobrunn, Germany

DEVELOPER: IABG/SOP Ottobrunn, Germany

PURPOSE: KORA is used for force structure and weapons [illegible] as well as a useful tool in support of operational and tactical [illegible]. The model addresses logistics and maintenance considerations of the fighting force. The model has been used for training of general staff officers.

GENERAL DESCRIPTION: KORA is a computerized, [illegible]-sided, deterministic time-step simulation that models air-land, non-nuclear combat. [illegible] designed for company versus battalion combat. The model can handle brigade vs division level engagements.

INPUT:

- Attrition coefficients
- Artillery effectiveness data
- Consumption rates
- Army and Air Force commands (orders)

OUTPUT: Printout and plot with raw game data. Statistical data (post an evaluation routine) selective outputs for [illegible] troops, artillery, anti-tank, helicopter, and Air Force, consisting of: event lists, status and availability data.

MODEL LIMITATIONS: Two military unit levels between command level and assessment level.

HARDWARE:

- Computer: CDC CYBER 175
- Operating System: NOS
- Minimum Storage Required: 145,000 octal words (core)
- Peripheral Equipment: Plotter

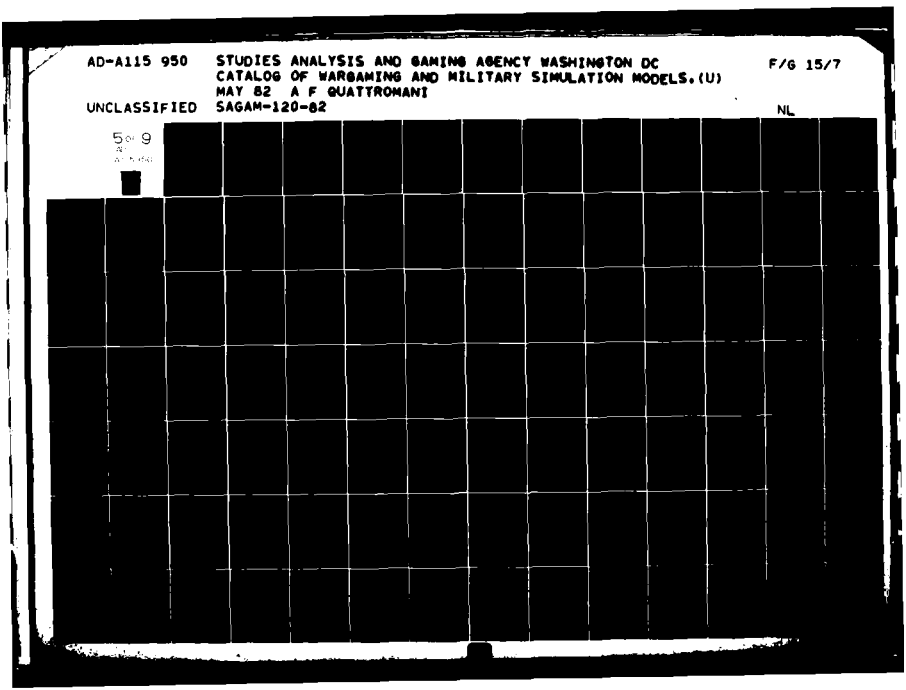
SOFTWARE:

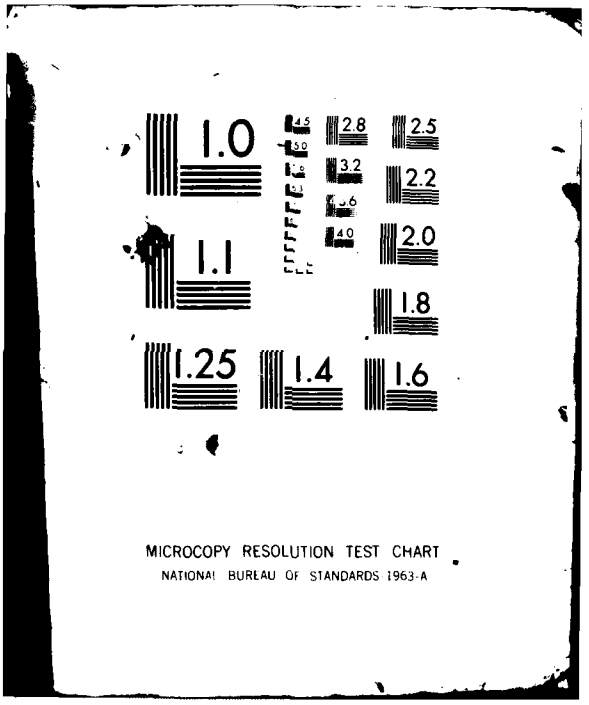
- Programming Language: FORTRAN IV
- Documentation: Available printed in German

TIME REQUIREMENTS:

- To acquire data base: [illegible] months
- To structure data in Model Input format: 1 man-month
- Player learning time: [illegible] week
- Playing time per cycle: 2 cycles (up to 12 hours [illegible] time) per day
- CPU time per cycle: 300 [illegible] seconds (90 min batch)

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
MAY 82 A F QUATTROMANI
UNCLASSIFIED SAGAM-120-82 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

SECURITY CLASSIFICATION: CONFIDENTIAL, RESTRICTED

USERS: IABG/SOP, Fuhrungsakademie der Bundeswehr, Hamburg

POINT OF CONTACT: IABG
Abteilung SOP
Einsteinstrasse
D 8012 Ottobrunn, Germany

TITLE: LABS - Local Air Battle Simulation

PROPONENT: McDonnell Douglas Corporation

DEVELOPER: McDonnell Aircraft Company, McDonnell Douglas Corporation (IRAD funding)

PURPOSE: LABS is a computer-assisted, limited war, mission-level air combat simulation used as an analytical tool for evaluation and comparison of advanced fighter designs. The program addresses all phases of air-to-air combat, with emphasis on long-range and medium-range combat. A variety of missions, rules of engagement, and tactics may be simulated, using either perfect or imperfect information for tactical decisionmaking. The results may used in weapon system design studies or as inputs for theater-level models.

GENERAL DESCRIPTION: The LABS program is a time-step, two-sided computer simulation with representation of aircraft and their missiles, radar, fire control, ECM, and other weapon system characteristics. Up to 24 aircraft may be simulated in a combat arena 1600 NM square. Tactical decisionmaking can be accomplished either in a man-in-the-loop interactive mode or an all-digital mode. Interactive operation utilizes videographic displays to present the available tactical information to the operators. Ratio of game time to real time is approximately one-to-six, but will vary with the total number of aircraft in the engagement. Tactical selection problems are solved with linear programming and game theory techniques.

INPUT:

- o Weapon system definition data
- o Tactical options and restrictions
- o Initial flight states and geometry
- o Termination conditions

OUTPUT:

- o Summary of engagement outcomes
- o Time-history of key events
- o Graphical output of aircraft and missile flight paths
- o Graphical output of selected state variable time histories

MODEL LIMITATIONS: Presently limited to 24 aircraft and 24 missiles in simultaneous flight

HARDWARE:

- o Computer: VAX 11/780, CDC 760, IBM 370 MVS/TSO
- o Maximum Storage Requirements: 1000 K Decimal Bytes
- o Peripheral Equipment: Tektronix 4014 CRT (Interactive Version)

- o Programming Language: FORTRAN
- o Documentation
  - Users Manual
  - Annual IRAD project descriptions

TIME REQUIREMENTS:

- o One week to prepare weapon system input data
- o Two weeks to analyze tactics with interactive version
- o Two weeks to adapt all-digital tactics logic
- o One CPU minute per simulated minute for 2-V-4 engagement
- o One day to collect and review results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Advanced Design Project Personnel, MCAIR
AMRAAM Operational Utility Evaluation (USAF CRAD)

POINT OF CONTACT: Mr. James A Perkins
Dept 345, Bldg 101
McDonnell Aircraft Company
P.O. Box 516
St. Louis, MO 63166
Telephone: (314) 232-9999

MISCELLANEOUS: Coordinated utilization of both interactive and all-digital versions produces the most satisfactory results, although not necessary. Two-tube (Blue vs Red) interactive operation is most efficient means of exploring tactical possibilities. Air-to-surface and surface-to-air representation will be incorporated in 1982.

KEYWORD LISTING: Aircraft, Missiles, Air Combat, Simulation, Radar, Tactics

TITLE: LAE COPE - Lethal Attack of Emitter Combat Operational Performance Estimates

PROPONENT: LAE Special Study Group

DEVELOPER: US Army Materiel Systems Analysis Activity (USAMSAA)

PURPOSE: This model, like the other members of the COPE family, was developed to provide a rapid method of investigating the effect of system parameters and battlefield factors on the operational utility of weapon systems. In this case the weapons are passively homing anti-radiation weapons.

GENERAL DESCRIPTION: This is a one-sided, stochastic computer model representing a potential mission of the weapon system against a group of targets from the time a target begins radiating RF-energy until system kill. The methodology combines the performance characteristics of the system with the battlefield factors to give a tool with which it is very easy to test the sensitivity of the system to variations in its performance parameters. Two variants of the LAE COPE model exist. The first deals with an Anti-Radiation Projectile (ARP) concept while the second is for a loitering weapon, the mini-attack drone (MAD).

INPUT:

- Target Type
- Acquisition Sensor Type
- All Source Analysis Center Echelon Level
- Message Volume
- Percent of all targets that are Quickfire
- Whether the given target is a Quickfire target
- Weapon/Projectile performance characteristics
- Acquisition enablement altitude
- Target Operational Emission Profiles
- Loiter Time (DRONE)

OUTPUT:

- Probability of attempted engagement given a target radiates
- Probability of firing given an attempted engagement
- Probability of kill given a shot
- Probability of kill given a target radiates (overall Measure of Utility)

MODEL LIMITATIONS:

- ARP - Limited numbers of flight simulations have been completed resulting in data voids in the guided accuracy sensitivity part of the weapon performance characterizations.

- MAD - Survivability analysis based on RPV characteristics.

HARDWARE:

- Computer: CDC
- Minimum storage required: 30kg
- Line printer
- Magnetic disk with random access file

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: Model Descriptions and programming guide are

STAFF: Minimum staff required - one analyst

TIME REQUIREMENTS:

- Less than one day if all input data values are readily available
- Play: 45 seconds of computer time per case
- Analysis: Depends on number of cases run, typically one or two days

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Anticipate a few hundred cases will be run during LAE Special Study

USERS: LAE SSG; Fort Sill (Combat Developments); TRASANA; HQ, DARCOM (Development Engineering); AMSAA (Ground Warfare Division)

TITLE: LAMPSIM - Light Airborne Multi-Purpose System Simulation

PROPONENT: Lawrence Livermore National Laboratory

DEVELOPER: Lawrence Livermore National Laboratory

PURPOSE: LAMPSIM was built to study feasibility of nuclear ASW weapons either deliverable by air ASW platforms or surface-launched on air-developed datums. To do this a wide range of tactical options had to be built in.

GENERAL DESCRIPTION: LAMSIM moves through acoustic and motion simulations of screened battle group and attacking submarine in time-step fashion. The evolution can be monitored in faster than real time, or run Monte Carlo at high speed to produce sensitivity studies.

INPUT:

- o Scenario
- o Tactics
- o Ocean Basin and Season
- o Platform Characteristics including Acoustics
- o Weapon Characteristics

OUTPUT:

- o VIDEO: Frame by frame or continuous TV view
  Color movie
  Acoustic plots
  Tracks, etc.

- o LISTINGS: Battle event file
  Multiple statistics, e.g., PK, exchange ratio, probability of detection

MODEL LIMITATIONS - One threat, one aircraft.

HARDWARE:

- o Type of Computer: CDC 7600
- o Operating System: LTSS
- o Minimum Storage Required: 250 Kword
- o Peripheral Equipment: Video Monitors

SOFTWARE:

- o Programming Language: LLNL FORTRAN
- o Documentation: User's Manual (Draft), late 1981

TIME REQUIREMENTS:

- o To acquire Data Base. Available
- o To Structure Data in Model Input Format. 1 Day
- o To Analyze Output. 1 Hour
- o Player Learning Time. 1 Week
- o Playing Time per Cycle. 1 Hour
- o CPU Time per Cycle.
  - 5 Minutes monitored
  - 1 Second unmonitored

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Lawrence Livermore National Laboratory

POINT OF CONTACT:

Stanley A. Erickson 415-422-6548
Forrest Fairbrother 415-422-6546
John J. Rhodes 415-422-6550
D-Division, L-11
Lawrence Livermore National Laboratory
P.O. Box 808
Livermore, CA 94550

MISCELLANEOUS: Enhancements to multiple aircraft in planning.

KEYWORD LISTING: Lamps, Nuclear, Depthbomb; Screening; Towed-Array; Sonobuoy; S-3A

TITLE: LELAWS - Low-Energy Laser Weapon Simulation

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: AMSAA, Aberdeen Proving Ground, MD 21005

PURPOSE: This program models the propagation of pulse energy from a low-energy laser weapon (or laser rangefinder or laser designator) through a turbulent atmosphere to a point in the far-field where this energy is received by a target sensor. The target sensor could be the unaided eye, the optically-aided eye, an image intensifier or converter, or a TV system. The primary measure-of-effectiveness generated by the model is the probability that a given pulse (or train of pulses) reaching the sensor will exceed the damage threshold of the sensor. The model is used primarily for the evaluation of item-level performance of low-energy laser weapons in the anti-sensor role. In addition, the model can also be used in laser hazard/safety studies to estimate the level of laser eye hazard associated with low-energy lasers on the battlefield or during training exercises.

GENERAL DESCRIPTION: LELAWS is a completely digital, one-on-one. Monte Carlo simulation of a low-energy laser weapon operating in the anti-sensor role. Both land and air-based targets sensors can be in the model. Although the model was designed primarily for the one-on-one engagement, it can be used to predict effectiveness estimates for one laser versus several sensors. Solution techniques include probability theory and Monte Carlo inversion.

INPUT:

- o Laser weapon characteristics
- o Target sensor characteristics
- o Sensor damage thresholds
- o Atmospheric conditions
- o Engagement parameters

OUTPUT:

- o Detailed echo of input data
- o Laser beamspreading parameters as a function of range
- o Tables of sensor damage probability as a function of range, visibility, damage level, and number of pulses fired
- o Optional output includes power-fading distributions for each of the primary phenomena which affect the laser beam

MODEL LIMITATIONS:

- o Pulsed lasers only
- o Visible and near-infrared lasers only
- o Low-energy lasers only (i.e., no thermal blooming)
- o Smoke effects not presently included

HARDWARE:

- o Type of Computer: CDC 7600
- o Operating System: NOS
- o Minimum Storage Required: 47K
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Should be available by early 1982

TIME REQUIREMENTS:

- o Several man-weeks to acquire data base
- o Less than one hour to structure data in model input format
- o Immediate analysis of output
- o Running time (CPU) - 1-2 seconds per single engagement

SECURITY CLASSIFICATION: UNCLASSIFIED (without input data)

FREQUENCY OF USE: Several times per month (on request)

USERS:

- o Principal: USAMSAA
- o Other: USAMICOM, CAA, TRASANA
  BDM, GRC

POINT OF CONTACT: Director, USAMSAA
Attn: DRXSY-CS/Mr. P. Beavers
Aberdeen Proving Ground, MD 21005
Telephone: AUTOVON 283-2611
Commercial (301) 278-2638

KEYWORD LISTING: Low-energy lasers; laser weapons; anti-sensor laser weapons; laser countermeasures; laser eye threat; electro-optical countermeasures; optical countermeasures

TITLE: LOCNAP 1 - LOC Network Analysis Program 1

PROPONENT: AF/SAGP

DEVELOPER: AF/SAGP

PURPOSE: Analysis

GENERAL DESCRIPTION: This expected value, time step model charts the flow of combat and supply vehicles through a multi-element line of comunication (LOC) network. The network can be stressed by any number of airstrikes (with a variety of conventional munitions) and the resultant flow pattern of disruptions and delays measured.

INPUT:

- o LOC segment (route) descriptors - length, capacity, priority, choke point vulnerability, and intersection configuration.
- o Convoy descriptors - uninterdicted rates of movement, convoy composition and specific vulnerabilities to the weapons being investigated.
- o Air interdiction descriptors - number of sorties, timing, weapons, and targeting philosophy.

OUTPUT: The output is a set of tabular and graphic descriptions of the LOC network condition and the resulting throughput as a function of time (currently in one hour increments) to include:

- o Segment traffic flow pattern and densities
- o Existing delays/blockages and backups
- o Total network throughput
- o Cumulative damage to fixed structures and vehicles (by type)

MODEL LIMITATIONS: Unknown

HARDWARE: IBM 30-32, System "J"

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: As the model is still evolving documentation is incomplete at this time.

TIME REQUIREMENTS: This model requires data describing:

- o Weapon effectiveness in terms of coverage per pass or sortie, and probability of kill or damage given a hit
- o Convoy formation and composition
- o A targeting strategy that one wishes to examine

The first set of data comes from availabile JMEM manuals and intelligence reports similar kinds of data. (AIDA is a RAND model that AF/SAGP uses to partially develop this data). The second set of data comes from appropriate manuals and intelligence reports describing enemy movement doctrines and philosophies. The last set of data is user developed and is a function of the set of questions being investigated. Data research and preparation take the majority of the time required to use this model. Once the input data has been established, it is easily input. The model requires only a fraction of a second of CPU time for each increment (hour) of time examined.

SECURITY CLASSIFICTION:

- o UNCLASSIFIED without the data base
- o Output classification is a function of the classification and cource of the input data

FREQUENCY OF USE: Unknown

USERS: AF/SAGP

POINT OF CONTACT: AF/SAGP
The Pentagon
Washington, D.C. 20330
Telephone: (292) 697-0862

TITLE: LOGATAK - Logistics System Attack Model

PROPONENT: Defense Nuclear Agency (NATD)

DEVELOPER: The BDM Corporation

PURPOSE: LOGATAK is a computerized, analytical, limited war, and logistical model. It is used for the analysis of the operations of a transportation network/distribution system and the impact of interdiction attacks on delivery of materiel and troops. LOGATAK focuses mainly on the analysis of effectiveness of interdiction on the operation of a logistics system--both destruction of inventory and disruption of transportation network facilities. It also deals with the operation of a logistics/distribution system in peacetime or nondisruptive wartime mode.

GENERAL DESCRIPTION: LOGATAK is a one-sided, stochastic model which deals with land and air forces. It was designed to deal mainly with forces at the division level and can be manipulated from the corps level down to the battalion level. This model is event-store and uses network analysis, queuing theory and inventory theory as methods of solution.

INPUT:

- o Network description
- o Scenario--location and requirements of units
- o Initial stockage
- o Location and time of attacks

OUTPUT:

- o Supply status for each unit quantity ordered vs quantity received
- o Transporation workloads
- o Interim reports at any specified time with flexible level of detail
- o Save run/restart options
- o Tape file for graphical post-processing

MODEL LIMITATIONS:

- o Logistical operations only
- o Does not model combat with FEBA advancement

HARDWARE:

- o Computer: CDC 6600/CDC Cyber 176
- o Operating System: NOS/BE
- o Minimum Storage Required: 250 Octal Words
- o Peripheral Equipment: Tape/disk drives, CRT/Card reader, printer

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation:
  - LOGATAK User's Guide
  - MAWLOGS Simulation System complete documentation (17 volumes)
- o User's and Programmer's manuals complete
- o LOGATAK model was built from MAWLOGS system--modular system with complete documentation

TIME REQUIREMENTS:

- o 1 month required to acquire base data
- o 2 man months required to structure data in model input format
- o 1200 seconds CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS:

- o Defense Nuclear Agency
- o US Army Logistics Center
- o The BDM Corporation
- o SHAPE

POINT OF CONTACT: Defense Nuclear Agency (NATD) Washington, DC 20305 325-7403 or The BDM Corporation McLean, VA 22101 (703) 827-7852

MISCELLANEOUS:

- o Continued enhancement of input/output capabilities keyed to particular applications
- o LOGATAK II model was developed to represent individual vehicles in transportation system

KEYWORD LISTING: Analytical, Limited War, Logistics, Land, Air, Computerized, One-sided, Stochastic, Event Store

TITLE: LOGATAK I

PROPONENT: USA Logistics Center

DEVELOPER: The BDM Corporation

PURPOSE: LOGATAK I is a computerized, analytical, limited war and logistical model. The model represents a multi-echelon supply system connected by a multi-mode transportation network. Movement of shipments throughout the network is simulated over time for analyzing traffic flows and overloads. The model utilizes transportation capabilities to move all shipment, and chooses alternative routes if the routes are overloaded. The material being demanded through the supply channels and delivered by the transportation system is measured by the result of the simulation run.

GENERAL DESCRIPTION: LOGATAK I is a two-sided, stochastic model which deals with land, air, and sea forces. It was designed for corps/theater level down to brigade/division level. This model is an event-store and uses network analysis, probability, and quering theory as methods of solution. The transportation network description data required may be obtained from the computerized DAMSEL system.

INPUT:

- o Combat Provided:
  - Time-phased location of combat service support units (20)
  - Demand generation, time-phased requirement of demand at each unit
- o Logistics Provided:
  - Initial stockage
  - Transportation network description
  - Transportation network changes, time phased

OUTPUT:

- o Supply status: By node/class quantity ordered, received, due-ins
- o Transportation Status: Network characteristics, workloads
- o For each link and terminal: Average load, peak load total throughput, Queue build-up, attack results

MODEL LIMITATIONS: The number of commodity items and supply nodes and user units that are imposed on the system are limited by the computer storage capability. Availability of carriers (e.g., trucks) and capacities are not explicity represented.

HARDWARE:

- o Computer: CDC 6000 CDC CYBER 176
- o Operating System: NOS/BE or NOS
- o Minimum Storage Required: 92,600

SOFTWARE:

- o Programming Language: FORTRAN/GASP
- o Documentation:
  - MAWLOG
  - LOGATAK Users Manual, The BDM Corporation, 1978
- o User's and Programmer's manuals complete

TIME REQUIREMENTS:

- o 3 months required to acquire base data if not in DAMSEL system
- o 2 man-months required to structure data in model input format
- o 1 through 20 days playing time
- o 30 days (if no change required) learning time for players
- o 3 months required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 times per year

USERS:

- o Defense Nuclear Agency
- o USA Logistics Center
- o The BDM Corporation

POINT OF CONTACT: MAJ Paul R. Schuessler
Simulation Division, OAD
USA Logistics Center
Telephone: AUTOVON 687-5640

MISCELLANEOUS: As it stands now, utilizing MAWLOGs capabilities, changes can be made to this model as required.

KEYWORD LISTING: Analytical; Limited War; Logistics; Land, Air; Sea; Computerized; Two-sided; Stochastic; Event-store; Transportation; Network

TITLE: LOGATAK II

PROPONENT: US Army Logistics Center

DEVELOPER: The BDM Corporation

PURPOSE: LOGATAK II is a computerized, analytical, model. It is used as a tool for evaluating the performance of the logistic system (supply functions and detailed transportation) when placed under enemy attack. The primary use of LOGATAK II is to represent the logistic system, including supply functions and detailed transportation under attack.

GENERAL DESCRIPTION: LOGATAK II is a two-sided, stochastic model which deals with land, air, and sea forces. It is defined by user, constrained by computer size. This model is event-store and uses network analysis and comparative analysis as methods of solution. LOGATAK II differs from LOGATAK I only in the representation of specific carriers in the transportation system. The network data required may be obtained from the DAMSEL system.

INPUT:

- o Supply Structure
- o Related dedication transportation assets
- o Scenario
- o Transportation network description

OUTPUT:

- o Computer printouts:
  - Performance of supply system
  - Transportation network workloads and status
- o Tape output to be further analyzed by Output Data Post-processing System (ODPS)

MODEL LIMITATIONS:

- o 40 Supply Modes
- o Approximately 400 terminals and links

HARDWARE:

- o Computer: CDC 6000, CDC CYBER 176
- o Operating System: NOS/BE or NOS
- o Minimum Storage Required: 300K (octal)
- o Peripheral Equipment: Disk, tape, printer, card reader

SOFTWARE:

- o Programming Language: FORTRAN, GASP

- o Documentation:
  - MAWLOGS System
  - LOGATAK II User's Manual
  - LOGATAK II Programmer's Guide, The BDM Corporation, 1979
- o User's and programmer's manuals complete

TIME REQUIREMENTS:

- o 2 months required to acquire base data if not in DAMSEL system
- o 4 months required to structure data in model input format
- o 20 minutes required CPU time per model cycle
- o 2 weeks learning time required for players
- o 2 months required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS:

- o US Army Logistics Center
- o SAI Corporation
- o The BDM Corporation

POINT OF CONTACT: Mr. Sherm Cockrell
Simulations Division, OAD
US Army Logistics Center
Fort Lee, VA 23801

KEYWORD LISTING: Analytical; Logistics; Land; Air; Sea; Computerized; Two-sided; Stochastic; Event Store; Transportation; Network

TITLE: Longley-Rice Wave Propagation Model

PROPONENT: AFEWC/SATB

DEVELOPER: Institute for Telecommunication Sciences, Boulder CO 80302

PURPOSE: To predict long-term median transmission loss over irregular terrain

GENERAL DESCRIPTION: The method is applicable for frequencies between 20 MHz and 20 GHz, antenna heights between 0.5 and 3000 meters, and elevation angles less than 200 milliradians. It may be used either with detailed terrain profiles for actual paths, or with profiles that are representative of median terrain characteristics for a given area.

INPUT:

Card deck defining terrain

Frequency

Distance, etc.

OUTPUT: Table of decibel (dB) attenuation values for the reliability and confidence intervals specified

HARDWARE:

Computer: UNIVAC 418 III

Operating System: RTOS-9E

Minimum Storage Requirement: 64,000 words

Peripheral Equipment: Card reader, tape drive, printer

SOFTWARE:

Programming Language: FORTRAN

Documentation: Longley-Rice - An Implementation - 1979

TIME REQUIREMENTS: Requires 1 hour to structure input data and approximately 5 minutes CPU time per communications link

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS: AFEWC/SAT

POINT OF CONTACT: AFEWC/SAT
Lt Sam Harris
San Antonio, TX 78243
Telephone: 512/925-2391/AUTOVON: 945-2391

COMMENTS: Model is being used to study communications jamming

TITLE: LOTRAK II - ASW Localization Model (Phase 1 and 2)

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Applied Physics Laboratory, Johns Hopkins University

PURPOSE: LOTRAK is a computerized, analytical model that simulates search, detection, classification, localization, tracking, attack, and reattack by two helicopters (Phase 1) and two destroyers (Phase 2) against a single submarine, two destroyers with LAMPS against a single submarine, and a VP against a single submarine (Phase 3). The model is primarily concerned with ASW missions, destroyer effectiveness, helicopter effectiveness, and weapon effectiveness (ASROC, torpedo). In addition, it also can develop optimum localization tactics for two helicopters (Phase 1), two destroyers (Phase 2), or LAMPS and VP (Phase 3).

GENERAL DESCRIPTION: LOTRAK is a two-sided, stochastic model involving air and sea forces. It can consider either one or two vehicles. Outcomes are freely assessed. Simulated time is treated on an event-store basis. Approximately 3 hours of real-time simulation are simulated in 6 seconds of computer time. The primary solution technique is kinematic, with probabilistic event assessment.

INPUT: ASW scenario

OUTPUT:

- o Event-by-event history
- o Statistical analysis summary
- o Trial summary

MODEL LIMITATIONS:

- o 2 helicopters and 1 submarine (Phase 1)
- o 2 destroyers and 1 submarine (Phase 2)
- o 2 destroyers with LAMPS and 1 submarine (Phase 3)
- o 1 VP and 1 submarine (Phase 3)

HARDWARE:

- o Computer: IBM 360/91
- o Operating System: OS-360
- o Minimum Storage Required: 350K

SOFTWARE:

- o Programming Language: PL/1
- o Documentation:
  (1) "ASW Localization Model - LOTRAK II (Phase II), Operations Manual," PAG 41-71, OM 3360
  (2) "ASW Localization Model - LOTRAK II (Phase I), Operations Manual," PAG 36-70, OM 3360

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(3) "ASW Localization Model - LOTRAK II (Phase III), operations Manual," PAG 49-72, OM 3360 and PAG 51-73, OM 3360

- o Both user's and technical documentation are complete for Phase 1, Phase 2, and Phase 3.

TIME REQUIREMENTS:

- o 3 weeks to prepare input
- o Approximately 4 seconds CPU time per model cycle (approximately 8 minutes run time per 100 replications)
- o 2 weeks to analyze and evaluate results

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: Once

USERS: Strategic Analysis Support Group, OP-96

POINT OF CONTACT: Assessment Division
Johns Hopkins Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Telephone: 953-7100, Ext. 7311

MISCELLANEOUS: LOTRAK II supersedes LOTRAK I.

KEYWORD LISTING: Analytical, Limited War, Air Forces, Sea Forces, Computerized, Two-Sided, Stochastic, Event Store

TITLE: MABS - Mixed Air Battle Simulation

PROPONENT: Systems Analysis Division
Plans and Analysis Directorate
US Army Missile Command
Redstone Arsenal, AL 35809

DEVELOPER: Stanford Research Institute

PURPOSE: MABS is a computerized, analytical model that provides estimates of the effectiveness of alternative mixes of air defense forces (SAM, gun, and manned interceptors) against a mixed force of hostile aircraft and tactical ballistic missiles. It is primarily designed to provide a capability to simulate battles in which ground-based air defenses and manned interceptors on one side oppose coordinated air and missile attacks by the other side. In addition, it is concerned with the evaluation of alternative tactics, threat responses, rules of engagement, ECM levels, and the effects of defense in various types of terrain foliage.

GENERAL DESCRIPTION: MABS is a two-sided, stochastic model involving land and air forces. It is designed to consider SAM sites, manned interceptors, anti-aircraft guns and threat vehicles on an individual basis if desired and will aggregate up to a maximum of 255 ground sites, 100 manned interceptors, and 800 threat vehicles. Simulated time is treated on an event-store basis. Probability theory and numerical analysis are the primary solution techniques employed.

INPUT:

- o Weapon system performance parameters, delay times, rates of fire, etc.
- o Geographical locations of defense entities
- o Flight paths of enemy aircraft, damage parameters, flight tactics, and engagement doctrine

OUTPUT: Computer printouts of complete battle history of results, or statistics of several replications. Selective debug information may also be printed.

MODEL LIMITATIONS:

- o 255 ground sites
- o 100 manned interceptors
- o 800 threat vehicles
- o ECM not explicitly simulated but reduced radar performance for ECM environment is an input
- o All threat flight paths are two-dimensional (however, see "Miscellaneous," below)

HARDWARE:

- o Computer: CDC 6400/6600
- o Operating System: SCOPE 3.3
- o Minimum Storage Required: 53,300 words for 6400 version
- o Peripheral Equipment: Card reader, line printer

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Documentation is available for MABS VIII-A and B

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 man-weeks to structure data in model input format
- o CPU time per model cycle can range from 10 seconds for an average iteration to 20 minutes for large problems

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Variable

USERS:

- o Principal: ODDR&E (Land Warfare)
- o Other: SRI, US Army

POINT OF CONTACT: US Army Missile Command
Redstone Arsenal, Alabama 35809
Telephone: 205/876-2926

MISCELLANEOUS:

- o MABS uses data from the Terrain Simulation and Intervisibility Model (TIP) and the Air-to-Ground Intervisibility Assessment Program (AGIAP) in the form of three-dimensional effects resulting from terrain following flight profiles and line-of-sight.
- o MABS currently includes fire coordination and IFF.

KEYWORD LISTING: Analytical Model, Damage Assessment/Weapon Effectiveness, Land Forces, Air Forces, Computerized, Two-Sided, Stochastic Event Store

TITLE: MACATAK - Maintenance Capabilities Attack Model

PROPONENT: US Army Logistics Center

DEVELOPER: The BDM Corporation

PURPOSE: MACATAK is a computerized simulation model of a logistical system. The model was designed to measure the survivability/vulnerability of the division level maintenance in conventional, chemical, and nuclear environments. The model assesses the effectiveness of the maintenance system as it experiences both attacks on the fleet of end items it supports and on the system itself.

GENERAL DESCRIPTION: MACATAK is a one-sided stochastic model which deals with land forces. It was designed for division level. This model is event-store and uses discrete event simulation as a method of solution.

INPUT:

- o Number and type equipment in each of three brigades and division
- o Number and MOS of maintenance personnel
- o Inventory of DX components in the division
- o Equipment usages rates and failure rates
- o Maintenance action information:
  - time to repair
  - MOS skills required
  - recommended level of repair
  - frequency of occurrence
  - contact team
- o Time to:
  - wait for part
  - travel
- o Scenario (includes damage to fleet and system, equipment usage rates)

OUTPUT:

- o Tabular and graphic printouts of probable equipment availability
- o Tabular listing of equipment maintenance turnaround time (TAT)
- o Tabular listing of TAT broken into function segments
- o Tabular and graphic printouts of queue sizes for parts, skills and equipments as a function of time

SOFTWARE:

- o Programming language: FORTRAN/GASP
- o Documentation:
  - MAWLOGS
  - MACATAK Users Manual, The BDM Corporation, 1980

TIME REQUIREMENTS:

- o Scenario dependent
- o 2 months to structure data in model input format
- o 30 minutes CPU time per model cycle
- o 2 weeks learning time for players
- o 2 months required to analyze results of model

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times yearly

USERS:

- o US Army Logistics Center
- o The BDM Corporation

POINT OF CONTACT: Dennis A. Hopkinson
US Army Logistics Center
ATTN: ATCL-OSF
Ft Lee, VA 23801
Telephone: AUTOVON 687-1050

KEYWORD LISTING: Analytical; Logistics; Land, Computerized; Stochastic; Event-Store

TITLE: MAC - Military Airlift Capability Estimator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Military Airlift Command (MAC)

PURPOSE: MACE is a computerized, analytical logistics model that assists the transportation planner by providing rapid estimates of force closure times, utilizing airlift means. MACE is primarily designed for users who have a requirement to obtain estimates of large-scale troop and cargo movement closure times using military airlift force structure and general planning data.

GENERAL DESCRIPTION: MACE is a one-sided, deterministic model designed to consider single aircraft, individual requirements, and individual APOE-APOD. Aircraft can be grouped by aircraft type. The model works by successive increments and its aggregative ability is consequently limited only by the capacity of the computer. Numerical analysis is the primary solution technique used.

INPUT:

- o Force definitions
- o Aircraft ground time
- o Requirements (including APOE-APOD and distances)

OUTPUT:

- o Schedule of the daily movement capability of the aircraft employed
- o Closure time at the destination of the force being moved
- o Individual requirement traces
- o Aircraft mission traces
- o Aircraft utilization summaries
- o Requirement closure summaries

MODEL LIMITATIONS:

- o Air is the only mode of transportation considered
- o Aircraft can be pre-positioned for the first acquirement only. Thereafter they automatically appear where needed
- o No time-phased processing of requirements

HARDWARE:

- o Computer: IBM 360/65; HIS 6080
- o Operating System: OS/MVT (IBM); GCOS (HIS)
- o Minimum Storage Required: 300K bytes (IBM); 36K words (HIS)
- o Peripheral Equipment: Magnetic tape and disks

SOFTWARE:

- o Programming Language: PL/1
- o Documentation: User's Manual - CSM-UP 112-70
- o User's documentation is complete. Technical documentation is not.

TIME REQUIREMENTS:

- o 1 man-month to acquire base data
- o 1-1/2 man-weeks to structure data in model input format
- o 30 minutes CPU time per model cycle
- o 2 man-weeks learning time for users
- o 1-1/2 man-weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 75 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-5464

MISCELLANEOUS:

- o MACE passes data to MASS (MACE Special Summaries Program) for summarization.
- o MACE generates data for MORMAC (MORSA/MACE Interface Program) to reformat MORSA requirements data.

KEYWORD LISTING: Analytical Model; Logistics; Air Forces; Computerized; One-Sided; Deterministic

TITLE: MACRO MODEL 12

PROPONENT: Military Airlift Command

DEVELOPER: MACRO Task Force

PURPOSE: The MACRO Model 12 is a computerized, analytical, logistics (including transport/transshipment) model evaluating the Military Airlift Command (MAC) airlift delivery system for wartime scenarios using notional locations and aggregate ground support services. The principal focus is the measurement of the total delivery performance of the MAC system reflecting the effects of aircraft queueing anywhere. The model addresses the effects of station denials, air refueling, alternate routing, various fleet mixes, and limited ground support.

GENERAL DESCRIPTION: The MACRO Model 12 is a one-sided, stochastic model. It was designed for individual aircraft movements and considers aircraft fleet size, cargo movement requirements, up to 8 aircraft types, up to 4 cargo classes, and subject to 18 notional locations. The primary solution technique used is network simulation using Q-GERT simulation language.

INPUT:

- o Applied aircraft (number and type)
- o Initial aircraft availability schedule
- o Cargo requirements (from-to by cargo class)
- o Current configuration of wartime scenario (if different from present configuration)

OUTPUT:

- o Flying hour requirements
- o Aircraft UTE rates
- o Route usage by leg segment
- o Aircraft waiting times
- o Movement closure time
- o Closure by cargo class and aircraft type
- o Delivery rate by cargo class
- o Location workload
- o Number of aircraft queueing by location
- o Aircraft handling requirements
- o Ground time histograms
- o System onload/offload history
- o Periodic reports reflecting aircraft and cargo status by location or various time intervals
- o Standard Q-GERT output including trace options
- o Designed user specified output as desired

MODEL LIMITATIONS:

- o All cargo is measured in terms of aircraft loads
- o Routing algorithm is completely probabilistic
- o Specified locations are aggregated into notional locations
- o Aircrew resources are not addressed
- o Tanker aircraft are assumed available by the model

HARDWARE:

- o Type of Computer: Honeywell 6080
- o Operating System: GCOS
- o Minimum Storage Required: 77K

SOFTWARE:

- o Programming Language: Q-GERT and FORTRAN
- o Documentation: Available in form of User's Manual, a Q-GERT User's Manual and technical documentation
- o Documentation was prepared for use by an operations research analyst and contains an overview of the model, input and output requirements, FORTRAN flow charts of all user-written sub-programs, and a complete listing of the necessary computer files.

TIME REQUIREMENTS:

- o 3 hours to structure data in model input format
- o 30 minutes CPU time for 90-day war scenario
- o 6 hours to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o Principal: MAC Headquarters
- o Other: N/A

POINT OF CONTACT: Capt Victor J. Auterio
MACRO Task Force, HQ MAC/XPSR
Scott AFB, Illinios 62225
Telephone: Autovon 638-3470

KEYWORD LISTING: Analytic, Logistics, Air Forces, Computerized, One-Sided, Stochastic, Event Store

TITLE: MAIT - Matrix Analysis of the Insider Threat

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Science Application Inc. (SAI), La Jolla, CA

PURPOSE: MAIT is a global evaluation modeling system for fixed site physical security systems based on the access and control rights of site personnel.

GENERAL DESCRIPTION: MAIT uses an input command language to input a representation of the facility, access and control rights of personnel, and security system. By evaluation of all combinations of personnel, those individuals or pairs are found which present a potential threat to the security system.

INPUT:

- o Facility description
- o Personnel access
- o Personnel control
- o Security system

OUTPUT:

- o Personnel pairs
- o Critical paths

MODEL LIMITATIONS: Facility size

HARDWARE:

- o Computer: PE 3220, 7/32
- o Operating System: OS 32/MT
- o Minimum Storage: 400 KB
- o Peripheral Equipment: Printer

SOFTWARE:

- o Language: FORTRAN VII
- o Documentation: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 10-16 hours to input facility, security system, personnel access/control
- o 10 minutes for complex facility

SECURITY CLASSIFICATION:

- o Model: UNCLASSIFIED
- o Data: Function of facility
- o Results: Function of facility

POINT OF CONTACT: Mr. Ed Jacques
NSWC/G42
White Oak
Silver Spring, MD 20910
Telephone: (202) 394-2396

KEYWORD LISTING: Physical Security Modeling, Insider Threat Analysis

TITLE: MASC - Maintenance Support Concepts Model

PROPONENT: US Army Logistics Center

DEVELOPER: BDM Services Company

PURPOSE: MASC is a computerized, analytical, and logistical model. It is intended to measure the impact on maintenance system effectiveness of changes in maintenance policy and organization.

GENERAL DESCRIPTION: MASC is a one-sided stochastic model which deals with land and air forces. No limitation on size of individual units. Model is limited to a heirarchy of no more than six echelons or levels. This model is event-store and uses discrete event simulation as methods of solution.

INPUT:

- o Number of maneuver units, number and type equipment in units, number and MOS of maintenance personnel
- o Scenario (includes unit activity, description of maintenance support)
- o Assignments by unit, equipment usage rates
- o Probability density functions for time to diagnose
- o Statement of Probability
  - Correct Diagnosis
  - Correct Repair
  - Parts Availability
- o Time to
  - Wait for parts
  - Repair
  - Inspect
  - Travel
  - Wait for travel

OUTPUT:

- o Tabular and graphic printouts of probable equipment availability
- o Tabular listing of equipment maintenance turnaround time (TAT)
- o Tabular listing of TAT broken into function segments
- o Fixed output format, no options

HARDWARE:

- o Computer. CDC 6500
- o Operating System: NOSBE II
- o Peripheral Equipment: 2 nine track tapes, 2 disc pacs

SOFTWARE: Programming Language: FORTRAN IV Ext, GASP IV

TIME REQUIREMENTS: Scenario Dependent

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Less than once a year since initial development

USERS:

- o US Army Logistics Center
- o US Army OCC&S

POINT OF CONTACT: Dennis A. Hopkinson
US Army Logistics Center
ATCL-OS
Fort Lee, VA 23801
AUTOVON: 687-1050

KEYWORD LISTING: Analytical, Logistics, Land, Air, Computerized, One-sided, Stochastic, Event Store

TITLE: MATSS - Movable Area Target Survivability Simulator

PROPONENT: Science Applications, Inc. (proprietary model)

DEVELOPER: Science Applications, Inc.

PURPOSE: MATSS is a computerized analytical tool that predicts (1) the survivability of a family of high-value targets and (2) the effectiveness of the opposing target acquisition and attack systems in a theater war setting. The model is structured to accommodate a full range of targets occupying the deep battlefield (i.e., beyond line of sight), to include nuclear delivery units, communication centers, and supply points. It simulates the target acquisition, attack decision, and attack processes carried out against these targets. The model is unique in its treatment of the fusion of target information collected by different sensor types, making it appropriate and applicable to "movable" as well as fixed targets.

GENERAL DESCRIPTION: MATSS is a one-sided, event-store simulator involving a prescribed set of high-value targets on one side and the conventional and unconventional forces employed against deep targets on the other side. The model simulates the tactical operations of the targetable units, including the generation of visual, aural, RF, IR, and radar imaging signatures. The opposing acquisition and attack systems respond by gathering target information from their various sensors, by making attack decisions on individual targets, and by monitoring their "perceived" target list. The key element in the model is the "state-of-knowledge" (SOK) index by which the threat system fuses target information from multiple sensors and by which the attack decision process is triggered. Sensors include tracking agents, low level agents, COMINT, RDF, satellite reconnaissance, airborne visual, IR, radar, and counterbattery radar. The attack mechanisms include unconventional warfare teams, aircraft, and missiles. The one-sided model can be applied either in a red-on-blue mode or in a blue-on-red mode. The model has a limited "two-sided" aspect in that it reflects the attrition of the agents, unconventional warfare teams, and air assets. The simulation techniques used in the model are stochastic treatment of chance events and stochastic treatment of the timing between events in a sequence.

INPUT:

- o Target System
  - initial deployment of individual units
  - movement rules, performance parameters
- o Threat System
  - sensor detection probabilities, reporting time delays
  - attack modes: resource limitations, range, response times, required SOKs
- o Scenario Exogenous Events
  - readiness/alert
  - weather/visibility conditions
  - scheduling of sensors

OUTPUT:

- o Event list
- o Time-slice Status Reports: User may select any combination of
  - real target list
  - perceived target list
  - cumulative damage summary (by target type)
  - cumulative resource expenditure summary

MODEL LIMITATIONS:

- o Damage assessment and reconstitution must be analyzed off-line
- o High-value target systems must be analyzed separately, necessitating the slicing of the threat on input
- o Target systems close to the FEBA (i.e., artillery units) cannot be analyzed because the central battle is not modeled
- o Parametric limits on individual targets (99), target types (25), attack modes (15)

HARDWARE:

- o Computer: DECsystem-10, CDC CYBER 176
- o Operating System: TOPS-10, NOS
- o Minimum Core Storage Required: 70K
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN IV; duo-compilable source code
- o Documentation: Description available at SAI; no formal documentation

TIME REQUIREMENTS:

- o To acquire data base: 2 to 6 weeks, depending on (1) user's familiarity with model input structures and, (2) state of completeness of target system concept
- o To structure model Input Data Set: 1 day
- o CPU time per run: 30 to 150 seconds, depending on scenario, at least 5 runs required for case study
- o To analyze and evaluate results: 1 day

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20 to 30 case studies (100 to 150 runs) per year

USERS: SAI has used this model in programs for the following client agencies:
- o Principal users: DNA, OUSRE, OSD (PA&E)
- o Other users: Defense contractors

POINT OF CONTACT: Science Applications Inc.
ATTN: Military Requirements Operation
1710 Goodridge Drive
McLean, Virginia 22102

MISCELLANEOUS: MATSS contains in its source program a growing "library" of movement mode routines. The library currently contains movement mode routines for deep target systems (e.g., PERSHING, GLCM) and for shallow systems (i.e., LANCE). Movement mode routines for second echelon maneuver units are being developed.

KEYWORD LISTING: Analytical; Theater War; Land, Air, Computerized, One-sided, Stochastic, Event-store; Target acquisition, Signatures

TITLE: MAWLOGS - Models of the Army Worldwide Logistics System

PROPONENT: US Army Logistics Center

DEVELOPER: General Research Corporation

PURPOSE: MAWLOGS is a computerized, simulation logistics modeling system that generates models to simulate the activities and measure the behavior of a particular logistics system structure with specific policy and procedure content at a level of detail chosen by the user. Its primary focus of concern is to simulate any of a wide range of alternative logistics system structures, policies and procedures involving maintenance, supply, transportation, and communications and their interactions, and to measure characteristic workloads, performance, and costs.

GENERAL DESCRIPTION: The keystone of the MAWLOGS system is the model assembler, a program which constructs a simulation model of a system represented as a network of functional nodes whose policy and procedural content are specified in terms of modules (i.e., blocks of computer program logic representing a logistics activity or policy). The level of aggregation may be varied widely, from much to little detail, from troop unit to wholesale activities. Simulated time is treated on an event-store basis. The primary solution technique of MAWLOGS is stochastic discrete event simulation. Except for a shortest chain algorithm in the route selection logic of transportation, no optimizing algorithms are in the present module library, but they can be added.

INPUT:

- To model assembler: Description of system for which a model is to be generated--in terms of nodes and modules, a module library (on tape or cards)

- To a model: Policy parameter settings, resource levels, demand characteristics of supported population, performance characteristics, such as capacities, delay times, and constraints of system elements.

OUTPUT: Output is in the form of computer printouts of summary statistics showing totals, averages, maxima, minima, variances, and histograms. Optionally, a tape file of detailed transaction data for a variety of post analyses may be obtained. Post processors are available for analyzing the time behavior, sample size, and statistical confidence of a variety of variables and for developing a variety of costs of the logistics system. A routine to plot graphs on a printer is available.

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MODEL LIMITATIONS: The modeling system is open-ended in that the user is free to add any module of interest to the module library. Thus, there is no limitation to the scope of the model. However, modules to be used together must have compatible data structures, which limit the number of feasible combinations that may be formed. There is a small loss in efficiency (i.e., a greater running time) caused by the logic linkage generated by the assembler to make possible the flexibility of model definition described above.

HARDWARE:

- Computer: CDC 6400 or CDC 6500
- Operating System: SCOPE 3, 4
- Minimum Storage Required: Variable, from about 20,000 words upward
- Peripheral Equipment: Card reader, printer, two tape files plus one to five tape or disk files

SOFTWARE:

- Programming Language: FORTRAN
- Documentation: ANSI FORTRAN (CDC FTN Version). May contain an occasional Control Data Corporation 6000 series FORTRAN peculiarity.
- User's documentation and technical documentation is complete.

TIME REQUIREMENTS:

- CPU time varies from 1 minute to hours, but 1 hour has been typical.
- Approximately 3-6 months to analyze and evaluate results, varying with the problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: BDM Corporation and US Army Logistics Center

POINT OF CONTACT: US Army Logistics Center
Operations Analysis Directorate (ATCL-OS)
Fort Lee, VA 23801
Telephone: AUTOVON 687-5640/3449

KEYWORD LISTING: Analytical Model; Logistics; Computerized; Stochastic; Event Store

TITLE: MAWM - Modular Air war Model

PROPONENT: McDonnell Aircraft Company (IRAD funding)

DEVELOPER: McDonnell Aircraft Company, McDonnell Douglas Corporation

PURPOSE: Analysis of relationships among aircraft capabilities and quantities in combined air-air and air-ground combat, and the impact of aircraft design alternatives on overall theater-level air and ground combat results.

GENERAL DESCRIPTION: MAWM is a two-sided, deterministic, event-store model of conventional theater-level conflict. This model emphasizes the impact of tactical aircraft on theater outcomes. Launching and attrition of air raids against specific airbases and ground units are represented by event. Geography, including airbases, is treated explicity. Ground forces are assessed at the armored division equivalent level. Inputs include tables of aircraft effectiveness data from lower level models.

INPUT:

- o Airbases and initial FEBA locations
- o Aircraft assets, by type and airbase
- o AAA and SAM assets
- o Maneuver unit assets (armored division equivalents)
- o Initial allocation of aircraft to missions (airbase attack, escort, ground attack, intercept, CAP)
- o Raid timing and sizing factors
- o Lookup tables for air-air attrition rates based on types engaging and engagement force ratio
- o Surface-to-air PKs by SAM type/aircraft type combination
- o Airbase attack attrition, damage and repair factors
- o Ground attack attrition rates per sortie
- o Ground war factors affecting deployment of reserves, terrain and defense posture
- o Aircraft failure rates, repair times and turnaround rates

OUTPUT:

- o Summary report (one page) for each run. Summaries of multiple runs can be stored on disk for comparative analysis.
- o Basic daily/periodic report:
  - Aircraft inventories
  - Aircraft losses by type by source
  - Sorties flown and successful sorties by mission type
  - Distribution of surviving aircraft by state (airborne, mission-ready, turnaround, and repair substates)
  - Airbase status
  - FEBA positions
  - Ground unit status
- o A more detailed event ledger can also be obtained for selected intervals

MODEL LIMITATIONS:

- o Straight line FEBA throughout theater
- o Ten SAM/AAA types (no limit to number of aircraft types, airbases, or ground units, except core constraint)
- o Limited logic for dynamic allocation of aircraft against specific ground units
- o Unconstrained logistics
- o Perfect information (no C3I degradations)

HARDWARE:

- o Computer: CDC 760, CDC 176, VAX-11
- o Minimum Storage Required: 360K
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation:
  - Users Manual
  - Annual IRAD project descriptions
  - Sample problem report

TIME REQUIREMENTS:

- o 5 months to develop new data base, including aircraft engagement effectiveness data and air and ground orders of battle
- o 10 seconds CPU time per day of war (CDC 760)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 4 projects per year (many runs each project)

USERS: McAir project personnel in Advanced Design and Advanced F-15

POINT OF CONTACT: Mr. John L. Schudel
McDonnell Aircraft Company
P.O. Box 516, Dept 345, Bldg 32
St Louis, MO 63166
Telephone: (314) 233-6470

MISCELLANEOUS: The ground war module currently used was extracted from RAND's TAGS Model (based on ATLAS). Tentative plans are to replace the TAGS treatment with ground war and supplies modules of IDA's TACWAR Model in 1982. Additional work is planned in the area of resource allocation and the air interdiction mission.

KEYWORD LISTING: Computerized, theater-level, simulation, tactical aircraft, air war analysis

TITLE: MACS - MARS/AMSAA Minefields and Barriers Combat Simulation

PROPONENT: MA4 Branch, RARDE, Sevenoaks, England and AMSAA, Aberdeen, MD

DEVELOPER: As above in conjunction with computer software contractors: Scicon International Ltd., UK and Falcon Research Ltd., USA

PURPOSE: To provide a mean cost basis for investigation of all aspects of interest with regard to minefield and barrier warfare.

GENERAL DESCRIPTION: MACS is an event sequenced, two-sided, stochastic simulation for representing a battalion versus combat team battle. A detailed model of terrain is used so that its effect on mobility and intervisibility are represented. Terrain heights are recorded at the intersection of major grid lines (typically every 100m) while intermediate heights are calculated by linear interpolation. Surface vegetation and soil type are described with a series of smaller grid squares (typically 20m x 20m). There is a detailed representation of both RDM and conventional minefields, barriers, Armoured Defence Vehicles, target acquisition, and direct and indirect fire weapon systems. Standard operating procedures for vehicles may be modified for any time or phase of the battle. They may also be conditional on situations that arise during the battle. All input is processed (pre-processor stage) before the running of the MACS main simulation. After a required number (typically 10) of replications have been completed an analysis program collates the more pertinent results.

INPUT:

- o Vehicle data (dimensions, engine/mobility characteristics)
- o Weapon data (load and aim times)
- o Ammunition data (time of flight curve - a function of amount of target visible (3 types), target vehicle type, target aspect (3 types), ammunition type and range for stationary and moving observer and target
- o Mines data (actuation limits, probability of detonation and probability of kill against track, belly, plough, skid and roller of enemy vehicles)
- o Disposition of vehicles, minefields, barriers
- o Orders
- o Terrain data - assessed from a data base
- o Intervisibility data - calculated from separate program

OUTPUT: Detail of each event. Analysis of kills as a function of time, analysis of distribution of kills and shots as a function of range, summaries of each replication.

MODEL LIMITATIONS: Currently no representation of smoke nor infantry. The effects of command and control delays are not fully represented, nor are fatigue and the general fog-of-war.

HARDWARE:

- o ICL 1906A aat RARDE
- o CDC 7600 at AMSAA

SOFTWARE:

- o Written in ANSI FORTRAN
- o Present size is 400,000 words overlaid to 140,000 words
- o Documentation exists at RARDE and AMSAA

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used in three studies between 1977 to 1980 to assess the effect of various barrier systems. Not at present being used by RARDE in a study.

USERS:

- o MA4 Branch, RARDE, Sevenoaks, England
- o AMSAA, Aberdeen Providing Ground, MD

MISCELLANEOUS: With 23 Red vehicles and 12 Blue vehicles each replication took an average of 5.5 minutes of CPU time on an ICL 1960A. Reducing the number of blue vehicles to 6 each replication took an average of 4 minutes CPU time. The pre-processor and analysis programs require about 60 minutes of CPU time and 60,000 words for a similar scenario

TITLE: MEM-Multiple Engagement Module

PROPONENT: Joint Strategic Target Planning Staff (JSTPS)/CNO (OP-654)

DEVELOPER: Science Applications, Inc.

PURPOSE: MEM is a computerized, analytical, general war model. It assesses attrition of the ICBM/SLBM portion of the SIOP visible to Soviet ballistic missile defenses. MEM is a computer program for evaluating attrition of the US ICBM/SLBM forces during an attack against defended targets. The MEM is a time sequenced program which steps through the engagement in chronological order: entering vehicles, moving them along their trajectories, determining radar acquisitions, computing intercept conditions, launching interceptors, and processing the nuclear detonations which result. Measures of merit computed include the Probability of Penetration (PTP) by individual sortie basis, by weapon systems and by targets. MEM also concerns itself with ABM fratricide avoidance, chaff/blackout, radar data processor overload, ABM defense doctrines, and nuclear effects.

GENERAL DESCRIPTION: MEM is a two-sided, stochastic model which deals with land and sea forces. It was designed to be executed for individual sorties; it can be manipulated for 6 radar types, 30 radars, 5 ABM types, 15 weapon types and 10 booster types. The level that MEM was primarily designed to operate on is the individual sortie or weapon system level. It can range from 1000 exoatmospheric objects to 250 total targets. MEM is a time-step model which uses Runge-Kutta numerical integration and spherical rotating earth equations of motion.

INPUT:

- o Weapon data file
- o Nuclear effects data file
- o Defense data file
- o Offensive/target data file

OUTPUT:

- o Attrition summary
- o Launch summary
- o Launch rate plots
- o Sortie analyses
- o PTP summary
- o Radar load plots
- o Engagement history
- o Battle summary
- o Common block contents

HARDWARE:

- o OP 654 (NARDAC) Washington, DC
  - Computer: UNIVAC-1108
  - Operating System: EXEC-8
  - Minimum Storage Required: 64K
  - Peripheral Equipment: Tape drive, printer
- o JSTPS (Offutt AFB)
  - Computer: IBM 3033
  - Operating System: V52
  - Minimum Storage Required: 400K bytes
  - Peripheral Equipment: Tape drive, printer

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation:
  - MEM User's Manual, June 1975
  - MEM Subroutine Descriptions, June 1975
  - MEM Testing and Evaluation Summary
  - MEM Program Description, June 1975
- o User's and programming manuals are complete

TIME REQUIREMENTS:

- o 1 month required to acquire base data
- o 1/4 man-months required to structure data in model input format
- o 30 minutes CPU time per model cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 40 times per year

USERS:

- o JSTPS
- o OP-654, JCS (SAGA), DIA

POINT OF CONTACT: Deputy Chief of Naval Operations (OP-654C)
Plans, Policy and Operations
The Pentagon, Washington, D.C.
Telephone: 697-7300

MISCELLANEOUS:

- o Linked to Nuclear Exchange Model (NEMO-III)
- o MEM ABM attrition data file is used to supplement the NEMO III simulation results in the SIOP/RISOP games
- o Planned revision of radar filtering algorithms

KEYWORD LISTING: Analytical; General War; Land; Sea; Computerized; Two-sided; Stochastic, Time Step

TITLE: MIDAS - Model for Interactive Deployment by Air and Sea

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The Model for Interactive Deployment by Air and Sea is a computerized analytical model designed to provide a method for measuring the capabilities of a fixed set of transportation resources. Additionally, it determines levels of equipment prepositioning required to deliver a specified set of military forces and supplies in contingency operations.

GENERAL DESCRIPTION: The MIDAS model represents a further advance in strategic mobility models. While it is capable of doing everything that its predecessor, the ISDM model can do, it incorporates additional refinements that required addressing. It is capable of scheduling both the movement of personnel and cargo, it can restrict the throughput of APOEs and APODs and can allocate airlift based on theaters of operation. With sealift, it is capable of specialized uses and capabilities of specific ship types as well as simulating different types of ship operations to different theaters.

INPUT:

- Scenario file containing all data relating to the scenario
- Force requirements data file containing all of the data on forces
- Ships data file containing all ship data pertaining to characteristics and availability

OUTPUT:

- All ISDM outputs to include specialized reports that relate to the model's refinements

POINT OF CONTACT: Organizaitcn of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 695-3156

TITLE: Military Satellite Communications (MILSATCOM) (in development)

PROPONENT: AFEWC/SA

DEVELOPER: Dell Technical Operations

PURPOSE: Simulate and analyze vulnerability of military satellite communications.

GENERAL DESCRIPTION: MILSATCOM Vulnerability Assessment Model (MVAM) is a general model which enables analysts to simulate any sort of current or proposed satellite communications system to determine vulnerability of the systems to jamming.

INPUT: Equipment characteristics, weather scenario.

OUTPUT: History files.

MODEL LIMITATIONS: Unknown.

HARDWARE: Type Computer: Being developed on CDC CYBER 172 and will be converted to run on PDP 11/70.

Operating System: CYBER 172
PDP 11/70 - IAS V3.0

Minimum Storage Requirements: Unknown.

Peripheral Equipment: Disc drives, line printer.

SOFTWARE: Programming Language: FORTRAN IV

Documentation Identification and Availability: Standard DEC documentation.

TIME REQUIREMENTS: Unknown.

SECURITY CLASSIFICATION: Unclassified.

FREQUENCY OF USE: Projected, 50 times per year

USERS: AFEWC/SA

POINT OF CONTACT: AFEWC/SA
Lt Col Kenneth D. Herring
San Antonio TX 78243
Telephone: 512/925-2514/AUTOVON: 945-2514

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TITLE: Mine Hunting Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory Warfare Analysis Department

PURPOSE: The Mine Hunting Model is a computerized, analytical model that evaluates the effectiveness of a mine field against mine hunting countermeasures. The model evaluates proposed minefields, with the purpose of helping the minefield planner to determine the number and type of mines, ship counts, arming delays, replenishments, mine settings, location of fields, etc., necessary to obtain the desired results against an expected mine hunting effort.

GENERAL DESCRIPTION: The Mine Hunting Model is a two-sided, stochastic model involving sea forces only. It is capable of considering mines and ships on an individual basis if desired, and can aggregate up to a maximum of 300 minelike objects of 60 types, 50 countermeasure ships, and 5 types of traffic ships. This upper limit may be indefinitely extended, however, depending on available computer capacity. Simulated time is treated on an event-store basis. Monte Carlo simulation and probability are the primary solution techniques used.

INPUT:

- o Mines and their charcteristics
- o Characteristics of mine hunting ships
- o Characteristics of traffic ships
- o Configuration of minefield and channel
- o Type of bottom and amount of clutter
- o Expected schedule of countermeasures and traffic

OUTPUT:

- o Computer printout giving mines detected and neutralized, mines fired, damage to ships, and threat of the minefield as a function of time.
- o The interval at which output is given is variable. Printout of status of entire minefield with other output is optional.

MODEL LIMITATIONS:

- o Computer storage
- o Cost of storage and running time

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE
- o Minimum Storage Required: 50K words

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SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a command manual programmers manual, and input guide.

TIME REQUIREMENTS:

- o 2 days-week to acquire base data
- o 1 day to structure data in model input format
- o CPU time depends on the length of time simulated and the number of mines involved, e.g., a mine simulation over days with heavy traffic took 500 seconds of CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice per year

USERS: NSWC/DL for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 703/663-7406 or 663-8645

MISCELLANEOUS: The Mine Hunting Model has the option of using the output of the Mine Delivery Model and the Minefield Planning Model.

KEYWORD LISTING: Analytical Model, Damage Assessment/Weapon Effectiveness, Sea Forces, Computerized, Two-Sided, Stochastic, Event Store

TITLE: MOST - Multiweapon Optimizer for Strategic Targets

PROPONENT: Defense Nuclear Agency (NATD)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: MOST is a computerized, analytical, damage assessment/ weapons effectiveness model. It selects nuclear weapon aimpoints for complexes of targets, minimizing the number required and taking compound damage into account. It was designed primarily to find minimum number of weapons required to achieve multiple damage requirements on target complexes.

GENERAL DESCRIPTION: MOST is a one-sided model which deals with land, air, and sea forces.

INPUT:

- o Set of targets
- o Target kill requirements
- o A weapon

OUTPUT: A set of aimpoint and associated targets with damage analysis.

MODEL LIMITATIONS: Does not currently handle multiple weapon types.

HARDWARE:

- o Computer: Major Mainframe
- o Operating System: Any
- o Minimum Storage Required: 35K 32-bit words
- o Peripheral Equipment: Disk storage

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: User's guide and project final report
- o User's and Programmer's manual complete

TIME REQUIREMENTS:

- o Time required to acquire data base is immediate
- o Time required structure data in model input format is immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USER: JSTPS

POINT OF CONTACT: Defense Nuclear Agency (NATD)
Washington, DC 20305

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Land, Air, Sea, Computerized, One-sided

TITLE: MPRES - Method for Presenting Received Signals

PROPONENT: CINCPAC

DEVELOPER: Calspan Corporation

PURPOSE: The purpose of the model is to determine, given an air defense situation, the times at which each target is detected or redetected by each radar, if at all; the times at which each target is lost by each radar, because of a face or terrain masking, and the length of each radar track. The main purpose for using the model at CINCPAC was to generate the so-called "detect/leave" events needed for the air defense model known as K-MABS. However, it was also used to determine radar detection ranges and time windows under noise jamming.

GENERAL DESCRITPION: The model periodically updates the positions of single aircraft and computes the signal-to-noise ratio for each aircraft and radar pair. Several aircraft can be grouped into raid points which are treated as notional aircraft. Signal-to-noise ratio is converted to detection probability using curves determined empirically. The geographical area that can be handled is limited only by the extent to which the Earth's surface can be approximated by a rectangular coordinate system.

INPUT

- For each aircraft: The flight path in terms of a series of straight line segments in three dimensions
- For each aircraft: Radar cross section as a function of aspect in three dimensions
- For each jammer: Power and antenna pattern as a function of aspect in three dimensions
- For each radar: Antenna pattern in three dimensions, vertical and horizontal beam widths, PRF, receiver noise figure, power

OUTPUT:

- A coded display with time on the abscissa and radars listed on the ordinate, showing, for each raid point, the times the aircraft is detected by each radar and the times when the target is not detectable.
- Magnetic tape containing all detect and leave events for input into other models.

MODEL LIMITATIONS: The only form of jamming handled explicitly by the model is noise jamming.

HARDWARE:

- Computer with FORTRAN compiler
- Core requirements vary with scenario, 100-200K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: None

TIME REQUIREMENTS:

- o To acquire data base: varies
- o 3-5 days to structure data in model input format
- o To analyze output: varies
- o 3-5 days for player learning time
- o Playing time per cycle: varies
- o 60-180 minutes CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: Research and Analysis Division
CINCPAC, Box 15, J55
Camp H. M. Smith, HI 96861

FREQUENCY OF USE: As needed

USERS:

- o CINCPAC
- o US Forces, Japan
- o Japan Self Defense Forces

KEYWORD LISTING: Radar Effectiveness, Jamming Effectiveness, Noise Jamming simulation, Air Defense.

TITLE: MS3 - Missile Surveillance System Simulation

PROPONENT: DCA/CCTC - C610

DEVELOPER: DCA/CCTC - C630, BDM, CSC, MITRE

PURPOSE: The sponsor simulation produces messages. The messages properly sequenced and interpreted on graphic displays, aid in the training of those responsible for the identification of a valid attack and determinaton of proper methods for dealing with the attack.

GENERAL DESCRIPTION: A launch detected by a sensor whether singly or in a salvo is stored as an event. Probability determines detection at each sensor. If detected, the missile is tracked out of coverage, while messages are produced at intervals during detecton and tracking.

INPUT: Weapon strike information and scenario and sensor start and stop times.

OUTPUT: Ouput consists of computer listings with trajectory tracking and impact data for each sensor sequenced by event time. An output message processor generates sensor messages to both paper and tape. The tapes are input to CCPDS simulation displays, the DDC files and the NORAD 427 file.

HARDWARE:

- o Computer: Honeywell 6080
- o Operating System: GCOS
- o Minimum Storage Required: 55K
- o Peripheral Equipment: Tapes, Disk Storage, Printer

SOFTWARE:

- o Programming Language: FORTRAN and GMAP
- o Documentation: MS3 Run Book, 30 Jun 78, MS3 User's Manual, 29 Sep 79 (S), documentation on individual sensors and modules available (all Secret)

TIME REQUIREMENTS:

- o To acquire Data Base: Reload upon new release - 1 day
- o To Structure Data in Model Input Format: 2 days
- o To Analyze Output: 1 hour
- o Player Learning Time: 1 day
- o Playing Time per Cycle: 1 day
- o CPU Time per Cycle: 1 hour

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: As required

USERS: SAGA

POINT OF CONTACT: Mr. Joe Callier (C610)
Defense Communications Agency
Command and Control Technical Center (C312)
The Pentagon
Washington, DC 20301
Telephone: (202) 437-2647

MISCELLANEOUS: A new format used to generate data for the CCPDS wallboard display will be incorporated in a few months and it has been proposed to combine MS3 with two other existing models to produce a more versatile TWAA model.

KEYWORD LISTING: NORAD; sensors; simulation; tactical; warning; attack; assessment

TITLE: MTM - McClintic Theater Model

PROPONENT: US Army War College

DEVELOPER: US Army War College

PURPOSE: The McClintic Theater Model was designed to fulfill two purposes at the US Army War College. It is used as part of the Army War College curriculum as an educational tool for senior officers, and it is used by general officers and their senior staff as an analytical tool to examine corps strategy, tactics, and sustainability as part of the US Army Tactical Command Readiness Program. The model is used to compare alternate military concepts, strategies, and forces in order to gain insight into potential problem areas and to uncover opportunities for success. It serves as a dynamic discussion vehicle for examining time and space relationships on the battlefield, to include joint operations. Utilization of the model allows the players to become familiar with real-world aspects of the terrain and units in the order of battle.

GENERAL DESCRIPTION: The McClintic Theater Model is a closed, two-sided, four-service, interactive computer model that allows simultaneous input of orders from both sides. It is built on a philosophy which recognizes that those who participate in the war game learn the most from it. Consequently, the model has been written so that the players do not need a knowledge of computer programming. Player inputs (orders) are entered in a natural, English-like manner in which spacing, order, and extraneous words do not matter. The model is time driven at rates varying from zero up to 72 to 1, dependent upon the players' ability to keep up. It is a four-service model that not only looks at each service separately, but also looks at the interactions between services, such as airlifts, sealifts, naval gunfire, suppression of enemy air defenses, close air support, and interdiction. Factors considered include weather, intelligence, local population, ten classes of supplies, unit-carrying capacities, and others.

INPUT:

- o Pregame
  - Terrain and road network data
  - Orders of battle (25 data items on each unit)
- o During game
  - Orders to units (free form, English-like)

OUTPUT:

- o During Game
  - Estimated times of arrival
  - Logistics warnings
  - Logistical reports
  - Situation reports
  - Intercepted enemy radio traffic

- Indirect fire damage reports
- Airstrike damage reports
- Nuclear/chemical weapons usage
- Five types of intelligence reports
- Combat/battle reports
- Other reports

o Afteraction Analysis
  - Graphical outputs in graph, bar chart, or map form, of any variables in the war game

MODEL LIMITATIONS:

- o Maximum number of units is 300 (These limitations can be overcome by changing the DIMENSION statements if additional memory is available)
- o Maximum map area is 6 feet high by 8 feet wide (These limitations can be overcome by changing the DIMENSION statements if additional memory is available)

HARDWARE:

- o Computer: Honeywell 6060 (WWMCCS or Altos 800 series microcomputer)
- o Operating System: GCOS or microcomputer OS
- o Minimum Storage Required: 69K Honeywell, 208K Altos
- o Peripheral Equipment: Tektronix Graphics Terminal (Optional)

SOFTWARE:

- o Programming Language: FORTRAN (Honeywell); PASCAL (microcomputer)
- o Documentation: McClintic Theater Model
  - Volume I - War Game Director's Model
  - Volume II - User's Manual
  - Volume III - Controller's Manual

TIME REQUIREMENTS:

- o One day to acquire existing data base through WWMCCS Information Network (WIN) or to mail computer tapes
- o One day to structure new data in model input format
- o Output analysis time varies with purpose of the exercise, but is assisted by graphical outputs at the end of the war game
- o Run time varies with length of time to be simulated and speed of play (up to 72 times real time)
- o 2-4 hours for player learning time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Monthly at USAWC

USERS: JCS/SAGA, Pentagon
Readiness Command, MacDill AFB, FL
VII Corps, Stuttgart, FRG
Army War College, Carlisle Barracks, PA

POINT OF CONTACT: Commandant
US Army War College
ATTN: AWCAG (Mr. Fred McClintic)
Carlisle Barracks, PA 17013
Telephone: AUTOVON - 242-3017
Commercial - (717) 245-3017

KEYWORD LISTING: Theater level, Four-service model, Integrated battlefield, Multi theater warfare, Global warfare, Joint Operations, Land warfare, Sea Warfare, Air warfare

TITLE: MULTRI - Multivariate Triangular Matrix weather Simulation Model

PROPONENT: United States Air Force Enviornmental Technical Applications Center (USAFETAC)

DEVELOPER: USAFETAC

PURPOSE: The MULTRI model, in its basic form, produces successively independent vectors of N cross correlated random variables, i.e., a random vector with specified cross correlation. In practice, the model can generate (1) N elements of a synthetic weather observation, such as ceiling, visibility, temperature, humidity, rainfall, wind speed, etc., at a single location; (2) M weather elements at N-M locations, e.g., sky cover and rainfall at 10 locations simultaneously, (3) N lagged weather elements at a single location, e.g., sky cover at times t + 3 hr, and t + 6 hr at one station, and (4) various combinations of the above. MULTRI is a computerized submodel designed to generate synthetic weather observations for input to combat doctrine, strategy and tactics development simulations, force mix studies, war games and other user applications.

GENERAL DESCRIPTION: The model is based on a result of multivariate normal theory. In a typical design, the MULTRI model would be incorporated as a subroutine or procedure within the user's larger model, producing a single cross correlated vector of weather variables each time the user calls the weather model. The user specifies the date/time so the diurnal and seasonal variability of the weather can be taken into account. The MULTRI model is best categorized as a continuous stochastic process model, especially when expressed in time stepping form rather than the basic form. All descriptions of the model in the sections below refer to the basic, nontime stepping form of the model, in which serial correlation is not preserved.

INPUT:

- o Climatology, especially processed to estimate the parameters of the model
- o Current date/time for which synthetic weather is requested

OUTPUT:

- o Cross correlated vector of weather variables, either for a single location, for several locations, or for several lags, consistent with the date/time requested

MODEL LIMITATIONS:

- o Model becomes cumbersome form a mathematical/computational point of view for N > 30.

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- o In the basic form of the model, successive output random vectors have no serial (time) correlation. Thus the basic form of the model cannot be used to generate a time series of weather variables. For many applications, the lack of serial correlation is not limiting. Some experimentation has been done by USAFETAC on a version of MULTRI that preserves a specified serial correlation. The results of this limited experimentation were encouraging, but the model has never been used operationally in an application where preserving serial correlation was necessary.
- o The N variables, none individually transformed to the normal probability distribution, are assumed jointly distributed according to the multivariate normal distribution. The validity of this assumption is subject to test each time the model is cast in a different form; so far the assumption has proved to be a good one.

HARDWARE:

- o Type Computer: IBM 360, 370, 4341; DEC System 10, PDP 11/45, easily adaptable to others
- o Operating System: IVM VM/370 DOS; TENEX; RSK-11M
- o Minimum Storage Required: Depends on length of the random vector. An implementation of this model for a vector of length 17 required 10.4 K words of storage
- o Peripheral Equipment: None

SOFTWARE:

- o Programing Language: FORTRAN IV
- o Documentation: USAFETAC Technical Note, to be published 1981

TIME REQUIREMENTS:

- o Depends greatly on the nature of the problem posed, the number of weather variables and locations to be modeled, and availibility and suitability of climatological data for the weather variables and locations chosen. One 8-station, 17-lag project in sky cover was completed in about 5 calendar months.

- o Depends on the length of the random vector, but for a vector of length 17, 2.5 milliseconds CPU time were required on a DECSystem 10 computer to generate a single random vector.
- o Output weather is not analyzed in its own right, but rather is played directly into the user's simulation or game, so no time is required for analysis of output.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required by the end user, in that the weather model is executed every time the user's model or simulation is run.

USERS: USAFETAC

POINT OF CONTACT: Maj Roger C. Whiton
USAFETAC/DNS
Scott AFB, IL 62225
Telephone: AUTOVON 638-5412
Commercial (618) 256-5412

MISCELLANEOUS: USAFETAC will adapt this model to meet the user's specific needs making such changes in the FORTRAN code as are necessary to satisfy the user's specific requirements regarding variables and locations to be simulated, inputs/outputs/interfaces desired, computer environment restrictions to be met, etc.

KEYWORD LISTING: Climatology, Cholesky reduction, computerized, continuous, correlation matrix, cross correlation, dispersion matrix, environmental simulation, lags, meteorology, multivariate normal, normal distribution, random variable (vector), serial correlation, stochastic process, triangular matrix, weather, weather observations

TITLE: MUTS - Multiple Target Simulation

PROPONENT: DARCOM

DEVELOPER: AMSAA

PURPOSE: MUTS is designed to provide estimates of the availability of targets for a friendly weapon system in a mid-intensity, high-density threat environment. MUTS represents a friendly company-team defending against an enemy reinforced motorized rifle battalion. MUTS simulates a COPPERHEAD/GLLD target of opportunity situation and assesses the probability that a target, having been engaged, will be in line-of-sight (LOS) to the FO and inside of a COPPERHEAD footprint at the end of some response time variable. MUTS does not assess the likelihood of missile acquisition, or of hit, or of kill.

It should be noted that the basic MUTS consists of a tactical situation set on digitized terrain; that each of five friendly FO and forty-seven enemy targets is discretely identified and randomly paired for engagement each 20 seconds. It is possible to use this basic enemy-friendly-terrain situation with appropriate modification to simulate many other weapon systems.

GENERAL DESCRIPTION MUTS is a computerized, Monte Carlo tactical situation/weapon system simulation set on terrain about 7KM NW of FULDA, FRG. Each replication of the model simulates 800 to 1200 seconds of actual battle time. Individual enemy company, platoon and individual vehicle assault routes, target speed and intervals between units and vehicles are randomly selected each replication.

It is possible, using off-line plotting equipment, to plot the development of the situation at any time during the model run. This plot shows the location of enemy attack routes, friendly and enemy tactical boundaries, friendly FO and the location and identification of each enemy target; further it accounts graphically for targets that have been attrited or have completed play. The situation plot is over-printed with a 1000 meter grid and is to the same scale as the topographic map used on the simulation allowing the plot to be used as an overlay to the map.

A COPPERHEAD target of opportunity fire mission is simulated. An FO-target pair is randomly selected for possible engagement; if there is LOS, target speed and direction are used to determine a target intercept and COPPERHEAD ballistic aim point at some future time. Several system errors are introduced to perturb the final location of the ballistic aim point. At the end of the response time of interest, the same target is located, LOS with the original FO checked, and the footprint regression equations solved to determine if the original, or if appropriate, an alternate target is inside of the footprint.

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INPUT:

- o Random selection of target paths, speeds, intervals
- o Digitized LOS tape
- o Enemy target attrition (0-100%)
- o Ballistic offset equation
- o System response time variable
- o System ballistic dispersion
- o FO height of eye; target exposure criteria for LOS
- o Cloud ceiling (regression equations simulating COPPERHEAD glide footprint)
- o Maximum horizontal visible range
- o Coordinates of COOPERHEAD firing battery center
- o SD of observation post location error
- o COPPERHEAD ballistic dispersion
- o Size and composition of enemy force
- o Number and location of friendly FO

OUTPUT:

- o At the end of a response time variable, probabilities of:
  - Original target in LOS to FO
  - Original target in LOS and in COPPERHEAD footprint
  - If original target not in LOS or in footprint or has been attrited:
    - -- alternate target in LOS to same FO
    - -- alternate target in LOS and in original footprint
  - At least one target in LOS and in footprint
- o Target location errors
  - Original target to predicted intercept point
  - Original target to ballistic aim point
  - Closest target to ballistic aim point
- o Overlay, to map scale, showing targets, routes, targets attrited

MODEL LIMITATIONS:

- o Does not simulate fire and maneuver
- o Battlefield obscuration not played (to be added)
- o Only one terrain played (additional terrain to be added)
- o Only simulated GLLD/COPPERHEAD target of opportunity fire mission (can be added)

HARDWARE:

- o Computer: CDC
- o Minimum storage required: 90K
- o Line printer
- o Tape drive
- o CALCOMP off-line plotter

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: To be released in an AMSAA Interim Note

TIME REQUIREMENTS:

- o 5-10 minutes run time per 10 replications
- o 2 man-months to change terrain
- o 4 man-months to change tactical situation/weapon systems
- o .5 man-months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not yet established

USER: AMSAA, GWD

POINT OF CONTACT: Jonathan M. Weaver, LTC (USA, RET)
AMSAA (DRXSY - GI)
Aberdeen Proving Ground, MD 21005

TITLE: M-14 (Model 14)

PROPONENT: Headquarters, Military Air Command/XPSR

DEVELOPER: HQ MAC-XPSR

PURPOSE: The M-14 is a computerized, analytical model that allows the identification and resolution of strategic aircraft chokepoints at the airbase level during wartime surge situations.

GENERAL DESCRIPTION: The M-14 is a one-sided, stochastic model designed for individual aircraft movements of four types that service worldwide cargo requirements of four types from multiple scenarios by utilizing a 422 airbase network over which aircraft are routed to use idle resources and to avoid facility and personnel saturation.

INPUT:

- o Station data, e.g., location, resources, climatology, type
- o Aircraft operating envelopes
  - Movement requirements
  - Policies

OUTPUT: All outputs are raw data--mission itineraries, requirement histories, GASP statistics, queuing files--and other simulation information against which retrieval utilities are developed and run for analysis purposes. Off-line analysis depends upon the study intent.

MODEL LIMITATIONS:

- o Heuristic routing
- o Unscheduled maintenance a function of maintenance actions/ flying hours

HARDWARE:

- o Type of Computer: CRAY 1S
- o Minimum Storage Required: 600K 64 bit words
- o Peripheral Equipment: CDC 640 for input/output interface to the CRAY

SOFTWARE:

- o Prorgamming Language: FORTRAN
- o Documentation: HQ MAC/XPSR Background Paper, "The M-14 Simulation Model," dated 1 Oct 81

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TIME REQUIREMENTS:

- o To Acquire Data Base: 2 man-weeks
- o To structure Data in Model Input Format: 2 man-weeks
- o To Analyze Output: 1 man-week
- o CPU Time per Cycle: 20 seconds/simulated day

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Once a month

USERS: OSD/PA&E/HQ MAC

POINT OF CONTACT: Mr. Kowalsky
HQ MAC/XPSR
Scott Air Force Base, IL 62225
Telephone: AUTOVON: 638-5560

MISCELLANEOUS: To be made interactive for crisis management training.

KEYWORD LISTING: Computerized, Stochastic, Logistics, Event Store, GASP, Strategic Mobility

TITLE: M-51 Software System/Route Analysis Processing System (RAPS)

PROPONENT: AFEWC

DEVELOPER: AFEWC

PURPOSE: To analyze proposed flight routes for threat radar visibility along a specified flight route.

GENERAL DESCRIPTION: This system uses DIA electronic-order-of-battle (EOB) information and terrain information supplied by the Defense Mapping Agency (DMA). The system analyzes the route point-by-point for earth terrain masking of the flight path points.

INPUT:

DIA tape

Terrain tape

Flight-path points in space

Limits of terrain to be considered (latitude/longitude)

Types of radars and maximum ranges

OUTPUT:

History matrix which defines visibility of each radar versus each flight-path point

MODEL LIMITATIONS:

No ECM effects considered

Accuracy of terrain limited to 1 minute of latitude/longitude, due to limited core storage of computer

HARDWARE:

Computer: UNIVAC 494

Operating System: OMEGA

Minimum Storage Required: 32,000 core; one million words on disk file

Peripheral Equipment: disk, tape drive, card reader, printer

SOFTWARE:

Programming Languages: FORTRAN and COBOL

Documentation: M-51 documentation, HQ ESC/ADY; limited to flow diagrams, format layouts, and program listings

TIME REQUIREMENTS: One hour of computer time per 100 radials. A radial is defined as the pair match-up between flight path point and EOB site.

SECURITY CLASSIFICATION: SECRET NOFORN, output has limited distribution

FREQUENCY OF USE: Projected use is six to eight times annually.

USERS: HQ ESC and AFEWC

POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

COMMENTS: Capability exists of adding manually-extracted terrain data to the files to fill in gaps in the digitized-terrain information from DMA.

TITLE: NADS - Naval Air Defense Simulation

PROPONENT: Chief of Naval Operations (OP-654)

DEVELOPER: TRW, Project Waterwheel

PURPOSE: NADS is a large scale simulation of the defense of a carrier battle group under attack by antiship missiles launched from ships, submarines and aircraft. NADS treats the airborne assets of the attacking force and the AAW assets of the defending force in considerable detail.

GENERAL DESCRIPTION: The Naval Air Defense Simulation is a carrier battle group anti-air warfare model. NADS treats all defense-in-depth elements as concurrent operations which are interdependent. There are multiple concurrent engagements which are all different, each is simulated and none are independent. Battle damage is assessed during the battle and both sides are subject to attrition and AAW capability degrades. Both nuclear and conventional weapons are modeled.

INPUT: Scenario data that define initial battle conditions and the prescheduled events. Technical data consists of physical and performance characteristics of various types of hardware.

OUTPUT: Computer printout giving statistical results summary of survivability, battle damage, and utilization of assets.

MODEL LIMITATIONS:

- o Maximum 50 VF
- o Maximum 35 total ships & VAW
- o Red units - 200 maximum
- o Red A/C - 60 maximum up to 20 types
- o Red missiles - 10 types maximum time - 9 hours game time

HARDWARE:

- o Computer: IBM - 360, 370, 3033
- o 1 Megabyte

SOFTWARE: FORTRAN for geometry, time system GPSS for event sequence logic performance and tactical logic

TIME REQUIREMENTS:

- o 1-2 man-weeks to acquire data base
- o 2 man-days to structure data in model input format
- o 1-2 man-weeks to analyze output
- o 30 seconds to 4 minutes CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 12 times/year estimated

USERS: OP-654, DNA

POINT OF CONTACT: Chief of Naval Operations (OP-654D)
Telephone: 697-7300

MISCELLANEOUS: To be used with the Naval Nuclear Warfare Simulation. Planned enhancements include external surveillance, long rang interceptor surface-to-air missile, and nuclear air-to-air missile.

KEYWORD LISTING: Naval, air defense simulation, carrier, battle, group, damage-assessment, nuclear-effects, computerized, conventional

TITLE: Naval Nuclear Warfare Simulation

PROPONENT: CNO OP-654

DEVELOPER: Applied Physics Laboratory/Johns Hopkins University

PURPOSE: The Naval Nuclear Warfare Simulation is a computer-assisted, analytical, limited war model with interactive decisions. It is intended to model the interaction and results of US/NATO Naval Forces versus Soviet Forces on a theater-wide basis, in all naval warfare areas, for an extended time duration (campaign). The Naval Nuclear Warfare Simulation focuses on the outcome of theater-wide naval conflict and theater nuclear weapon requirements and deployment. It also addresses the contribution of naval assets to conflict outcome.

GENERAL DESCRIPTION: The Naval Nuclear Warfare Simulation is a two-sided, mixed model which deals with air and sea forces. It can consider VP, SSNs/SSBNs, SUSC on the Blue side and SSNs/SSBNs on the Red side. The Naval Nuclear Warfare Simulation is an event-store model for which the game time to real time ratio is 1:10. It is based on multiple, deterministic, solution techniques.

INPUT:

- o Scenario
- o Unit Posts/Missions
- o Unit Capabilities
- o Environmental Data Base
- o Weapons Da
- o Automated ROE

OUTPUT:

- o Raw Game Data (user specified event data)
- o Post Processor (user specified event data)

MODEL LIMITATIONS: Currently limited to ASW operations

HARDWARE:

- o Computer: IBM 3033
- o Operating System: TSO
- o Minimum Storage Required: Virtual Memory
- o Peripheral Equipment: DEC 4 or 2 disc, 3 Mega tek graphics terminals, 3 DEC VT IOC video terminals, PDP 11/34 or PDP 11/60, 1 line printer

SOFTWARE:

- o Programming Language: PL1, FORTRAN

- o Documentation:
  - Operations Manual
  - User's Guide
  - Programmer's Manuual
  - System Description Manual
- o Model in development

TIME REQUIREMENTS:

- o 6 months required to acquire base data
- o 6 months required to structure data in model input format
- o CPU time per model cycle is not yet known
- o 1 month of learning time for players
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: SECRET

USERS: OP-654

POINT OF CONTACT: Chief of Naval Operations (OP-654D)
Telephone: 697-7300

MISCELLANEOUS:

- o This model will be linked to the Naval Air Defense (NADS) Model developed by TRW
- o This model supersedes ASGRAM and WASGRAM
- o This model will be improved annually as new systems are added to naval forces

KEYWORD LISTING: Analytical, Limited War, Air, Sea, Computer-assisted (with interactive decisions), Two-sided (with umpire), Mixed, Event Store

TITLE: New Corps Model (NCM)

PROPONENTS: LA1 and LA2 Divisions, DOAE, West Byfleet, Surrey, England

DEVELOPERS: As above

PURPOSE: The model is designed for the aggregation of results from lower level models (e.g., at Battlegroup Level) so as to produce a quantitative description of the battle at Corps or Divisional level. The most recent version of the model places particular empnasis on the way artillery and air can contribute to the battle at this level. The model has been applied to cost effectiveness studies, among others.

GENERAL DESCRIPTION: The model is an event based simulation in which the representation of direct fire enegagements is deterministic, while some aspects of indirect fire and air operations are stochastic. Input data on the contact battle is usually derived from the DOAE Battlegroup Module (BGM, q.v.), while data on the effect of artillery and air support in depth is derived from various models which assess the affect of specific weapon systems against particular target complexes. Input data on aircraft attrition also requires the support of models representing air defence weapon sites. The smallest independent units represented are Blue Battlegroups, Red Regiments, artillery batteries, air defence sites and groups of aircraft in close formation. Terrain is represented in terms of Red routes of advance, and the places along these where Blue could fight defensive battles of various kinds (these are derived from a map study). Rules for Blue maneuver also assume that the progress of the battle along routes can be divided into pre-defined phases and that a single set of rules will define Blue behavior in each phase.

INPUT:

- Mutual attrition data for Blue Battlegroup and Red Regiments
- Data on artillery, air and air defence effectiveness
- Movement rates
- Land ORBAT
- Aircraft available for support of land operations
- Red attack plan
- Blue defence plan

OUTPUT:

- Battle time histories, including attrition and movement on both sides

MODEL LIMITATIONS:

- Absence of command and control
- Limited ability to vary allocation of Red and Blue forces between routes according to progress of battle
- No facility to represent Blue counter-attack

HARDWARE:

- Nil

SOFTWARE:

- Model written in FORTRAN and occupies 650 kilobytes on ICL 2970. Detailed documentation exists at DOAE.

STAFF:

- No permanent staff, but intensive use of the model would require one or two scientists full time and at least one military officer part time.

TIME REQUIREMENTS:

- Preparation: Setting up a data base for the model from nothing takes about one man week, assuming availability of data from low level models.
- Simulation: Sixteen replications of eight days of battle takes about eight hours of computer mill time.
- Analysis: Once a data base is set up, one man can prepare the data for, and analyze the results of, about five battles a week.

SECURITY CLASSIFICATION: Methodology: This description unclassified; more detailed descriptions, UK RESTRICTED.
Database: Usually UK SECRET

FREQUENCY OF USE: Continuous

USERS: LA1 and LA2 Divisions, DOAE, Parvis Road, West Byfleet, Surrey KT14 6LT, England. Byfleet (093 23) 41199

MISCELLANEOUS:

- The model is continuously amended and revised to meet the needs of particular studies.
- A deterministic version of the model exists which has less detailed representation of air and artillery; this is generally referred to as the Old Corps Model.

TITLE: NEMO III - Nuclear Exchange Model, Mod III

PROPONENT: Chief of Naval Operations (OP-654)

DEVELOPER: Naval Regional Data Automation Center

PURPOSE: NEMO III is a computerized, analytical model designed for use in evaluating the SIOP when gamed against the RISOP. The model addresses the problem of simulating the interaction of strategic nuclear offensive forces contained in the SIOP and the opposing defensive forces.

GENERAL DESCRIPTION: NEMO III is a detailed two-sided event stored simulation model. It plays individual missiles, RVs, bombers, ASMs, and decoys as programmed in the SIOP and RISOP. The model has both stochastic and deterministic elements. Both sides are played against their respective defense concurrently. Model can simulate the performance of one weapon or several thousand. The two-sided game can be command interrupted to provide intermediate attack execution results.

INPUT:

- o RISOP and SIOP
- o SAM and ABM sites: Location and vulnerability
- o Aircraft interceptor bases: Location and vulnerability
- o Offensive and defensive system performance parameters

OUTPUT:

- o AGZ tapes for successful weapons
- o Computer listings summarizing results in terms of number of vehicles, weapons, yield of weapons, etc.
- o Detailed information on the performance of each weapon and vehicle

MODEL LIMITATIONS:

- o The model does not allocate weapons to targets
- o Running time is extensive which limits the number of possible runs
- o Building and maintaining the data base is a major effort

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC - 8
- o Minimum Storage Required: 64K
- o Peripheral Equipment: Drum, Tape, Disc, Printer, Card punch/reader

SOFTWARE:

- o Programming Languages: COBOL, FORTRAN
- o Documentation:
  - NEMO III Users Manual (Volumes I and II), NEMO III Manned Interceptors Tech Note, TN-01 of Jan 1976
  - NEMO III Surface-to-Air Missiles (SAM) Tech Note, TN-02 of Jan 1976
  - NEMO III Anti-Ballistic Missiles (ABM) Tech Note, TN-03 of Oct 1976

TIME REQUIREMENTS:

- o 2 months to acquire base data
- o 2 man-months to structure data in model input format
- o 6 hours CPU time per model cycle for simulation only; 8 hours for input, 2 hours for output
- o 3 months to analyze and evaluate results from a gaming cycle

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 50-60 cycles per year

USERS: Chief of Naval Operations (OP-654); Studies, Analysis, and Gaming Agency, OJCS

POINT OF CONTACT: Chief of Naval Operations (OP-654C)
NARDAC (Code 44)
Washington Navy Yard
Washington, DC 20374
Telephone: 697-5743

MISCELLANEOUS:

- o The Quick Model generates the RISOP battle plan for input to NEMO III. The SIOP Is provided by JSTPS.
- o AGZ output used as input to SIDAC Model operated by CCTC
- o Supersedes NEMO II
- o Model operation, support and maintenance requires the full time effort of about 15 skilled personnel.
- o Multiple Engagement Module (MEM) assesses attrition to tthe ICBM/SLBM portion of the SIOP visible to Soviet ballistic missile defenses and/or directed against defended targets within the Soviet Union.

KEYWORD LISTING: Computerized; Analytic; Two-Sided; Dynamic; Strategic; Nuclear; Missiles; Bombers

TITLE: NEWAIR

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: NEWAIR is a theater-level air battle simulation model which addresses the outcome of a conflict between air forces employing conventional weapons. The model is designed for the evaluation of relative air force capabilities in central Europe. The model can be used for interactive wargaming, with the players communicating with the program through remote terminals. A completed campaign, conducted interactively, may subsequently be run as a batch job to perform sensitivity excursions.

GENERAL DESCRIPTION: NEWAIR is a deterministic, time-step model. It will compute the attrition to attacking and defending aircraft and the damage inflicted on runways, shelters, aircraft on the ground, and terminal defense weapons. The model will also compute the number of sorties delivering ordnance to close air support and interdiction targets. The computations are performed separately for each target attacked, reflecting the weapons and aircraft actually taking part in each engagement.

INPUT: The following are the main inputs to the model:

- o Aircraft performance data for each aircraft type to be played
- o Airbase data
- o Target data (close air support and interdiction targets)
- o CAP pattern data
- o Attrition data

OUTPUT:

- o The program displays an attrition summary at the terminals at the end of each time period simulated
- o More detailed output is printed on the line printer. This includes an airbase report, a CAP-pattern report, and a counter air report

MODEL LIMITATIONS:

- o The number of aircraft types and airbases that can be handled are limited by the core storage available
- o 40 aircraft types and 150 airbases can be handled with 120 K words

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.4, INTERCOM
- o Storage Requirement: 100 K words
- o Peripheral Equipment: Line printer, at least one terminal

SOFTWARE:

- o Programming Language: SIMULA-67
- o Documentation: No documentation available

TIME REQUIREMENTS:

- o The acquisition of a data base can be fairly time consuming. The coding of the input data in the format required by the model should not take more than 1-2 weeks
- o CPU time requirement is data dependent, typically 100-200 seconds per cycle (8 hours)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not in regular use

USER: SHAPE Technical Centre, with military participation

POINT OF CONTACT: SHAPE Technical Centre
P. O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Deterministic, Theater Level, Time Step, Air Forces

TITLE: NUBAM-Nuclear Weapons Battlefield Analysis Model

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Applications, Inc (POST)

PURPOSE: It is an analytical tool for studying the effects of nuclear weapons on different combinations of military units.

GENERAL DESCRIPTION: NUBAM is a computerzed model that measures the effectiveness of different relative tactical nuclear weapons where the measurable damage mechanism is the neutron and gamma radiation to personnel. It is a single weapon type sequential allocation model that requires target array data provided by the US Army Concepts Analysis Agency.

INPUT:

- o Descriptors for a single weapon
- o Specific MOE's & DGZ's
- o Divisional deployment arrays

OUTPUT: Number of casualties and units to break criteria.

MODEL LIMITATIONS: Does not calculate damage to equipment, blast and therral radiation.

HARDWARE: MULTICS

SOFTWARE:

- o Programming language-ANSI FORTRAN (MULTICS)
- o User documentation is available

TIME REQUIREMENTS: 2 minutes (with random motion calculations up to 10 minutes).

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times a year.

USERS: OD (PA&E)

POINT OF CONTACT: OD(PA&E)
Strategic Programs
The Pentagon, Washington, DC 20301
Telephone: (202) 695-5587

KEYWORD LISTING: Computerized, analytical model, nuclear weapons, tactical, theater, allocation

TITLE: NUCLEAR STRIKE SIMULATIC'

PROPONENT: Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Ontario, Canada.

DEVELOPER: As above.

PURPOSE: This simulation was designed to assess the personnel casualties resulting from a nuclear strike modelled in research war games.

GENERAL DESCRIPTION: This simulation permits the choice of one of eleven nuclear yields, ranging from .1 KT to 1 MT (1000 KT). The choice of a weapon yield and a location results in a list of units affected and the information needed to process each unit. Once this data is collected and entered into the program, each unit is assessed to determine the number of personnel casualties resulting from the blast and radiation. The procedure is very similar to that of the Chemical Strike Simulation

The program operates interactively; which means that the operator is constantly aware of which unit is being processed. This allows for a check in the synchronization of data being entered into the program.

The final result is the total number of personnel casualties suffered by the unit. It is also shown how this number is distributed over five various postures. This demonstrates the major vulnerability of a unit as well as aiding in the determination of equipment losses.

INPUT:

- Weapon performance data is enclosed within the program. Inputs of a general nature include the weapon yield and the location of the strike. The unit relate inputs consist of the unit type, situation and dress.

OUTPUT:

- The output includes for each unit involved, the unit serial number, name, location, distribution of casualties in five postures and the total number of casualties suffered as a result of the nuclear strike.

MODEL LIMITATIONS: As in the case of the Chemical Strike Simulation a good deal of time is spent collecting data for input. Also the lost of equipment due to the blast is not calculated. It is hoped that both of these problems will be corrected in the near future.

HARDWARE: PDP 11/34 computer.

SOFTWARE: Programmed in FORTRAN.

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STAFF:

- A computer operator is required to run the program and input data. The War Game Controllers and Artillery Assessor provide the input data.

TIME REQUIREMENTS:

- Preparation: Data collection and input can take from several minutes to a half hour depending on the size of the strike.
- Play: Running time is approximately thirty seconds.
- Analysis: Included in research war game analysis.

SECURITY CLASSIFICATION: NATO Confidential.

FREQUENCY OF USE: Seldom used, in fact the simulation has not been called for in war game play to date (Feb 82).

USERS: DLOR War Games Section.

TITLE: NUCROM - Nuclear Rainout Model

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: NUCROM was designed for damage assessment studies of the hazard from rainout from nuclear clouds over a wide range of input conditions. It was designed so that the user could choose from a number of assumptions concerning the initial conditions and the physical rainout mechanics.

GENERAL DESCRIPTION: NUCROM is a single burst rainout model that provides radiation exposure rate and exposure dose patterns for a wide range of input conditions.

INPUT:

- o Weapon yield
- o Fission fraction
- o Height of burst
- o Wind direction and speed at various altitudes
- o Precipitation cloud geometry, location, type, and duration
- o Activity distribution in debris cloud
- o Scavenging rates

OUTPUT:

- o Rainout arrival times
- o Exposure dose rate pattern
- o Exposure dose pattern

MODEL LIMITATIONS:

- o Single burst model
- o Airbursts only

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Storage Required: 40K
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "NUCROM: A Model of Rainout From Nuclear Clouds," DNA 3389F, August 1974
- o Documentation Availability: Limited to US Government Agencies, DDC No. 921975L

TIME REQUIREMENTS:

- o Prepare Inputs: Nominal
- o CPU Time per Cycle: 4 to 10 seconds
- o Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Very limited, i.e., only when rainout effects are being studied.

PRINCIPAL USERS: Stanford Research Institute

POINT OF CONTACT: Mr. Sanford Baum
Engineering Systems Division
Stanford Research Institute
333 Ravenswood Avenue
Menlo Park, California 94025
Telephone: 415/326-6200

KEYWORD LISTING: Rainout, Washout, Tactical Nuclear Weapon Effects, Damage Assessment

TITLE: NUDACC - Nuclear Damage Assessment Computer Code

PROPONENT: DCSOPS, HQ Army

DEVELOPER: Harry Diamond Laboratories, DARCOM

PURPOSE: NUDACC is a computerized, division-level damage assessment model used as an analysis tool to assess the survivability of theater nuclear forces in various battlefield scenarios. The model provides a sufficiently detailed representation of nuclear weapons effects - total dose, thermal, blast, neutron fluence, gamma dose rate, EMP - to determine the actual vulnerability of battlefield units and to identify the worth of equipment hardening or modifications in doctrine and tactics to improve the survivability of these units. The output from NUDACC can be used as the nuclear kill input in higher level wargames and simulations, such as TACWAR and FOURCE.

GENERAL DESCRIPTION: NUDACC is a deterministic nuclear damage assessment model, which makes use of probability of survival functions for the various nuclear weapons effects. The model considers the land forces of either the Blue or Red side, one side at a time. The model was primarily designed to be exercised for a division-sized scenario, but can be extended to include corps elements. The level of aggregration is down to platoons and batteries, with a possible manipulation range to squads. Treatment of simulated time proceeds by a series of snapshots of the battlefield, the time between which is determined by the user. Primary techniques for determining the equipment survival probabilities are by means of cumulative log normal functions of the environments.

INPUT:

- o Location, size and orientation of units
- o Equipment/personnel lists for each unit
- o Weapon laydown
- o Vulnerability parameters for equipment items, for each nuclear environment

OUTPUT:

- o Computer printout of expected surviving equipment/personnel for each unit as a resultant of each successive nuclear detonation
- o Dominant nuclear weapons effects at each unit location

MODEL LIMITATIONS:

- o Battlefield is static, no movement or reconstitution of units is possible
- o Target location error is not included
- o Height of burst of nuclear rounds is fixed at 60W 1/3
- o Algorithm for calculating EMP is not accurate within the source region

(Work is proceeding to eliminate most of these limitations).

HARDWARE:

- o Computer: IBM 370/168
- o Operating System: OS/VS2
- o Minimum Storage Required: 20K
- o Peripheral equipment: Printer; card reader or TSO terminal

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation:
  "NUDACC Programmer's Guide - Version II", HDL-SR-81-3, June 1981
  "NUDACC - A Nuclear Damage Assessment Computer Code," HDL-PR-78-3, November 1978

TIME REQUIREMENTS:

- o Extensive analysis may be required to calculate the equipment vulnerability parameters
- o 1 week to structure data in model input format
- o 1 to 2 hours to analyze output
- o 2 weeks player learning time
- o 10 minutes running time per cycle, including 30 seconds CPU time

SECURITY CLASSIFICATION: *UNCLASSIFIED*

POINT OF CONTACT: Harry Diamond Laboratories
ATTN: DELHD-NW-RA (J. Michalowicz)
Adelphi, MD 20783
301-394-3100

FREQUENCY OF USE: 3 times per month

USERS: TRASANA, BRL, USANCA

MISCELLANEOUS: *NUDACC is linked with the Residual Combat* Capability (RCC) model at BRL to translate equipment/personnel loss into unit combat capability degradation.

KEYWORD LISTING: Damage assessment; tactical nuclear; computerized; land forces; nuclear weapons effects; equipment survivability; probabilistic survivability functions; equipment hardening; division-level; platoon-sized units; time snapshots; deterministic.

TITLE: NUFAM II - Nuclear Fire Planning and Assessment Model II

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: NUFAM is a computerized, analytical model designed to simulate a nuclear exchange and perform damage assessment. Using a static target array, the model performs the fire planning needed in a nuclear engagement, considers civilian collateral damage constraints, simulates the nuclear exchange, and then determines prompt and delayed casualties and material damage to a target bank and to a civilian population data base resulting from the timed sequence nuclear strikes.

GENERAL DESCRIPTION: NUFAM is a two-sided, mixed model involving land forces only. It is primarily designed to consider groupings ranging in size from a battery or battalion to a corps size force. The resolution size, however, may be manipulated to consider units anywhere between a platoon and a brigade, while the force size may be adjusted to consider a division to a theater. Simulated time is treated on an event-store basis, using the GASP IV language. The nuclear exchange is simulated through an automated process, based on input criteria for the selection of nuclear targets and the allocation of firing assets against these targets while minimizing civilian damage.

INPUT:

- Required input data defines the commander's firing guidance, fire planning priorities, weapon characteristics, assessment parameters, pre-planned targeting information, civilian collateral damage criteria, and target unit type characteristics.
- Separate Inputs Include:
  - Potential Targets List as generated from target acquisition model
  - Battlefield Unit status file

OUTPUT:

- Timed sequenced list of all events, flee-fire
- Assessment results
- End of Period status of all units
- Civilian population at risk
- Histograms and CALCOMP plots (optional)

MODEL LIMITATIONS: No cumulative radiation from multiple burst, or distribution of delayed casualties in time.

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 72K words
- o Peripheral Equipment: One tape drive, FASTRAND Format mass storage

SOFTWARE:

- o Programming Language: FORTRAN, ASSEMBLER, and GASP IV

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 2 man-days to structure data in model input format
- o 80 minutes CPU time for 5000 targets and 500 fires on UNIVAC 1108
- o 4 days or less to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Support for 1 study per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Chief, Nuclear and Chemical Aanlaysis Group
US Army Concepts Analysis Agency (CSCA-RQN)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-1669

MISCELLANEOUS:

- o NUFAM shares a common data base with Target Acquisition Routine (TAR)
- o NUFAM has been upgraded to allow GDZ offset for collateral damage constraints and to aggregate collocated targets
- o Fireplanning by the model uses target oriented methodology. Manual fireplanning using the preclusion oriented methodology can be simulated by providing a list of DGZ locations as input to NUFAM
- o A revised model, NUFAM III, written in SIMSCRIPT II.5 and incorporating target acquisition and other processes not now a part of NUFAM II, is currently in the tesing phase and expected to be operational in early 1982

KEYWORD LISTING: Analytic Model; Computerized; Limited War; Nuclear Exchange, Two-Sided; Land Forces

TITLE: NUWEP - Nuclear weapon employment code for simulating the movement, acquisition and nuclear attack of mobile ground forces.

PROPONENT: Lawrence Livermore National Laboratory

DEVELOPER: Lawrence Livermore National Laboratory

PURPOSE: NUWEP is a computer code for (1) simulating the movement of mobile ground forces from garrison to engagement in the central battle, (2) simulating the acquisition of these forces, and (3) assessing the military and civilian casualties and damage resulting from the prompt effects of user-developed nuclear strikes. It is used for analyzing the utility of nuclear weapon systems in support of the central battle and for interdicting uncommitted forces.

GENERAL DESCRIPTION: NUWEP is a one sided, mixed deterministic/stochastic code which assesses the effects of nuclear weapons on ground forces and civilians. Aggregation is at the company/battery level with primary manipulation of forces at the division level. Movement of forces and target acquisition are time stepped, and nuclear strikes are event stepped. Many aspects of force movement, target acquisition, and nuclear employment are treated probabilistically.

INPUT:

- o Road and/or railroad network.
- o Ground forces (type, contents, march routes, assembly area locations, march and assembly area configurations, etc.)
- o Acquisition probabilities and CEPs.
- o Civilian data base.
- o Nuclear strike (aimpoints, yields, types, time of employment, CEPs)

OUTPUT:

- o Acquired targets
- o Detailed listings of casualties and damage
- o Summary listings at battalion, regiment and division level

MODEL LIMITATIONS:

- o One sided
- o 40 divisions
- o No consideration of delay caused by obstacles

HARDWARE

- o Computer: CDC 7600
- o Operating System: Lawrence Livermore National Laboratory
- o Minimum storage required: 100K words

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: None

TIME REQUIREMENT:

- o To acquire data bases; variable; most data bases exist.
- o To structure data for input: 1 day
- o To plan nuclear strike: 1 hour
- o To analyze output: variable; depends on scope of study
- o CPU time: few minutes

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: 100 times/year

USERS: Lawrence Livermore National Laboratory

POINT OF CONTACT: Robert Gard, L-7
Lawrence Livermore National Laboratory
P. O. Box 808
Livermore, CA 94550
(415) 422-6575

KEYWORDS: Nuclear, Ground Forces, Target-Acquisition, Damage-Assessment, Collateral-Damage, Land

TITLE: OASIS - Operation Analysis Strategic Interaction Simulator

PROPONENT: U.S. Army Ballistic Missile Defense Organization

DEVELOPER: Science Applications, Inc., Huntsville, Alabama

PURPOSE: OASIS is a general purpose computer program for simulating the effects of strategic nuclear and non-nuclear engagements. It can be used to determine the effectiveness of BMD system constructs against offense scenarios, optimize offense or defense systems, or determine the nuclear environments experienced during the engagement.

GENERAL DESCRIPTION: OASIS is a single pass, time-step simulation of the operation of a BMD system including RVs, ICBMs, SLBMs, ABMs and aircraft. Thirteen nuclear environments (e.g., neutron, gamma, x-ray, blast, thermal, dust, EMP) are calculated and compared against instantaneous and cumulative vulnerabilities of each system components (e.g., RVs, ABM and ground structures). If vulnerabilities are exceeded, a vehicle or component is removed from the simulation. Nuclear effects that degrade performance such as radar signal propagation through disturbed regions are calculated using radar models derived from the RANC program. Spatial areas up to approximately 100 miles on a side can be modeled including up to 1000 aimpoints, 1000 RVs, 1000 interceptors, 30 radars, 30 interceptor farms, 10 RV types, 5 interceptor types and 6 radar types. Several battle management logic options are available for the RV intercept point selection doctrine, as well as preferential defense capabilities. Logic is included to allow track data handover between radar sites in the event of blackout or radar damage. Many of the calculations made are deterministic, but where appropriate (e.g., CEP or time-on-target variation) stochastic analyses are made. The ratio of game time to real time can vary from 1 to 10 for a simple problem to approximately 10 to 1 for the largest, most complex simulation. The program itself is very modular and contains sufficient comments for easy software modification.

INPUT:

- o Location and critical parameters for all ground facilities
- o Vulnerabilities of all vehicles and ground facilities
- o Complete description of radar capabilities
- o Description of RVs, aimpoints, detonation times and altitudes
- o Interceptor performance description
- o Battle management logic and defense description
- o Miscellaneous data

OUTPUT: The output from OASIS consists of a summary of all events happening during the current time step (normally 1 second) such as radar acquisitions, intercept point selection, interceptor launch, detonations, blackout occurrence, facility losses, and all of the nuclear environments experienced by the components. Post-prosessors are available to condense the output to an abridged form.

MODEL LIMITATIONS: There are few portions of OASIS that are machine dependent, it has been used on most CDC, IBM, and UNIVAC computers. The minimum storage requirements are very dependent on the size of the problem.

HARDWARE:

- o Computer: CDC 5600
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: 300K Octal

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:

The OASIS-II Program, Vol I, Part I: Program Descripton, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol I, Part II: Tracking/Filtering and Defense Logic, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol II: User's Manual, SAI-74-251-LJ, December 74
The OASIS-II Program, VOL III: Subroutine Descriptions, SAI-74-251-LF, December 74
The OASIS-II Program, Vol IV, Part I: Environmental Models, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol IV, Part II: Erosion/Ablation System Analysis Program, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol V: OASIS-II Listings, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol VI, Part I: OASIS-AIRCRAFT Program Description, SAI-74-251-LJ, December 74
The OASIS-II Program, Vol VI, Part II: OASIS-AIRCRAFT Listings, SAI-74-251-LJ, December 74

TIME REQUIREMENTS:

- o Acquire and input data: 1-4 man-weeks
- o Analyze output: 1 man-day
- o Analyst learning time: 1-3 man-months
- o CPU time per cycle: variable depending on problem

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 0-50 times per month

USERS: SAI, SAC, and JCS

POINT OF CONTACT: Henry T. Smith
Science Applications, Inc.

MISCELLANEOUS: The program is modular to facilitate modifications. Many additions have been made to the original program to aid in modeling proposed BMD systems. The modular design also allows removal of large portions of unwanted logic to create a smaller, faster running program. It is one of the few programs which models nuclear lofted dust, and subsequent erosion to vehicles, flying through the dust clouds.

KEYWORD LISTING: Computerized, Analytical, Nuclear, Damage-assessment, System-effectiveness, Strategic, BMD, Engagement, Simulator, Dust, and Radar

TITLE: OPTSA - Optimal Sortie Allocation

PROPONENT: Institute for Defense Analyses

DEVELOPER: Institute for Defense Analyses

PURPOSE: OPTSA is a computerized, general war, analytical model. It considers theater-level conventional air campaigns. OPTSA is primarily concerned with the determination of optimal strategies for allocation both sides' combat aircraft to major combat missions. It models air combat and evaluates the outcome of air combat if each side uses its optimal strategy.

GENERAL DESCRIPTION: OPTSA is a two-sided, mixed model which plays air forces. It can be used for ATAF through theater levels. OPTSA is a time-step model which uses game theory as its basis for solution.

INPUT: Number of aircraft and their effectiveness

OUTPUT:

- o Raw game data
- o Frequency of distribution
- o Expected value or probable outcome
- o Very detailed through campaign summary (7 output options are available)

MODEL LIMITATIONS: The modeling of air combat is simplified in order to be able to find the optimal strategies.

HARDWARE:

- o Computer: CDC 6400 or larger
- o Minimum Storage Required: 50,000 (base 10)

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: "Revised OPTSA Model," IDA Paper P-1111, Institute for Defense Analyses, Arlington, VA, September 1975
- o User's and Programmer's manuals are complete
- o See also "Two Optimal Sortie Allocation Models," IDA Paper P-992, Institute for Defense Analyses, Arlington, VA December 1973

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TIME REQUIREMENTS:

- o 1 man-month to structure data in model input format
- o CPU time is 6 seconds/cycle for 2 strategy periods and 24 seconds/cycle for 3 strategy periods
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used in two studies.

USERS: J. Bracken
Institute for Defense Analyses

POINT OF CONTACT: Jerome Bracken
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202
(703) 558-1503

MISCELLANEOUS:

- o Linked to theater-level models for air (only) or air/ground combat, such as IDATAM, TAC WARRIOR, IDAGAMII, and VECTOR II
- o OPTSA can supply air allocation strategies to these models
- o This model supersedes TAC CONTENDER

KEYWORD LISTING: Analytical, General War, Air, Computerized, Two-sided, Mixed, Time Step

TITLE: OZ - Optical Countermeasures Effectiveness Model (Optical Zinger)

PROPONENT: JTCG/AS, Countermeasures Subgroup
Technical Monitor: Air Force Avionics Laboratory, AAWA-1

DEVELOPER: Quest Research Corporation
McLean, Virginia 22101

PURPOSE: OZ is a computerized mission analysis model that uses detailed flight path data, a digitized description of the aircraft and its optical countermeasures (OCM) characteristics, and a full aerodynamic and guidance model of surface-to-air threats to evaluate the effectiveness of a non-protected (and various levels of) OCM protected aircraft.

GENERAL DESCRIPTION: OZ is a two-sided model involving hostile air defense weapons located throughout a mission region and a single aircraft with adjustable levels of OCM. This OCM effects optical detection and tracking subroutines that results in reduction or enhancement of overall mission survivability and achievement. This achievement metric is used to compute the total number of aircraft and support resources required for a campaign, e.g., 400 units of targets struck, and the associated cost effectiveness of the proposed OCM concepts.

INPUT:

- Flight path parameters such as location, velocity, aircraft altitude, and altitude versus 1/3 second time steps for flights up to 1 hour duration, visibility, solar direction
- Target description in terms of surface dimensions, reflectivities, surface normal vectors, vulnerable areas, radar cross section
- Threat descriptions in terms of location, optical parameters, missile or round guidance and aerodynamics, warhead spray patterns, radar parameters, zonal attrition rates
- Cost description in terms of airframe logistics, repair, development/production of various levels of OCM
- Masking data with respect to digitized terrain

OUTPUT:

- Computer printout of survivability versus position along flight path due to multiple, interacting threat engagements
- Detailed data output options that include glimpse-by-glimpse detection probabilities, inherent and apparent contrast, single engagement fly-out parameters and Pk, mission achievement, and cost effectiveness data based on multiple missions and various OCM levels

POINT OF CONTACT: Quest Research Corporation
McLean, Virginia 22101

MISCELLANEOUS: There are three versions of the OZ model thus far with a fourth under development. The basic model incorporated two of the TAC ZINGER SAM threat models, the second added AAA engagement models, the third incorporated nap-of-the-earth helicopters with full 3D imagery, and the fourth will include the TAC ZINGER IR SAM models and active OCM systems.

KEYWORD LISTING: Computerized, Analytical, Missile/AAA engagements, Optical detection and tracking, Optical countermeasures, Cost effectiveness, Probability of survival, Mission achievement, Aircraft descriptions, Reflectivity, OCM effects

TITLE: PACER

DEPARTMENT: OSD/PA&E

DEVELOPER: Science Applications, Inc.

PURPOSE: The PACER model was developed as a force data base management tool to allow the user to build and easily modify the weapon system projections and their characteristics.

GENERAL DESCRIPTION: PACER is a data base manipulation and force static measures display program. It operates on a user-designated force file which typically consists of a number of weapon systems by name, their pertinent characteristics and their deployment projections (historical and future). PACER then lists the data, modifies it, or creates an entirely new force file. The model will produce a listing of the entire file for display purposes and will generate the various static measures important to strategic force analysis.

INPUT: Weapon system deployment projections and their characteristics, consisting of:

- Alert and generated availability rates
- Warheads per carrier
- Yield
- CEP
- Throw weight
- IOC date
- Reliability

OUTPUT:

- A MULTICS file compatible with the GROSA and SOSAC models containing weapon system projections and characteristics
- Static measures of effectiveness can also be output

MODEL LIMITATIONS:

- Model does not have separate categories for all the factors that contribute to the probability of arrival of a weapon system
- Factors, such as probabilities of launch survival and penetration, and weapon loadings for aircraft types cannot be easily handled in the model and are usually treated as a total quantity of SRAM or ALCM.

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: Unknown

TIME REQUIREMENTS: One to three hours required to build an arsenal file.

SECURITY CLASSIFICATION: UNCLASSIFIED

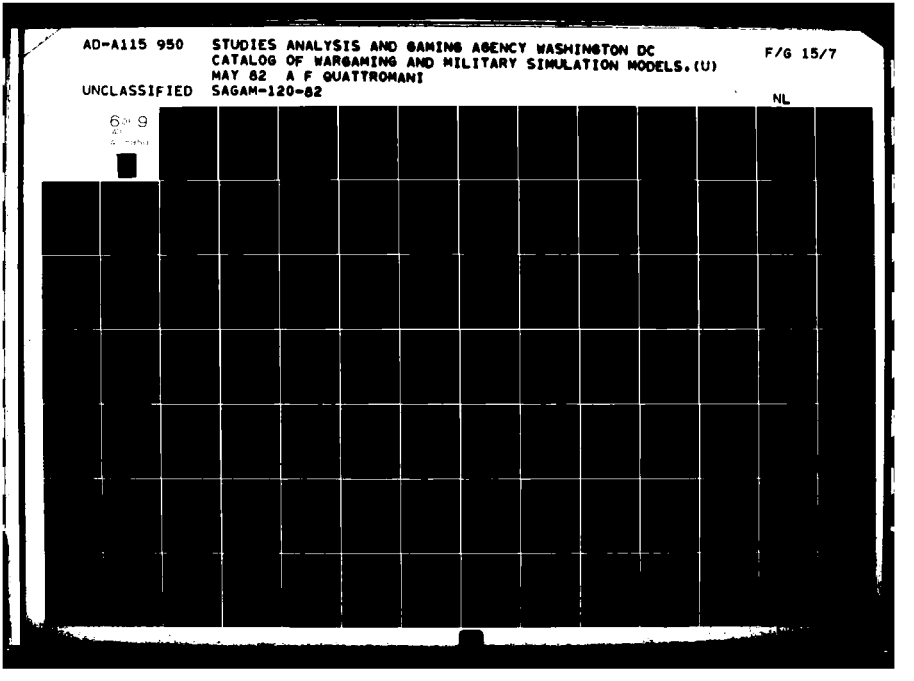
FREQUENCY OF USE: 200 times a year

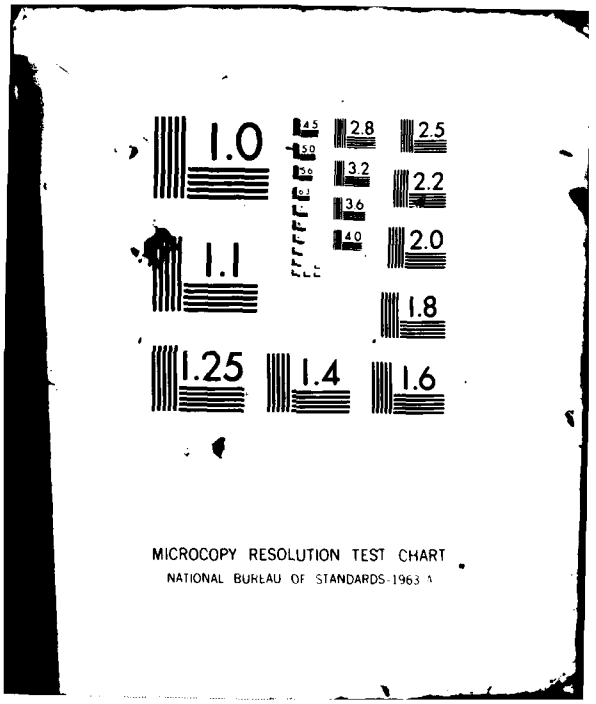
USERS:

- o OSD/PA&E
- o AF/SASF
- o Science Applications, Inc.

POINT OF CONTACT: OSD/PA&E (Bob Bott)
The Pentagon
Washington, D.C. 20330
Telephone: (292)695-5587

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
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TITLE: PAM - COPPERHEAD Probability of Acquisition and Maneuver

PROPONENT: US Army Materiel Systems Analysis Activity (USAMSAA)

DEVELOPER: US Army Materiel Systems Analysis Activity (USAMSAA)

PURPOSE: Determine limitations of COPPERHEAD system. By developing first order estimates of engagement possibility as a function of range, meteorological conditions, and weapon characteristics. The model is used for developing performance estimates for COPPERHEAD and related weapon systems.

GENERAL DESCRIPTION: PAM is a single target Monte-Carlo model.

INPUT:

- o Seeker Energy Threshold
- o Angle of Fall
- o Anglet
- o Target Velocity
- o Target Reflectivity
- o Designator Energy
- o Nominal Response Time
- o Gun Target Range
- o Delivery Errors
- o Footprint Data
- o Visibility Data
- o Extinction Data

OUTPUT: Probability of acquisition and maneuver as a function of above variables.

MODEL LIMITATIONS: Does not play overspill/underspill.

HARDWARE:

- o Computer: CDC 7600
- o Operating System: NOSBE/NOS
- o Minimum Storage Required: 42K

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: A Monte Carlo model for determining COPPERHEAD Probability of Acquisition and Maneuver, August 1980, USAMSAA TR-308

TIME REQUIREMENTS:

- o 1 man-month to acquire data base
- o 1 man-day to structure data in model input format
- o 1 man-day to analyze output
- o 60 seconds CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Four times per year

USERS:

- o Primary: US Army Materiel Systems Analysis Activity (USAMSAA)
- o Other: USAFACS, Naval Postgraduate School

POINT OF CONTACT: US Army Materiel Systems Analysis Activity
Michael Starks
ATTN: DRXSY-GS
Aberdeen Proving Ground, Maryland 21001
AUTOVON 280-4704

MISCELLANEOUS: This model serves as a preprocessor to AMSAA's COPE model; it has also been embedded in the Naval Postraduate School STAR model.

KEYWORD LISTING: COPPERHEAD, Precision Guided Munitions, Laser Guided Weapons

TITLE: PATCOM

PROPONENT: C&EAB, CSD, AMSAA, APG, MD

DEVELOPER: As above

PURPOSE: To predict bit error rates produced by an airborne jammer in digital data message transmitted through the redundant PATRIOT data network.

GENERAL DESCRIPTION: This model computes the probability that an error free data message will reach its destination in the presence of airborne jamming. Messages propagate via redundant paths through a line of sight radio relay network. The model accommodates a variety of jammer altitudes and flight paths, relay station locations and network configurations. Propagation losses are calculated for the jammer taking into account masking, diffraction, reflection and cancellation over specific, high resolution terrain profiles and radio relay station antenna characteristics and orientation. Point-to-point propagation losses between stations are computed taking diffraction and masking into account for specific terrain profiles.

INPUT:

- Aircraft Flight Path(s) and Altitudes(s)
- Digitized Terrain Data
- Jammer Characteristics
- Communication Nodes and Connections
- Antenna Patterns
- Communications Received & Transmitter Characteristics
- Measured Bit Error Rate vs Jam to Signal Ratio
- Electrical Characteristics of Earth and Air

OUTPUT:

- Probability of Message Transfer Between Specified Nodes
- Terrain Data Profiles Constructed on Output Printer
- Running History of Jamming Levels Versus Signal Levels

MODEL LIMITATIONS: Currently tailored to PATRIOT system. Requires one second of computer time for each terrain profile which is constructed and analyzed.

HARDWARE:

- Computer CDC 7600
- Minimum storage required
- Disk Drive for Terrain Data Base 50,000,000 words
- Large Core Memory 100K
- Small Core Memory 150K

SOFTWARE:

- FORTRAN IV Extender
- Preliminary documentation prepared, but is not up-to-date

POINT OF CONTACT: Donald Barthel, AV 283-4030

TITLE: PEGASUS

PROPONENT: Manual and Computer Supported Simulations Division, Battle Simulations Development Directorate, Combined Arms Training Developments Activity

DEVELOPER: Proponent

PURPOSE: To exercise battalion and brigade command groups in the performance of ARTEP tasks associated with the control and coordination of combined arms in a simulated combat environment.

GENERAL DESCRIPTION: A command post exercise control system which employs a free-play manual simulation system with opposing forces designed to exercise brigade/and or battalion commanders and staffs in the control and coordination of combined arms operations.

TITLE: PEN SQUARE

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: PEN SQUARE was developed to allow investigations of the relative vulnerability of various aircraft to anti-aircraft guns during attack sorties. The mission profile can include penetration to, attack of, and escape from a target defended by anti-aircraft guns.

GENERAL DESCRIPTION: PEN SQUARE is an expected-value model for estimating aircraft attrition during penetration to and attack of targets defended by anti-aircraft guns. The attacking aircraft may be in nonlevel flight but are constrained to maneuver only in the vertical plane containing the target. Attrition can be calculated for any number of aircraft penetrating to the target; however, the aircraft must all be of the same type and perform identical maneuvers. To simplify procedures required to prepare cases for analysis, calculations required to define aircraft flight profile (e.g., based on input values for aircraft speed, altitude, and dive and climb angles) are performed by the program. These calculations include verification and, if necessary, an adjustment of the input flight-profile data. The model is fast running, and inputs are easily prepared. It is a good screening device for comparing the vulnerability of various attack aircraft against a target and defense array. Defenses and targets can be spaced automatically in a grid or placed at precise locations.

INPUT:

- Aircraft vulnerable areas for each aircraft and defense type
- Target and defense locations (or spacing)
- Flight path data: Escape altitude, minimum allowable flight altitude, penetration altitude, bomb release altitude, safe escape radius, climb and dive angles, mask angles, etc.
- Defense data: Number, firing rate, projectile weight, maximum effective range, time delay, type of fire control, ballistic parameters, reload time, total rounds, etc.
- Aircraft data: Velocity in each segment of flight path, g's, number of aircraft in flight

OUTPUT:

- All input data is displayed
- Firing history
- Final results: For each defense type separately or combined, for a single aircraft and total aircraft

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MODEL LIMITATIONS:

- o Two dimensionsal flight
- o 25 defense units, each of same type, but no limit on number at a given unit
- o 10 flight profiles
- o 10 aircraft types

HARDWARE: Computer: IBM 360 or derivative

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: RM-5278-PR, PEN SQUARE: An Expected-Value Model for Computing Attrition to Maneuvering Aircraft Attacking a Target Defended by Anti-Aircraft Guns, July 1967

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: Natalie W. Crawford

TITLE: PETRONET

PROPONENT: US Army Logistics Center

DEVELOPER: The BDM Corporation

PURPOSE: PETRONET is a computerized, analytical, and logistical model. The model was designed to represent multimode petroleum distribution systems delivering POL in the theater of operations. The purpose of the bulk POL distribution system model is for comparing alternative systems and their operations which reflect established or proposed policies and procedures. It also deals with the simulation of multiple bulk POL distribution networks representing four modes (rail, highway, hoseline/pipeline, and waterway) of intratheater transportation and transshipment between modes.

GENERAL DESCRTIPTION: PETRONET is a two-sided, mixed model which deals with land, air, and sea forces. The model was designed to deal with units from theater level down to the brigade level. This model is event-store and uses queuing theory, probability, and network analysis as methods of solution. PETRONET interfaces with the DAMSEL transportation network and can be applied anywhere in the world covered by that data base.

INPUT:

- Product storage dedication
- Product stockage objective quantity
- Above average issue quantity
- Order - delivery time
- Safety level quantity
- Product inventory
- Pipeline fill
- Priorities
- Daily demand rate
- Various transportation network and vulnerability parameters from DAMSEL data base

OUTPUT:

- Pipeline fill
- System stockage statistics
- Terminal stockage statistics
- Transportation network description
- Link workload
- Mode workload

MODEL LIMITATIONS: The number of nodes and user units imposing on the system are limited by the computer storage capability.

HARDWARE:

- o Computer: CDC 6000
- o Operating System: NOS/BE
- o Minimum Storage Required: 225K (octal)

SOFTWARE:

- o Programming Language: FORTRAN, GASP
- o Documentation:
  - MAWLOGS
  - PETRONET manuals, The BDM Corporation, 1979
- o User's and programmer's manuals are complete with a combination of MAWLOGS documentation

TIME REQUIREMENTS:

- o 3 months required to acquire base data if not in DAMSEL system
- o 2 months required to structure data in model input format
- o 1 through 20 days required for playing time
- o 30 days required learning time for players
- o 3 months required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times yearly

USERS:

- o Defense Nuclear Agency
- o US Army Logistics Center
- o The BDM Corporation

POINT OF CONTACT: Mr. Sherm Cockrell
Simulation Division, OAD
US Army Logistics Center
Fort Lee, VA 23801

MISCELLANEOUS: Utilizing MAWLOGS model assembly capabilities, changes can be made to this modular model as required.

KEYWORD LISTING: Analytical, Logistical, Land, Air, Sea, Computerized, Two-sided, Mixed, Event Store, Transportation, Pipeline, Network

TITLE: PEV - Population Evacuation Model

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Model Division OS/FEMA

PURPOSE: The PEV is a computerized analytical model to determine a post-evacuation geographic population distribution under various restrictions on population movement. Evacuation means a movement from a pre-defined high risk area to a pre-defined low or no risk area.

GENERAL DESCRIPTION: PEV is a one sided, deterministic model that is used to determine (1) which areas are evacuation and host areas and (2) what is the post-evacuation population distribution. There are three major evacuation options; (1) no risk or distance constraints, (2) no risk constraints with a distance constraint, and (3) risk constraints with no distance constraints. A special version of the model is being programmed to consider both distance and risk constraints.

INPUT:

- o Pre-attack data on shelter spaces by shelter type and population identified by common geographic areas.
- o Data file identifying common geographic areas as host or risk areas, neither host or risk areas.
- o Data file that carries an overpressure (PSI) and/or an Equivalent Residual Dose (ERD), from a user defined attack pattern for common geographic areas.

OUTPUT:

- o Hard copy output showing the evacuation area population, population actually evacuated, host area populations and populations absorbed for each area (Area's generaly defined as States).
- o Tape output containing the post evacuation population for every point in the file. This output data can than be merged into the ready resource file for use in the Ready Damage Estimation System.

MODEL LIMITATIONS: The model does not consider geographic barriers, transportation capability or time constraints.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System UNIVAC 1100 Series
- o Minimum Storage Required: 65K (UNIVAC)
- o Peripheral Equipment: Honeywell Page Printer System and UNIVAC 9300 Card Reader and Printer

SOFTWARE:

- o Programming Language: FORTRAN V (UNIVAC 1108)
- o Documentation: Population Evacuation Model FEMA TM-298

TIME REQUIREMENTS:

- o Time to generate data to change the risk factors (PSI or ERD) for each geographic area varies with the study requirement.
- o CPU time per model cycle varies from several minutes to one or two hours, depending on the requirements of the study.
- o Days to weeks to analyze and evaluate results, depending on the scope of the study under consideration.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 to 25 times per year

USERS:

- o Principal: Federal Emergency Management Agency
- o Other federal non-Defense Department and Agenciees with emergency responsibilities under Executive Order 11490, 28 Oct 69.

POINT OF CONTACT: Dr. William Fehlberg
OS/FEMA, Computer Model Division
Federal Emergency Management Agency,
Donohoe Building
Washington, DC 20472
Telephone: (301) 926-5411

KEYWORD LISTING: Analytical Model, Deterministic, Crisis Relocation Planning, Shelter space, Conglomerates, Host, risk, PSI, CRP

TITLE: PFM - Patient Flow Model

PROPONENT: Director, Combat Developments and Health Care Studies, Academy of Health Sciences, US Army

DEVELOPER: Office of the Surgeon General, Department of the Army

PURPOSE: The Patient flow Model is a computerized, logistics flow analysis tool. The flow of patients through as many as four echelons can be simulated, while varying strengths, admission rates, skip echelon policies, fast or slow evacuation means and dispersion factors are evaluated. Forecasts of hospital bed requirements and patient evacuation requirements by echelon, plus impact upon the CONUS hospitalization system from admissions evacuated from the theater are also evaluated. The model can be used to evaluate effects of changes in evaluation policy, changes or use of skip policy, and sensitivity of any assumptions concerning input variables.

GENERAL DESCRIPTION: The model is a one-sided, deterministic, time-step patient flow analyzer for theater-level land forces. The smallest group is usually a division, but brigades, task forces, and other unique combat elements can be separately analyzed. Primary solution techniques involve probability distributions of patient accumulation and dispositions.

INPUT:

- o Dispersion factors
- o Number of time periods
- o Length of periods
- o Number of echelons
- o Number of regions per echelon
- o Troop strengths by region by time period
- o Wounded, disease and nonbattle injury rates by region by time period
- o Evacuation and skip policy

OUTPUT:

- o Admission summary by echelon
- o Patient flows and status at each time period in each echelon (bed requirements, evacuees, deaths, discharges, skipped evacuees)

MODEL LIMITATIONS:

- o Maximum of 24 time periods
- o Total days not to exceed 360
- o Four echelons; eight regions each
- o 2 day minimum time period

HARDWARE:

- o Type of Computer: CDC 6500
- o Operating System: NOS/BE
- o Minimum Storage Required: 70 Octal K
- o Peripheral Equipment: Reader, printer, 2 disk files

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Complete in one manual with narratives, flowchart, program listing, and input formats. Data base probability distributions are also included. User's documentation is complete, but technical documentation is limited.

TIME REQUIREMENTS:

- o 5 man-months to acquire base data.*
- o 1 man-month to structure data in model input format.*

  * Given the present data base (probability distribution), it takes only 5 to 30 minutes to structure an input deck.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS:

- o Principal: Director, Combat Developments and Health Care Studies, US Army
- o Other: US Army Command and General Staff College
  Office of The Surgeon General
  Department of the Army

POINT OF CONTACT: Director
Combat Developments and Health Care Studies
(HSA-CSD)
Academy of Health Sciences, US Army
Fort Sam Houston, Texas 78234
Telephone: Autovon 471-3303

MISCELLANEOUS: The "T52" module of the OJCS JOPS III System is an interactive version of this model in COBOL. The "T52" adds several enhancements to include blood/fluid utilization, air/surface evacuation requirements, and other planning information.

KEYWORD LISTING: Analytical, Patient Flow, Logistics, Land Forces, Division Level, Deterministic

TITLE: POSTURE System

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: POSTURE is a computerized, analytical logistics model designed to assist in defining the strategic mobility resources required for contingency situations and to assist in assessing the delivery capability of a given set of resources. The primary problem addressed is that of determining the optimal least-cost strategic mobility resource system required to meet time-phased strategic deployment requirements or, conversely, the maximum deployment capability of the given mobility resources. The model is concerned with both commercial and military mobility resources, DOD transportation requirements to meet concurrent non-war and peacetime obligations, time-phased readiness of movement requirements and availability of lift resources, intermediate transfer points, mixed commodity loads, peacetime economic value of military resources, mobility support constraints, and multiple contingencies.

GENERAL DESCRIPTION: The POSTURE System is actually three computer programs or phases. These are the matrix generation, the LP and the Report Writer. All are run on HIS 6080. POSTURE involves land, air and sea forces. It is designed to consider troops, vehicle groups, and cargo categories at the infantry level. The model is deterministic. Simulated time is treated on a time step basis. Linear programming is the primary solution technique employed.

INPUT:

- o Origin/destination sets for force transfers
- o List resources
- o Cost parameters for the resources
- o Time-phased requirements by contingency and unit type
- o Vehicle characteristics, speed, payload
- o Allowable routes and route distances
- o Operational delay assumptions
- o Attrition factors (if used)
- o Convoy limits by theater and time period
- o Resource availability
- o Cargo characteristics: Containerized or outsize

OUTPUT:

- o Computer printout of optimal solution, giving 10-year system cost, fleet sizes, level of deployment activities, and basing and readiness levels of resources. Report writer tables are also available aggregating, manipulating, and interpreting solution results.

MODEL LIMITATIONS:

- o 5 theaters
- o 5 world areas
- o 20 time periods (variable length)
- o 12 commodity types
- o 9 origins
- o Vehicles are fractionalized
- o All events are deterministic
- o Cargo requirement integrity is not maintained

HARDWARE:

- o Computer: HIS 6080
- o Operating System: HIS: 6080 GCOS
- o Minimum Storage Required: 70K words
- o Peripheral Equipment: Tapes and Disk

SOFTWARE:

- o Programming Languages: FORTRAN IV and LP6000
- o Documentation:
  (1) OAD-CR-5: "POSTURE System Description and USER's Manual" June 1973
  (2) OAD-CR-52: "Prepackage - A Model of the POSTURE Linear Programming System" August 1974
  (3) OAD-CR-67: "POSTURE-to-Simulator (POSSIM) - A Module of the POSTURE Linear Programming System" October 1974
  (4) "Matrix Generator (MATGEN) Module of the POSTURE Linear Programming System" (Draft) February 1977

TIME REQUIREMENTS:

- o 2 weeks to acquire base data
- o 1 week to 2 man-months to structure data in model input format
- o 40 minutes to 1 hour CPU time per model cycle
- o 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 times per year

USERS: Organization of the Joint Chiefs of Staff (J-4)
Office of the Assistant Secretary of Defense (SA)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-3686

KEYWORD LISTING: Analytical Model; Logistics; Land Forces; Air Forces, Sea Forces; Computerized; Deterministic; Time Step

TITLE: PROFORMA - Pre-Voyage Performance Analysis

PROPONENT: Military Sealift Command

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory Warfare Analysis Department

PURPOSE: PROFORMA is a computerized model that provides Headquarters, Military Sealift Command with comparative ship voyage, income, and expense data to assist management decision making in the acquisition and economical utilization of shipping. The model addresses the problem of how to economically transport cargo by sea.

GENERAL DESCRIPTION: PROFORMA is a one-sided model and is based on a deterministic algorithm. The model determines the cost incurred, revenue gained and length of time involved in the movement of cargo by a specified ship. The model's results give costs and revenue of potential voyages from which decisions can be made concerning future ship voyages and expected shipping requirements for the future. The model considers events in a time step fashion and uses heuristic logic.

INPUT: The model contains a data base with the following information:

- o Characteristics of all MSC controlled dry cargo ships
- o Cargo handling capability of all worldwide water ports
- o Distance between ports
- o Billing rates for transporting cargo to various ports from a given port

Therefore, a user need only to select a ship, ports of call, and the cargo to be moved for a simulation.

OUTPUT:

- o Income by cargo type
- o Ship costs incurred
- o Ship schedule (arrivals, departures, cargo by type lifted and unloaded)
- o Optimal ship usage after a planned voyage has been terminated

MODEL LIMITATIONS:

- o Current year +1 for ship schedule projections
- o 40 ports
- o 30 commodities

HARDWARE:

- o Computer: CDC 6700
- o Operating System: SCOPE 3.3 or 3.4
- o Minimum Storage Required: 54K octal 64 bit words
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: NSWC/DL Technical Report T-3568, The PROFORMA Model (MOD 2), (Command-Users Manual)

TIME REQUIREMENTS:

- o A few minutes to structure input
- o 90 seconds CPU time per model cycle
- o A few minutes to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: Military Sealift Command

POINTS OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 663-7406 or 663-8645

Commander, Military Sealift Command
Ship Operations Branch (M-3711)
Washington, D. C. 20390
Telephone: Autovon 292-2911
Commercial 202/282-2911

MISCELLANEOUS:

- o The current version of PROFORMA supersedes the original version of PROFORMA
- o Modifications have been made to increase flexibility and efficiency

KEYWORD LISTING: Analytical Model; Logistics; Costing; Scheduling: Sea Transportation

TITLE: PWM - Patient Workload Model

PROPONENT: Assistant Superintendent, Combat Developments and Health Care Studies, Academy of Health Sciences, USA

DEVELOPER: US Army Logistics Center

PURPOSE: PWM is a computerized, analytical, logistics model designed to assess the resource requirements for health care delivery to the Army-In-The-Field. It determines the number and types of patients expected from specific combat situations and resources required to process this workload through a Division medical support system.

GENERAL DESCRIPTION: The Patient Workload Model is a one-sided, stochastic model dealing with land forces only. It was designed to generate realistic paitent loads impacting on the combat zone medical systems by accessing the MEDPLN automated data base; to process combat division patients from the battalion aid station to the supporting combat hospitals, providing reports on this processing useful to medical planners; and to produce a patient stream suitable for further processing by the Hospital Model. The model is divided into two submodels, the Patient General Submodel which accomplishes the patient generation function, and the Division Processor Submodel which accomplishes the patient processing function through a divisional level medical support system.

INPUT:

- o Scenario-unit, area, type operations, terrain, climate, troop strength, length of engagement
- o Medical system structure
- o Medical doctrine

OUTPUT:

- o Number of admissions by class
- o Number of outpatients by class
- o Statistics on patient flow, treater utilization, ambulance utilization

MODEL LIMITATIONS:

- o Does not play nuclear warfare
- o Applies to Army-In-The-Field personnel only

HARDWARE:

- o Computer: CDC 6500
- o Operating System: SCOPE 3.4.4
- o Minimum Storage Required: 140K octal

SOFTWARE:

- o Programming Languages: FORTRAN IV and SIMSCRIPT
- o Documentation: Complete in one manual

TIME REQUIREMENTS:

- o 2 man days to structure data base
- o 15 to 30 minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USERS: Assistant Superintendent, Combat Developments and Health Care Studies

POINT OF CONTACT: Assistant Superintendent
Combat Developments and Health Care Studies
Academy of Health Sciences (HSA-CSD)
Fort Sam Houston, Texas 78234
Telephone: Autovon 471-3303

KEYWORD LISTING: Analytical, Medical, Computerized, Land Forces, One-Sided, Stochastic, Event Store

TITLE: P001 - Antiaircraft Artillery Simulation Computer Program

PROPONENT: AF/SAGF

DEVELOPER: Air Force Armament Laboratory

PURPOSE: Analysis

GENERAL DESCRIPTION: P001 computes the single shot probability of kill (SSPK) of a target aircraft flying through anti-aircraft artillery (AAA). Aircraft attrition along an entire flight path is attained through accumulation of the SSPKs. The major portion of the program is concerned with the analysis of the various sources of random errors which influence the effectiveness of the AAA. After assessment of these errors, the vulnerable area of the aircraft is located within the total distribution of AAA trajectories, and the probability of kill is computed.

INPUT:

- o Gun type
- o Firing constraints
- o Site array

OUTPUT: Computer printout summarizing results

MODEL LIMITATIONS: One-on-one simulation

HARDWARE: MULTICS computer

SOFTWARE:

- o Program is written in FORTRAN
- o Documentation is available from the Naval Weapons Center, China Lake, for the original version. No documentation is available on the SAGF modified version

TIME REQUIREMENTS: Typical run times are on the order of five minutes

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Sixty times a year

USERS: AF/SAGF (Special modified version)

POINT OF CONTACT: Original Version
Commander
Code 3181
Naval Weapons Center
China Lake, CA 93555

AF/SAGF Modified Version:
HQ USAF/SAGF
The Pentagon
Washington, D.C. 20330

COMMENTS: AF/SAGF version currently being modified to include multiple aircraft components.

TITLE: QJM - Quantified Judgment Model

DEVELOPER: Historical Evaluation and Research Organization (HERO), a Division of T.N. Dupuy Associates, Inc.

PURPOSE: The QJM is a computer model of combined arms combat aggregated at the divisional level, providing hierarchical representation of land combat with conventional and tactical nuclear weapons at levels from battalion through army group and theater, in order to estimate personnel and material losses and combat movement.

GENERAL DESCRIPTION: The QJM is a two-sided deterministic model reflecting individual weapons effects, the interactions of weapons, and the effects of factors representing all identifiable environmental and tactical/operational variables on weapons and forces. It was developed from historical data on 60 World War II engagements in Italy in 1943-1944. It has been validated statistically against data for 60 additional World War II engagements in Northwest Europe, Italy, East Europe, and Okinawa, 51 engagements in the 1967 and 1973 Middle East Wars, and three in World War I. It has been used to analyze amphibious and airborne operations. There are two submodels for: (1) Tactical nuclear combat, and (2) Electronic battlefield effects.

INPUT:

- o Forces
  - Force structure
  - Personnel
  - Weapons characteristics
  - Combat and transport vehicles
  - Organic aircraft
  - Close support and interdiction air sorties
  - Location
- o Tactical varibles
  - Defensive posture
  - Air superiority
  - Surprise
  - Mobility
  - Vulnerability
- o Other variables
  - Terrain
  - Weather
  - Season
  - Fatigue over time
  - Day/Night effects
  - Mission
  - Strength/Size
  - Opposition
  - Electronic variables
  - Shoreline effects (over beach or river bank)
  - Road quality and density
  - Stream/River delay effects

OUTPUT:

- o Success/Failure (based on combat power)
- o Attrition
  - Personnel
  - Tanks
  - Artillery
  - Other major equipment items
- o Distance of FEBA movement
- o Combat effectiveness

MODEL LIMITATIONS:

- o Aggregated treatment of air defense
- o Logistics not handled directly

HARDWARE: Any microcomputer with 48K memory

SOFTWARE:

- o Programming Language: Basic and Assembler
- o Documentation:
  - "The Impact of Nuclear Weapons Employment on the Factors of Combat,"! report for the Defense Nuclear Agency, 1980
  - NUMBERS, PREDICTIONS & WAR, by T.N. Dupuy, New York, 1979
- o Users Manual

TIME REQUIREMENTS:

- o 2 weeks to acquire data
- o 1 week to structure data
- o 2 hours to run 1 day of combat

SECURITY CLASSIFICATION:

- o QJM proper, UNCLASSIFIED
- o Tactical Nuclear Submodel (QJM/TNSM), SECRET

FREQUENCY OF USE: 100 or more times per year

USERS: HERO for:

- o Defense Nuclear Agency
- o US Air Force, Studies and Analysis
- o US Army, DCSOPS
  TRADOC
- o SHAPE Technical Centre
- o UK MOD
- o Jordanian Armed Forces

POINT OF CONTACT: Colonel T.N. Dupuy, USA, Ret
President
T.N. Dupuy Associates, Inc.
PO. Box 157
Dunn Loring, Virginia 22027
(703) 560-6427

KEYWORD LISTING: Validation, Variables, Factors, Combat Power, Conventional, Tactical Nuclear, Hierarchical, Electronic Warfare, Historical Data, Combined Arms, Attrition, Movement

TITLE: QUICK - Quick-Reacting General War Gaming System

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Command and Control Technical Center (CCTC) with contractor support.

PURPOSE: The system is designed to assist the military war gaming analyst at the Joint Staff level with the generation of detailed strategic nuclear war plans from general objectives and available forces and targets suitable for stochastic (Monte Carlo) event simulation of war plans, and the statistical evaluation of war plans.

GENERAL DESCRIPTION: QUICK is a fully computerized, two-sided strategic nuclear exchange war gaming system which consists of four functional subsystems as follows:

(1) Data Management: QUICK employs the HIS Integrated Data Store (IDS) System to maintain and control an integrated data base which includes all target and offensive weapon information required to produce a general war plan. In this type data base, all record types are interconnected in a logical fashion such that any data item may be queried in a generalized manner.

(2) Weapon/Target Identification: This subsystem assembles and processes target and offensive weapon data selected by the user and reformats the data to make it acceptable to the QUICK Integrated Data Base.

(3) Weapon Allocation: This module allocates offensive weapons to targets so that a near optimum laydown, subject to user-input constraints, is generated. The near optimum laydown is achieved through the generalized LaGrange multiplier technique. Targets are assigned value in the data base and a weapon price is developed in the allocation process. The system allocates weapons to one target at a time so as to achieve maximum profit. Profit is defined as the difference between target value destroyed and weapon cost. A near optimum laydown is achieved when all weapons in the given stockpile have been allocated so that profit is maximized for each target.

(4) Sortie Generation: This module assembles and evaluates detailed missile and bomber attack plans.

The heart of the QUICK model is the plan generation subsystem which permits investigation of such problems as optimum weapon allocation; force posture effects; targeting criteria; antiballistic missile defense; command and control degradation; air defense; multiple independently targetable reentry vehicles; war plane valuation; strategic retargeting alternatives; interval, aggregate play of naval forces; automatic tanker allocation and dynamic bomber recovery.

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INPUT: With input of an offensive nuclear missile and bomber force and a set of fixed targets, QUICK can produce a detailed plan of attack, suitable for Monte Carlo war gaming, which is near optimum for user specified conditions.

OUTPUT: Output from the QUICK System:

(1) An expected value estimate of the results of the planned attack.

(2) A file of weapon desired ground zeros suitable for input to external attack execution simulation systems.

MODEL LIMITATIONS: Model detail is as great as possible, but does not include individual encounters. Model is extremely data sensitive. Proper structuring of input requires considerable experience and expertise.

HARDWARE: QUICK is operational on the Honeywell Information System (HIS) 6080 at the Command and Control Technical Center (CCTC).

SOFTWARE: The QUICK System runs under control of the HIS 6000 General Comprehensive Operating Supervisor (GCOS). Utility type subroutines are written in the Generalized Macro Assembler Program (GMAP). All QUICK programs are written in the FORmula TRANslator (FORTRAN) computer language. Through the QUICK System Central Operations Processor (COP), the user can direct the execution of the system through text english commands which are imperative sentences that provide meaning to the executive software. These commands permit data construction, access, maintenance, validation, and display, as well as an option for QUICK module execution. The other option for module execution is the batch mode.

- o Documentation:
  - TM 153-77, The CCTC Quick-Reacting General War Gaming System (QUICK) General Description, 1 June 1977 (A045 422) CSM UM 9-77 VOL I, The CCTC Quick-Reacting General War Gaming System (QUICK) Users Manual VOL I, Data Management Subsystem, 1 June 1977 (A047 256)
  - CSM UM 9-77 VOL II, The CCTC Quick-Reacting General War Gaming System (QUICK) Users Manual VOL II, Weapon/Target Identification Subsystem, 1 June 1977 (A056 204)
  - CSM 9-77 VOL III, The CCTC Quick-Reacting General War Gaming System QUICK) Users Manual VOL III, Weapon Allocation Subsystem, 15 April 1978 (A055 848)
  - CSM UM 9-77 VOL IV, The CCTC Quick-Reacting General War Gaming System (QUICK) Users Manual VOL IV, Sortie Generation Subsystem, 15 April 1978 (A057 232)
  - CSM MM 9-77 VOL I, The CCTC Quick-Reacting General War Gaming System (QUICK) Maintenance Manual VOL I, Parts 1 and 2, Data Management Subsystem, 1 August 1977 (A054 377 and A054 310).

- CSM MM9-77 VOL II, The CCTC Quick-Reacting General War Gaming System (QUICK) Maintenance Manual VOL II, Weapon Target Identification Subsystem, 5 July 1977 (A050 081).
- CSM MM 9-77 VOL III, The CCTC Quick-Reacting General War Gaming System (QUICK) Maintenance Manual VOL III, Weapon Allocation Subsystem, 15 April 1978 (A055 847)
- CSM MM 9-77 VOL IV. The CCTC Quick-Reacting General War Gaming System (QUICK) Maintenance Manual VOL IV, Parts 1 and 2, Sortie Generation Subsystem, 15 April 1978 (A058 436 and A058 406)

TIME REQUIREMENTS: Computer time requirement is scenario dependent. Average approximately 6 hours.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly.

USERS: Studies, Analysis, and Gaming Agency (SAGA)

POINT OF CONTACT: Defense Communications Agency (DCA)

Command and Control Technical Center (C-314)
Strategic Forces Branch (C314)
The Pentagon
Washington, D. C. 20301
Telephone: (202) 695-9331 or 697-2932

MISCELLANEOUS:

- o QUICK generated output may be used as input to the Nuclear Exchange Model (NEMO), the Event Sequenced Program (ESP), and SIDAC models.

KEYWORD LISTING: Analytical Model, General War, Air Forces, Sea Forces, Computerized, Two-Sided, Mixed Deterministic/Stochastic, Event Store

TITLE: Radar Track Analysis Model (FPS-7/FPS-26 Tracking of one F-11 with ECM and two F-15s without ECM when all are flying in a formation)

PROPONENT: Tactical Air Command (TAC)

DEVELOPER: AFEWC/SAA

PURPOSE: To predict burnthrough range for the formation

GENERAL DESCRIPTION: By scanning 160 milliradians of the main lobe across each of the aircraft and examining the resolution cells of the radar, a composite of the tracking signal returns and the J/S ratios can be plotted. By comparing the returns to the Radar MDS (minimum detectable signal) and the jamming to the J/S required for no track it is also possible to predict burnthrough range.

INPUT:

Jammer Pattern and Parameters

Radar Pattern and Parameters

OUTPUT:

Tracking and J/S ratios at each range increment

Tracking above MDS and J/S less than required for jamming

MODEL LIMITATIONS: Limited to 160 milliradians of antenna movement in two milliradian steps

HARDWARE:

Computer: UNIVAC 418-III

Operating System: RTOS 9E

Minimum Storage Requirement: 30,000 words

Peripheral Equipment: Card reader

SOFTWARE:

Programming Language: FORTRAN

Documentation: Listing only

TIME REQUIREMENTS: Two minutes CPU time/formation evaluated

SECURITY CLASSIFICATION: UNCLASSIFIED Program, Output SECRET

FREQUENCY OF USE: As required

USERS: AFEWC/SAT

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POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

COMMENTS: Other aircraft and radars may be substituted for those currently in the model.

TITLE: Radio Direction Finder Performance

PROPONENT: HQ, U.S. Army Test and Evaluation Command (TECOM)

DEVELOPER: R. W. Moss and H. H. Jenkins, Electronics Technology Laboratory, Georgia Tech Engineering Experiment Station, Atlanta, Georgia

PURPOSE: Assess the system performance of a net of unfriendly DF systems in the HF and UHF frequency region.

DESCRIPTION: Probability of intercept and the elliptical probable error (EPE) are considered to assess system performance. The probability of intercept provides a measure of the likelihood that a signal will be received at a remote point, and the EPE quantifies the radiolocation error when two or more DF sites obtain bearings. It should be apparent that both of these performance measures involve a number of parameters which characterize any given situation. Typical of these parameters are: transmitter power, antenna heights, DF angular accuracy, frequency, and soil and terrain characteristics. Basically the analysis model consists of HF and VHF propagation models, radio noise models, soil and terrain features, DF performance parameters, and EPE plot routines.

INPUT: Season of the year: summer, winter, or transitional

Time of day (0 - 2400)

Level of noise: high, medium, or low

Type of terrain: plains, hills, and mountains

Number of direction finder (DF) sites

Soil dielectric constant: excellent > = 80, good $\geq$ 10, poor < 10

Soil conductivity: excellent > = 4, good $\geq$ .003, poor < .003

For each DF site:

X and Y coordinates of the DF site

Instrumental Variance

Normalized variance of error

Modulation factor K(0<K< = 1)

Number of DF scans

Antenna height (meters)

DF receiver bandwidth

DF antenna gain

Number of Target Transmitters

For each target transmitter:

X and Y coordinates of target transmitter

Power (watts)

Frequency (MHZ)

Gain (DB/isotropic)

Type of polarization of target transmitter antenna

2-vertical 1-horizontal

Antenna height (meters)

OUTPUT: Major axis of CEP ellipse

Minor axis of CEP ellipse

Maximum signal noise ratio (SNR) at any DF due to stated target

Maximum probability of intercept at any DF due to stated target

Graph of CEP ellipse and DF sites

HARDWARE: HP 9830A with plotter

SOFTWARE: Program Language: BASIC

Documentation: Partial - Report: "Mathematical Modeling of Radio Direction Finder Performance" July 1976 by R. W. Moss and H. H. Jenkins, Electronics Technology Laboratory, Georgia Tech Engineering Experiment Station, Atlanta, Georgia

TIME REQUIREMENTS: Run time - 3 minutes per target DF setup

SECURITY CLASSIFICATION: For official use only (FOUO)

FREQUENCY OF USE: once

USERS: TECOM

POINT OF CONTACT: Commander
U.S. Army Test & Evaluation Command
ATTN: DRSTE-AD-S
Aberdeen Proving Ground MD 21005
AUTOVON: 283-2775/3286

COMMENTS: Approximately 20 sample runs, which varied different parameters, were duplicated by our HP version of the program.

TITLE: RADOBS SYSTEM - Radar Observations System

PROPONENT: Headquarters, NORAD, ADCOM/XPYS

DEVELOPER: RCA-NORAD/ADCOM

PURPOSE: The RADOBS System is a computerized analysis model comprising several programs which will generate a series of vacuum-ballistic (rotating earth) trajectories for a given set of launch and impact points and radar look angles for each generated trajectory. Subsequent programs are designed to process the generated data. Missile trajectories may be generated (via table lookup) to match intelligence estimates of apogee altitude versus range. The model is designed for the analysis of the coverage capabilities of single or multiple radar systems and to analyze the timeliness of generated look angles.

GENERAL DESCRIPTION: The RADOBS programs are two-sided models which have deterministic elements. Both land and sea-launched ballistic missiles may be used. RADOBS is capable of considering individual radar-trajectory pairs and, if desired, can aggregate up to a maximum of 98 radar sensors, 600 launch point coordinates, and 300 impact point coordinates. The two-sided nature of the programs allows the user to determine radar sensor coverage of either launch or impact areas, plus associated radar detection-to-impact times. Simulated time is treated on an event store basis. Network analysis and queuing theory are the primary solution techniques used.

INPUT:

- o RADOBS Driver:
  - RUN mode card
  - Sensor parameters and location
  - Launch point coordinates and launch angles
  - Impact point coordinates
  - Table lookup (X-Y pairs of launch angle versus ground range)
- o Data Processing Programs:
  - Special processing card
  - Time frequency
  - Radar sub-systems

OUTPUT:

- o Computer printout of trajectory and radar look angles
- o Magnetic tape containing trajectory parameters and radar detection-to-impact times
- o Computer printout summarizing coverage data by launch point, impact point, and detection-to-impact times

MODEL LIMITATIONS:

- o Keplerian orbits - no perturbations
- o Vacuum trajectories
- o No powered flight
- o No atmospheric reentry
- o Fan-shaped sensors (two fans)
- o 98 sensors, 600 launch points, 300 impact points

HARDWARE:

- o Computer: Honeywell 6060
- o Operating System: GCOS
- o Minimum Storage Required: 8 to 60K per program
- o Peripheral Equipment: 2 random access temporary files; up to 3 magnetic tape drives

SOFTWARE:

- o Programming Language: FORTRAN IV and SIMSCRIPT II.5
- o Documentation:
  (1) R. J. Winkelman, "The Philosophy, Mathematical Methods, and Computational Methods for the MEWSAC System and the MEWSAC Program" Radio Corporation of America, Moorestown, N. J., Dec 1961
  (2) user's documentation for RADOBS, SUMMARY, and SUMMTRSP is in preparation.

TIME REQUIREMENTS:

- o 1 day to 1 week to acquire data base, dependent on input
- o 1 day to 1 week to structure data
- o CPU time processed at 470 launch-impact-radar combination per minute
- o Subsequent processing varies from 1-2 minutes per radar system
- o 1 day-3 months to analyze and evaluate results

SECURITY CLASSIFICATION:

- o Model is UNCLASSIFIED
- o The data base may be SECRET

FREQUENCY OF USE: 100 times per year

USER: NORAD/XPY

POINT OF CONTACT: Headquarters, NORAD (XPYS)
Peterson AFB, CO 80914
Telephone: AUTOVON 692-3535/3161
Commercial (303) 635-8911, Ext 3535/3161

MISCELLANEOUS: The RADOBS system utilizes several programs including the RADOBS driver (a version of the MEWSAC program), SUMMARY and SUMMTRSP. Several other programs not currently in normal use (e.g., for CONUS plots of iso warning times) are available for use within the system. Several updates of the model have been made since the original MEWSAC program was developed. These changes include a magnetic tape output capability, a table lookup feature, capability to process depressed/lofted trajectories, plus changes to improve the efficiency of the program. Follow-on data processing programs may be added as required.

KEYWORD LISTING: Analytical Model, General War, Limited War, Damage Assessment, Land Forces, Sea Forces, ICBM, SLBM, MRBM, Forces, Sea Forces, ICBM, SLBM, MRBM, IRBM, Radar, Radar Systems, Warning, Detection-to-Impact, Computerized, Two-Sided, Deterministic, Event Store, Keplerian, Ballistic

TITLE: RAPIDSIM - Rapid Intertheater Deployment Simulator

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: General Research Corporation

PURPOSE: The Rapid Intertheater Development Simulator is a computerized, analytical logistics model designed to simulate the rapid deployment of combat units and their resupply required for a military contingency operation. The model is used to determine the minimum time required to deliver each portion of the unit to its destination using ships and/or aircraft. All units are assumed to have a priority for movement. All movement of units are scheduled according to priority.

GENERAL DESCRIPTION: The RAPIDSIM is a deterministic model involving both aircraft and ships. Cargo tonnage is made available at ports of embarkation (POEs) according to schedules that reflect the readiness for movement of the units, the order of priority of units to be moved, and the movement times to the POEs from origin points. Specified airlift and sealift resources are initially applied to the movement of the cargo on the basis of a schedule of the availability of the resources at the POEs. The unit delivery rate is determined primarily by vehicle speed, vehicle capacity, and the time for loading and offloading.

INPUT:

- o Available number of aircraft by class
- o Available number of ships by class
- o POEs
- o PODs
- o Convoy Routes
- o Transportation modes
- o Time periods for initial ship availability
- o Commodities and units
- o Attrition rate of vehicles

OUTPUT: In addition to a detailed log of movements, summary reports are available as follows:

- o Summary of Materiel Movements -- showing for each POD the amount of each commodity required, moved, closed, the amount of the requirement which was not satisfied, and the amount lost
- o Summary of Aircraft Idleness -- showing the number of utilization hours remaining unused during each day
- o Summary of Unused Ship Resources at POE -- showing the ship periods of availability at each POE by time period and ship type
- o Summary of Unused Ship Resources at POD -- showing the ship periods of availability at each POD by time period and ship type
- o Summary of Aircraft Sorties from POEs -- showing the number of aircraft sorties to each POE by 5-day time period

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- o Summary of Aircraft Sorties from PODs -- showing the number of aircraft sorties to each POD by 5-day time period
- o Summary of Ship Attrition -- showing each ship the number made available, the number entering deployment, the number surviving, the number lost, and the percentage of deployed ships lost
- o Summary of Ships Arriving at POD -- showing for each POD the scaled number of ships arriving by ship and time period along with its implication of which ships were convoyed.
- o Summary of Convoy Utilization -- showing for each convoy route the number of convoyed ships departing during each period; also shown are the numbers arriving in convoy and the convoy size limit for each period
- o Summary of Ships Departing from POE -- showing the number of ships by each type sailing from each POE by 5-day time period
- o Summary of Non-Convoy Ships Sailing to Each POD -- showing the number of ships leaving each POE and sailing to each POD by time period

MODEL LIMITATIONS:

Parameter	PARAMETER RANGES Maximum No.	Minimum No.
Time Periods	*	1
Aircraft Classes	*	1
Ship Classes	*	1
POEs	*	1
PODs	*	1
Convoy Routes	10	0
Mode Definitions	3	1
Time Periods for Initial Ship Availability	30	1
Commodities	40	1
Attrition Rate Changes at Each POD	6	0
Movement Requirements	Unlimited	1
Partially Used Vehicles (at each point in the run)	400	0

*Limited by computer size

HARDWARE:

- o Computer: Honeywell 6080 or Honeywell 6180 for MULTICS
- o Operating System: GCOS
- o Minimum Storage Required: 36K plus scenario core requirements
- o Peripheral Equipment: Magnetic tapes and disk

SOFTWARE:

- o Programming Languages: FORTRAN Y and PL1
- o Documentation: User's Manual by General Research Corporation, 1 June 1974. Update in progress. Technical documentation is not available.

TIME REQUIREMENTS:

- o 2 weeks to acquire data base
- o 1 week to 2 man-months to structure data in model input format
- o 1 minute CPU time per model cycle
- o 4 hours to 2 man-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 260 times per year

USER: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-3686

KEYWORD LISTING: Analytical Model; Logistics; Transportation Airlift; Sealift; Closure Dates; Computerized; Deterministic

TITLE: RCC - Residual Combat Capability

PROPONENT: Vulnerability/Lethality Division, BRL, Aberdeen Proving Ground, MD.

DEVELOPER: Dr. J. Terrence Klopcic, VLD/BRL

PURPOSE: RCC provides a quantitative detailed assessment of the effectiveness of a unit (maximum size-battalion). Inputs (described below) come from many sources, including higher level war games. Outputs are compatible for use in such war games.

GENERAL DESCRIPTION: RCC is a one-sided, fully automated, event-sequenced model. Quantification begins with the definition of capabilities needed for a unit mission. These capabilities are vested in the various personnel and equipment, with full, user-definable, multi-capable elements allowed. Personnel and equipment are deployed, including identification of posture - nuclear as well as conventional. Weapons are employed using Monte Carlo techniques to portray target location errors and both volley-correlated and uncorrelated delivery errors. Casualties and damage are assessed for both nuclear and conventional threats using current techniques. Then, at realistic times during the engagement, the unit assets are reallocated and redeployed to optimize mission performance capability. Options include a comprehensive, asset competitive repair/return-to-service capability, reliability, dynamic posture changes and secondary casualty effects.

INPUT: The input module for RCC is a user-oriented, mnemonic interpreter. Inputs are keyed by English words, with all data free field. Input data include:

- Standard and alternate mission performance procedures
- Unit composition and deployment
- Elemental capabilities, degradations and repair
- Threat (Acquisition, Warhead Delivery, Warhead types)
- Vulnerability/Lethality Information

OUTPUT:

- Residual Combat Capability vs. time
- Weak Link (limiting capability) analysis
- Casualty/damage reports
- Operating procedure reports

MODEL LIMITATIONS:

- Level of detail limits practical applicability to battalion sized units.
- Communications included as normal liks (no special model)
- Full utilization requires good input data

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SOFTWARE:

- Totally contained in FORTRAN program (approximately 10K statements). Current input instruction list included. Documentation has been periodically updated. Program development accomplished on CDC 7600.

TIME REQUIREMENTS:

- Dependent on level of detail input preparation requires 1-4 man-months. Run time (CDC 7600) is in the order of minutes for a fairly complicated, multi-attack scenario on a full unit.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuous

USERS:

- BRL
- TRADOC Systems Analysis Agency (TRASANA)
- USALOGCNTR

MISCELLANEOUS: Extensions planned to include toxic chemical effects. Interfacing with higher level wargames (e.g., AMSAA's AFSM, TRASANA's FOURCE) is in progress.

TITLE: REACT - Requirements Evaluated Against Cargo Transportation

PROPONENT: Commander, Military Sealift Command

DEVELOPER: Naval Command Systems Support Activity

PURPOSE: REACT is a computerized, analytic, logistics model which simulates the movement of cargo and passengers by air or sea between up to 9 theater and 40 individual ports by merchant ships and tankers. REACT determines the capability of current or projected Sealift and Airlift forces to deliver required cargo in a contingency or general war situation.

GENERAL DESCRIPTION: REACT is a two-sided, deterministic model involving both air and sea forces. It considers individual ship and measurement ton of cargo, with a range of possible manipulations of up to 750 ships, 998 cargo generations, and 40 ports. Simulated time is treated on a combination time step and event store basis. The primary solution techniques used are linear programming network analysis, and probability theory.

INPUT:

- o Cargo movement requirements
- o Projected number of ships, theaters, and ports of interest
- o Distance table
- o Productivity figures for loading and unloading ships
- o Convoy size and speed
- o Projected attrition rates

OUTPUT:

- o Computer printout showing daily event listing and system status summary at selected time intervals
- o Data may be displayed in any desired format utilizing an attached report writer capability

MODEL LIMITATIONS:

- o 750 ships or 1,000 aircraft
- o 998 cargo generations
- o 40 ports
- o 9 theaters
- o 9 cargo types
- o 50 ship types

HARDWARE:

- o Computer: UNIVAC 1108/1110
- o Operating System: EXEC VII
- o Minimum Storage Required: 30K
- o Peripheral Equipment: Printer, Card Reader, Tape Drive

SOFTWARE:

- o Programming Language: FORTRAN V ANSI COBOL
- o Documentation: User's Manual - NAVCOSSACT DOC NO 53E302C, 4M-1 Program Maintenance Manual - NAVCOSSACT DOC NO.55E302C, MM-01, VOL I and II
- o Both user's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o 1 man-month to structure data in model input format
- o 1 to 60 minutes CPU time per model cycle
- o Substantial learning time for players
- o Matter of days for each run to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: No longer used.

USERS:

- o Principal: Chief of Naval Operations OP-96
- o Other: OP-405, Commander, Military Sealift Command

POINT OF CONTACT: Director
Integrated Sealift Systems, M-62B, CDR Horne
Building 210
Washington Navy Yard
Washington, D. C. 20374
Telephone: Autovon 288-3633
Commercial 202/433-3633

KEYWORD LISTING: Computerized, Analytic, Logistics, Two-Sided, Deterministic, Air Forces, Sea Forces, Combination Time Step and Event Store

TITLE: REACT Model

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: REACT is a computerized, on-line trans-attack damage prediction model, designed to provide quick estimates of losses or residual values for a select group of priority resources while a nuclear attack is in progress and thus provide the basis for policy decisions. The REACT Model predicts the extent of damage or casualty losses on selected resources by measuring the impact of nuclear detonations on the basis of parameters used in matching the weapon characteristics against those of the targets or resources in question. The specifications for the parameters, the structure of the damage and casualty assessment procedures, and the output information afforded parallel those basis elements in the READY model except there is no radiological fallout computation in REACT. They are described in the discussion of that model. The REACT system is characterized by speed and flexibility and is user oriented in that the computer, which constitutes the center of operations, can be queried in English language statements for the output, or have input data entered, by the user(s) from remote terminals. Answers will normally be provided in a matter of seconds, but may require minutes for extensive printouts. This model is intended for use in providing individualized up-to-the-minute status reports. Therefore, it is designed primarily for use in an interactive mode.

GENERAL DESCRIPTION: REACT is a one-sided, deterministic model capable of considering individual resource locations if desired, and also capable of aggregating losses over all of the 31,000 resource items within the United States now residing in the REACT data base. Probability theory is the primary solution technique used. Simulated time is created on an event store basis. Damage predictions are computed against the data base as each weapon is inputted.

INPUT: Basic input parameters can be classed as weapons and resources. The point of detonation for each weapon is the actual ground zero (AGZ) or the best approximation to it. Weapon characteristics consist of the yield of warhead, the height of burst, and time of detonation. Resource locations are provided in the same coordinate system used for the weapon locations. The resource data also include vulnerability characterizations or structural type of identification capable of being interpreted into the vulnerability characterization. Provision is also made to carry the identifying information, the classification code by which the category is structured, and up to ten data fields of category value. The population data were prepared by randomly selecting a 10% sample from Standard Location Areas (SLA) within each U.S. county. The population count for each county was forced to the pre-sampled (1979 projected) population total by multiplying each selected county data point population by the ratio of the total pre-sample county population to the total post-sample county population.

OUTPUT: Outputs are available primarily as visual displays on CRT terminals or as printouts from teletype compatible terminals. Certain selected displays can be coupled into closed circuit TV. On special request, printer listings of REACT weapons or resource files can be obtained. Estimates of damage and casualty status are given either for individual points or in summary form for selected resource categories. Summaries of the weapons are also available.

Thus, the analyst may ask a wide range of questions interactively with the model in order to obtain an estimate of the most recent status of the attack pattern and its effects on selected critical resources. The precision of the model analysis is the same as READY because the line of analysis is the same. But, since the entire data base currently contains only about 31,000 items, in order to insure expeditious real-time response, much of the detailed coverage afforded by the application of READY to the data base carried in the emergency package has been sacrificed.

MODEL LIMITATIONS: REACT uses the same weapon effects parameters used by READY in matching the weapon and resource data to make the damage and casualty assessment estimates. Their reliability is subject to the same limitations described for READY results. REACT casualty estimates are based on direct effects only; there is no consideration of radioactive fallout.

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: 1100 Series Operating System
- Minimum Storage Required: 65,000 words
- Peripheral Equipment: Interactive teletype compatible terminals connected on-line, remote and local

SOFTWARE:

- Programming Language: VULCAN
- Documentation:
  (1) "REACT Trans-Attack Information Systems," REG-103, National Resource Analysis Center, Resource Evaluation Division, OEP, September 1969
  (2) REACT User's Guide GSA/OP/MCL TM-251, Revision No. 5, December 1980

TIME REQUIREMENTS:

- Data base presently exists: See "REACT User's Guide" Section V
- Typically 1 minute or less response time per query
- 10 seconds CPU time per model cycle
- 4-8 hours learning time for users, depending on complexity of results desired
- 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Participated in several exercises. The system is also being used continually as a training device for a number of Federal civilian agencies.

USERS:

- o Principal: Federal Preparedness Agency
- o Other: Federal non-Defense departments and agencies with emergency responsibilities under Executive Order 11490

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, D. C. 20472
Telephone: 301-926-541[illegible]

MISCELLANEOUS: It is planned to improve the operating capability of the REAC model by reducing core requirements and improving real time response while expanding the operational data base.

KEYWORD LISTING: Analytical Model; Training Model; General War; Damage Assessment/Weapons Effectiveness; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

TITLE: READY MODEL

PROPONENT: Federal Emergency Management Agency, (FEMA)

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: READY is a computerized, nuclear attack damage assessment model designed to provide an adequately realistic simulation of a hypothetical post-attack situation as a basis for preparedness exercises and planning. It is intended to simulate the effects of a nuclear exchange on the resources, including population, of one adversary. From explicit information on weapon detonations, winds and the location and availability of resources, READY assesses the direct (prompt) effects and fallout radiation levels for all points of concern and estimates the expected damage or casualty level. From these estimates, the expected surviving population and facilities are developed in summary form. For large data categories, samples or selected subsets can be developed to provide rapid assessment of national resource totals.

GENERAL DESCRIPTION: READY is a one-sided, deterministic model capable of considering individual resource locations if desired and capable of aggregating up to a worldwide scale. Although designed primarily for use with the extensive FPA data bank on the US, the model can operate worldwide with appropriate input data. Probability theory is the primary solution technique used. Simulated time is treated on an event-store basis.

INPUT:

- o Nuclear weapons data: Yield of warhead, height of burst, time of detonation, fission ratio, actual ground zero or designated ground zero with the circular error probable, and wind data
- o Pre-attack status of resources data: Available in FPA files (three million records organized into approximately 110 categories) maintained for the most part in the READY format. The essential ingredients for the resource data are geographic locations, physical vulnerabilities of each data item, and value quantifications indicating the significance of the items within their resource categories

OUTPUT: The two basic types of output are point estimations and summary analyses. Generally, point estimations show pre-attack information together with estimates of post-attack status. Summaries include time-phased population conditions and availability of facilities, special presentations of items requiring unique assumptions of vulnerability (e.g., livestock and crops) and special comparisons of local time-phased supply requirements as the basis for deriving apparent deficits in housing and medical service. The levels of

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aggregation in these summaries may be provided for geographical totals such as an FPA region, an individual state, or individual standard metropolitan statistical areas, or may cover selected functional areas.

MODEL LIMITATIONS: READY reflects only the direct effect of blast, fireball gamma and thermal radiation, and fallout radiation. The effects of prevailing cloud cover, fire or firespread in the areas affected by the blast, earth shock, electromagnetic pulse and induced radiation are not considered.

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: EXEC VIII (UNIVAC)
- o Minimum Storage Required: 65K (UNIVAC)
- o Peripheral Equipment: Honeywell Page Printer System and UNIVAC 9300 Card Reader and Printer

SOFTWARE:

- o Programming Language: FORTRAN V (UNIVAC 1108)
- o Documentation:

  UNIVAC 1108 Technical Documentation:
  (1) READY I - Weapons Preparation Program GSA/FPA/MCL TM-234 Rev. 2, APRIL 1977
  (2) READY I - Attack Conditions Program, GSA/FPA/MCL TM-235, Rev. 1, Nov 1974
  (3) READY I - Weapons Effects Program GSA/FPA/MCL TM 231, Rev. 1, Nov 1974
  (4) READY I - Point Analysis Program GSA/FPA/MCL TM-232, Dec 1974
  (5) READY I - Summary Analysis Programs GSA/FPA/MCL TM-233, June 1977
  (6) READY I - Selector Program (Revision No. 1) GSA/FPA/MCL TM-247, June 1977

TIME REQUIREMENTS:

- o The existing data base is described in "Resource Data Catalog," GSA/FPA/MCL TM-258, Feb 1976
- o Time to structure data in model input format varies with the requirements of the study in hand
- o CPU time per model cycle is highly variable, ranging from minutes to many hours, depending on the problem under consideration
- o Days to weeks to analyze and evaluate results, depending on the scope of the exercise or study.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 to 25 times per year

USERS:

- o Principal: Federal Emergency Management Agency
- o Other: other Federal non-Defense Department and agencies with emergency responsibilities under Executive Order 11490, 28 Oct 1969

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources
Resource Management and Administration
Federal Emergecny Management Agency
Washington, D. C. 20472
Telephone: 301-926-5411

MISCELLANEOUS:

- o READY can use weapon assignments from the Attack Model.
- o READY provides attack residuals for the economic models.
- o It is currently planned to add more local supply/requirement comparisons network analyses, and reconnaissance reports to the model. It is being revised for interactive terminal accessing.

KEYWORD LISTING: Analytical Model; General War; Damage Assessment/ Weapons Effectiveness; Nuclear Forces; Computerized; One-Sided; Deterministic; Event Store; Vulnerability Analysis

TITLE: RECEIVER ONE

PROPONENT: HQ USAF/SAGM

DEVELOPER: HQ USAF/SAGM

PURPOSE: Computerized analysis of airfield saturation during force deployment.

GENERAL DESCRIPTION: A one-sided, stochastic, event-store model of possible Aerial Port of Debarkation (APOD) aircraft congestion and throughput capability during a major force deployment. The APOD processes each aircraft through approach, landing taxiing, offloading, maintenance, refueling, and takeoff. Effects of weather, interdiction, and air base losses can also be included. The computer run time required is heavily scenario dependent. A five APOD model with full aircraft mobilization simulated 30 days of deployment in about five minutes.

INPUTS:

- o Base characteristics, such as parking space and amount of material handling equipment
- o Aircraft characteristics, such as average payload
- o Average expected arrivals of each type aircraft at each destination APOD (may change daily)

OUTPUTS:

- o Computer printouts on utilization of APOD facilities
- o Queueing delays at various stages of base processing
- o Aircraft elapsed times
- o Tons delivered
- o Tons diverted from primary APOD

MODEL LIMITATIONS: Currently limited to seven APOD's and twenty aircraft types (could be expanded if required)

HARDWARE:

- o Type Computer: IBM 360/370
- o Operating System: System J
- o Minimum Storage Requirements: 400K bytes of storage
- o Peripheral Equipment: none

SOFTWARE:

- o Programming Language: GPSS V
- o Documentation: Available in HQ USAF/SAMC and SAGM

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TIME REQUIREMENTS:

- o 8-10 hours to complete new scenario, about one hour for moderate changes
- o 1-20 minutes CPU time per cycle, depending on scenario
- o 1-2 hurs data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Five times per week

USER: AF/SAGM

POINT OF CONTACT: HQ USAF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone: (202) 694-1844
AUTOVON 224-8155

MISCELLANEOUS: While not specifically linked to another model, RECEIVER ONE can use the sorties per day output from the OSD/PA&E ISDM/MIDAS models as an input

TITLE: REGRIP - Revised Growth Requirements for Industrial Preparedness

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Batelle Northwest Laboratories for the Resources Preparedness Office, Office of National Preparedness Programs, Federal Emergency Management Agency

PURPOSE: REGRIP is a computerized Dynamic Linear Programming Model designed to:

- o Identify industries in the economy that could not expand rapidly enough to meet the demands of a mobilized economy
- o Evaluate minimum cost approaches to provide the industrial capacity, skilled labor and strategic materials inventories necessary to meet all civilian and defense needs in wartime economy
- o Determine investment paths to either maximize defense goods production in one version or to meet all civilian and defense demands in another version

REGRIP employs the Leontief Dynamic Inverse Tehcnique to simulate impacts of mobilization for war on the domestic economy. The model can be used to analyze the economic effects of both general and limited war. There are two versions of the REGRIP model - REGRIP-MAX and REGRIP-MIN. REGRIP-MAX maximizes the weighted production of goods for the Department of Defense subject to sufficient production levels of intermediate goods, investment goods, defense goods and consumer goods and subject to capacity, lead-times, materials, and employment constraints. REGRIP-MIN minimizes the costs of adding increments in capacity, skilled labor, and strategic materials stockpiles to the peacetime economy to meet all civilian and defense requirements during mobilization. REGRIP models have been employed to address two problems: (a) to identify potential bottlenecks in capacity and skilled workforce in satisfying defense goods production requirements, and (b) to estimate required levels of civilian austerity to meet defense requirements. The model begins with a given level of defense goods requirements based on a given mobilization scenario. Then REGRIP solves for industrial outputs subject to capacity and workforce skill constraints. REGRIP is dynamic in a time-step sense and simulates up to eight six-month periods. Investments are generated where needed, but capacity expansion is limited by lead times for capacity installation.

GENERAL DESCRIPTION: REGRIP is a one-sided, deterministic model capable of considering industrial production to support land, sea, air, and paramilitary forces as well as civilians. REGRIP was primarily designed to consider 115 US industrial sectors, from which it in its present form cannot vary. The model can consider from four to eight six-month time periods.

INPUT:

- o Defense and civilian goods requirements
- o Input-Output tables
- o Occupational employment matrices
- o Materials consumption ratios
- o Industrial capacities and workforce occupational availability

OUTPUT: Computer printouts of linear programming solutions including lists of industries constrained by capacity of workforce occupational limitations.

MODEL LIMITATIONS:

- o Certain critical industry bottlenecks will not be revealed by a consideration of 115 aggregate industries
- o Inappropriate for use in estimating national production or workforce goals in its present configurations
- o Limited by lack of adequate maximum capacity data
- o National in scope with no regional, local or establishment detail

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: UNIVAC 1180 series
- o Minimum Storatge Required: 32K 36 bit words
- o Peripheral Equipment: Disc, UNIVAC 9300 printer, Honeywell Printer

SOFTWARE:

- o Programming Language: FMPS, FORTRAN V
- o Documentation: "A Model to Identify Potential Resource Constraints in a War Mobilization," Final report to FEMA by Atelle Northwest Laboratories (Aug 1979). No draft copies currently available

TIME REQUIREMENTS:

- o 3 months to structure data in model input format
- o One day to analyze output
- o 40 Minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 30 times per year

USER: Resources Preparedness Office, National Preparedness Program, Federal Emergency Management Agency

POINT OF CONTACT: Mr. E. L. Salkin
Resource Preparedness Office
National Preparedness Program Office
Federal Emergency Management Agency
Washington, D.C. 20472
Telephone: 202 287-0150

KEYWORD LISTING: Linear programming, Economic, Resources, Capacity, Manpower

TITLE: RELACS - Real Time Land Air Conflict Simulation

PROPONENT: IABG/SOP Ottobrunn, Germany

DEVELOPER: IABG/SOP Ottobrunn, Germany

PURPOSE: Analysis of land and Air Force force structure and operational concepts at the theater level. RELACS is also using as a training game at the Command and Staff College.

GENERAL DESCRIPTION: RELACS is a computer assisted, two-sided, theater level, mixed (stochastic-dererministic) event store simulation. Its primary solution techniques are lanchester equations and probability theory.

OUTPUT: Printout describing course of land and air battles and unit status. Post processor provides detailed game statistics.

MODEL LIMITATIONS:

- o Maximum ground force units - 300
- o Maximum types aircraft - 30
- o Maximum types SAM's - 9
- o Maximum types AAA - 8
- o Supply not considered

HARDWARE:

- o Computer: CDC CYBER 175
- o Operating System: NOS
- o Minimum Storage Required: 150,000 Octal words

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Available in German

TIME REQUIREMENTS:

- o To acquire Data Base: 1 month
- o To Structure Data in Model Input Format: 1/2 month
- o Player Learning Time: 1 week
- o Playing Time: 1 month
- o CPU Time per Cycle: 800-1500 seconds

SECURITY CLASSIFICATION: RESTRICTED

FREQUENCY OF USE: 120 times per year

USERS: IABG/SOP

POINT OF CONTACT: IABG
Abteilung SOP
Einsteinstrasse
D 8012 Ottobrunn, Germany

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TITLE: RISK II

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: RISK II is a computerized, nuclear attack assessment model designed to facilitate the production of "hazard" studies which provide emergency planners with comprehensive characterizations of the impact of contingencies created by nuclear attacks. Hazard studies establish best-to-worst characterizations of the spectrum of estimated effects of nuclear attack or post-attack survival conditions pertinent to planning contingencies. In each case, the spectrum presumes to cover the range of plausible effects/conditions considering enemy offensive capabilities used in the study. Alternative nuclear attacks, i.e., options, are devised to represent varying possibilities with respect to the initiation of a nuclear war. For each option, a series of outcomes (trials) is gamed through the Monte Carlo program of RISK II. The heart of the model is the "Point Experience Computation" wherein for each trial, nuclear effects are computed for geographic reference points and their associated resource categories. These effects include blast overpressure, fallout radiation intensity, time of first fallout arrival and equivalent residual dose. The results for all trials and reference points make up the "Point Experience Library" and provide the basic profile of the possible range of nuclear effects which may be anticipated. Physical vulnerability and shelter protection factors are applied to the spectrum of nuclear effects resulting in point analysis and summary analyses probability ranges which are essential for nuclear contingency planning.

GENERAL DESCRIPTION: RISK II is a one-sided, stochastic model capable of considering resource points on an individual basis if desired, and of aggregating up to a worldwide level. Although designed primarily for use with the extensive FPA data bank on the US, the model can operate anywhere in the Northern Hemisphere with the appropriate input data. Monte Carlo methods and theory are the primary solution techniques used.

INPUT: Weapon application lists for each option with nuclear detonation data, trial structure specifications and resource data.

OUTPUT:

- For various geographic reference points, selected probable results of basic nuclear effects are recorded in various formats. The most extensive application of this type provides probable effects for several thousand representative reference points organized alphabetically by cities within states by FEMA regions.

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- Summary analyses provide the planner with a prospective best-to-worst range of resources available after a nuclear attack. A routine is also available to develop a probable range of local, time-phased, supply requirement comparisons which indicate prospects for a surplus or deficit in such items as medical service housing and time-phased casualties.

MODEL LIMITATIONS: The weapon application list is limited to 3,000 weapons per option. Since the relative numbers of trials determine the relative weighting of the options, each option is given sufficient trials to provide representation of the principal variables (circular error probable, probability of arrival and wind season). In past studies, trials per option have ranged from eight to twenty. A discussion of the statistical reliability of RISK II is in National Resource Evaluation Center (NREC) Technical Report No. 22, "An Analysis of the Reliability of the RISK II Computer Statistical Model." Tables of confidence levels are given in the documentation. Nuclear Attack Hazard in the United States - (HAZARD-III is in preparation.)

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: UNIVAC 1100 Series
- Minimum Storage Required: 64K
- Peripheral Equipment: UNIVAC 9300 Card Reader and Printer, and Honeywell Page Printing System

SOFTWARE:

- Programming Language: FORTRAN V (UNIVAC 1108)
- Documentation: NREC Technical Report #11, RISK II NREC Vulnerability Analysis Comutation System, June 1965 (to be revised to reflect the latest changes in the methodology used by the system.)
- Documentation of the RISK II computer routines is currently being prepared for the programs which have been converted to the UNIVAC 1108 and will be published as Technical Manual 272.

TIME REQUIREMENTS:

- Approximate y 1-2 weeks with current data base; approximately 1 month to acquire and structure a new data base
- CPU time per model cycle is variable, ranging from a few to many hours, depending on the problem under consideration
- Days to weeks to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Major studies: HAZARD-69, HAZARD-III

USERS:

- o Principal: Federal Emergency Agency
- o Federal non-defense departments and agencies with emergency responsibilities under Executive Order 11490, 28 October 1969

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, D. C. 20472
Telephone: 301-926-5411

MISCELLANEOUS: RISK II takes weapon assignments from the Attack Generator Model.

KEYWORD LISTING: Analytical Model, General War, Damage Assessment/ Weapons Effectiveness, Nuclear Forces, Computerized, Stochastic, Vulnerability Analysis

TITLE: RPM - Rapid Production Model

PROPONENT: US Arms Control and Disarmament Agency

DEVELOPER: Academy for Interscience Methodology

PURPOSE: RPM is a computerized, analytical model designed to provide the capability for concise, detailed study of strategic force exchanges.

GENERAL DESCRIPTION: The model provides the capability to utilize any weapon force against any target type as described by the user. Force effectiveness is measured in target and collateral damage and personnel fatalities and casualties from fallout.

INPUT: Weapons system descriptions
Target and collateral data bases (coordinates, hardness, value, radius, etc.)

OUTPUT: Computer printout of target and collateral damage and fallout fatalities and casualties.

HARDWARE:

- o Computer: CDC CYBER 170
- o Minimum Storage: 100K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Available from USACDA

TIME REQUIREMENTS: Dependent on Problem - 2 man weeks to structure average problem

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: USACDA, JSTPS, CNO (OP604)

POINT OF CONTACT: Office of Operations Analysis
U.S. Arms Control and Disarmament Agency
State Department
320 21st Street NW
Washington, D.C. 20451

KEYWORD LISTING: Computerized; Strategic; Fallout; Nuclear

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TITLE: RRAM - Recruiting Resource Allocation Model

PROPONENT: Air Force Human Resources Laboratory, Manpower and Force Management Systems Branch, Decison Models Function (AFHRL/MOMD)

DEVELOPER: Same as proponent

PURPOSE: To develop a mathematically optimal scheme for the utilization and allocation of scarce Air Force Recruiting Service resources, especially recruiter resources.

GENERAL DESCRIPTION: RRAM allocates man-months of recruiter effort across the Air Force Recruiting Service structure down to the office level. For some 1000 offices (the size of the model at the time of development) an extensive recruiting productivity and demographic data base was constructed and nonlinear regression was used to produce a marketing effort function for each office. That functional response to recruiting effort is then an objective function in a dynamic programming allocation routine.

INPUT:

- o Interactive input
- o Number of offices, recruiters initially desired, and limitations on recruiter mobility
- o Recruiting Service program
- o Required number of recruits

OUTPUT:

- o Desired number of recruiters to achieve goals
- o Allocation of recruiting effort by office, flight, squadron, and group
- o Comparison of desired with previous actual productivity

MODEL LIMITATIONS:

- o Allocation must be by fixed recruiting structure--model does not indicate where nonexisting offices should be located
- o Nonlinear response function may not always be appropriate for data
- o Maintaining of data base currency

HARDWARE: Currently running interactively on UNIVAC 1108/81. Printer required for hard copy.

SOFTWARE: FORTRAN IV

TIME REQUIREMENTS: For 1000 office allocation of 2000 recruiters, approximately one minute.

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SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o AFHRL for development
- o Air Force Recruiting Service for operational use

POINT OF CONTACT: Air Force Human Resources Laboratory
Decision Models Function
Manpower and Personnel Division
Brooks AFB, Texas 78235
Telephone: AUTOVON 240-3648
Commercial 536-3648

KEYWORD LISTING: Optimization model, Resource Allocation model, Dynamic programming, Nonlinear Regression, Sales Force Allocation Model

TITLE: SAFE - Safeguards Automated Facility Evaluation

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Sandia Laboratories

PURPOSE: Safeguards Automated Facility Evaluation (SAFE) is a global evaluation for fixed site physical security systems using optimum pathing algorithms.

GENERAL DESCRIPTION: SAFE uses a digitized representation of the facility under evaluation. Together with such parameters as guard response times, penetration times, movement speeds, security detectors, etc., the security system is evaluated in a deterministic or stochastic manner.

INPUT:

- o Facility description
- o Guard response
- o Guard arms
- o Threat speed
- o Threat arms
- o Probability of detections

OUTPUT:

- o Probability of detection
- o Probability of interruption
- o Probability of system win

MODEL LIMITATIONS:

- o Tactics limitations
- o Facility complexity

HARDWARE:

- o Computer: PE 3220, 7/32
- o Operating System: OS 32/MT
- o Minimum Storage: 450KB
- o Peripheral Equipment: Printer, Graphics CRT, Digitizer

SOFTWARE:

- o Language: FORTRAN VII
- o Documentation: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 10 hours to input facility description and other security system details
- o 15 minutes for complete analysis of security system

SECURITY CLASSIFICATION:

- o Model: UNCLASSIFIED
- o Data: Function of facility
- o Results: Function of facility

POINT OF CONTACT: Mr. Ed Jacques
NSWC/G42
White Oak
Silver Spring, MD 20910
Telephine: (202) 394-2396

KEYWORD LISTING: Physical Security Model

TITLE: SAMEM Sustained Attrition

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Naval Surface Weapons Center/Dahlgren Laboratory
Warfare Analysis Department

PURPOSE: SAMEM is a computerized, analytical model that evaluates the effectiveness of a mine plan that includes mine choice and field design. The primary problem addressed is that of demonstrating the capability of a minefield of causing casualties and of identifying that which would need to be done to the minefield if it did not perform as advertised. It can also be used to test mine countermeasure (MCM) tactics.

GENERAL DESCRIPTION: SAMEM is a two-sided, stochastic model involving mining and influence minesweeping. It is designed to consider individual mines, individual ships and specific mine settings, and can aggregate up to any level for the normal minefield. Simulated time is treated on an event store basis. Monte Carlo simulation is the primary solution technique used.

INPUT: All data relative to the mines countermeasures and traffic ships, e.g., mine sensitivity, charge weight, ship speed, displacement, number of mines, placement, countermeasure data, etc.

OUTPUT:

- Number of casualties
- Number of mines fired
- Level of damage to each casualty

HARDWARE:

- Computer: CDC 6700
- Operating System: SCOPE
- Minimum Storage Required: 33K

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation consists of a Command Manual and an Input Guide

TIME REQUIREMENTS:

- 2 days to acquire base data
- 1 man-day to structure data in model input format
- Average of 5 seconds CPU time per model cycle
- 1 day to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice per year

USERS: NSWC for COMINWARFOR

POINT OF CONTACT: Naval Surface Weapons Center/Dahlgren Laboratory
Operations Research Division (Code KC)
Dahlgren, Virginia 22448
Telephone: 703/663-7406 or 663-8645

KEYWORD LISTING: Analytical Model, Damage Assessment/Weapon Effectiveness, Sea Forces, Computerized, Two-Sided, Stochastic, Event Store

TITLE: SAMS - Surface-to-Air Missile Simulation (TOP DOWN ZINGER)

PROPONENT: JTCG Model Repository at Wright Patterson AFB

DEVELOPER: AF/SAGF

PURPOSE: Analysis

GENERAL DESCRIPTION: SAMS is a family (SA-2 to SA-11) of computer models which simulate either an infrared or radar surface-to-air missile (SAM) system. The models include interaction of a maneuvering aircraft flight path with a guided missile flight path. For the radar controlled SAMS the interaction includes considerations of target radar signature, command generation, guidance dynamics, missile kinematics, tracking uncertainties, and proximity fusing. For the IR SAM the interaction takes into account target infrared signature, atmospheric attenuation, seeker sensitivity, guidance dynamics, and missile kinematics. Both the IR and Radar SAMs use aircraft vulnerable area.

INPUT:

- o Number and array of missile sites
- o Specifics on firing conditions and interactions with terrain as applicable
- o Model has a preprocessor

OUTPUT:

- o Computer printout of results of engagements
- o Information printed is user selectable
- o Model has a postprocessor

MODEL LIMITATIONS: Model is a one-on-one simulation

HARDWARE: Model is designed for CDC and IBM computers and easily transportable to other machines

SOFTWARE:

- o Models are written in standard ANSI X3.9-1966 FORTRAN
- o Documentation: Excellent documentation available at the JTCG Model Repository at Wright Patterson AFB

TIME REQUIREMENTS:

- o A single shot one-on-one engagement will use 30 seconds of run time
- o Total run time depends on both the number of sites and the shots per site

SECURITY CLASSIFICATION: SECRET/NOFORN

FREQUENCY OF USE: Ten to twenty times a month

USERS: This model has been made available to ASD, AFFDL, AFAL, FTD, Naval Weapons Support Center, AFTEC, USAFE, IDA, ADTC, General Dynamics, Rockwell, Martin-Marietta, AMRL, TFWC/SA, Los Alamos Scientific Laboratory, Sandia, Naval Postgraduate School, Naval Air Systems Command, Joint Cruise Missiles Program Office, McDonnell-Douglas, Fairchild Republic, Calspan, AF School of Aerospace Medicine, SAI, Northrop, Booz-Allen, Texas Instruments, Boeing, Grumman, AMSAA, Honeywell, and Quest

POINT OF CONTACT: AFWAL (FIMB)
ATTN: Jim Folck
AUTOVON 785-5888

COMMENTS: SAMs is currently under test thru contract with TRIAD Microsystems, Inc. Model is expected to be available to the repository in the winter of 1981. Model will be validated against FTD/MIA intelligence data in the CY 81/82 time frame.

TITLE: SATB HORSE V.20

PROPONENT: AFEWC/SATB

DEVELOPER: AFEWC/SATB

PURPOSE: Use one-way beacon equation modified by EPM 73 (ECAC) Propagation Loss Model to evaluate single jammer vs. single/multiple threat(s).

GENERAL DESCRIPTION: This program set permits developing a data file of potential threat locations and jammer parameters. This data is selectively used to construct a work file; in turn, this work file profices the data required to determine the area of coverage of a threat location employing a transceiver for which the parameters have been added to the work file. This program set includes computation of radio-propagation losses due to atmospheric anomalies; these anomalies are used in conjunction with the one-way beacon equation in log form to compute terminal-point-signal density of both jammers and transmitters.

a. The ratio between jammer and signal intensities is compared against a required J/S, relative range ratios are modified as required, and the evaluation is repeated or the data point stored. Data output is both graphical and tabular.

b. Tabular data output includes:

(1) Jammer, Location (lat/long)

Parameters

LOS (line-of-site) LOS Range

Frequency

J/S Required

Terrain Type

(2) For each Site:

Name and Reference Number

Location (lat/long)

Location (Range/Bearing from Jammer)

Transmitter Power

Transmit Antenna Gain

Area of Coverage for each 10° ground site

Graphic output displays relative relationship between jammer, sites, and each site's area of coverage on a scaled chart.

INPUT:

To Data Tape

Name/Designation of Site

Lat/Long Location in Deg, Min, Sec

For Jammers; both items above plus

Jammer Power

Jammer Antenna Gain

Jammer Bandwidth

To Work File

Extracts of Data Tape

Antenna Polarization

Receiver Bandwidth

Type of Terrain

J/S Ratio Required

OUTPUT: Tables and graphics as described in the General Description

MODEL LIMITATIONS:

Frequency: $40 \leq F \leq 1000$ units

Altitude: $0 \leq ALT \leq 40{,}000$ Ft

Model is static

HARDWARE:

Computer: TEKTRONIX 4051 w/tape drive

Minimum Storage Required: 32,000 bytes (8 bits/byte)

Peripheral Equipment: Hardcopy Printer TK 4631

SOFTWARE:

Programming Language: TEKTRONIX BASIC for TK 4051

Documentation: None as of 30 Jan 80

TIME REQUIREMENTS:

Fully load one data tape: 30 min

Run one jammer against 10 sites: 35 min

SECURITY CLASSIFICATION: CONFIDENTIAL

FREQUENCY OF USE: 3 days per week

USERS: AFEWC/SATB

POINT OF CONTACT: AFEWC/SATB
Capt L. P. Kelley
San Antonio, TX 78243
Telephone. 512/925-2427/AUTOVON: 945-2427

TITLE: SA-7B.VO1 (SA-7B Intercept Capabilities)

PROPONENT: AFEWC/EWTR

DEVELOPER: AFEWC/EWTR

PURPOSE: Display SA-7B intercept capabilities

GENERAL DESCRIPTION: Program incorporates SA-7B time/velocity data and calculates missile position relative to aircraft for the intercept event. Program intended only for approximation of intercept times.

INPUT:

Target Aircraft Velocity

Target Aircraft Altitude

Target Aircraft Y offset from SA-7 Launch Site

Launch delay time (time after aircraft passes SA-7 position (along X axis) before SA-7 launch)

OUTPUT:

Altitude versus range plot of aircraft and missile positions

Missile intercept time relative to launch time

MODEL LIMITATIONS:

A. Program Assumes:

1. Missile Tracking error = 0
2. No counte.measures used by target aircraft
3. Target aircraft in straight and level flight at constant airspeed
4. No wind

B. SA-7 velocity/time data is a curve fitted approximation of intelligence da a obtained 1976

HARDWARE:

Computer: PDP-11

Operating System: TEKTRONIX WDI BASIC

Minimum Storage Requirement: 28,000 or memory

Peripheral Equipment: CP100 cassette tape drive

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SOFTWARE: Programming Language: WDI BASIC language

TIME REQUIREMENTS: 60 seconds total run time

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Once each year

POINT OF CONTACT: AFEWC/EWTR
Mr. David Brown
San Antonio, TX 78243
Telephone: 512/925-2567/AUTOVON: 945-2567

KEYWORD LISTING: SA-7B, Intercept

TITLE: Screen Model - Wagner "Screen" Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Wagner Associates

PURPOSE: Screen Model is a computerized, analytical, and damage assessment weapon effectiveness model. It analyzes engagements in which a force of one or more submarines attempt to approach a group of carriers (or other protected force) through various detection fields projected by any arbitrary configuration of active and passive sensors surrounding the group of carriers. Its primary function is to evaluate the probability of submarine detection within the screen. It also deals with cost trade-offs between platforms.

GENERAL DESCRIPTION: Screen Model is a two-sided, deterministic model which deals with air and sea forces. It was designed to deal with forces at task group - individual ship or air unit. Model was designed for surface screen and can be manipulated from surface platforms to submarines to airborne platforms. This model uses probability as method of solution.

INPUT:

- o Sensor beam patterns
- o Processor characteristics
- o Environmental data
- o Target and own force noise data
- o Relative target and sensor motion

OUTPUT:

- o Computer printout listing probability of detection
- o Cumulative probability of detection as a function of time
- o Pattern of probability of detection posed by all sensors combined
- o Area of uncertainty associated with each target over time

MODEL LIMITATIONS: Maximum of 40 sensors and 10 targets

HARDWARE:

- o Computer: Various
- o Operating System: Large Capacity

SOFTWARE:

- o Programming Language: FORTRAN FOUR
- o User's and Programmer's manuals are not complete

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS:

- o OP-961
- o CNA
- o OP-02

POINT OF CONTACT: Mr. Robert Hallex (OP-961)

MISCELLANEOUS:

- o Linked with campaign models
- o Provides screen data

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Air, Sea, Computerized, Two-sided, Deterministic

TITLE: SCSS - Ship Combat System Simulation

PROPONENT: Naval Ocean System Center

DEVELOPER: Naval Ocean System Center
Naval Weapons Center
Naval Surface Weapons Center
CACI Inc.

PURPOSE: The Ship Combat System Simulation (SCSS) is a tool for evaluating the effectiveness of ship command and control systems within the following context: (1) total ship combat system, and (2) multithreat/multiwarfare environment. The SCSS capability can be used in the following applications: (1) a combat system design tool for combat system engineers, (2) equipment trade off analysis, (3) quantifying measures of effectiveness and, (4) develop fleet tactics.

GENERAL DESCRIPTION: The SCSS is written in a process orientation of Simscript II.5. The simulation has two distinct yet overlapping world views. First, there is the external world in which all the observable objects (processes) operate. Each of these observable objects can involve many processes which communicate with each other. The Shipboard Combat System represents the internal view of the observable object. In the external world interprocess communication is accomplished by appropriate calls to a BOOKKEEPER routine, whereas, the shipboard combat system processes communicate via node-link-message construct. The ship combat system is represented in SCSS as a network of information processors. Each node in the network represents a decision or action unit in the system. A node is connected to other nodes in the system by explicit links. A link serves as an information transfer path. Some links represent computer transfer paths. Others represent voice phones, etc. A message is sent over a link from one node to another. Associated with each node is a process description of the simulated combat system element. Examples of such processes range from the radar which interfaces with the external world to the launcher, the air detector/tracker, the ship weapons coordinator, etc. The model is intentionally very modular so that, as requirements change, new systems may be quickly integrated into it.

INPUT:

- o Threat position and speed
- o Combat system node/link diagram
- o Combat system component performance data (node data)
- o Weapon probability of kill

OUTPUT:

- o Computer printout of events versus time
- o Sequence/timing diagrams
- o Node/message summary
- o Trajectory plots
- o Node statistics

MODEL LIMITATIONS:

- o Partial ASU capability
- o No ASW capability

HARDWARE:

- o Computers - Honeywell 6060, CDC 6500, UNIVAC 1108
- o Peripheral equipment - line printer, Gould plotter, eight track tape drive

SOFTWARE:

- o Programming language - Simscript II.5 language
- o Documentation - Users Manual, Model Description Baseline Run
- o Above three documents are complete

TIME REQUIREMENTS: Approximately one month to obtain (SCSS model, data base, documentation)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: SCSS is used many times throughout the year

USERS: Naval Ocean Systems Center, Naval Weapons Center, Naval Surface Weapons Center, Hughes Aircraft, CACI Inc., Sperry Univac, Honeywell, and Raytheon

POINT OF CONTACT: M. Pohoski
NOSC/824
San Diego, California

KEYWORD LISTING: Combat system simulation, Simulation, Combat system engineering, Wargaming

TITLE: SDEM-System Dynamics Economic Model

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Civil Preparedness Office, Office of National Preparedness Programs (contract) and Computer Management Office, Office of Information Resources Management, (assimilation), Federal Emergency Management Agency

PURPOSE: The purpose of the System Dynamics Economic Model are as follows:

1. To develop a robust modeling technique which could overcome deficiencies in convergence and feasibility of solutions of conventional econometric, input-output and mathematical programming methods for evaluating post nuclear attack economic conditions.

2. To evaluate capabilities and policies for wartime production and economic recovery in the US following nuclear attack.

3. To evaluate impacts of Federal fiscal and monetary policies under an extreme range of emergency economic conditions including survival and recovery from nuclear attack and mobilization for conventional or general war.

4. To evaluate the effects of Federal resource management policies on economic and industrial response and recovery reactions to a variety of emergency situations including mobilization for war and nuclear attack.

5. To evaluate the effects of social, political and psychological factors on economic performance during and following severe emergencies.

SDEM is a computerized analytical system for simulating the dynamics of emergency economic and industrial performance. The system is designed for analytical rather than training purposes. It could, however, be adapted to the training of emergency planning analysts. Presently, the SDEM does not play a significant role in FEMA emergency planning.

GENERAL DESCRIPTION: SDEM considers US economic and industrial performance in a dynamic, deterministic manner. Stochastic relationships could be modeled by extension of the model. The model is concerned with production and consumption of goods and services including those required for military purposes.

SDEM considers 11 production sectors, households and government and government in its economic configuraation. It cannot be easily changed from that sectoring. The model was designed to robustly evaluate all conceivable ranges of domestic economic emergencies.

Time is incremented on a step-wise basis but extremely small time intervals can be evaluated. A simulated span of many years can be evaluated in a few minutes of elapsed time.

The SDEM, as its name implies, employs the System Dynamics (DYNAMO) technical of solution.

INPUT: To define a scenario, numerous parameters in the model may be altered. For exapmple, in a nuclear attack scenario, assessed weapons effects; damage to capital stocks, population and financial institutions; psychological and political factors; and changed demands for goods and services would be inputs to the SDEM.

OUTPUT: The SDEM outputs constitute simulated values of industrial production, consumption, inflation, employment for numerous categories. The user has great flexibility of choice in specifying output intervals and data to be listed or plotted. A severe difficulty with outputs of SDEM is the unstructured and awkward tabular format.

MODEL LIMITATIONS: The limitations of the SDEM include:

- o A lack of careful review, testing, and validation to fully determine analytical limitations.
- o Poor report generating capabilities to facilitate presentation of model results.
- o Limited capabilities to simulate a wide variety of proposed fiscal and monetary policies.
- o System dynamic technique is inappropriate for statistical forecasting.
- o Analysis of current economic conditions is limited because model is benchmarked to the 1965 rather than 1980 economy.
- o Data on which SDEM is based is undocumented.
- o Eleven industrial sectors are too highly and inappropriately aggregated for most purposes.

HARDWARE: SDEM is resident on the FEMA UNIVAC 1108 computer and is executable in 60,000 words of main memory.

SOFTWARE: SDEM is programmed in DYNAMO, a FORTRAN-based macro language. The documentation for SDEM is unpublished and presently incomplete. Draft copies are not yet available.

TIME REQUIREMENTS: SDEM was developed at a cost of $160,000 in contract funds. In-house development has required four staff months to date and unknown amounts of computer time. Testing and modification of the model may require another staff year of effort and around 500 hours of standard units of precessing. Depending on the numbers of time periods required, a simulation can be completed in 10 minutes of computer time. Analysis of output in its present form is a herculean task.

SECURITY CLASSIFICATION: UNCLASSIFIED. Simulations may require classification depending on content.

FREQUENCY OF USE: Before SDEM was fully developed, it was applied in a mobilization exercise, a study of alternative civil defense strategies and studies of economic stabilization strategies in FY 1981. SDEM is likely to be applied in up to six different projects per year. Simulations of individual scenarios or policy strategies may number in the hundreds annually.

USERS: SDEM is used by FEMA in support of mobilization exercises, planning for emergency economic stabilization and by the FEMA Advisory Board to evaluate civil defense strategies. The Department of the Treasury utilizes SDEM on the FEMA computer in its emergency preparedness activities.

POINT OF CONTACT: Dr. William T. Fehlberg
Computer Management Office
Office of Information Resources Management
Resource Management and Administration
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS: It is planned, depending on resources available, to develop report generating capabilities for SDEM and to re-benchmark SDEM to 1980 economic conditions.

KEYWORD LISTING: Economics, Industrial, Nuclear, War, Mobilization, DYNAMO, Dynamics, Simulations, Model, Systems

TITLE: SDM - Security Device Model

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Computer Software Analysts

PURPOSE: Security Device Model (SDM) is an analysis tool for use in assessing the effectiveness of a sensor and processor in detectng physical security phenomona.

GENERAL DESCRIPTION: SDM contains sub-models of the room being detected, the sensor, the processor, and target. By running SDM in deterministic or Monte Carlo mode, the effectiveness of the security device under evaluation can be determined against the target.

INPUT:

- o Room dimensions
- o Fixed obstacle
- o Moving targets
- o Sensor characteristics
- o Run mode

OUTPUT:

- o Event trace
- o Detection log

MODEL LIMITATIONS: Run time

COMPUTER SYSTEM:

- o Computer: PE 3220,7/32
- o Operating System: OS 32/MT
- o Minimum Storage Required: 650 KB
- o Peripheral Equipment: Terminal, printer

SOFTWARE:

- o Language: FORTRAN VII
- o Document tion: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 10-20 minutes to set up scenario
- o 19-120 minutes depending on run length and time step

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SECURITY CLASSIFICATION: Unclassified

POINT OF CONTACT: Ed Jacques
NSWC/G42
White Oak, Silver Spring MD 20910
(202) 394-2396

KEYWORD LISTING: Secuirty Device Model

TITLE: SEACOP - Strategic Sealift Contingency Planning System

PROPONENT: Military Sealift Command

DEVELOPER: Navy Regional Data Automation Center (NARDAC)

PURPOSE: SEACOP is a computerized planning model developed to assist planner-analysts in determining whether movement requirements specified in a CINCs Operation Plan (OPLAN) can be satisfied by available sealift resources.

GENERAL DESCRIPTION: SEACOP is an automated computer system designed for the Military Sealift Command (MSC) to provide shipping transportation schedules based on the cargo, troop, and POL requirements of a joint operations plan (OPLAN) or exercise/study. Using the shipping resources available to MSC along with characteristics of the ports to be used and the specified assumptions and planning factors, the system identifies the types and numbers of ships required to accomplish the sealift tasks. If the sealift schedule reflects a large shortfall and time permits, SEACOP can be rerun with revised input parameters to produce alternative movement schedules that may be feasible for MSC to support. The movement schedule plus the corresponding reports or annexes produced by SEACOP supply the military plans analyst with the information necessary to determine if the sealift requirements can be delivered within the established time frame. The types of parameters available to the user are: Panama/Suez Canal status, peacetime, wartime or ocean clearance ship availability computations, strategic warning (days), independent and/or convoy shipping, escorts, attrition, minimum/maximum convoy size, peacetime or wartime port throughput capability; minimum load for scheduled ships; and combat/administrative loading factors for ships.

INPUT:

- o Time-Phased Force Deployment Data (TPFDD)
- o Summary Reference File (SRF)
- o Type Unit Data File (TUCHA)
- o Port characteristics
- o Ship characteristics
- o Ship locations
- o User parameters

OUTPUT:

- o Movement Table for each OPLAN Force Requirement Number, Resupply or Replacement Increment Number
- o Ship schedules showing loading/discharging schedules and listing the requirements carried
- o Summaries of requirements scheduled, delivered, attrited, and flagged by type requirement and by time frame
- o Port workload summaries showing number of ships and amount of requirements by type by day

MODEL LIMITATIONS:

- o Port of origin/destination matrix limited to 50

HARDWARE:

- o Computer: Honeywell 6000 (WWMCCS)
- o Operating System: GCOS
- o Minimum Storage Required: 25,000 little links of temporary and mass storage
- o Peripheral Equipment: Central Processing Site - One card reader, one printer, two tape drives; Remote Processing Site - one remote line printer, RLP-300T, one 7705 CRT terminal

SOFTWARE:

- o Programming Language: COBOL/FORTRAN
- o Documentation: Users Manual and Program Maintenance Manual completed 1 October 1981

TIME REQUIREMENTS: 4-20 hours clock time for a complete system run for one OPLAN.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice weekly

USERS: Military Sealift Command

POINT OF CONTACT: Commander, Military Sealift Command
ATTN: J. Katherine Wiswesser (M-63)
Washington, DC 20390
Telephone: Autovon 292-2899
Commercial (202) 282-2899

MISCELLANEOUS: Input must be in JCS Joint Operation Planning System (JOPS) TPFDD format.

KEYWORD LISTING: Computerized; Analytic; Logistics, Sealift Feasibility, Politico-Military Situations.

TITLE: SEALIFT

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Center for Naval Analyses

PURPOSE: SEALIFT is a computerized, analytic model of limited war which measures the battle between a convoy system with protective ASW forces against a submarine force opposing it. Deliveries and losses of various types are calculated.

GENERAL DESCRIPTION. This two-sided stochastic model deals with land and sea forces (primarily one convoy and one submarine). Time is treated in the event store mode. It's primary role is to measure the effectiveness of an ASW force assigned to protect a convoy system resupplying a country under attack.

INPUT:

- o Forces
- o Weapon effectiveness
- o Engagement probability
- o Exchange ratios

OUTPUT:

- o Printout of mean results with standard deviations
- o Printed quantities include deliveries, losses and losses of combatants
- o Output can be by day or cumulative

MODEL LIMITATIONS:

- o Model is basically a bookkeeping device with no physical calculations.

HARDWARE:

- o Programming Language: FORTRAN IV
- o Documentation: CNA NWG Study 47, App. F

TIME REQUIREMENTS:

- o Structure base data: 1/2 man-month
- o CPU Time: minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Annually

USERS: Chief of Naval Operations, OP-96

POINT OF CONTACT: Center for Naval Analyses
1401 Wilson Boulevard
Arlington, Virginia 22209
Telephone: 703/524-9400

KEYWORD LISTING: Analytical; Limited War; ASW; Computerized; Two-Sided; Event Stor

TITLE: SEALIFT

PROPONENT: OJCS/SAGA

DEVELOPER: Institute for Defense Analysis

PURPOSE: SEALIFT is a computerized, analytical, general war model. SEALIFT is a computerized analytic model of conventional naval combat which assesses battle between convoys with AAW and ASW protection, CTFs, submarine and mine barriers and the opposing air and submarine forces. It determines resources delivered by shipping convoys or independent sailing and portrays the naval engagements to defend against the sub and air threat by AAW/ASW, CTF, and mine resources. It also is used for the evaluation of effectiveness of all naval resources in the protection of sea lines of communication.

GENERAL DESCRIPTION: SEALIFT is a two-sided, deterministic model which deals with air and sea forces. It was primarily designed to portray convoys and/or independent sailing, CTFs and AAW/ASW protection against enemy subs and aircraft. The model is a time-step model which has a ratio of game time to real time of one combat cycle for 1 day. It uses combat simulation logic as primary method of solution.

INPUT:

- Number of convoy ships
- AAW/ASW forces
- Number and effectiveness of CTFs
- P-3 ASW aircraft
- Enemy submarines and aircraft
- Effectiveness of defending submarine barriers and mine barriers

OUTPUT:

- Raw data for analysis with some detailed and summary output tables
- Daily output options of selected summary data

MODEL LIMITATIONS: Command and control and the ECM/ECCM capabilities are played implicitly only--i.e., requires a degradation in the probabilities of detection and kill

HARDWARE: Computer: HIS 6000, CDC 6400

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: IDA Report R-102, SEALIFT Model, August, 1973
  - VOL 1 - Summary Description
  - VOL 2 - Analytical Description
  - VOL 3 - Testing
  - VOL 4 - Computer Program Documentation
- o User's and Programmer's manuals complete

TIME REQUIREMENTS:

- o 1-3 months required to acquire base data
- o 1 man-month required to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS:

- o JCS/SAGA
- o CCTC

POINT OF CONTACT: Dr. Jerome Bracken (558-1503)
Institute for Defense Analyses
400 Army-Navy Drive
Arlington, VA 22202

MISCELLANEOUS: Supersedes (in methodology development, but not with all users) the IDA-developed Campaign Execution Model (CEM). IDA Report R-165 "Navy Force Structure Study (3 volumes) VOL III-CEM

KEYWORD LISTING: Analytical, General War, Air, Sea, Computerized, Two-sided, Deterministic, Time-step

TITLE: Exercise SEA LION

PROPONENT: Central Studies Establishment

DEVELOPER: Central Studies Establishment

PURPOSE: Exercise SEA LION consists of a series of one sided administrative war games designed to provide instruction in road, sea and rail terminal operations at all levels.

GENERAL DESCRIPTION: Exercise SEA LION consists of a series of games designed to exercise HQs and provide instructions in terminal operations in such areas as unitisation of cargo, ship discharge, HQ staff work, cargo movement control, and air, road, rail and sea transportation. Game I considers a Terminal Regiment conducting a beach operation. Game II considers a Terminal Regiment involved in road, beach, rail and inland water operations. Game III considers a Terminal Corp HQ employing up to four Terminal Regiments conducting road transport, rail, beach and cargo movement control operations through several terminals. Game IV concentrates on the movement control aspects and the movements of shipping.

INPUT: An administrative plan requiring 6000 tons per day. Ship loading manifest and planning state are in the handbook.

OUTPUT: Consequences of players action.

LIMITATIONS: Adjudication rules have to be simplified to cater for quick manual adjudication.

HARDWARE: Game Handbook.

SOFTWARE: Manual war game.

STAFF:

- Control - 3 officers and 3 NCOs.
- Player teams - 3 to 4 persons per headquarter played.

TIME REQUIREMENTS:

- Preparation: Three hours required for preparation for the HQ and familiarization of handbook.
- Play: Three days with between eight to 10 hours to play per day.
- Analysis: For 30 hours of game play about three hours.

SECURITY CLASSIFICATION: Unclassified

FREQUENCY OF USE: Six plays per year.

USERS: 10 Terminal Regiment and Army School of Transport

MISCELLANEOUS: As game play is increased and the experience base is enlarged, the game will be expanded to cater for a broader spectrum of events. Work has commenced on the development of an Air Support Regiment and a Third Line Road Transport War Game. When completed these games will be further developed into CPX mode play.

TITLE: SEER III - Simplified Estimation of Exposure to Radiation

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Stanford Research Institute

PURPOSE: SEER III is a computerized single nuclear burst fallout model that was designed for fallout damage assessment purposes. The design requirements were that it require a short computer execution time and that its output fallout exposure patterns simulate those of the DELFIC fallout model for the same inputs.

GENERAL DESCRIPTION: SEER III is a computerized single nuclear burst fallout mode that will produce fallout dose and dose rate patterns for weapon yields in the range from 0.01kt to 100mt, for various burst altitudes, and various winds aloft. SEER III only requires a few seconds of CDC 6400 computer execution time per run.

INPUT:

- o Total weapon yield
- o Fission fraction
- o Height of burst
- o Wind speeds and directions at various altitudes

OUTPUT:

- o Exposure dose rate patterns
- o Exposure dose patterns from time of fallout arrival to any user specified time

MODEL LIMITATIONS:

- o Weapon yields from 0.01kt to 100mt
- o Surface and above surface bursts only

HARDWARE:

- o Computer: CDC 6400
- o Operating System: Batch
- o Minimum Storage Required: 120K
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation Identification: "SEER II: A New Damage Assessment Fallout Model," DNA 3008F, May 1972. Supplemental Users Instructions for SEER III not formally documented, but are available with program
- o Documentation Availability: Distribution unlimited, DDC No. AD 754144

TIME REQUIREMENTS:

- o Prepare Inputs: Nominal
- o CPU Time per Cycle: 2 to 10 seconds
- o Data Output Analysis: Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Used from time to time for various studies at SRI where fallout is part of the research problem. Also being used by other defense oriented organizations.

USER: Stanford Research Institute

POINT OF CONTACT: For information

Mr. Paul W. Wong
Engineering Systems Division
Stanford Research Institute
Menlo Park, California 94025
Telephone: 415/326-6200

For Computer Program:

Mr. Joseph Maloney
US Army Ballistic Research Laboratories
Aberdeen Proving Ground, Maryland 21005

MISCELLANEOUS: SEER III has been incorporated into CIVIC and DACOMP, "Damage Assessment Computer Program," to efficiently assess fallout damage from very large numbers of nuclear detonations.

KEYWORD LISTING: Fallout, Nuclear War, Damage Assessment, Radiation, DELFIC

TITLE: SEM - Helicopter Sortie Effectiveness Model

PROPONENT: US Army Combined Arms Combat Developments Activity

DEVELOPER: Combat Operations Analysis Directorate

PURPOSE: SEM is a computerized, analytical, limited war model used to assess the effectiveness and survivability of an attack helicopter team (AHT) on a per sortie basis. SEM summarizes AHT effectiveness and survivability versus an armored threat battalion with Air Defense (AD) capabilities based on Helicopter Individual Engagement Model outcomes.

GENERAL DESCRIPTION: SEM is a two-sided, deterministic, first-order attrition model involving both land and air forces. The level of aggregation for this model considers one AHT with scouts versus threat company. The largest combination of units the model considers is multiple AHT or AH task force versus battalion threat with AD. Outcomes may be extrapolated to larger areas of consideration. Simulated time is treated on an event store basis. SEM employs game theory and queuing theory to predict player losses as a function of battle time.

INPUT:

- o IEM outputs
- o AHT mix
- o Threat AD mix
- o AH/Scout standoff ranges
- o Threat array density and approach velocity
- o AHT laser designation option (autonomous and Scout or ground remote)

OUTPUT:

- o AH/Scout losses
- o AH missile expenditure
- o Threat target losses (including AD)
- o Sortie durations

MODEL LIMITATIONS:

- o Independent and constant event probabilities
- o Constant AH/Scout relocation and FARRP transit times
- o Uniform threat density

HARDWARE:

- o Computer: CDC 6400/6500
- o Operating System: SCOPE
- o Minimum Storage Required: 65K words
- o Peripheral Equipment: Card reader, printer, CRT terminal for interactive play

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Planned to be published as an appendix to the AH-IS/ITV Force Structure Analysis (AFSA) Report OAB June 1977
- o User's documentation is not complete
- o Technical documentation is complete

TIME REQUIREMENTS:

- o Time for IEM outputs
- o 1 week to structure data in model input format
- o Less than 5 CPU minutes per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: Source Code UNCLASSIFIED

FREQUENCY OF USE: 5-10 times per year

USER: Principal: USA Combined Arms Combat Developments Activity

POINT OF CONTACT: Dr. L. Pfortmiller
Combat Operations Analysis Directorate (ATCA-CAT)
USA Combined Arms Combat Developments Activity
Ft. Leavenworth, Kansas 66027
Telephone: Autovon 552-5140

MISCELLANEOUS: SEM uses output summary directly from IEM runs. The outputs have been used in the CACDA Scores Jiffy Game.

KEYWORD LISTING: Computerized, Analytical, Limited War, Land Forces, Air Forces, Two-Sided, Deterministic, Event Store

TITLE: SESTEM III

PROPONENT: Aeronautical Systems Division (ASD/XRM), Air Force Systems Command

DEVELOPER: ASD/XRM

PURPOSE: The model is a Monte Carlo simulation that determines whether the missile fuzed and calculates the single shot probability of kill vs CEP or miss distance. The primary damage mechanisms are direct hit, blast, and single fragment penetration.

GENERAL DESCRIPTION: SESTEM III is a program for calculating the probability of kill of an aircraft by SAM or AAM. It is a single missile - single aircraft encounter program which uses a geometry and probability techniques to perform the calculations.

INPUT:

- o Target geometric description
- o Blast
- o Warhead and fuze
- o Vulnerable areas
- o Encounter conditions

OUTPUT:

- o Component Pk's
- o Total Aircraft Pk's
- o Warhead detonation position
- o Data file is created to be used as inputs to post-processing program (Displays several different graphs)

MODEL LIMITATIONS:

- o Maximum number of component/target
- o Maximum number of vulnerable area tables
- o Fuze model

HARDWARE:

- o Computer: CDC CYBER 74 & 750
- o Operating System: NOS/BD Level 481
- o Minimum Storage Required: 65K8 overlayed
- o No peripheral equipment needed to run model

SOFTWARE:

- o FORTRAN IV Extended (CDC)
- o No documentation

TIME REQUIREMENTS:

- o 2 months to acquire data base
- o 1 month to structure data in model input format
- o 1 week to analyze output
- o 5 to 6 model applications player learning time
- o CPU time per cycle varies

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100-400/year

USERS: ASD/XRM

POINT OF CONTACT: ASD/XRM
Attn: Russell Cramer/Gerald Bennett
Wright-Patterson AFB, OH 45433
Telephone: AUTOVON 785-6395

MISCELLANEOUS: There is a series of pre- and post-processing programs that messages the Data and Displays Plots and Graphs.

KEYWORD LISTING: Endgame, Computerized, PKs, Vulnerability, Monte Carlo, CEP, Geometry, Blast, Fragments, SAM, AAM

TITLE: SIDAC - Single Integrated Damage Analysis Capability

PROPONENT: OJCS, Director, J-3 Operations Directorate, NMCS ADP Support Division

DEVELOPER: Command and Control Technical Center, DCA (CCTC)

PURPOSE: SIDAC is a computerized analytical model designed to provide nuclear damage analysis information for both the Red and Blue resource monitoring subsystems of the General War System at the ANMCC. SIDAC is a modularly designed system with expandable capabilities that will fulfill user requirements for nuclear damage assessment in the operational environment and vulnerability analysis in planning support studies. SIDAC's modularity feature provides for rapid incorporation of state-of-the-art advances and adaption for unique user needs.

GENERAL DESCRIPTION: SIDAC is a general purpose model that simulates land, air, and sea forces, as well as the civilian population and paramilitary forces. It can consider weapons or weapon systems individually and the modularity of its design allows the user to aggregate up to any level, depending upon specific requirements. Simulated time is treated on an event store basis. The model uses a mixture of deterministic and stochastic elements. Probability is used as the primary solution technique for prompt damage by means of the methodology developed by the Physical Vulnerability (PV) Division of the United States Air Force Intelligence. Delayed radiation effects are estimated by means of the methodology originally developed by the Weapon Systems Evaluation Group (WSEG).

INPUT: Input is required for three files designated as target, weapon, and wind, respectively, as follows:

- The basic CCTC source of target information for damage assessment vulnerability analysis studies is the 330 character Joint Resource Assessment Data File (JAD). The JAD format is not the only format the SIDAC system will accept since the user can format his own input file. A complete description of the JAD can be found in Joint Chiefs of Staff (JCS) Pub 6.

- Input into the weapons file consists of two standard type reports: strike (used to describe a weapon that has arrived and detonated or a weapon that was launched successfully), error (used to delete the effects of a previously reported strike), and collate/search and situation (used for reporting damage or collating targets for output).

- Input into the wind file originates from the Air Force Global Weather Central (AFGWC), Offutt AFB, Nebraska. Wind speed and direction are received at each point on either the AFGWC numerical Weather Prediction Grid (NWPG) or the Global Applications Data Base (GADB).

OUTPUT:

- o Hardcopy output is prepared from a SIDAC created file by use of the output features of compilers (e.g., COBOL, FORTRAN). Basic procedures are provided to help the user in translating the basic effects information into more meaningful terms.
- o Graphical presentation is possible by use of GIPSY, TPLOT, etc., programs.

MODEL LIMITATIONS:

- o Target base contains only static targets. Moving targets are not taken into account.
- o Targets must be assigned a VN number to calculate prompt damage.
- o Fire ignition and spread, as well as communications blackout modules, are not available.

HARDWARE:

- o Computer: HIS/6000
- o Operating System: GCOS
- o Minimum Storage Required: 36K words of core storage
- o Peripheral Equipment: Card reader, printer, magnetic tape handler 9 channels (optional), and at least one disc storage unit

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation:
  - Functional Description (U), SPM FD 7-73, (AD 910 6141).
  - Test and Implementation Plan (U), SPM PT 7-73, (AD 912 420).
  - Users Manual (U), CSM UM 67-79, (AD B041 761L).
  - Description of Mathematics for the Single Integrated Damage Analysis Capability (SIDAC) (U), TM 15-80, (AD B049 340L).
  - Advanced Single Integrated Damage Analysis Capability (SIDAC) Concepts, (U), TM 91-74, (AD 921 242).
  - Action Officer's Handbook for the SIDAC, (U), TM 154-81, (AD B057 354L).

TIME REQUIREMENTS:

- o Prepare Data Base - variable
- o CPU Time per Cycle - variable
- o Data Output Analysis - variable

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Over 600 times per year

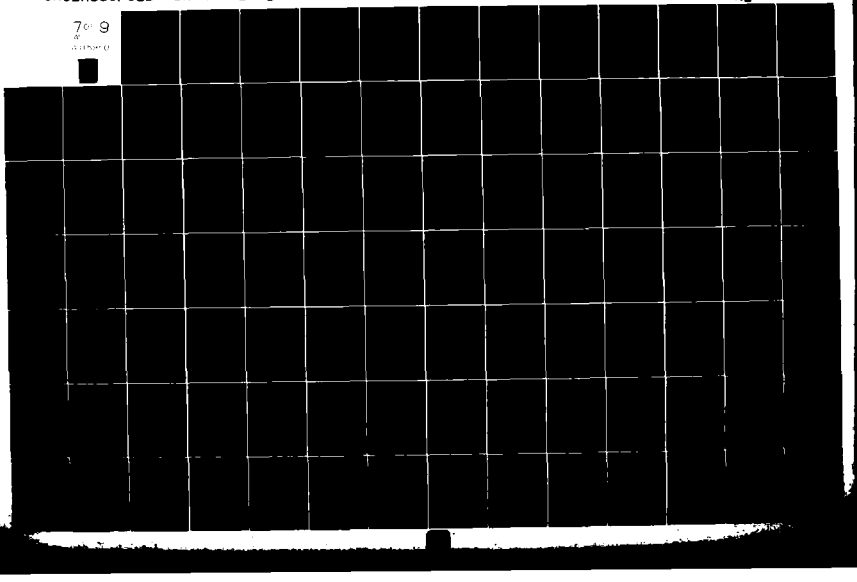
USERS: Studies, Analysis, and Gaming Agency; Survivability Office of the Defense Communications Agency; Deputy Director for Strategic Programs, Defense Intelligency Agency, Assistant Secretary of Defense, Program Analysis and JSTPS; CINCLANT; NORAD; CINCPAC; and US Army.

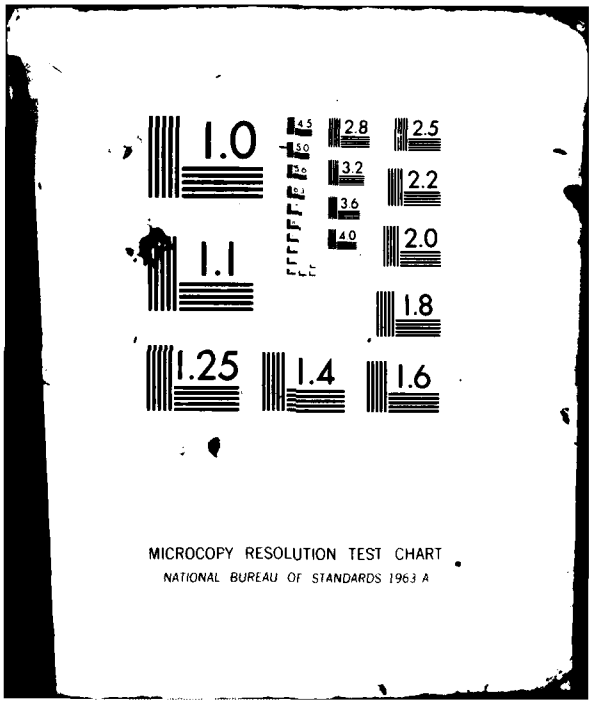
POINT OF CONTACT: Defense Communications Agency
Command and Control Technical Center (C312)
The Pentagon, Washington, D. C. 20301
Telephone: (202) 697-4421

MISCELLANEOUS: Used as the nuclear damage analysis portion of the GENERAL WAR SYSTEM.

KEYWORD LISTING: Nuclear; fallout; radiation; assessment; fatalities; casualties; weapon effects; prompt effects; residual effects; mathematical model, computer simulation.

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
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TITLE: SIGMALOG I - Simulation and Gaming Methods for Analysis of Logistics, Part I: Requirements Analysis System

PROPONENT: US Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG I is a set of computer-assisted, analytical logistics models used to test the logistic feasibility of contingency plans, including the adequacy of stock levels specified, transportation capacities and capabilities, maintenance capabilities and construction of facilities. The primary focus of concern is on time-phased logistic requirements to support the forces involved in an operation/contingency plan or study, including combat service support units, materiel, maintenance, transportation, and construction. In addition, the model may be used to determine time-phasing and adequacy of combat service support units on a troop list, hospital bed requirements, and personnel replacements.

GENERAL DESCRIPTION: SIGMALOG I models are deterministic. The types of forces involved may be land, air, paramilitary, and/or civilian. It is capable of considering one US Army platoon or team or equivalent USMC/USAF units, if desired, and of aggregating up to the level of theater level or worldwide forces. Simulated time is treated on a time-step basis.

INPUT: Time-phased force deployment list data, Allied Forces data, local labor data, scenario, tactical matrix, PW policy, hospital policy, evacuation policy, supply stockage policy, supply network, maintenance policy, transportation policy, transportation network construction policy, refugee policy, personnel replacements policy.

OUTPUT: Computer printouts reduced to summary format, e.g., tables, matrices, and two-dimensional graphic displays, or variations as desired such as detailed reports or selective retrievals.

MODEL LIMITATIONS: 30 groupings of personnel, 30 categories of personnel using materiel or requiring support, 20 categories of materiel, 20 time periods, 20 regions, 5 modes of transportation.

HARDWARE:

- Computer: CDC 6400/IBM 7094/UNIVAC 1108
- Minimum Storage Required: 32,000 words
- Peripheral Equipment: Printer, 12 tape drives, and disk storage

SOFTWARE:

- Programming Languages: FORTRAN, COBOL
- Documentation: Both user's and technical documentation are complete.

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TIME REQUIREMENTS:

- o Presimulation Phase: 1 month
- o Simulation Phase: 3 months
- o 13 hours CPU time per cycle
- o Post Simulation Phase: 2 months

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Total system once per year; selected models, as required

USERS: US Army Logistics Evaluation Agency

POINT OF CONTACT: US Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, Pennsylvania 17070
Telephone: Autovon 977-6742

MISCELLANEOUS:

- o SIGMALOG I can be linked by automated interface to US Army Engineer Study Group Model Computer-Assisted System for Theater-Level Engineering (CASTLE) and the US Army Concepts Analysis Agency theater round out model FASTALS
- o Improvements and modifications are made as requirements dictate

KEYWORD LISTING: Logistics, Deterministic, Time Step, Computer-Assisted

TITLE: SIGMALOG II - Simulation and Gaming Methods for Analysis of Logistics, Part II: Capability Analysis System

PROPONENT: US Army Deputy Chief of Staff for Logistics (DCSLOG)

DEVELOPER: General Research Corporation

PURPOSE: SIGMALOG II is a computer-assisted, logistics capabilities analysis system that compares time-phased Army logistic resources with time-phased deployment and resupply requirements determined by SIGMALOG I for combat service support units, major end items, inter-theater transportation, and ammunition for the support of one to three contingency plans.

GENERAL DESCRIPTION: SIGMALOG II accepts logistic requirements for up to three theaters, and together with analyst inputs, compares these with the logistic resources recorded in Army data files in order to identify the Army's logistic capability in the four resource areas listed above. The term "time-phased" refers to the requirements in each of the (up to 20) distinct time periods into which a contingency plan is divided in SIGMALOG I. Since SIGMALOG II can accommodate up to three theaters, time periods overlap and a maximum of 36 time periods may be used.

INPUT: Time-phasing requirements of the three theaters, current assets, and future availability of assets. All major inputs are tape files produced by SIGMALOG I and drawn from Army resource files.

OUTPUT: Computer printouts stating by combat service support unit (standard requirements code), major end item (line item number), ammunition by round (DOD ammunition code), and transportation carrier, the number required, available, and the differences by time period.

MODEL LIMITATIONS:

- o 12 commodities
- o 12 carriers
- o 36 time periods
- o 3 theaters
- o There are no restrictions on the number of CSS units, major end items, or types of ammunition rounds

HARDWARE:

- o Computer: CDC 6400, three modules on IBM 7094, UNIVAC 1108
- o Minimum Storage Required: Three modules - 32,000 words; One module - 65,000 words
- o Peripheral Equipment: Printer and four tape drives

SOFTWARE:

- o Programming Language: FORTRAN and COBOL
- o Documentation: CDC related manuals -- The paper, "Simulation and Gaming Methods for Analysis of Logistics, Part II (SIGMALOG II); Capability Analysis System," RAC-TP-432, dated August 1971, (AD 888044L), by Richard C. Robinson et al, is the complete documentation
- o The above represents both complete user's documentation and complete technical documentation

TIME REQUIREMENTS:

- o Provided that SIGMALOG I generated requirements are available, 1 month to required to analyze and evaluate results
- o 5 hours CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USER: US Army Logistics Evaluation Agency

POINT OF CONTACT: US Army Logistics Evaluation Agency
Planning and Operations Research Division
New Cumberland Army Depot
New Cumberland, Pennsylvania 17070
Telephone: Autovon 977-6742

MISCELLANEOUS:

- o SIGMALOG II uses the following four SIGMALOG I models: Force Employment, Major Item Resupply, Ammunition Resupply, and Transportation. Data is transmitted via magnetic tape.

KEYWORD LISTING: Analytical Model, Logistics, Land Forces, Computer Assisted, Deterministic, Time Step, Linear Programming

TITLE: SIMCE - Simulation - Communications - Electronics

PROPONENT: USA Signal School, Fort Gordon, Georgia 30905

DEVELOPER: Booz Allen Applied Research, Inc.

PURPOSE: SIMCE is a computerized, analytical model designed to size and analyze a multichannel communications system, given a statement of user requirements communications support requirements (COMSR). The model is used to size army communications as to unrouted and routed requirements for each mode (voice, page, graphic, data). In addition, it is also concerned with communications requirements as a function of user location and user density.

GENERAL DESCRIPTION: SIMCE is a one-sided model having both deterministic and stochastic elements. Only land forces are involved. It is designed to consider groupings ranging in size from an army to a theater. Linear equations are the primary solution techniques used.

INPUT:

- o User communications requirements (COMSR)
- o Unit locations
- o Node locations
- o Node-to-node connectivity
- o Network routing

OUTPUT:

- o Unrouted and routed communications requirements for each mode
- o Local and long distance distribution
- o Security requirements
- o Regression curves for traffic volume as function of number of units at a node
- o Output can be selective retrievals at each stage of processing, such as unrouted and routed communication requirements
- o Communications requirements as a function of user location of user density

MODEL LIMITATIONS: User communications requirements are needed for each force model in use.

HARDWARE:

- o Computer: IBM 360 or CDC 6500
- o Operating System: OS/MVT (IBM); SCOPE (CDC)
- o Minimum Storage Required: 200K bytes
- o Peripheral Equipment: Printer, tape drive, disk, card reader, plotter

SOFTWARE:

- o Programming Language: FORTRAN IV/USA FORTRAN
- o Documentation: SIMCE User's Manual Volume I (AD 800-335), II (AD 880-336), III (AD 880-421), and IV (AD 880-422)
- o Both user's documentation and technical documentation are complete.
- o Technical documentation is part of the user's manual.

TIME REQUIREMENTS:

- o 1 month to initialize communication system configuration
- o 212 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 10 times per year

USERS: Concepts and Studies Division, DCD, USASIGS, Fort Gordon, Georgia

Point of Contact: Concepts and Studies Division (ATSN-CD-CS-R)
US Army Signal School
Fort Gordon, Georgia 30905
Telephone: Autovon 780-4462

KEYWORD LISTING: Analytical Model, General War, Land Forces, Computerized, One-Sided, Mixed Deterministic/Stochastic

TITLE: Simulation Model for Interference Analysis of Nodal Systems (SIMIANS)

PROPONENT: U.S. Army Electronic Proving Ground - Electromagnetic Environmental Test Facility

DEVELOPER: U.S. Army Electronic Proving Ground - Electromagnetic Enviornmental Test Facility

PURPOSE: Analysis of traffic flow in a switched nodal system with radio and wire links.

DESCRIPTION: Stochastic, event store model of call/message routing and flow in a switched (alternate routing) nodal network subject to circuit degradation due to interference, jamming or equipment failure. Will handle a corps-sized network, detailed at the individual user/telephone level with component and operator representation.

INPUT: Detailed deployment information giving equipment, location, trunking, routing tables, subscriber identification, need line information (COMSR data or similar information), and data base of equipment performance data.

OUTPUT: Computer printout of complete call and message transaction histories, reduced data giving call completion rates, messages lost, and call and message average delays for calls or messages broken down by various categories.

LIMITATIONS: Model must be updated to represent new equipment logic of desired to model systems not currently represented.

HARDWARE: Type Computer: CDC CYBER, 6000 or 7000 series machines (currently running on CYBER 172)

Operating System: NOS

Minimum Storage Requirement: 160,000 central memory. Mass storage - dependent on problem size.

Peripheral Equipment: Nine-track tape drive.

SOFTWARE: Programming Language: FORTRAN IV, EXTENDED (model written in SLACS with SLACS to FORTRAN precompiler provided).

Documentation Identification and Availability: User's manuals for SLACS and for SIMIANS, program documentation for SIMIANS, all available through proponent.

TIME REQUIREMENTS: Prepare data base: 1 to 10 months, depending on size of problem and applicability of existing data bases.

CPU time per cycle: For corps-sized network, about 1 hour CPU per 1 hour simulated time.

Data output analysis: 1 week to 4 months, depending on problem details.

SECURITY CLASSIFICATION: Model only - Unclassified.

FREQUENCY OF USE: Model is too new to establish.

USERS: Proponent only to date - model is too new to establish user group.

POINT OF CONTACT: EMETF
U.S. Army Electronic Proving Ground
ATTN: STEEP-MT-DS (Mr. Wilburn)
Fort Huachuca AZ 85613
AUTOVON: 879-6284

TITLE: SIM II

PROPONENT: Chief of Naval Operations, OP-095

DEVELOPER: Electric Boat Division of General Dynamics

PURPOSE: SIM II is a computerized, analytical, limited war model. It models detailed and rigid naval warfare situations. The program is completely precompiled, such that any desired situation can be simulated through the use of input data, without any programming. The model is designed to focus on primarily naval warfare tactical situations, especially submarine warfare situations. It also is used for the transfer of tactical information between platforms.

GENERAL DESCRIPTION: SIM II is a two-sided, mixed model dealing with air and sea forces, and primarily designed for modeling the submarine in direct support of a task force. The model considers one versus one platform up to one versus eighteen platforms and task force size groups. Simulated time is treated on an event store basis. Monte Carlo simulation is the primary solution technique used. Information exchange, however, is not treated as a stored event. Whenever information exchange can occur, the sampling interval is adjusted to a value that will accommodate the measure of information exchange. Accurate modeling is achieved in the presence of mutual interference among elements.

INPUT:

- o The input data is grouped into two categories. The first includes the description of the environment and the element. The second outlines the tactical responses of the elements based upon their available information.
- o The model has been designed to accept tactical input data in a specially developed format. This format includes English vocabulary words in a sentence-like structure, accompanied by numerical data. The structure is easily readable, and the commands that the words represent are pre-programmed to minimize the effort required in setting up a tactical situation. The words are also analogous to the commands that would be given to a navigator, helmsman, or fire-control party, so the interpretation of the tactical situation is as direct as possible.
- o The model also utilizes input describing the operating medium. In the case of submarine simulation, this is concerned largely with sonar transmission losses that are functions of the depths of source and receiver.

OUTPUT: There are three basic types of output data available. The first is a time history of the events simulated and is available over a wide range of detail on a selective basis. It can provide, in complete sentence structure, the situation with respect to each ship at each time step in the program. The second type is a tabular output

data at those times when significant scales and other pertinent data are provided. The third type of output is statistical, and it includes histograms, graphs, means, standard deviations, percent of occurrences, and tallies of significant events and cases. This feature is particularly useful in evaluating tactics and in forming the basis for decisions.

MODEL LIMITATIONS:

- The number of platforms used by the model is limited by computer core size
- The current model in use takes 48,000, 32 bit words and provides approximately 18 platforms

HARDWARE:

- Computers: UNIVAC 1110, UNIVAC 1108, CDC 6700, HONEYWELL 635
- Minimum Storage Required: 48,000, 32 bit words

SOFTWARE:

- Programming Language: FORTRAN IV
- Documentation: General Dynamics Corporation, Electric Boat Division, Report U440-76-018, 1 March 1976, VOL I and II
- User and technical documentation available
- Documentation contains typical examples

TIME REQUIREMENTS:

- Various months required to acquire base data
- 0.5 man-months to structure data in model input format
- 30 seconds (UNIVAC 1108, 1110) CPU time per model cycle
- 0.75 months to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2-3 times per year

USERS:

- Principal: COMSUBDEVRON Twelve
- Others: US Naval Academy, COMSUMPAC, Naval Underwater System Center, New London, NSRDC

POINT OF CONTACT: Mr. Thomas Downie
General Dynamics Corporation
Electric Boat Division
Groton, CT 06340
Telephone: (203) 446-6790

MISCELLANEOUS: This model is not linked to any other models and does not supersede any model. It is planned to add new capabilities to this model to expand the capability of each platform so that it can possess more than one sensor.

KEYWORD LISTING: Analytical Model; Limited War; Air and Sea Forces; Computerized; Two-Sided; Mixed Event; Event Store

TITLE: SINBAD - Single Nuclear Burst and Damage Model for Naval Forces

PROPONENT: Naval Surface Weapons Center/White Oak Laboratory/Combat Systems Department/N13

DEVELOPER: Same as Proponent

PURPOSE: SINBAD is a computerized nuclear damage assessment model to be used for training or analysis of naval forces. Given a specific burst yield and location, the program evaluates a user-specified combination of eight nuclear effects and estimates the damage or mission impairment to each ship, submarine, and plane in the force.

GENERAL DESCRIPTION: SINBAD is a one-sided, deterministic nuclear damage model. Bursts can occur underwater, at the surface, or in the air. The program then evaluates any or all of the permissible combinations of the eight effects for the burst at the specified height. The eight effects included are: peak overpressure, thermal flux, flash blindness/retinal burns, prompt radiation, communications blackout, electromagnetic pulse, underwater shock, and ocean reverberation (blueout). For the present, the first six effects listed are assumed to be of significance only for surface or air bursts. The last two effects are assumed to be of significance only for under burst.

As appropriate for each effect selected, the results are given in terms of its magnitude and/or damage level for individual units and/or the fleet as a whole. For overpressure effects on surface ships and for underwater shock effects on surface ships and submarines, damage levels are expressed in terms of percent impairment to seaworthiness, mobility, and weapon delivery.

INPUT:
- o platform type, location, depth/height
- o overpressure damage class for surface ships
- o burst yield, location, height

OUTPUT:
- o graphs of peak overpressure, thermal flux, prompt radiation fluxes, prompt radiation fluxes, peak electric field, versus distance from burst
- o graph of fireball size, shape, height versus time after burst
- o diagrams showing rings of constant peak overpressure, fireball size, peak electric field superimposed on platform distribution
- o diagram showing "dead-safe" regions for overpressure, prompt radiation, underwater shock effects superimposed on platform distribution
- o diagram showing probable ranges of skin burns, flash blindness, retinal burns superimposed on platform distribution
- o tables of peak overpressure, thermal flux, prompt radiation fluxes, peak electric field at each platform
- o tables of probable damage from peak overpressure, skin burns, flash blindness, retinal burns, prompt radiation, underwater shock at each platform
- o paragraphs describing possible effects of fireball on atmospheric communications and of ocean reverberation on underwater detection systems

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MODEL LIMITATIONS:

- o single nuclear burst
- o 50 platforms
- o area 100,000 yards square
- o burst yields 1 to 30,000 kt
- o burst heights -50,000 to +50,000 feet
- o blackout and blueout addressed in general terms only
- o plane motion is neglected

HARDWARE:

- o computer: HP 9845B
- o minimum storage required: 64K

SOFTWARE:

- o Programming Language: HP Basic
- o Documentation: brief user's manual, remainder internal to program

TIME REQUIREMENTS: Running time depends on amount of data, whether entered from keyboard or tape, number of effects selected, and user's time in looking at graphs and tables. Probable time 10-20 minutes.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: newly developed

USERS: Seond Fleet TAC D&E

POINT OF CONTACT: Combat Systems Performance Assessment and Analysis Branch
N13 2-123
Naval Surface Weapons Center
Silver Spring, MD 20910
Telephone: 202-394-1235
Autovon 290-1235

KEYWORD LISTING: One-sided; Deterministic; Computerized; Nuclear; Damage Assessment; Naval; Tactical

TITLE: SIRNEM - Strategic International Relations Nuclear Exchange Model

PROPONENT: United States Arms Control and Disarmament Agency

DEVELOPER: Academy for Interscience Methodology

PURPOSE: SIRNEM is a computerized, analytical model designed to study strategic force exchanges and interactions. The model simulates various missiles and bombers as well as tactical aircraft and satellites.

GENERAL DESCRIPTION: The model is "n"-sided, event store and considers land, air and sea forces. Individual weapons and targets are considered. The model's chief focus is on strategic force effectiveness against counter value and counterforce target systems. Primary solution techniques are LaGrange multipliers, probability and geographic relationships.

INPUT:

- o Target coordinates, hardness level, value and identifier
- o Weapon coordinates, number, yield, accuracy, reliability and identifier

OUTPUT:

- o Computer printout of percent target base destroyed, weapons allocated and collateral effects

MODEL LIMITATIONS:

- o Command and control not explicitly simulated

HARDWARE:

- o Computer: CDC CYBER 170
- o Minimum Storage Required: 220K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Documentation available from USACDA

TIME REQUIREMENTS:

- o 2 man-months to structure data base
- o CPU time problem dependent

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 12 times per year

USERS: USACDA, Lawrence Livermore Laboratory, JSTPS, CNO (OP 604)

POINT OF CONTACT: Office of Operations Analysis
US Arms Control and Disarmament Agency
State Department
320 21st Street NW
Washington, DC 20451

MISCELLANEOUS: A subroutine called AIRPEN to simulate manned bomber penetration and interactions with complex defensive systems is currently under development.

KEYWORD LISTING: Computerized; Strategic; Missile; Bomber; Nuclear; Event Store

TITLE: SITAP - Simulator for Transportation Analysis and Planning

PROPONENT: Organization of the Joint Chiefs of Staff (J-4)

DEVELOPER: Computer Sciences Corporation (CSC)

PURPOSE: The SITAP is a computerized, analytical, transportation model designed to give the analyst a broad spectrum of transportation systems. A transportation system, for this purpose, is any system that can be viewed as a network through which vehicles move in order to satisfy movement demands arising at nodes in the network. The movement demands, vehicles, and defined network are controlled by the analyst. SITAP produces cargo and vehicle throughput, depot holdings, and utilization of facilities and manpower.

GENERAL DESCRIPTION: The SITAP is a deterministic model involving airlift and sealift vehicles, transportation networks, and requirements for cargo movement. Requirements may be considered individually or they may be grouped. Numerical analysis is the primary solution technique used.

INPUT: The input source is card images and/or MACE generation of events. Inputs are: (1) the network, (2) parameters, (3) vehicle characteristics and movements, (4) cargo description and quantities, and (5) facilities. Each of these areas may have as many input cards as necessary to complete the problem scenario.

OUTPUT:

- o Traffic generated over each link of the network and simulated flow of cargo through the network
- o Mean response times between cargo ordering and delivery
- o Cargo throughput
- o Vehicle throughput
- o Depot holdings
- o Resource, manpower, and facility utilization
- o Vehicle waiting times, service times, and idle times for each vehicle type and node

MODEL LIMITATIONS: Limitations are directly related to computer core size. The HIS 6080 can accept the following:

- o 20 nodes
- o 10 cargo types
- o 20 vehicle types
- o 15 resources
- o 500 individual vehicles
- o 1000 individual cargo movement requirements

HARDWARE REQUIREMENTS:

- o Type of Computer: IBM 360/65 or HIS 6080
- o Operating System: OS/MVT for IBM and GCOS for HIS
- o Minimum Storage Required: 350K bytes for IBM 360/65 and 110K words for HIS 6080
- o Peripheral Equipment: Tapes and disk

SOFTWARE:

- o Programming Language: FORTRAN IV, IBM 360/65; FORTRAN Y, HIS 6080
- o Documentation: User's Manual, CCTC, 18 January 1971 and Technical Manuals in draft only, CCTC

TIME REQUIREMENTS:

- o 1 to 2 weeks to acquire base data
- o 1 man-week to structure data in model input format
- o 10 minutes to 1 hour CPU time per model cycle
- o 1 hour to 2 days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USER: Organization of the Joint Chiefs of Staff (J-4)

POINT OF CONTACT: Organization of the Joint Chiefs of Staff
Logistics Directorate (J-4)
Technical Advisor Office
The Pentagon, Washington, DC 20301
Telephone: (202) 697-3686

KEYWORD LISTING: Analytical Model; Transportation; Logistics; Airlift; Sealift; Nodes; Throughput; Computerized; Deterministic

TITLE: SLATEM - Submarine Launch Assignment, Targeting, and Effectiveness Model

PROPONENT: US Army Ballistic Missile Defense Program Office

DEVELOPER: Stanford Research Institute - Huntsville

PURPOSE: SLATEM is a computerized, analytical, damage assessment/ weapon effectiveness model used to design and evaluate a nearly optimum attack by an SLBM force against a time-varying value structure. In the development of this program, emphasis has been given to modeling an attack against the Strategic Air Command (SAC) alert aircraft forces while defended by a BMD system.

GENERAL DESCRIPTION: SLATEM is a two-sided, deterministic, air/sea force model that was primarily designed to simulate the attack of one SAC base by one submarine. The model may be manipulated to simulate a typical SLBM force versus any SAC aircraft deployment. The level for which the model was primarily designed is 350 launch points, 72 SAC bases, 4 types of aircraft, 16 SLBMs per Sub, 40 Subs. Range of possible manipulation is any combination of above. Sides use a time step in mechanizing the closed-form probabilistic equation.

INPUT:

- o Number of SAC bases
- o Location of each base
- o Number of each type of aircraft on alert at each base
- o Total alert aircraft
- o Warning time
- o Decision and communication time
- o Reaction time
- o Time to safety
- o Average time between departures
- o Departure lag
- o Number of submarines on station
- o Number of available SLBMs on each submarine
- o Number of launch points
- o Location of each launch point
- o Minimum SLBM range
- o Maximum SLBM range
- o SLBM trajectory time-of-flight coefficients

OUTPUT: For each submarine in the attacking force, the expected number as well as type of aircraft destroyed.

MODEL LIMITATIONS: In addition to the input limitations as shown above there are two additional: (1) The launch points and target lists are selected sequentially for each submarine rather than simultaneously for all submarines. The difference between sequential and simultaneous selection for the cases considered has been less than 3% of the total SAC alert force; (2) The effects of exhaustion of the defense's interceptor stockpile is not considered.

HARDWARE:

- o Type of computer: CDC 6400
- o Operating System: SCOPL 3.4
- o Minimum Storage required: 30,000 words of core

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: SRI memorandum by J. O. Carroll, H. A. Lewis, and W. H. Winter, "Methodology for Evaluating SAFEGUARD SAC Defense Effectiveness: (U), SRD-EG53 (March 1971)

TIME REQUIREMENTS:

- o Acquire base data: Unknown
- o CPU time per model cycle: Unknown
- o Analyze and evaluate results: Unknown

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: Principal: BMDSCOM
SRI

POINT OF CONTACT: J. O. Carroll (principal contact), W. H. Winter, H. A. Lewis, W. J. Medal
Stanford Research Institute
Huntsville, Alabama
Telephone: 205/837-3050

MISCELLANEOUS: Model(s) to which linked: Analysis of SAFEGUARD Repertoire (ANSR). ANSR is capable of generating a list of SAC bases that can be attacked by avoiding the defense from each SLBM launch point; this list is then input into SLATEM as possible launch points for use against SAC. SLATEM is not a replacement for an existing model. The following modifications are planned for SLATEM: (1) Mix aircraft types on a runway; (2) Mix threat elements; and (3) Add a more efficient means of handling bases which have dual runways.

KEYWORD LISTING: Analytic Model, Damage Assessment/Weapon Effectiveness, Computerized, Two-Sided, Deterministic, Time Step

TITLE: SNAP - Safeguards Network Analysis Procedure

PROPONENT: Naval Surface Weapons Center, White Oak, Code G42

DEVELOPER: Sandia Laboratories

PURPOSE: SNAP is a scenario oriented modeling system that allows for rather complex guard and adversary tactics and activities to be evaluated.

GENERAL DESCRIPTION: SNAP uses a network description of a facility, guard tactics, and adversary tactics as an input to an event driver simulation of the resulting scenario. It can be run for either a deterministic or Monte Carlo analysis with aggregate results.

INPUT:

- o Facility Description
- o Guard Tactics
- o Guard Arms
- o Threat Tactics
- o Threat Arms
- o Security Sensors

OUTPUT:

- o Scenario event listing
- o Probability of detection
- o Probability of interruption
- o Probability of system win

MODEL LIMITATIONS: Facility size

HARDWARE:

- o Computer: PE 3220, 7/32
- o Operating System: OS 32/MT
- o Minimum Storage Required: 600 KB
- o Peripheral Equipment: Printer, graphics CRT, digitizer

SOFTWARE:

- o Programming Language: FORTRAN VII
- o Documentation: User's/Programmer's Manual

TIME REQUIREMENTS:

- o 25-40 hours to imput facility, guard and adversary tactics depending on complexity
- o 5 minutes per Monte Carlo iteration

SECURITY CLASSIFICATION: UNCLASSIFIED

- o Model: UNCLASSIFIED
- o Data: Function of facility
- o Results: Function of facility

POINT OF CONTACT: Mr. Ed Jacques
NSWC/G42
White Oak
Silver Spring, MD 20910
Telephone: (202) 394-2396

KEYWORD LISTING: Physical Security Model, Physical Security Scenario

TITLE: SNAP - Strategic Nuclear Attack Planning System

PROPONENT: Command and Control Technical Center, Defense Communications Agency (CCTC/DCA)

DEVELOPER: CCTC/DCA

PURPOSE: SNAP is a computerized analytical system designed for use in nuclear weapons allocation, nuclear forces requirement studies and blast damage assessment. The chief focus of concern is the achievement of a nuclear stockpile allocation minimizing overkill, maximizing the number of targets killed while minimizing weapon expenditures. This allocation is achievable with or without restraints, using or not using launch areas for weapon systems; and obeying or ignoring restraints/optional with-holds.

GENERAL DESCRIPTION: SNAP is a one-sided deterministic system comprised of five programs, one of which is the allocator, and is designed to consider a wide variety of nuclear weapon arsenals in allocations resulting for user control. Depending on the usage, one allocation run or a number of them may be required to achieve a solution acceptable to the user. If more than one is required, the printed output from a given run will permit an improvement of the achieved solution in the next run. The number of runs required will depend on the nature of the request and the familiarity of the user with SNAP. The SNAP system will allocate up to thirty weapon systems from up to forty launch areas to JAD type target data bases. The target data bases can be coded or uncoded (minor changes would be required on up to two of the auxiliary preprocessing programs of the system to adapt to any properly prepared target data base). An uncoded data base permits the user to generate attack instructions on the targets in the data base according to their category or subcategory. A coded data base permits the generation of attack instructions according to the resulting pseudocategories and/or tide codes. The primary solution technique used for the determination of the DGZ is a complex multivariable dependent process exercised on a geometric plane resulting from a transformation from a probabilistic one.

INPUT:

- o Target base with the information requirements depending upon the task at hand. Minimum requirements per target are: Latitude, Longitude, Radius, VNTK, Point Value, and/or Capacity. For P-95s the capacity is required.
- o Weapon system inventory with the information requirements depending upon task at hand. Minimum information per weapon system: Number available, CE, Yield, Height of Burst, and Probability of Arrival.

OUTPUT:

- o Computer printouts giving a statistical synthesis of the results of the laydown with highly detailed information for further analytical studies of various options.
- o Magnetic tape file containing DGZ listing with pertinent information per DGZ. A similar listing may be included as part of the printed output.
- o Visual display of the data base and DGZ determination can be generated via plotter.

MODEL LIMITATIONS:

- o Targets - Only point targets and circular area targets, the latter can be uniform or normally distributed.
- o Weapon Systems - 30
- o Launch Areas - 40
- o Systems within each launch area - 10

HARDWARE:

- o Computer: HIS 6080
- o Operating System: GCOS
- o Minimum Storage Required: 83K
- o Peripheral Equipment: Card reader, disk drives, printer, tape drives

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Strategic Nuclear Attack Planning System (SNAP) - Users Manual NMCSSC - 1975

TIME REQUIREMENTS:

- o Given a data base in JAD format the time from receipt to conversion to SNAP would be less than 3 days. From this converted base any subset will be generated as part of the run to be made by the allocator preprocessor.
- o Preparation time for an initial SNAP run will vary depending on user familiarity with SNAP and the complexity of the required task. A minimum of 2 or 3 days should be allowed for the process. Subsequent SNAP runs normally require minimal time (10 to 20 minutes) to modify input data.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 200 times per year

USERS: Studies, Analysis, and Gaming Agency

POINT OF CONTACT: CCTC/C314
Mr. C. G. Thompson
The Pentagon, Room ME688
Washington, DC 20301
Telephone: OX-59331

KEYWORD LISTING: Analytical Model; General War; Damage Assessment; System-Launch Areas Allocator, Deterministic; Acceptable Solution; Minimal Weapon Expenditure, Minimal Target Overkill, Maximum Target Destruction per DGZ.

TITLE: SNAPPER

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: SNAPPER is a general nuclear damage assessment model originally developed to treat limited strategic options and counterforce strikes. Subsequent additions have adapted it for use in assessing theater nuclear strikes.

GENERAL DESCRIPTION: SNAPPER is a Monte Carlo model that computes the damage to targeted installations, collateral damage to other specified facilities, and casualties to the surrounding population. The program includes a choice of fallout models (WSEG/NAS, SEER III, CAMEL, or MILLER). Casualties are estimated based on a population sampling technique.

INPUT: The following are the mass inputs to the model:

- o Yield, CEP, intended height of burst, and reliability of attacking weapons
- o Target hardness, size, and location
- o Hardness, location, and size of facilities for which damage assessment is desired
- o Population data base
- o Monte Carlo variables are:
  - Actual ground zero
  - Weapon reliability
  - Air-burst fuzing reliability
  - Height of burst
  - Fallout wind pattern

OUTPUT:

- o Damage and casualty data (fatalities and injuries) are displayed for each Monte Carlo iteration and the expected results
- o Distribution of damage by specified target or installation classes

MODEL LIMITATIONS:

- o 49 Monte Carlo iterations
- o 1500 population samples
- o 100 target classes
- o 50 weapon types
- o 2500 targets per class

HARDWARE:

- o Computer: IBM 370/158
- o Operating System: VS2 - Rel. 3.8
- o Storage Requirement: 350K

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SOFTWARE: Programming Language: FORTRAN G

TIME REQUIREMENTS:

- o Acquisition of the target and population data base can be lengthy
- o CPU time depends upon the number of weapons and targets involved and strongly on whether fallout calculations are required. Typically, one weapon on each of about 300 targets required 150 CPU sec without fallout calculations; 150 large surface-burst weapons with fallout calculations takes as much as 750 sec

SECURITY CLASSIFICATION:

- o Program UNCLASSIFIED
- o Data base may be CLASSIFIED

FREQUENCY OF USE: Presently not in use

USERS: The Rand Corporation

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: J.W. Ellis Jr., or R.H. Frick

KEYWORD LISTING: Continental/Theater; Analytical; Monte Carlo; Nuclear; Damage Assessment/Weapons Effectiveness; Fallout; Casualties; Two-sided; Event

TITLE: SOSAC-Son of Super Ace-Central

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Applications, Inc (SAI)

PURPOSE: SOSAC is the primary general purpose weapon allocator for strategic countercentral systems. It minimizes the cost incurred to achieve a set damage level on a specified target, and permits the user to select a wide range of allocation controls.

GENERAL DESCRIPTION: SOSAC is a computerized model that provides for the allocation of strategic nuclear forces against targets of strategic importance. It consists of a set of computer codes that uses linear programming and decomposition theory to optimally allocate weapons to targets. It can calculate RFS statistics for each allocation of a waved attack. SOSAC considers economic and military targets presently in the Soviet Union and the NSWP and treats DE as unidirectional, allowing the user to be creative in specifying relative cost and requirements.

INPUT:

- o Arsenal data files
- o Target data files
- o Allocation controls

OUTPUT:

- o Residual aresenals
- o Target damage summaries
- o Relative force size/arsenals used

MODEL LIMITATIONS: It does not allocate a specific weapon to a specific target, does not consider command, control and communication nor the effects of time; and it does not capture many operational considerations including range and footprint.

HARDWARE: MULTICS

SOFTWARE: Programming language: ANSI FORTRAN (MULTICS)

TIME REQUIREMENTS: 2 to 8 minutes depending upon problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Hundreds of times during studies and at major points during the PPBS cycle.

USERS: OD(PA&E)

POINT OF CONTACT: OD(PA&E)
Strategic Programs
The Pentagon, Washington, DC 20301
Telephoen: (202) 695-5587

KEYWORD LISTING: Linear programming, computerized, intercontinental forces, RFS, allocation.

TITLE: SOSAT-Son of Superace Theater

PROPONENT: Office of the Director for Program Analysis and Evaluation (OD(PA&E))

DEVELOPER: Science Application, Inc (POST)

PURPOSE: SOSAT is a computerized model that analyzes long range nuclear forces against fixed targets in the European theater.

GENERAL DESCRIPTION: SOSAT is a small, fast executing model that uses arsenal data management. It maintains geographic (range) sensitivity and provides summary information on residual arsenal value, goal achievement and collateral target damage. It compares the effectiveness of NATO and WARSAW PACT theater nuclear forces against targets in the European theater. Warheads and delivery vehicles are described and allocated to specific target objectives. It allows for analysis of nuclear stockpiles and delivery vehicle requirements. It provides for summary and retention of target damage status and residual attacker arsenal and allows the transfer of target damage information into SOSAC for countercentral force allocation and analysis.

INPUT:

- o Warhead and delivery vehicle data files
- o Target data files
- o Allocation controls

OUTPUT:

- o Detailed target damage summaries
- o Information on force structure, DE level and CDE and target coverage
- o Arensal status by warhead and delivery system
- o Retention of residual arsenal and damage target information

MODEL LIMITATIONS: Discrete time line of events. Effects of prior conventional force applications is crudely treated and exchange dynamics are ignored.

HARDWARE: MULTICS

SOFTWARE: Programming language-ANSI FORTRAN (MULTICS).

TIME REQUIREMENTS: 3 to 15 minutes per arsenal allocation depending upon the problem.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Several hundred times per year.

USERS: OD(PA&E)

POINT OF CONTACT: OD(PA&E)
Strategic Programs
The Pentagon, Washington, DC 20301
Telephone: (202) 695-5587

KEYWORD LISTING: Theater Nuclear Forces, Linear Programming.

TITLE: SPEED - Simulation of Penetrator Encountering Extensive Defenses

GENERAL DESCRIPTION: The SPEED model is a stochastic, event-based simulation of air vehicles (and weapons) penetrating through and interacting with air defense systems. Penetrating vehicles/weapons encompass: manned aircraft, drones, airborne decoys, and various air-launched ordnance, vis., ASM and gravity bombs. Air defense systems encompass: area defenses (specifically, ground EW net, AWACS, airborne interceptors (AI), airbases, GCI stations, along with the integrating C&C structure), and point defenses (specifically integrating C&C structure), and point defenses (specifically SAM sites and AAA sites). Weapon targeting can include air-defense elements. The SPEED model is compatible with and complements the Advanced Penetration Model (APM).

COMPUTER INFORMATION: SPEED is programmed in FORTRAN IV and operates on the IBM 360. Running time for a large bomber force is from 30 minutes to 1 hour on IBM 360. Model is being moved to IBM 3032, which will shorten run time and/or allow larger scenarios.

DOCUMENTATION: User and programmed documentation is available in AF/SASB.

TITLE: SQUARE DEAL - Battalion in Aid of the Civil Power

PROPONENT: Wargames Section, Directorate of Land Operational Research (DLOR), Operational Research and Analysis Establishment (ORAE), Ottawa, Canada

DEVELOPER: As above

PURPOSE: The game is designed to exercise the battalion command post in the conduct of stability operations in Aid of the Civil Power.

GENERAL DESCRIPTION: This is a closed, two-sided, manually conducted game with a 15-minute game time interval. Although desirable to play in real time, this may seldom be achieved because of the time required to complete the control assessments. However, an overall real time/game time ratio of 1:1 can normally be expected. Blue Sideroom organization approximates the operations center of the police and military forces deployed and has with the control room an intelligence link, two operations links and a telephone link simulating the public telephone system terminating in a police switchboard. The setting is an imaginary city in Canada on detailed large scale maps including construction details of all buildings and with a level of resolution down to section size, individual vehicles and snipers.

Assessment procedures cover the following areas: kidnapping, sabotage/demolitions, riots, fire bombing, sniping actions, bomb search, cordon and search, non-crime service calls, crime service calls, crisis-generated calls, vandalism, looting and robbery.

The game is designed for company and battalion level but can be expanded to brigade. The police and civil forces include provincial police, city police, railway police, fire department, campus police, coast guard, and RCMP marine station. Red Sideroom includes the regional leader and cell leaders. This wargame can be conducted by staff colleges and combat arms units.

INPUT:

- Game directive including game objectives, level and scope of the game, player appointments, game assumptions, order of battle and a brief outline of the tactical situation
- Game scenario
- Wargame package prepared by DLOR containing all proformae, rules and assessment procedures

OUTPUT: Detailed control room and sideroom logs are maintained for post-game critique.

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MODEL LIMITATIONS:

- Because of the cyclical nature of assessments it is not possible to state the specific time at which certain events took place but only that they did take place within the 15 minutes.
- It is not possible to determine the precise step by step involvement of action and counter action for each individual or subunit involved.

HARDWARE: Large scale detailed city map

SOFTWARE: Nil. Manual Assessments. Detailed logs in control room and siderooms.

STAFF: Control Room staff of twelve. Sideroom staff a minimum of eight in Blue Sideroom and four in Red Sideroom

TIME REQUIREMENTS:

- Preparation: Given the scenario, operational plans and assessment packages, a one-day period for training control room staff and setup is required.
- Play: The wargame portion of the exercise usually is conducted in three or four hours. Thus several separate exercises, with same forces and staffing, can be conducted over a few days.
- Analysis: All detailed logs are retained and analyzed.

SECURITY CLASSIFICATION: RESTRICTED

FREQUENCY OF USE: Not known. Staff colleges and all combat arms units have individual SQUARE DEAL wargame packages.

USERS: As above

TITLE: SSA - Static Sector Analysis Model

PROPONENT: Office of the Assistant Secretary of Defense
Program Analysis and Evaluation (PA&E)

DEVELOPER: Office of the Assistant Secretary of Defense,
Program Analysis and Evaluation (PA&E)

PURPOSE: This is a computer assisted model for calculating force requirements directly by comparing measures of the combat effectiveness of opposing forces of various points in time after mobilization. The model does not consider movement of units within a theater or FEBA movement, and therefore, it is classified as static, although it does consider the buildup of forces in theater with time.

GENERAL DESCRIPTION: The combat effectiveness of defending forces is calculated for each sector and for the theater reserve. Effectiveness is expressed in terms of Weighted Unit Value (WUV), which is the total worth of all effective weapons in a force; however, any set of force effectiveness indicators could be used. The total WUV of the attacker is determined and an attack axis(es) selected. The amount of defender WUV deployed in sectors off the main attack is determined, and enough attacker WUV is allocated opposite those sectors to fix the defending force in place. That is, the attacker allocates enough force in those sectors to keep the defender from exceeding the stalemate force ratio. This ratio can be varied. The remaining attacker WUV is then assumed to be applied on the main attack sectors and compared with the defender's WUV in those sectors plus in his entire reserve. If the defender does not have enough WUV to keep the attacker from exceeding the stalemate force ratio, a requirement is generated. If the defender has too much WUV, an excess is calculated. The WUV output is translated into a more convenient measure, such as the equivalent WUV in armor divisions (ADEs), to make comparisons easier. This process is repeated at each point in time after M-Day for which results are desired, updating the force deployments to reflect the availability of any additional units in the theater of operations. This model has been used by OASD(PA&E) to estimate US force requirements for Europe and Northeast Asia.

INPUT:

- o A battlefield description which includes FEBA location, sector subdivisions within the theater, initial deployment of friendly forces to sectors and theater reserve, and identification of likely attack sectors for enemy forces.
- o A set of combat value scores describing the relative contribution of each unit to overall force effectiveness.
- o A time-phased deployment/availability schedule for friendly and enemy forces
- o A value for the maximum attacker/defender effectiveness ratio that still allows the defender to hold the attacker on a defensive line (called "stalemate force ratio").

OUTPUT: The output measure of the model is the incremental amount of force effectiveness (+ or -) that a defender would require to stalemate an attacker at a given point in time. Force effectiveness is usually measured in terms of Armor Division Equivalents (ADEs), which is the combat effectiveness score for a standard US armor division.

MODEL LIMITATIONS:

- o Geography is not explicitly considered
- o Considers only ground forces
- o Does not consider logistics or combat attrition
- o Is limited to static comparisons

HARDWARE:

- o Computer: IBM 360/50, IBM 360/65, CDC 6400, GE 635, UNIVAC 1108/1110, Honeywell 6000, IBM 370
- o Operating System: OS Release 20 (IBM); SCOPE (CDC)
- o Minimum Storage Required: 100K bytes
- o Peripheral Equipment: Standard scratch disk plus permanent disk for war file

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available.

TIME REQUIREMENTS:

- o 1 day to acquire and structure base data in model input format
- o 10-30 seconds CPU time per model
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED. Data is up to TOP SECRET.

FREQUENCY OF USE: Several times per year

USER: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Europe Division
The Pentagon
Washington, D. C. 20301
Telephone: OX-54347

KEYWORD LISTING: Analytical Model; Conventional War; Land Forces; Computerized, Two-Sided; Deterministic

TITLE: STAB II - Anti-Air Warfare Battle Model

PROPONENT: Naval Air Systems Command (AIR-503)

DEVELOPER: Naval Air Development Center

PURPOSE: STAB II is a computerized, analytical general war model used to analyze the effectiveness of airborne weapon systems, including the aircraft, weapons control system, and weapons, against one or many airborne targets attacking ships or a task force. The primary focus of concern is the combat effectiveness of the system in fleet air defense environments. In addition, the model may be used to study the effects of command and control systems functions, ECM, aircraft performance, maintainability and reliability, threat variations, and reaction time on fleet air defense.

GENERAL DESCRIPTION: STAB II is a two-sided model having both deterministic and stochastic elements. It is capable of considering one interceptor or one target, if desired, and of aggregating up to the level of 10 groups of 6 resolvable targets per group or 10 groups of 64 unresolvable targets per group. Simulated time is treated on an event store basis. The Game Time: Real Time ratio is variable, depending upon the number of interceptors and targets being considered. Probability is the primary solution technique used.

INPUT:

- Threat description
- Aircraft performance: Acceleration, fuel usage, etc
- Weapon system performance
- Command and control logic

OUTPUT:

- Computer printout stating times of initiation and completion of combat and interceptors against targets and the expected number of kills achieved.

MODEL LIMITATIONS:

- Two types of target groups, two types of interceptors
- 10 target groups: 6 resolvable targets per group and/or 64 unresolvable targets per group
- 30 interceptors (Combat Air Patrol plus deck-launched interceptors)

HARDWARE:

- Computer: CDC 6600
- Minimum Storage Required: 40,000
- Peripheral Equipment: Mass storage (disk)

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: FORTRAN extended reference manual

TIME REQUIREMENTS:

- o 0.5 months to prepare input
- o 5 minutes CPU time average per game
- o Less than 1 day to evaluate results of 1 game; varies with number of parametric variations in total evaluation of systems

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 25 times per year

USERS:

- o Principal: NAVAIR (AIR-503), CNO (OP-96)
- o Other: OSD, Systems Analysis; NADC is support of other projects

POINT OF CONTACT: Systems Analysis and Engineering Department
Naval Air Development Center
Warminster, Pennsylvania 18974
Telephone: Autovon 441-2595

MISCELLANEOUS: STAB II can be linked with the Weapon System Engagement (WSE) model where an analog simulation determines launch opportunities versus a threat and the Launch Acceptability Region (LAR) provides missile launch zones against selected targets. This data is punched on cards for input into STAB II.

KEYWORD LISTING: Analytical Model, Computerized, Two-Sided, General War, Aircraft, Deterministic

TITLE: STANDARD ARM Flight Profile Model

PROPONENT: AFEWC

DEVELOPER: US Navy - China Lake

PURPOSE: To model/predict STANDARD ARM trajectories

GENERAL DESCRIPTION: A second-by-second layout of this missile is modeled from launch to impact

INPUT: Launch conditions

OUTPUT: Table of trajectory times, speeds, altitudes, mode of operation and various angles

MODEL LIMITATIONS: Does not run footprint

HARDWARE:

Computer: UNIVAC 418-III

Operating System: RTOS-9E

Minimum Storage Requirement: 64,000

Peripheral Equipment: Card reader/printer

SOFTWARE:

Programming Language: FORTRAN

Documentation: China Lake Report

TIME REQUIREMENTS: Requires 1 hour to structure input and 1 minute of CPU/trajectory

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: As required

USERS: AFEWC/SA and EW

POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

TITLE: STAR - Simulation of Tactical Alternatives Responses

PROPONENT: US Army Training and Doctrine Command, Fort Monroe, VA

DEVELOPER: TRADOC Research Element, Monterey (Naval Postgraduate School)

PURPOSE: The simulation is designed for high resolution analysis of combined arms task force operations at the Blue Brigade - Red Division level. Its primary use is to investigate the effects of tactics, doctrine and hardware components in the context of the air/ground environment. The simulation is totally played on the computer with no manual interaction.

GENERAL DESCRIPTION: STAR is a high resolution, event structured, stochastic, two-sided simulation of the combined arms air/land conflict. The model may be run using either digitized terrain or a continuous, functional terrain representation developed at NPS. All units are resolved to the individual vehicle or soldier level. Conflicts are modelled between a Blue Brigade/Red Division echelonment, or any subset of these organizations. The mode is capable of playing a wide range of resource allocation, fire and maneuver tactics easily modified by the user. Development, expansion and implementation is an ongoing effort. The features discussed below describe the operational model status as of January 1982, except as specifically noted otherwise.

FEATURES:

Terrain: The macro terrain is represented as a series of hills which are ellipsoids in horizontal cross section and have the characteristic normal bell shape in vertical cross section. Any desired representation of the battlefield contour map may be achieved by under or over laying additional functional hill masses. Elements exist at any arbitrary coordinate on the continuous battlefield. Features such as forests, vegetation, soil types, rivers, built-up areas, obstacles, minefields, etc., are represented by geometric overlays on the macro terrain. These features may be created or destroyed as required. Line of sight and mobility are precisely determined analytically, because of the functional nature of the representation.

Ground Model: The ground model is capable of playing the full range of armor/anti-armor systems, to include dismounted ATGMs. The basic event sequence of acquisition (based on time to detect), target selection, fire and impact characterizes the basic model flow. In addition, several unit movement and firing tactics are played at various organizational levels.

Air/ADA: Capable of representing the two-sided play of helicopters and air defense systems, as well as close air support fixed wing aircraft. A full range of firing tactics and acquisition modules are played, to include indirect missile firings and hand-off illumination when required. All air and ADA systems are explicitly portrayed on the high resolution battlefield.

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Field Artillery: Consists of six basic modules, all of which are explicitly represented on the battlefield. The FO module determines targets to be fired, categorized by FPF, trigger areas, and clusters (for targets of opportunity). The allocation module and fire direction module are capable of playing a range of target prioritization capabilities, including IACIRL. The gun module and asessment module provide the capability to represent either volley or individual tube fire and assessment as required by the munition and supportive data. The counter-battery module represents appropriate radar acquisition and target selection methodology. The artillery, and air are linked to permit play of aerial observers. HE, DPICM, PGM and smoke munitions are modelled.

Limited-Visibility/Smoke: Provide a dynamic representation of the physical environment which continually changes as a function of appropriate parameters. Smoke clouds are dynamically created, moved and degraded during the battle. Sensor physics is employed to describe a wide range of devices and to determine environmental attenuation. Finally, times to detect are determined from physical considerations, as well as the mode of sensor employment.

Communications/Electronic Warfare: Provides explicit representation of all artillery nets, as well as the ground unit tactical nets. A spectrum of two sided EW methods are also planned. Ongoing development of modules for radar countermeasures, ADA Command and Control, air request nets, red DF/Artillery nets, and the remote designators will result in a total COM/EW capability for the model.

Dismounted Infantry: Capable of representing close combat between dismounted troops at the individual soldier level of resolution. Dismount and remount of troops from personnel carriers are explicitly modelled, including the selection of primary and alternate firing positions and routes. Research is continuing to develop enhanced close combat modules, as well as a variety of tactics modules to be employed in conjunction with the combat vehicle deployment modes.

Suppression: Represents the effects of direct and indirect fire on the delay of element functions such as detection, firing, and movement. Current lack of data requires that parametric estimates of the suppression factors be provided as module inputs.

Logistics: Initial design of high resolution ammo/fuel logistics module is complete (individual carrier level of resolution) which dynamically represents the logistics/combat interactions from brigade trains to the actual resupply of the combat vehicles. Implementation of these modules is an ongoing development effort.

INPUT:

- o Detailed weapon system characteristics
- o Fire and maneuver tactical parameters
- o Scenario
- o Acquisition and communication procedures

OUTPUT:

- o Approximately 25 attributes of each shot fired in the battle
- o Periodic attribute lists for each element
- o 12 post processor outputs including such items as time line attrition curves, shot distribution by range, aspect angles, fiber-target movement status, etc.

MODEL LIMITATIONS: Not interactive at the present time

HARDWARE: Has been executed on IBM 360/370, CDC 6500 and UNIVAC 1108

SOFTWARE: SIMSCRIPT II.5

TIME REQUIREMENTS: Based on IBM 360/370, CDC 6500 and UNIVAC 1108, 2 battle minutes per CPU min (Battalion model with 325 elements).

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuously

USERS:

- o US Army Armor Center
- o US Army Air Defense School
- o US Army Aviation Center

POINT OF CONTACT: Dr. Sam Parry
Code 55-Py
Naval Postgraduate School
Monterey, CA 93940
AUTOVON: 878-2779

TITLE: STATE III - Simulation for Tank/Anti-Tank Evaluation

PROPONENT: SHAPE Technical Centre

DEVELOPER: SHAPE Technical Centre

PURPOSE: STATE III is a critical event, stochastic, land combat model for simulating armor/anti-armor engagements. The model may be run as a pure simulation without human intervention or it can be used in a wargaming mode with the progress of the battle displayed on a graphics device. STATE II is a damage assessment model which is used to analyze the effectiveness of various weapons mixes and/or tactics.

GENERAL DESCRIPTION: The STATE III model is a two-sided, stochastic, event oriented land combat assessment model for simulating armor-anti-armor engagements. Close air support, minefields, smoke, and artillery can also be simulated in the model. The activities simulated include movement, detection, firing, changing speed, terminal effects including suppression, smoke, visibility, and tactics. The desired tactics to be used by both sides are input in the form of an order set. The tactical orders used are of two basic types: those which define a movement or posture change, and those which are based upon conditions which occur stochastically within the model such as damage levels. Terrain, cover, concealment, and visibility are also simulated by the model.

INPUT: The following data are used as inputs to the model:

- o Game control data
- o Terrain boundaries
- o Digitized landforms, vegetation and man-made obstacle elevations
- o Group data which identifies the composition and starting location of the combat units. (A combat unit can consist of one or more individual weapons.)
- o Weapon characteristics data
- o Minefield locations
- o Close air support data
- o Artillery data
- o Ordnance data
- o Tactical orders
- o Sensor data (for detection purposes)
- o Hit and kill probability data

OUTPUT: The results of the simulation can be output in three ways:

- o An event by event listing of each replication of the battle can be listed on a computer printout.
- o A summary of the results of the several replications can be output in both tabular form and graphical form
- o In the interactive mode, the progress of the battle in terms of movement and kills can be observed in a series of graphical displays on a cathode ray tube device.

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LIMITATIONS:

- o Infantry (riflemen) is not simulated
- o Model does not simulate attack helicopters at the present time
- o Maximum of 60 individual combat units
- o Maximum of 6 unit types
- o Maximum of 3 weapon types per unit

HARDWARE:

- o Computer: CDC 6400
- o Operating System: SCOPE 3.4
- o Minimum Storage Required: 105 K words according to scenario
- o Peripheral Equipment: Disk and tape Tektronix 4002A (for interactive mode)

SOFTWARE:

- o Programming Language: FORTRAN IV COMPASS
- o Documentation:
  (1) STC TM-344 "Simulation for Tank/Anti-Tank Evaluation (STATE II) User's Guide," April 1973 (NU)
  (2) STC TM-324 "Simulation for Tank/Atni-Tank Evaluation (STATE II) Concept and Model Description," May 1972 (NU)
  (3) STC TM-422 "An Interactive Version of the STATE II Model," May 1974 (NU)

TIME REQUIREMENTS:

- o Develop and code 5 x 8 km terrain area - 5 man-days
- o Prepare input deck (including order set) - 4 hours
- o CPU time for 30 replications - 2-5 hours
- o Analysis of results - 1-3 man-days

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: SHAPE Technical Centre
IABM (FRG), RARDE (UK)
Martin-Marietta (USA)

POINT OF CONTACT: SHAPE Technical Centre
P. O. Box 174
The Hague
Netherlands
APO New York 09159

KEYWORD LISTING: Simulation; Monte Carlo; Critical Event; Tank Warfare; Anti-Tank Weapons: Land Combat; Stochastic; Effectiveness; Guided Missiles; Model; Direct Fire; Tactics; Interactive

TITLE: STOCHADE

PROPONENT: MA Department, RARDE, Sevenoaks, Kent

DEVELOPER: Operational Research Branch
Royal Military College of Science
Shrivenham, Swindon SNG 8LA UK

PURPOSE: A fast-running, highly aggregated model of a heterogeneous direct-fire battle

GENERAL DESCRIPTION: STOCHADE is a computerized direct fire model based on the solution of attrition equations and is available in stochastic or deterministic form. The stochastic version is a simulation solution of time/range dependent Lanchester-type differential equations. The deterministic version uses the Runge-Kutta algorithm to solve the equivalent system of deterministic differential equations. There is no restriction on the number of weapon types that may be included on either side. The stochastic model has a variance reduction option which yields smaller confidence intervals for estimates of battle outcomes.

INPUT: Numbers of each weapon type; kill rates; speed of advance; target selection rule; intervisibility and detection probabilities; fractional kill rate capabilities for moving weapons and targets; proportion of fire on dead or false targets

OUTPUT:

Stochastic Version:

Optional - For each run: casualties, target weapon, firing weapon, battle time, order of kill

Program routine - A summary of a number of replications gives:

- Number of Red and Blue wins
- Estimated probabilities of Red and Blue wins with 95% confidence intervals
- Average time of battle, average time for Red win, average time for Blue win (all with standard deviations)
- Mean and standard deviation of number of Red and Blue survivors for each weapon type; frequencies and histograms of numbers of survivors for each weapon type

Deterministic version

The number of survivors of each weapon type as a function of time and range

MODEL LIMITATIONS: STOCHADE is a highly aggregated model in which ranges of engagement are modelled according to the "centres of gravity" of the force

HARDWARE: A Hewlett Packard 9835A desk-top computer and VDU, with optional disk-drive, printer and graph plotter

SOFTWARE: Program language: Hewlett Packard Extended BASIC
Documentation available: User Guide; Program Listing; Model descriptions

TIME REQUIREMENTS:

- Minutes to input kill rates on file
- One minute to enter data at run time
- Battle with between 5 and 15 weapons on each side takes approx. 3 to 15 seconds per replication

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuous for investigations into the dynamics of the direct-fire battle

USERS: RARDE, DOAE, RMCS

POINT OF CONTACT: Head of OR Branch
RMCS
Shrivenham
SWINDON SN6 8LA UK
Telephone: 0793-782551 Ext 409

TITLE: Stochastic Combat Model

PROPONENT: Mobility Team, BMD, BRL

DEVELOPER: Mobility Team, BMD, BRL

PURPOSE: Determine trade-off relations between mobility and armor protection of a combat vehicle

GENERAL DESCRIPTION: The model computes probability of winning a tank duel and probability of surviving a closing-on maneuver, both as functions of a number of shots fired. It also computes an expected duration of a duel, expected number of shots fired and expected distance traveled.

INPUT:

- Weapon characteristics: accuracy, lethality firing rate. Also percentage of time on the move during combat and average speed

OUTPUT:

- Complete set of probabilities of all duel events consisting of shots fired, distance traveled and the state of duelists

MODEL LIMITATIONS:

- No simultaneous firing of the duelists is allowed. Distribution of time between shots is independent of the previous sequence of shots. A duelist can be only in two states: fighting and defeated.

TITLE: Stockpile Model

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Resources Preparedness Office, Office of National Preparedness Programs and Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: The Stockpile Model provides both computerized and computer assisted analytical capability for the estimation of stockpiled materials imbalances (demands less supplies) in time of general or limited war. The stockpile model is used to generate the estimates of stockpile imbalances issued each year in the FEMA Annual Materials Plans. For a given mobilization scenario, the stockpile model translates Gross National Product forecasts and defense goods requirements estimates into estimates of stockpile imbalances for the Department of Defense, essential civilian and basic industrial tiers for each year of the study. The Stockpile Model addresses no other problems. Stockpile imbalances refer to the differences between estimated available supply and estimated requirements for strategic and critical raw materials during a major war three years in duration.

GENERAL DESCRIPTION: The Stockpile Model is a one-sided deterministic simulation model that considers requirements to supply land, air, sea, and paramilitary forces as well as civilians. The model was designed to estimate stockpike imbalances in the US economy for 69 raw materials, employing 110, 1967 domestic input-output industrial sectors and 129 foreign countries as material sources. The stockpile model could handle 93 raw materials and 178, 1967 input-output sectors. The model was designed to simulate three-year wars as time-step phenomena. Model solution techniques include linear econometric equation estimation (regression techniques), linear forecasting and projection techniques, input-output techniques and linear algebra.

INPUT: Gross National Product Forecasts and Defense Department war material requirements are fed into the stockpile model. Also inputted are historic material consumption by four-digit SIC industries, supply estimates for 129 source countries for normal and expanded production, 110 sector 1967 FIOS tables, substitution rate estimates, transportation loss estimates, civilian austerity estimates, and supply source reliability estimates.

OUTPUT: Computer printouts include Gross National Product components and other macroeconomic estimates, defense expenditures, final demand and total output estimates resulting from the foregoing, raw materials requirements by year and tier, historical materials consumption, supply available by year, supply adjustments, stockpiled materials imbalances, stockpiled materials inventories, and stockpiled materials goals.

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MODEL LIMITATIONS: The limitations of the Stockpile Model include:

- o Limited numbers of stockpiled materials
- o National model only - no regional or local detail
- o Three year estimates only
- o Limited Input-Output detail -- 110 sectors
- o Model linearity and fixed technical Input-Output co-efficients inflate stockpile imbalances and goals
- o Degree of over estimation in stockpile imbalances and goals untested and unknown
- o 196. FIOS data base is obsolete

HARDWARE:

- o Computer: UNIVAC 1108
- o Operating System: Level 33/36 Executive
- o Minimum Storage Required: 64K 36 Bit Words
- o Peripheral Equipment: Disk/Drum, UNIVAC 9300 printer Honeywell Printer

SOFTWARE:

- o Programming Languages: Basic, FORTRAN, Assembly Language, Matrix Arithmetic Programming System (MAPS)
- o Documentation: All unpublished, none available

TIME REQUIREMENTS:

- o To acquire Data Base: 4-6 weeks
- o To structure Data in Model Input Format: 1-1 1/2 months
- o Playing Timer per Cycle: 4 months
- o CPU Time per Cycle: 5 hours

SECUPITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: One per year, multiple runs

USERS: National Resources Division, Resources Preparedness Office, National Preparedness Program, Federal Emergency Management Agency

POINT OF CONTACT: Natural Resources Division
Resources Preparedness Office
National Preparedness Program Office
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (202) 287-3935

MISCELLANEOUS: Based on:

- o CHASE Econometric Model for Macroeconomic Expenditure estimates
- o Matrix Arithmetic Programming System (MAPS)
- o 1967 FIOS Tables

KEYWORD LISTING: Computerized, stockpile, analytical, imbalances, goals, strategic, materiels

TITLE: Stockpile/Production Base Trade-Off Model

PROPONENT: Deputy Under Secretary of Defense for Research and Engineering (Tactical Warfare Programs)

DEVELOPER: Institute for Defense Analyses

PURPOSE: The Stockpile/Production Base Trade-Off Model is a computerized, analytical, logistics model. The model solves for the least cost investment in production base and end item stocks that will satisfy both wartime and peacetime demands. This model addresses the questions of how much and when should the Defense Department invest in production base and end item stockpile of an item consumed in wartime.

GENERAL DESCRIPTION: The Stockpile/Production Base Trade-Off Model is a one-sided, deterministic model which employs land, air, and sea forces. It was designed to consider items on the level of an individual ammunition round and can be manipulated for any wartime consumable. Linear programming is the main method of solution.

INPUT:

- o Wartime demands
- o Peacetime demand
- o Initial stockpile levels
- o Initial production capacity
- o Cost to expand production capacity
- o Time lags to build new capacity and produce from it
- o Time lag to ship item to the war zone
- o Costs of storage, maintenance and production
- o Rate of deterioration of both stockpiled items and production base
- o Budget constraints
- o Discount rate

OUTPUT:

- o Investments in stockpiles and production base over time
- o Stockpile levels over time
- o Total discounted costs

MODEL LIMITATIONS:

- o Assumes production capacity can be expanded in arbitrarily small amounts
- o Does not treat components making up an item
- o Does not treat interactions between items

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HARDWARE:

- o Computer: Any
- o Operating System: Any
- o Minimum Storage Required: 200 K bytes

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: IDA Paper P-1418 (in draft form)
- o User's manual is not yet complete
- o Technical manual is complete

TIME REQUIREMENTS:

- o 3 months required to acquire base data
- o 1 man-month required to structure data in model input format
- o 5 minutes CPU time per model cycle
- o 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS: IDA

POINT OF CONTACT: Jeffrey Grotte or Paul McCoy
Institute for Defense Analyses
400 Army Navy Drive
Arlington, VA 22202

KEYWORD LISTING: Analytical; Logistics; Land; Air; Sea; Computerized; One-sided; Deterministic

TITLE: STRATEGEM - Strategic Relative Advantage Model

PROPONENT: Headquarters, Strategic Air Command (SAC/XPS)

DEVELOPER: XPSF, Headquarters, SAC

PURPOSE: STRATEGEM is a computerized, analytical model that determines the relative position of advantage after each of a possible series of limited nuclear exchanges. The model provides an analytical tool for investigating the implications of a less-than-all-out nuclear exchange. The relative strategic position of both sides after each limited exchange and the remaining options for a subsequent exchange are assessed.

GENERAL DESCRIPTION: STRATEGEM is a two-sided, deterministic model involving land, air and sea forces. It is capable of considering an individual weapon against an individual target, if desired, and can aggregate both weapons and targets up to any level the user wishes. Expected values are the primary solution techniques used.

INPUT:

- o Fixed inputs: weapon yield, CEP, height of burst, target vulnerability, type of overpressure and adjustment factor for each target category and the minimum and maximum vulnerability (VNs) bounds for applications of each weapon type.
- o Scenario inputs: option to change yields, CEPs, and min/max weapon VNs in fixed inputs, weapon system reliabilities and penetration rates, the number of targets per DGZ category, number of weapons by type, number of weapon carriers (limited to 4 bomber types, 12 land-launched missile types, and 4 sea-launched missile types), and the maximum number of weapons each target may receive.
- o Exchange inputs: Identification of the side attacking and type of attack (suppression or objective), minimum acceptable damage expectancy for initial weapon consideration, minimum acceptable compounding DE for more than one weapon per target, maximum DE (i.e., upper bound cut-off for weapon allocation), determination of weapon allocation and target types (i.e., percent of weapons and percent of targets), target eligibility (i.e., a numerical value assigned each target category to predetermine the type of weapon: bomber, ICBM, or SLBM, which is to be used in the initial attack), target value, (i.e., subjective order in which targets are to be attacked), and attack timing sequence which may be bypassed, but could be used for sensitivity study on bomber regeneration after an attack.

OUTPUT: The output of numerical results, tabulated for each exchange, includes a current inventory of weapons and targets showing those remaining, used and destroyed. A final summary provides an inventory of weapon types remaining after each exchange and at the end of all exchanges.

MODEL LIMITATIONS:

- o Targets currently handled as point targets
- o Maximum of 14 bomber weapon types
- o Maximum of 16 missile types
  - ICBMs: 12 for Blue, 12 for Red
  - SLBMs: 4 for Blue, 4 for Red
- o Range is not simulated
- o FOOTPRINT is not simulated
- o No geographical constraints are simulated

HARDWARE:

- o Computer: IBM 360/85
- o Operating System: 360 OS
- o Minimum Storage Required: 28,600 words

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation consists of a brief description of subroutines and their purpose. User's documentation is complete, is the form of a computer printout listing. Technical documentation is not complete.

TIME REQUIREMENTS:

- o 1/3 month to acquire base data
- o 3 man-days to structure data in model input format
- o 1 minute CPU time per model cycle
- o 2 days to 2 weeks learning time for users
- o A few hours to analyze and evaluate results

SECURITY CLASSIFICATION: FOR OFFICIAL USE ONLY

FREQUENCY OF USE: 50 times per year

USER: XPSF, headquarters, SAC

POINT OF CONTACT: Headquarters, Strategic Air Command
Directorate, Future Force Structure Studies and Evaluation (XPS)
Offutt Air Force Base, Nebraska 68113
Telephone: Autovon 271-4316

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Air Forces; Sea Forces; Computerized; Two-Sided; Deterministic

TITLE: STRAT CROW - Evaluation of the Effects of Electronic Countermeasures on Strategic Communications Systems

GENERAL DESCRIPTION: STRAT CROW is a computer simulation model which quantifies the effects of various types of electronic countermeasures (ECM) against digital communications links. The program models noise, continuous wave (CW), and frequency modulated (FM) jamming against frequency shift keyed (FSK) signals, and can handle many frequency hopping signals. The computer program has been expanded to include noise, CW, and FM jamming against phase shift keyed (PSK) signals and is now in test. this capability will permit analysis of the most modern spread spectrum signalling techniques.

COMPUTER INFORMATION: The model is written in FORTRAN computer language for the CDC 6500 scientific omputer and contains approximately 3,000 instructions. Running time for the program is normally less than 1 minute. The bulk of the code has also recently been integrated into the STRAT COMMAND Network Status Model.

DOCUMENTATION: Limited documentation is available in USAF/SACS.

TITLE: STRAT DEFENDER - NORAD Air Defense Simulation Program

PROPONENT: Air Force Assistant Chief of Staff, Studies and Analyses

DEVELOPER: CACI

PURPOSE: STRAT DEFENDER is a computerized, analytical model designed to evaluate overall effectiveness of a strategic defense system. Analyzes the effectiveness of a strategic defense system (including SAM sites, ground based radars, AWACS, and manned interceptors, against airborne raiders which can make both gravity bomb and air-to-surface missile attacks on targets in the defended area. The size, basing, tactics, capabilities, and integration of manned interceptors, AWACS, SAM sites, and ground radars are modeled in order to compare options in defensive force structure.

GENERAL DESCRIPTION: STRAT DEFENDER is an event oriented, Monte Carlo simulation which tracks the movement of bombers and air-to-surface missiles over a spherical earth, and schedules detections and interceptions of these raids by the strategic defensive forces. Surveillance and detection systems include ground radars, SAMs, AWACS, and manned interceptors on Combat Air Patrol (CAPs). Interceptors are committed from bases or CAPs on a variety of intercept profiles with complete fuel monitoring, reattack, and recommit logic available. End-game actions of detection, conversion, and missile kill are modeled stochastically.

INPUT:

- o Air intercept missile data: Range, altitude, and probability of kill against various raid classes.
- o Interceptor aircraft data: Airborne radar range, fuel capability and consumption, turnaround time, reliability, speeds, weapon loading, probability of detection and corversion, firing doctrine, and initial base locations.
- o Base data: Location, aircraft type, and servicing capability.
- o Radar data: Location, altitude, and range.
- o SAM data: Location
- o AWACS data: Altitude, speed, orbit location, radar detection and tracking parameters.
- o Raid data: Number of penetrators in each raid, timing, raid path, and target.

OUTPUT: Computer printouts are produced on-line during program execution and do not require decoding or interpretation.

- o Input summary reports list a selected set of the input data for the run.
- o Chronological reports are one-liners which report significant events as they occur during the simulation run. Included are events such as: (1) raid turn points, ASM launch, and gravity bomb impacts; (2) radar detections and loss of contact; (3) interceptor commitments, attacks, recoveries, and CAP manning; (4) SAM firings and intercepts.

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- o Final summary reports provide: (1) chronological history of each raid, (2) interceptor performance and kill distribution, (3) surface radar and AWACS detection reports, (4) tabulation of bomb/ASM impacts, and (5) SAM activities.

MODEL LIMITATIONS:

- o Terrain not modeled.
- o Perfect command and control of all defensive forces is assumed.

HARDWARE:

- o Type of Computer: IBM 3032
- o Operating System: TSO
- o Minimum Storage Required: 700K bytes
- o Peripheral Equipment: TSO display terminal, printer

SOFTWARE:

- o Language: SIMSCRIPT II.5
- o Documentation: Draft documentation available.

TIME REQUIREMENTS:

- o 1 month to acquire data base
- o 1 week to structure data in model input format
- o 1 to 5 days to analyze output
- o 5-10 minutes CPU time per case

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice per workday

USERS: AF/SASD, NORAD/XPY

POINT OF CONTACT: AF/SASD
Pentagon
Washington, DC 20330
Telephone: 202-695-3379
AUTOVON: 225-3379

KEYWORD LISTING: Computerized, Strategic, Aerospace Defense, Air Force, Interceptor, Stochastic.

MISCELLANEOUS: This model was originally developed by HQ NORAD and has been modified for AF/SAS use. Future plans include enhancements to (1) represent the defense system's reliance upon communications, (2) permit more intercepter tactics, (3) more closely represent AWACS operations, and (4) allow raids to take evasive action.

TITLE: SIRAT EXCHANGER

PROPONENT: AF/SASM

DEVELOPER: AF/SASM

PURPOSE: Analysis of ballistic missile counterforce allocations.

GENERAL DESCRIPTION: Strategic exchange analysis tool which calculates basic measure of merit for United States and Soviet ECBM and SLBM forces in counterforce strikes only.

INPUT:

- o Forces
- o Weapons
- o CEPs
- o Performance factors

OUTPUT: Allocation reported in standard MOEs

MODEL LIMITATIONS: 60 Force Categories

HARDWARE:

- o Type Computer: Honeywell 6066
- o Operating System: GCOS/MULTICS

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Available through AF/SASM

TIME REQUIREMENTS:

- o 2 man-months to prepare data base, recurring daily
- o 1 minute CPU time per cycle
- o 1 hour data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: AF/SASM

POINT OF CONTACT: AF/SASM
The Pentagon
Washington, D.C. 20330
Telephone: (202)695-9081

TITLE: STRAT MESSAGE - Development of Strategic Command and Control Report-Back Methodology

PROPONENT: United States Air Force, Studies and Analysis (USAF/SA)

DEVELOPER: Air Force Studies and Analysis and Systems Control, Inc.

PURPOSE: This computerized analytical general war model simulates the two-way flow of multi-priority messages from the NCA to forces (e.g., STOP execution messages) and from the forces back to commanders and the NCA (e.g., strike reports, launch reports, NUDET reports). The model determines the quantity and quality of information available to the NCA and commanders to assist them in decisionmaking in the trans- and post-attack phases of a general nuclear war.

GENERAL DESCRIPTION: STRAT MESSAGE is general in nature, such that either strategic or tactical C3 networks can be examined. The model was primarily designed for strategic forces (bombers, SSBNs, ICBM Launch Control Centers) and uses a stochastic time-step Monte-Carlo technique with a shortest path network algorithm to determine probabilities of message receipt as a function of time at special nodes. A scenario of hours duration can be run in minutes of CPU time.

INPUT:

- o Network topology (nodes and links)
- o Link availabilities
- o Node probabilities of survival
- o Node processing times and link delays
- o Node group data and queue lengths
- o Message types
- o Run parameters (number of Monte Carlo replications, game time, etc.)

OUTPUT:

- o Computer printout which includes probability of message receipt as a function of time and the percent of time that messages arrive at each destination node.
- o Detailed output at the end of each Monte Carlo cycle is available at the user's option. This data includes node dead times, node alive times, order of nodes receiving message, and message arrival times at each intermediate and destination node.

MODEL LIMITATIONS: Computer storage capability only.

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HARDWARE:

- o Type of Computer: GE-635
- o Operating System: GECOS
- o Minimum Storage Required: 100K storage cells (36 bits) for network of 30 nodes, 100 links, and 20 messages
- o Peripheral Equipment: Discs can be used for input/output data storage.

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: User's manual and Programmer's manual available.

TIME REQUIREMENTS:

- o Time required to acquire base data and structure data in model input format varies from hours to days, depending on size and complexity of network to be modeled
- o CPU time per model cycle is less than 5 minutes for moderate-sized network
- o Several weeks learning time for players
- o Hours-days to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100-200 times per year

USERS:

- o Principal: AF/SASC
- o Other: NSA

POINT OF CONTACT: United States Air Force
Studies and Analysis and Systems Control
The Pentagon, Room 1D431
Washington, D. C.
Telephone: OX-50547

MISCELLANEOUS: This model is linked to the Network Status Model (NSM), which computes link availabilities and node probabilities of kill for nuclear and electronic countermeasure environments which are used as input data. No intermediate data manipulation is required. The model is a follow-on to the Dynamic Network Simulator. A new upgrade to the NSM is being undertaken to include improvement in nuclear phenomenology and ECM techniques/simulations.

KEYWORD LISTING: Analysis; C3; Message Flow Networks; Stochastic; Nuclear Exchange; Network Topology

TITLE: STRAT PATROLLER - Autonomous Interceptor Search Model

PROPONENT: Air Force Studies and Analysis (AF/SASD)

DEVELOPER: General Research Corporation (GRC)

PURPOSE: The purpose of STRAT PATROLLER is to evaluate the scanning process of radar antenas and infrared search sets; the detection capability of radars, infrared search sets, and the aircrew; and the radar, infrared, and visual observability to distinguish between the various USAF interceptor aircraft. Noise jamming and chaff are also modeled. A secondary purpose of STRAT PATROLLER is to design orbit shapes and the sensor search patterns on each leg of the orbit so as to maximize the detection capability of a given interceptor aircraft against a given threat.

GENERAL DESCRIPTION: STRAT PATROLLER is an event-based simulation of interceptor aircraft with the missions of air surveillance.

INPUT:

- o Raid parameters
- o Jamming and chaff conditions
- o Interceptor orbit parameters
- o Detailed radar and infrared performance data

OUTPUT:

- o Selective levels of output detail are possible through a series of key words
- o Probability of detection for specific scenarios is the primary output of this simulation

MODEL LIMITATIONS: Terrain is not modeled

HARDWARE: The simulation runs on an IBM 3032

SOFTWARE:

- o Written in SIMSCRIT II.5 and consists of 12 subroutines
- o Documentation: None

TIME REQUIREMENTS: Initial preparation of the data base may take several hours. Analysis of the output requires less than an hour if detailed understanding of the specific case is not required.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 15 times a month

USERS:

- o AF/SASD
- o NORAD/XPY

POINT OF CONTACT: AF/SASD
The Pentagon
Washington, D.C. 20330
AUTOVON 225-3379
Telephone: (202)695-3379

TITLE: STRAT RANGE

PROPONENT: AF/SASB

DEVELOPER: AF/SASB

PURPOSE: STRAT RANGE is used to determine the range of strategic aircrat as a function of payload configuration, flight profile, and tanker support.

GENERAL DESCRIPTION: STRAT RANGE is a range/payload program that can be used to calculate the range of strategic aircraft on a variety of mission types. It is intended for calculating the range of existing aircraft for which performance data are readily available, and for aircraft in the design state for which performance data have been estimated. Aircraft performance data (e.g., fuel used during climb, cruise, etc.) are supplied to the computer program in the form of regression equations. The mission characteristics are supplied in a series of input cards which describe the nature of the mission from the first flight segment through the last flight segment in the same order as they would actually be flown. Calculation of desired mission characteristics such as radius or range of a particular flight segment is achieved by specifying certain options which govern the order in which flight segment calculations are made. The model also incorporates a routine to determine the number of tankers necessary to supply a given fuel offload to a stipulated bomber type.

INPUTS

- o Bomber type
- o Payload configuration
- o Fuel load
- o Reseves
- o Flight Profile (inputed along with the type of tanker)

OUTPUTS: Full or abbreviated printouts are available giving bomber flight distances, fuel remaining, and gross weights for each leg of the flight profile. Aerial refueling demand is noted in fractions of tankers.

MODEL LIMITATIONS: STRAT RANGE as presently configured does not permit the employment of a bomber in the shoot-then-penetrate role.

HARDWARE: HONEYWELL 6180 System M.

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Programmers Manual and User's Manual

TIME REQUIREMENTS: Data base preparation time, CPU time per cycle, and data output analysis time are all minimal.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Weekly

USER: AF/SASB

POINT OF CONTACT: AF/SASB (Major Russ Fitch)
The Pentagon
Washington, D.C. 20330
Telephone: (202) 695-3561

MISCELLANEOUS: A review and enhancement of the STRAT RANGE model is in progress.

TITLE: STRAT SPLASH

PROGRAM: Air Force Studies and Analysis (AF/SASD)

DEVELOPER: Riverside Research

PURPOSE: Simulate the air-to-air missile environment

GENERAL DESCRIPTION: The STRAT SPLASH model enables the user to estimate the single shot probability of kill (SSPK) for air-to-air missiles. While the missile aerodynamics form a significant portion of the model, the distinctive feature is the capability to estimate the effect of noise or deception ECM on missile guidance. The model incorporates an Army Material Systems Analysis Activity (AM-SAA) terminal effects model to evaluate the interaction of warhead lethality and target vulnerability.

INPUTS: Aircraft launch parameters, missile aerodynamic characteristics, warhead and guidance parameters are input in exacting detail

OUTPUT: Missile flyout and warhead interaction are output for detailed analysis.

MODEL LIMITATIONS: Model does not currently have the capability to simulate some of the new generation missiles such as the Advanced Medium Range Air-to-Air Missile (AMRAAM)

HARDWARE: The model is loaded on IBM 3032 and requires 350K of core storage.

SOFTWARE:

- Written in FORTRAN IV
- The source code listing is self documenting

TIME REQUIREMENTS: Preparing the data base can require several man-months particularly if new warhead data must be input or missile parameters must be researched and input.

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Three times per month

USERS:

- AF/SASD
- Boeing Aerospace

POINT OF CONTACT: AF/SASD
The Pentagon
Washington, D.C. 20330
Telephone: AUTOVON 225-3379
or (202) 695-3379

TITLE: STRAT SURVIVOR

PROPONENT: AF/SASB

DEVELOPER: AF/SAMC

PURPOSE: Analysis of the Strategic Base Escape Problem.

GENERAL DESCRIPTION: STRAT SURVIVOR is a detailed simulation model of ground alert aircraft escaping from a pattern attack by submarine-launched ballistic missiles. The model uses simplified descriptions of aircraft performance and vulnerability, and relatively comprehensive damage algorithms based on the DIA PHYSICAL VULNERABILITY HANDBOOK equations, the cumulative log-normal distribution, and algorithms developed by the Air Force weapons laboratory. The potential kills are summed and weighted to form an aggregated value matrix. The optimum weapon allocation is then selected using a standard transportation problem solution technique in a combination of base-by-base and missile round-by-round optimization. The model will allocate multiple missiles on a target when feasible and profitable.

INPUTS:

- o Aircraft characteristics
- o Threat data (types and locations of submarines) and some offensive and defensive data
- o The beddown can be scenario optimized, if desired

OUTPUTS:

- o Surviving aircraft are summarized by individual aircraft, by aircraft type, by base, and by submarine
- o Optional outputs include the peak overpressure and thermal levels experienced by individual aircraft and plots of aircraft paths and weapon DGZs

MODEL LIMITATIONS: Gust effects are not modeled (only blast and thermal). The individual who maintained the model is no longer with SA and how to obtain much of the optional output is no longer known. Likewise, much of the existing output is inexplicable.

HARDWARE: IBM 3032 and System J

SOFTWARE:

- o Programming Language: FORTRAN
- o No documentation

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TIML REQUIREMENTS:

- o Two weeks to prepare data bases
- o 30 minutes CPU time
- o 1 hour per set of replications for data output analysis

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: During a study, 10-12 runs per day, otherwise none.

USER: AF/SASB

POINT OF CONTACT: AF/SASB
The Pentagon
Washington, D.C. 20330
Telephone: (202) 695-0619

TITLE: Super-Ace

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: To provide a capability to evaluate alternative strategic forces in terms of their effectiveness against specified target sets or their contribution to the strategic nuclear balance.

GENERAL DESCRIPTION: Super-Ace is a computerized, analytical deterministic model that provides a capability to compare various strategic forces either by measuring their effectiveness against specified target sets, through the use of a single strike optimum weapon allocator, or by measuring static characteristics such as throwweight, number of warheads, megatonnage etc. The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired.

The capability exists to input either pre-stored arsenals and/or target sets or to create new ones. Additionally, weapon arsenals/target sets may be temporarily modified prior to production to facilitate sensitivity analysis or minimize set up time. The primary solution techniques used in weapon allocations are LaGrange multipliers, linear programming and probability.

INPUT:

- o Weapon variables
- o Target variables
- o Scenario variables
- o Allocation constraints
- o Static measures desired
- o Degree of output summarization desired

OUTPUT:

- o Static measure summaries
- o Throwweight drawdown
- o Summaries in terms of weapon allocation and value destroyed
- o Output options allow extremely detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o Geography is not explicitly considered
- o Aggregated target data base
- o Co-location not considered

HARDWARE:

- o Computer: Honeywell
- o Operating System: MULTICS
- o Minimum Storage Required: N/A
- o Peripheral Equipment: Interactive I/O device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- o 10-60 seconds CPU time for one strike allocation
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED. Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX-55587

KEYWORD LISTING: Analytical Model; Strategic Forces; Computerized; Deterministic; Linear Programming

TITLE: Surface Ship Survivability and Effectiveness Model

PROPONENT: Fleet Analysis Center (FLTAC), Naval Weapons Center, Seal Beach

DEVELOPER: Fleet Analysis Center (FLTAC)

PURPOSE: The model describes a general operational evaluation methodology useful for the efficient and effective allocation of resources while insuring ship survivability and effectiveness.

GENERAL DESCRIPTION: The model combines RMA ship vulnerability, weapon system performance, personal conformance and tactics to achieve its analysis objectives. Its primary solution techniques are discrete event simulation and parallel processes.

INPUT:

- o Mission attributes
- o Target model parameters

OUTPUT:

- o Event-state trace (network)
- o Statistical data
  - Mission effectiveness
  - Ship survivability
  - Target detection
  - Waiting time distributions
  - Ammunition expenditures

MODEL LIMITATIONS: Number of targets is limited by run time (30-40 target max practical)

HARDWARE:

- o Computer: IBM, UNIVAC or PDP-11
- o Operating System: UNIVAC 8360 and PDP-11/60

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Summary level model descriptions paper available Detailed model description under development

TIME REQUIREMENTS:

- o To acquire Data Base: 1 month
- o To Structure Data in Model Input Format: 1 week
- o To Analyze Outpuut: 2 weeks
- o Player Learning Time: 1 month
- o CPU Time per Cycle: 15 minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 8 months

USERS: FLTAC, CNA

POINT OF CONTACT: Dr. John R. Dyer
Code 8445, FLTAC
Corona, CA 91720

MISCELLANEOUS: Plan to add damage control process to ship model in future

KEYWORD LISTING: Operational Evaluation Modeling (OEM), discrete event simulation, parallel process

TITLE: SURVIVE

PROPONENT: Directorate of Aerospace Studies, Kirtland AFB, New Mexico

DEVELOPER: Directorate of Aerospace Studies, Kirtland AFB, New Mexico

PURPOSE: SURVIVE is a computerized, analytic, damage assessment/ weapons effectiveness model which evaluates the probability of survival of a single penetration flying in an environment defended by surface-to-air missile (SAM) systems.

GENERAL DESCRIPTION: SURVIVE is two-sided and stochastic, involving land and air forces. Level of aggregation for which this model was primarily designed is one SAM, the level of model exercise for which it was designed is theatre defense with a range of terminal defense through area defense. Treatment of simulated time is the time-step method, and the primary solution technique is probability.

INPUT:

- o SAM performance and locations
- o Penetrator flight profile

OUTPUT:

- o Computer printout giving survival probability by SAM type
- o Overall summary

MODEL LIMITATIONS:

- o Single penetrator

HARDWARE:

- o Type of Computer: Not machine dependent
- o Minimum Storage Required: 60K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: SURVIVE: A Computer Model for Single Penetrator/Surface-to-Air Missile Attrition, Directorate of Aerospace Studies, AFCMD/SA, Kirtland AFB, NM, July 77
- o Both User and Technical documentation complete

TIME REQUIREMENTS:

- o 1 month to acquire base data
- o .1 man-month to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: A. Foster Cooper
AFCMD/SAT
KIRTLAND AFB, NM 87117

FREQUENCY OF USE: 50 times per year

USERS: AFCMD/SA

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Land; Air; Computerized; Two-sided; Stochastic; Time Step; Probabalistic

TITLE: TAC ASSESSOR

PROPONENT: AF/SAGR

DEVELOPER: General Research Corporation

PURPOSE: Analysis of tactical command, control, and intelligence (C2I) and reconnaissance related issues.

GENERAL DESCRIPTION: TAC ASSESSOR is a computerized two-sided combined arms simulation with primary emphasis on command, control, communications, and intelligence (C3I) activities relating to air/ground tactical interactions. The geographic area of operations in TAC ASSESSOR is normally a Corps/Army area of operations. Air operations modeled include tactical reconnaissance, close air operations. Air operations modeled include tactical reconnaissance, close air support (CA), battlefield air interdiction (BAI) and defense suppression missions flown in support of CAS and BAI missions. Aircraft are modeled as flights and ground units are modeled at the battalion ADA fire unit level. C2I elements are modeled explicitly with their decision/intelligence processes modeled using artificial intelligence techniques. The model is an event sequence model with a capability to run in a batch mode or with interactive graphics.

INPUT: The following are the main inputs to the model:

- o Initial orders for air and ground headquarters
- o C3I structure
- o Air and ground units
- o Aircraft/weapon performance data
- o Ground unit characteristics
- o Sensor performance data
- o Ground weapon effectiveness data
- o Inputs to artificial intelligence routines for decision/intelligence logic
- o Preprocessing routines to assist in data input prepration

OUTPUT:

- o Computer printouts including a log and detailed event activity list, graphics or printer plots, output file for use with a post-processor
- o Post-processor includes graphics and some statistical analysis

MODEL LIMITATIONS:

- o Does not model weather, nuclear/chemical operations, air-to-air engagements
- o Does not have a detailed communications module
  Sensor model does not explicitly model SIGINT sensors

HARDWARE:

- o Computer: Honeywell MULTICS at AFCSC and the CPC CYBER and PDP VAX computers at contractor facility

SOFTWARE:

- o Programming Language: CIFTRAN, a structured extension to FORTRAN which produces standard FORTRAN output
  Model also uses Graphics Compatability System (GCS for its interactive graphics. Both CIFTRAN and GCS are available to government activities, and a FORTRAN version of the model can be made available
- o Documentation: Model documentation is available in the form of Methodology, Users, and a Programmers Manual

TIME REQUIREMENTS:

- o Approximately six months to generate a complete data base for a US Corps vs a comparable size enemy and associated air support for both sides
- o Two hours for data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Daily

USERS: AF/SAGR

POINT OF CONTACT: AF/SAGR
Washington, D.C. 20330
AUTOVON 225-5387
Area Code 202 695-5387

TITLE: TAC AVENGER - Tactical Air Capabilities, Avionics, Energy Maneuverability, Evaluation and Research

PROPONENT: United States Air Force, Studies Analysis (USAF/SA)

DEVELOPER: AI/SAG

PURPOSE: TAC AVENGER is a computerized, analytical model designed to evaluate the effectiveness of one aircraft versus another in a close-in air duel. The chief focus of concern is to evaluate the capabilities of two aircraft, opposing each other in a close-in air duel. During the duel, each aircraft can maneuver in three dimensions and launch weapons at the other aircraft. The kill probabilities of each firing pass are cumulative for the entire time of the air duel. Aircraft motion is computed by utilizing the standard aerodynamic equations of flight. As a result, an aircraft's actual aerodynamic maneuvering capability is simulated. Aerodynamic parametric variation may be exercised to determine the sensitivity of variables.

GENERAL DESCRIPTION: TAC AVENGER is a two-sided model having both deterministic and stochastic elements. It involves air forces only. It is primarily designed to consider two aircraft in an air duel, and is capable of aggregating up to thirty air duels lasting 5 minutes each. Aerodynamic equations of flight and probability theory are the primary solution techniques used.

INPUT: The aircraft description requires basic engineering data. Aerodynamic and structural capabilities defined by lift and drag curves, "G" limitations, visibility limitations, engine thrust, and fuel flow curves are necessary. The systems described include on-board sensors. Descriptions for missiles require complete definition of launch parameters, missile control, guidance and aerodynamic capabilities, and kill radius of warhead. Gun systems require complete ballistic information for the type of projectile under consideration, and gun and sight characteristics.

OUTPUT:

- o Second-by-second summary of aircraft's position, maneuvers, gun and missile firings
- o Gun summary
- o Missile summary
- o Computer graphics

MODEL LIMITATIONS:

- o The model simulates the air duel of two opposing aircraft, each of which may employ as many as 12 tactical maneuvers with variations in each.
- o Since the maneuver selection is stochastic, numerous duels are required to produce a usable data point.

HARDWARE:

- o Computer: Honeywell 635, Honeywell 6180
- o Operating System: GECOS III, Multics
- o Minimum Storage Required: 44k, 358 pages
- o Peripheral Equipment: 16 files

SOFTWARE:

- o Programming Language: FORTRAN IV
- o There is no documentation

TIME REQUIREMENTS:

- o 1 month to structure data in model input format
- o 4 minutes CPU time per model cycle
- o 2 years learning time for users

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20,000 times per year

USERS: AF/SAGF, HQ USAF

POINT OF CONTACT: HQ USAF
Assistant Chief of Staff/Studies and Analysis
AF/SAA
The Lynn Building
1111 19th Street
Arlington, VA 22209
Telephone: OX-48573

KEYWORD LISTING: Analytical Model; Damage Assessment/Weapons Effectiveness; Air Forces; Computerized; Two-Sided; Mixed Deterministic/Stochastic; Time Step

TITLE: TAC AVENGER II - Tactical Air Capabilities, Avionics, Energy Maneuverability Evaluation and Research

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: Analysis

GENERAL DESCRIPTION: The TAC AVENGER model is a digital computer simulation of two aircraft in a close-in maneuvering air duel. In this simulation, each aircraft maneuvers in three dimensions; each pilot reacts on a second-by-second basis to the maneuvers of the opponent; and each pilot extends ordnance against the other aircraft as opportunities occur. The individual aircraft tactics are selected from a range of reasonable choices based upon the tactical situation, the relative performance capability of the aircraft. Pilot preferences, derived from empirical, real-world data are selected using a random selection of avionics, energy maneuverability, and weapons to fighter effectiveness.

INPUT: Aircraft and weapons performance (engineering data)

OUTPUT: Aircraft position summary. Missile/target position summary. Gun/target summary. Missile/gun PK summary.

MODEL LIMITATIONS: Unknown

HARDWARE:

- The TAC AVENGER model is executed on the Honeywell 635 or IBM 3032 computer
- The model utilizes the GCOS III or OS/CS3MCS JCL operating system respectfully, and 46,000/G635 words or 500,000/IBM 3032 bytes or cors

SOFTWARE:

- The TAC AVENGER model is written in FORTRAN IV, contains 130 subroutines, and 25,000 source statements
- Documentation:
  NA-66-765, Air-to-Air Combat Simulation Model, 15 Jul 1966
  NA-66-IV, Vol I, FANTAC, 3 Oct 1966
  NA-66-IIV, Vol II, FANTAC, 3 Oct 1966
  NA-66-1120, FANTAC, 3 Oct 1966
  NA-68-729, FANTAC Radar Model, 30 Sep 1968
  NA-68-1022, Improved FANTAC Radar Model, 20 Dec 1968

TIME REQUIREMENTS:

- o Prepare data base: 1 Month
- o CPU time per cycle: 1-2.5 minutes per 5 minute simulation
- o Data Output Analysis: 1 day

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 500 engagements per month

USERS: AF/SAGR

POINT OF CONTACT: AF/SAGR (LTC Mottern)
Washington, DC 20330
Autovon 225-5387
Area Code 202 697-5677

TITLE: TAC BRAWLER

PROPONENT: AF/SAGI

DEVELOPER: Decision-Science Applications, Inc.
1500 Wilson Blvd., Suite 810
Arlington, VA 22209

PURPOSE: Analysis. TAC BRAWLER is a Monte Carlo computer simulation which models multiple aircraft air combat.

GENERAL DESCRIPTION: Each simulated pilot owns his own mental model in which he may observe changes in his environment and exchange message traffic with other members of his flight. The primary inputs to each pilot's mental model are from simulated visual and radar observations. Each pilot's decision as to what course of action (maneuver) to perform is made using a technique called "value-driven decision making". This technique allows the pilot to consider numerous options for his next maneuver, predict the consequences of employing that maneuver for the near term, appropriately score the results of such a maneuver, then select the maneuver which scores the highest.

INPUT:

- o Initial force sizes and starting conditions
- o Armament and fuel Loads
- o Specific tactics, if desired

OUTPUT:

- o Summary printout of important events
- o Detailed graphical displays

MODEL LIMITATIONS: Unknown

HARDWARE:

- o Type computer: HONEYWELL 645
- o Operating System: MULTICS
- o Minimum Storage Requirements: 3.4 million 36-bit words
- o Peripheral Equipment: TEKTRONIX 4014-1 Graphic Display Unit

SOFTWARE:

- o Programming Language: FORTRAN IV and PL/I
- o Documentation: "The TAC BRAWLER Air Combat Simulation" Three volumes, limited supply

TIME REQUIREMENTS:

- o Run Preparation: 0.5 -1.5 hours
- o CPU Time Per Cycle: 15 - 60 minutes per engagement

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 20 engagements per week

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Maj Koenig)
Pentagon
Washington, DC 20330
Area Code 202 697-5677

MISCELLANEOUS: TAC BRAWLER is presently in its sixth phase of development which will add unique tactics, ECM, COMJAM and GCI capabilities.

NAME: TAC CONTROLLER

DESCRIPTION: TAC CONTROLLER is a large-scale simulation of tactical air warfare which, in different versions, relates the parameters of the Tactical Air Control System (TACS) to the effectiveness of the Tactical Air Forces in a non-benign electronic environment. It has been designed for ease in making trade-off studies and sensitivity analyses. TAC CONTROLLER was designed to measure the impact of command and control on the conduct of air warfare. Specifically, it modeled the relationships between the parameters of the 407L/412L/AWACS as deployed in USAFE and the performance parameters of the counter air mission.

a. Modelling of the sequence of events occuring within the command and control system is achieved through the use of a network. This representation is maintained by the use of nodes and links to symbolize personnel, equipment, and communication links. Messages portray the flow of information between these various entities.

b. Resources are used to provide physical limitations to the capabilities of any element. Times, as well as priorities, constraints, and probabilities, can be associated with these nodes and links. Networks can be studied as a complete unit by arranging their constituents into groups, or by looking at each piece individually. Much of the information to be gained by the use of this network is derived from the queues which occur when some part of the system is overloaded. The model is being replaced by DADENS C^2 for theater air defense studies.

COMPUTER INFORMATION: The TAC CONTROLLER program deck of 10,000 FORTRAN cards contains 27 list processing subroutines, 34 basic subroutines, and 16 specialized subroutines. The simulator represents the tactical air control system with a 126 node, 137 link multilevel network using 47 resources. Execution of these routines on MULTICS handles up to 2,000 aircraft in a simulated period of over 4 hours with actual computer time of less than 30 minutes.

DOCUMENTATION: Reports describing the model, a User's Manual and logic flow documentation are available in USAF/SAGR.

TITLE: TAC DISRUPTER II

PROPONENT: EWOAS JTF & TFWC

DEVELOPER: General Dynamics, Fort Worth Division
C.A.C.I. Inc. - Federal, Las Vegas Office

PURPOSE: TAC DISRUPTER II is being developed to examine the interactions between a TACAIR mission package and a netted SAM/AAA threat air defense system. It is being designed to closely emulate the Nellis AFB range complex so that it can be used to assess and analyze operations on the Nellis ranges for pretest and post test analysis, exercise assessment, and tactics development.

DESCRIPTION: TAC DISRUPTER II is a multiple time-stepped, state-conditioned, digital computer simulation of interaction between an integrated (attack, strike, support jamming, and Wild Weasel) TACAIR mission package and a SAM/AAA defense network. It primarily uses deterministic algorithms to determine engagement opportunities and conditions and stochastic algorithms to determine engagement outcomes.

Strike/attack forces are either simulated with a modified 5 degree of freedom flight path generator that uses approximations for pitch, bank angle, acceleration, and climb/descent rates or time-space-position information (TSPI) from Nellis range instrumentation. Aircrew decision making is simulated in an Offensive Situation Module that controls the Flight Module to generate reactive flight paths. In this manner, the simulated flight paths are reactive to the defensive situation with Wild Weasel aircraft capable of target evaluation and selection as a function of current mission and existing conditions.

A Sensor Module simulates ground radar, infrared, and optical sensors and airborne ECM and RWR receivers. Both Offensive Module and Defensive Module simulated reactions are driven by the output of the Sensor Module which includes the effects of radar jamming.

A Defensive Situation Module controls the simulation of the air defenses which can be completely netted, completely autonomous, a combination, or dynamically changed from netted to autonomous during the simulation. The Defensive Situation Module simulates building of radar scope files, air situation broadcasts, early warning networks, command centers, threat prioritization, weapon assignment, communications, missile intercept, emission control procedures, and other functions of a SAM/AAA air defense system.

A Scoring Module determines the outcome of both air-to-ground and ground-to-air weapon firings as a function of the engagement conditions.

The environment simulation includes terrain masking calculated by the TACOS Terrain Assessment Software and either input in the form of mask patterns for operating in a reactive mode or intervisability events for operating in a TSPI mode. Due to the amount of detail included in the simulation, the scenario size is limited to approximately the major threats in a Combined Arms Army depending on the capacity of the mainframe computer being used.

INPUT: User inputs define weapon system characteristics, offensive and defensive procedures and doctrine, target arrays, ingress/egress checkpoints, ECM equipment parameters, RCS, IR signature, antenna patterns, lethality, SAM netting, and numerous other data items to describe the scenario and simulated players.

HARDWARE: Control Data Corporation computers (currently is on the CYBER 74 at Nellis AFB).

SOFTWARE: Input/Output Processor is written in SIMSCRIPT II.5 and the Main Program is written in FORTRAN IV. Documentation includes an Executive Summary, User's Manual, Analyst's Manual, and Programmer's Manual.

TIME REQUIREMENTS: Are a function of the scenario complexity and the computer use.

SECURITY CLASSIFICATION: Source code is Unclassified but most input and output data is SECRET.

USERS: 57 Fighter Weapons Wing Surface-to-Air Threat Assessment Project, Nellis AFB, Nevada

POINT OF CONTACT: 4440 TFTG/OA
Lt Col Glen Harris
Nellis AFB NV 89191
Telephone: 702/643-5450; AUTOVON: 682-5450

COMMENTS: TAC DISRUPTER II is a restructured, rewritten, redocumented, and substantially enhanced version of TAC DISRUPTER I with origins going back to the early 1960's and the Tactical Air Defense Battle Model (TADBM) developed for the Electronic Warfare Joint Test.

In order to facilitate validation, TAC DISRUPTER II is being developed so that it can be calibrated with data from the EWCAS test or the Air Force Electronic Warfare Evaluation Simulator (AFEWES).

Future development will involve adding jammer power management algorithms, input of exogenous offensive and defensive events from Nellis range instrumentation, and incorporation of more tactics options for attack and strike aircraft.

NAME: TAC EVALUATOR

SPONSOR: AF/SAGR

DEVELOPER: General Research Corporation and AF/SAGR

PURPOSE: Analysis. The TAC EVALUATOR model is designed to show the effect of various combinations of tactical air weapons support systems on the outcome of a dynamic, corps level ground battle.

GENERAL DESCRIPTION: The selection of functional modules permits detailed reconnaissance or command, control, and communications (C3) simulation. When the C3 module is selected, the effects of communications jamming can be portrayed.

TAC EVALUATOR is a dynamic, event-sequenced, expected value simulation. Lanchester equations are used to resolve the ground combat engagements. The model can reflect breakthrough tactics, single, double and vertical envelopments; and employment of tactical air.

The model keeps track of movement, strength, and attrition of up to 200 ground units, including both engaged and second-echelon units. It generates demand for close-air-support and interdiction missions, allocates available aircraft in either interactive or automatic mode, does targeting, and computes strike results and air losses on an aggregate basis.

Individual unit movement and timing permit freedom of maneuver in any direction. Offensive unit movement is simulated at engaged or approach march velocities with delays in movement of ground forces as a result of air strikes.

When the C3 module is selected, the model keeps tracks of the ground and air combat situations and tactical airpower decisions at tactical control facilities and below. Combat information and orders flow between C3 elements and airbases through detailed tactical communications emulation. When specified, detailed emulations of communications jammers (airborne and ground) interact with the represented communications transmissions (ground to ground, ground to air, and air to air) producing delay disruption of sorties over the battlefield. The model can be run in either an automatic or interactive mode. The automatic mode is used for studies in which only one condition or strategy is varied for each case to be analyzed. Interactive operation allows investigation of the dynamics of battlefield operations. It is used to reveal dependencies on doctrine and operational concepts without imposition of a fixed set of decision rules.

INPUT:

- Order of Battle, Weapon Effectivenss, Reconnaissance Plan.

OUTPUTS: An extensive graphics package is available to assist the user.

MODEL LIMITATIONS: None

HARDWARE: Model is designed for Honeywell 6180 (Multics) computer and Cyber 74 computer

SOFTWARE:

- o Programming Language: Coded in standard Fortran IV
- o The Multics version contains over 12,000 Fortran instructions in 140 subroutines
- o Documentation: General information manual and program descriptions for the routines are available in AF/SAGR

TIME REQUIREMENTS:

- o 5 days of war takes 1 to 2 hours running time (15-30 minutes on the Cyber 74 in the automatic mode
- o Running fully interactive requires 1/4 real time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Unknown

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF
Pentagon
Washington, DC 20330
Area Code 202 695-5387

TITLE: TAC LANCER

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: Analysis. TAC LANCER is a digital computer program for evaluating the effectiveness of air-to-air missiles in maneuvering combat.

GENERAL DESCRIPTION: The baseline TAC LANCER model was developed by SAGF to provide endgame missile effects in TAC AVENGER II. The model is used both on-line with TAC AVENGER II and off-line to assess missile capabilities.

The model is specifically designed to provide missile Pk in a maneuvering environment. TAC AVENGER II firing opportunity tapes describe the positions of attacker and target. Missile flyout is continued thru fusing and fragment impact. Pk's are further attenuated by modifiers for launch, guide, and fuse reliability.

INPUT: Missile performance is described in detailed engineering data.

OUTPUT:

- o Missile/target relative position summary
- o Terminal effects summary

MODEL LIMITATIONS: Unknown.

HARDWARE: The model is executed on the G635 computer and requires 32000 words of core.

SOFTWARE:

- o The TAC LANCER model used the CGOS III Honeywell operating system. It contains 25 subroutines and 2000 source statements.
- o Documentation: Located in SAGF

TIME REQUIREMENTS: Unknown.

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Unknown.

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Lt Col Mottern)
The Pentagon
Washington, D.C. 20330
Area Code 202 697-5677

TITLE: TAC RANGER

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: Analysis. The TAC RANGER computer program is used in fighter aircraft performance studies to establish range and payload for various combat missions.

GENERAL DESCRIPTION: Combat range/radius is an important performance parameter for the fighter aircraft. It establishes the boundary of the region in which a given fighter aircraft can operate. Payload (missiles and bombs) carried by a fighter aircraft is another important performance parameter. It determines the lethality of a fighter as a weapon system. However, range and payload are conflicting performance parameters in that an increase in payload results in a decrease in the maximum combat radius. Thus, the TAC RANGER computer program was developed to conduct combat range/ radius and payload trade-off studies.

INPUT: Detailed aerodynamic description of aircraft, aircraft weapon load, and mission

OUTPUT: Aircraft time, weight, fuel, range, altitude, true airspeed, Mach, and fuel flow at turn points

HARDWARE:

- o TAC RANGER is executed on a Honeywell 635 or IBM 3032
- o The model utilizes the GCOS III or OS/VS3MVS JCL 35,000/ G635 words or 100,000/IBM 3032 bytes of core

SOFTWARE:

- o Programming Language: FORTRAN IV, contains 45 subroutines and 3,000 statements
- o Documentation: VOL I, Analyst Manual; VOL II, User's Manual and Program Description and VOL III, Source Listing and Flow Charts

TIME REQUIREMENTS:

- o 1 month to prepare data base
- o 1 minute per mission CPU Time on G635
- o 20 seconds per mission on IBM 3032

SECURITY CLASSIFICATION: UNCLASSIFIED

INTENTIONALLY BLANK-NOT FILMED

FREQUENCY OF USE: Unknown.

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Lt Col Mottern)
The Pentagon
Washington, D.C. 20330
Area Code 202 697-5677

TITLE: TAC REPELLER MODEL

PURPOSE: To provide a computer tool for investigating attrition of BLUE aircraft by RED ground-based air defense systems, including radar-and IR-guided SAMs, and AD artillery. The model is designed for treatment of few-on-few engagements in detail. Processes modeled include aircraft movement (on prespecified flight paths), threat detection/prioritization, target selection by defensive units, target engagement, and defense suppression. Outcomes of individual engagements within the considered few-on-few scenario are determined by invoking detailed one-on-one engagement models (TAC ZINGER SAM models and POOI Gun Model). Model output is over time for each individual aircraft.

DESCRIPTION: TAC Repeller is a mixed, event-stepped and time-stepped, two-sided, Monte Carlo, combat simulation model which treats interactions between BLUE aircraft and individual component units of an integrated array of RED air defense units. "Players" in the simulation are individual BLUE aircraft, RED AD fire units (missile or gun), RED coordinating units which select targets for subordinate fire units, and RED detection radar units. Major processes treated involve movement of aircraft in the battle area, the detection and prioritization of threats, and the selection and engagement of individual aircraft by particular AD fire units. Suppression attacks by aircraft on fire units and coordinating units are also treated. Aircraft movement is on prespecified flight paths. Detection of aircraft by radar and visual means is modeled. Radar detection is based on a form of the radar range equation.

Threat prioritization is based on the positions of individual aircraft relative to "defended areas" with associated priorities. Targets are selected for engagement by both the fire units and coordinating units. Aircraft targets are selected for engagement based on assigned priority and projected engagement windows. Individual weapon flyouts are modeled in detail by special versions of the ZINGER models and POOI model. Countermeasures equipment (jammers and flares) carried by aircraft may affect both initial detection and target tracking.

RBC CAPABILITIES: RBC modeling in TAC REPELLER involves radar jamming and terrain. Terrain is currently represented as seen from specified "viewpoints." Associated with each such "viewpoint" is a set of individual "masks" specified in terms of azimuth limits, range and elevation angle. When an aircraft is behind a given mask as seen from a considered viewpoint; i.e. between the azimuth limits, beyond the range and below the elevation angle, it cannot be detected from that point. Also, jamming signals from that aircraft have an effect at the location of the viewpoint from which the aircraft is masked.

Jamming can affect both search and tracking radars. For search radars, only noise jamming is considered. They may be self-screening, escort, or stand-off jammers. Jammers used against search radars are described in terms of power, center frequency, bandwidth, and antenna gain pattern. For each search radar type, a signal-to-jam threshold must be input. The signal-to-jam ratio for a particular threat must then exceed this threshold for detection to be possible. In calculating jamming signal, the location and orientation of the jammer with respect to the radar are considered, along with gain pattern for jammer and radar. Jamming of tracking radars is modeled in TAC ZINGER models controlled by TAC REPELLER. The particular type of jamming modeled in each of these is the type considered most effective against the particular system represented.

MODEL LIMITATIONS: The model does not represent weather, obscurants, communication jamming or DF. It does not model ARMs or other CCM. Also, in engagement (tracking and weapon flyout) calculations, only countermeasures employed by the particular engaged aircraft are currently used. Thus, coordinated jamming of tracking radars is not being considered at this time.

INPUTS AND SOURCES:

INPUT	SOURCE
Aircraft characteristics; i.e. dimensions, RCS, IR signatures	System Command (AFSC)
Position data for radars, fire units	AFIN/USA/Foreign Country Sources
Individual A/C flight paths, position, velocity, orientation	User
Detention radar parameters, power, frequency sweep rate, S/N threshold for detn., antenna gain pattern	AFIN/USA/Foreign Country Sources
Terrain data as seen from viewpoints	User
Threat prioritization parameters	User
Command structure	User/AFIN/Army
Target selection parameters	User
Ammo stocks, reload times	AFIN/Army
Jammer characteristics, power, frequency bandwidth, gain pattern	AFSC/AFIN
Countermeasures equipment, jammers and flares carried by individual aircraft	AFSC/AFIN
Suppression attacks to be launched by particular aircraft with associated probability of kill	User, Tests/Models

REQUIREMENTS:

REQUIREMENTS	AVAILABILITY/INTEGRITY
RED radar data	Poor Quality
RED jammer data	Poor Quality

MODEL IMPROVEMENTS: There is an ongoing effort to incorporate modified versions of the TAC ZINGER one-on-one Air Defense Engagement Models into TAC REPELLER. These versions contain digitized terrain which will replace the "view-point" characterization presently in use, as described in paragraph 4, "RBC Capabilities." Also to include where appropriate, detailed treatment of clutter and multipath effects on tracking radars.

POINT OF CONTACT: AGS of Studies and Analysis, USAF, Pentagon
LTC Walton

TITLE: TAC SUPPRESSOR

PROPONENT: Air Staff, Studies and Analysis (AF/SAGR)

DEVELOPER: CALSPAN Corporation, Advanced Technology Center, P.O. Box 400, Buffalo, NY 14225

PURPOSE: The model is being developed to address air defense and defense suppression problems of a larger scope than one-on-one or few-on-few engagements, and of lesser scope than a theater-wide scenario. The model relies, in large part, on table look up techniques for the treatment of physical interactions. These inputs can be supplied by more detailed models such as TAC REPELLER or the TAC ZINGER series of models.

GENERAL DESCRIPTION: The TAC SUPPRESSOR digital computer model is a general purpose simulation of a possibly multiple-sided conflict between air defense force structures and penetrator force structures. It was designed to address the class of penetrator/air defense problems that are of wider scope than one-on-one or few-on-few highly detailed interactions, but of narrower scope than theater level scenarios, where time periods typically range from one week to several months. TAC SUPPRESSOR relies upon the highly detailed models for derived "table lookup" input and, in turn, provides output which can be supplied to models of wider scope and less detail.

a. Penetrator strike forces are represented in the model by aircraft flying preplanned and reactive flight paths. Preplanned flights are used for stand-off jammers and formations of bombers and jammers that are designated to hit target locations that are presumed to be "known" by analyst at the time he inputs the flight plans. Reactive flights are employed for 'WILD WEASEL' type aircraft that can choose targets to attack using onboard sensor data and guidelines input by the analyst.

b. Air defenses are represented by early warning sites, command centers, and fire units. All units are capable of autonomous operations, as well as varied modes of control by a specified echelon in the chain of command. Threat prioritization and weapon assignments functions are modeled, as well as other typical air defense functions. Missile intercept is calculated using the target's flight path, and relative geometry. If an intercept occurs, kill results are determined by Monte Carlo random draws based on table look up.

c. Jamming, flares, and chaff can affect sensor acquisition and tracking functions, with these effects calculated for each scan, or for whatever time period is appropriate.

INPUTS: User input defines the physical characteristics of the equipment modeled, as well as many of the features that are normally coded directly into most models. The latter features include defining the chains of command and their function, communication networks and their specific functions, and a great deal of the tactics and doctrine used by the opposing modeled forces.

OUTPUTS:

- o Printouts of events processed and variables for each event
- o Statistics (averages, standard deviation, frequency distributions) for variables, sorted by time windows, player types, or specific players

MODEL LIMITATIONS:

- o No practical limitations on number of sensors, weapons, number of players, etc.
- o Terrain is not played except for masking tables, weather is constant over scenario and only affects optics and IR sensor production

HARDWARE:

- o Computer: IBM 370 and 3330, VAX 11/780
- o Minimum storage requirements: one megabyte
- o Peripheral Equipment: Disc and tapes, line printer and CRT

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: User's Manual, Analyst's Manual, Programmer's Manual, and Management Summary (published by CALSPAN), available through AF/SAGP

TIME REQUIREMENTS: Run time/program size vary by the size of the "battle".

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Unknown

USERS; HQ USAF/SAGR

POINT OF CONTACY: AF/SAGR (SABER COUNTER Study Group)
The Pentagon, Room 1D384
Washington, D.C. 20330
AUTOVON 225-5550
Area Code 202 695-5550

TITLE: TAC TURNER

PROPONENT: AF/SAGF

DEVELOPER: AF/SAGF

PURPOSE: Analysis (change assessment) used primarily to generate inputs to TAC WARRIOR.

GENERAL DESCRIPTION: One-sided, mixed, event score, simulation model which simulates aircraft turn-around activities on a tactical airbase. The model determines surge sortie generation capabilities for various tactical aircraft when constrained by airbase resources (e.g., maintenance, manpower, spare parts, shelters, POL, munitions, aircrews). Turn-around functions such as arming, battle damage repair, unscheduled maintenance repair, cannibalization, attrition, refueling, weapons loading, and WRM resupply are incorporated in the model.

INPUT: The maintenance data, related to aircraft Work Unit Codes, include: failure rates, repair times, manpower (AFSC) required to repair, probability that a spare part is required, probability that a spare part can be repaired on base, and time and resources required for shop repair.

OUTPUT: Output is variable but typically includes: sorties ated versus time, distributions of repair and turn-around times; a. commission rates.

HARDWARE: TAC TURNER runs on the IBM 3032. Typical operation on the IBM 3032 requires 256K bytes of core

SOFTWARE:

- o TAC TURNER is written in the General Purpose Simulation System (GPSS) language
- o Documentation is available in AF/SAGF

TIME REQUIREMENTS:

- o For a standard 10-day simulation, TAC TURNER requires about 3 minutes of CPU time
- o Changing of the data base is a more lengthy process requiring 2 or 3 da to change the entire data base

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Normally 5 times each year. With specific studies, its usage can be as high as 10 times each day.

USERS: HQ USAF/SAGR

POINT OF CONTACT: AF/SAGR (Lt Col D. W. Rogers)
The Pentagon
Washington, DC 20330
Area Code 202 694-4247

TITLE: TAC WARRIOR

PROPONENT: Air Staff, Studies and Analysis (AF/SAGF)

DEVELOPER: Air Staff, Studies and Analysis (AF/SAGF)

PURPOSE: Analysis (change assessment)

GENERAL DESCRIPTION: The model simulates the allocation of tactical aircraft to various roles and missions, including close air support, barrier air patrol, offensive counter-air, defensive counter-air, interdiction, electronic warfare, and other missions of a theater campaign. The Red and the Blue forces can perform the missions simultaneiously with both employing up to four different airfield attack or interdiction aircraft, four different air defense, three Close Air Support (CAS) aircraft, Barrier Combat Air Patrol (BARCAP) aircraft, and three different airborne interceptors in the area of the FEBA.

The model accounts for both visual and radar search capabilities of the fighter aircraft as well as their speed, endurance, and air-to-air armament. The vectoring and warning capabilities of GCI and AWACS systems are accounted for in the model. The air-to-air duels are modeled as either 4-on-1, 3-on-1, 2-on-1, or 1-on-1 duels. The number of duels of each type is treated as a random variable dependent upon force allocations and commitment tactics which determine the total number of aircraft that are engaged as a function of time.

In the TAC WARRIOR model, the close air support mission effectiveness and attrition are based upon attacking targets in the forward edge of the battle area. The effectiveness and attrition continually change depending on the presence of electronic warfare support, the opposing level of surface-to-air defense, and target availability. The barrier combat air patrol (BARCAP) mission protects the close air support aircraft from the opposing air threat. The BARCAP's level of effectiveness depends on the aircraft avionics and capabilities in air-to-air engagements. The offensive counterair missions are targeted against airbases, ground control intercept sites, and surface-to-air missile systems. Defensive counterair is responsive to the opposing offensive counterair missions. Associated with defense counterair is the ground control intercept (GCI) system, the availability of an Airborne Warning and Control System, and surface-to-air systems including anti-aircraft artillery.

Interdiction missions are targeted against reserves and supplies. The availability of aircraft to perform each mission is dependent upon an airbase capability to generate ready aircraft. This generation process varies maintenance personnel, and the level of airbase destruction created by airbase attacks.

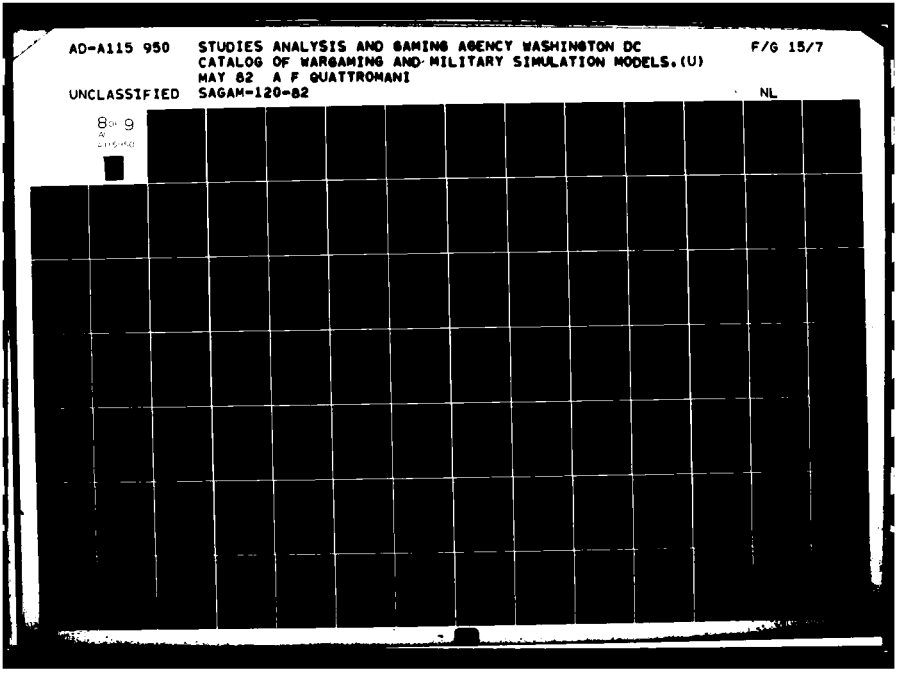
A unique feature of TAC WARRIER is the airfield portion of the model. It keeps track of two different classes of shelters, aircraft in shelters, and in the open, five different kinds of munitions, and POL. These resources, together with the times necessary to perform the various maintenance and service functions are used to generate sorties. If the airfield is attacked, all the resources are at risk, the damage done to the airfield is a function of how it is populated at the time of the attack. The time necessary to perform the maintenance and service tasks increases as the resources are consumed or destroyed by air attack.

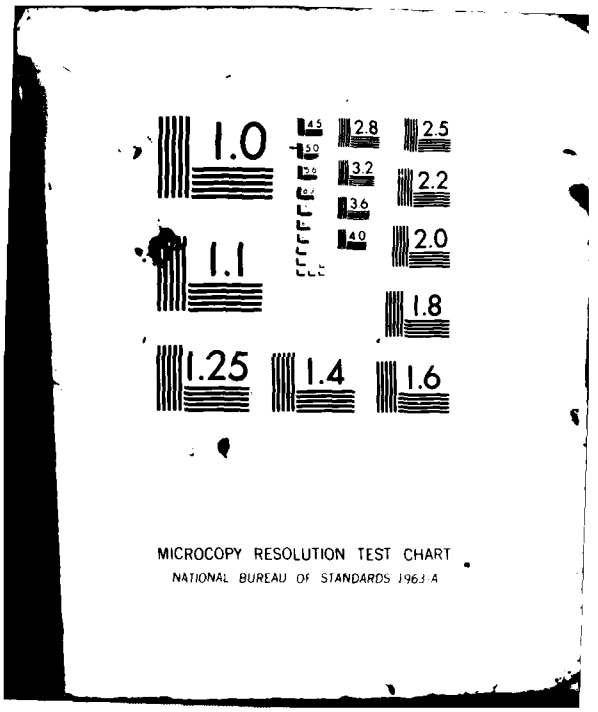
FREQUENCY OF USE. Normally, 5 times/year. With specific studies, its usage can be as high as 10 tiems/day.

USERS: AF/SAGF

POINT OF CONTACT: AF/SAGF (Lt Col D. W. Rogers)
Pentagon
Washington, DC 20330
Area Code 202 694-4247

AD-A115 950 STUDIES ANALYSIS AND GAMING AGENCY WASHINGTON DC F/G 15/7
CATALOG OF WARGAMING AND MILITARY SIMULATION MODELS.(U)
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

TITLE: TACJAM Simulation

PROPONENT: HQ, US Army Test and Evaluation Command (TECOM)

DEVELOPER: TECOM, Andrew L. MacKenzie

PURPOSE: The objective of this program is to evaluate the effectiveness of TACJAM against various enemy radio nets.

GENERAL DESCRIPTION: TACJAM is a countermeasure for single-channel tactical communication links in the 20 MHz to 150 MHz range. Nine frequencies can be monitored by the system and three signals can be jammed simultaneously. The model sets up enemy radio nets composed of up to 99 links, locates the jammer or jammers, randomly assigns link distances with the maximum and minimum distance, and then determines which links are jammed.

INPUT:

Number of different types of enemy transmitters

Frequency at which transmitter operates (MHz)

Transmitter peak signal power (watts)

Transmitter equipment losses (dB)

Transmitter antenna gain in direction of receiver (dB)

Transmitter antenna gain in direction of jammer (dB)

Transmitter antenna height (feet)

Mode of propagation

Number of different types of enemy receiver

Name of enemy receiver radios

Receiver antenna gain in direction of transmitter (dB)

Receiver equipment losses (dB)

Receiver signal frequency (MHz)

Receiver antenna height (feet)

Receiver antenna gain in the direction of jammer (dB)

Antenna gain of the jammer receiver (dB)

Effective radiant power of the jammer (dBM)

Frequency of the jammer (MHz)

Number of jammers

Minimum intercept signal level of the jammer (-dBM)

Jammer intercept receiver losses (dB)

Prioritized frequencies for the jammers (MHz)

Jammer field of view (degrees)

Requires jammer signal ratio

Antenna height of the jammer transmitter (feet)

Link distances for each echelon

OUTPUT:

Radio link number and location of the link's transmitter which has been jammed

Radio link number which has not been jammed

Propagation losses; enemy receiver to transmitter

Propagation losses; enemy receiver to jammer

Percent of links that have been jammed

HARDWARE:

Peripheral Equipment: Plotter

SOFTWARE:

Program Language: BASIC

Documentation: None

TIME REQUIREMENTS:

Run Times: Requires 1 to 12 hours for one production run

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Unknown

USERS: TECOM

POINT OF CONTACT: HQ TECOM
Mr. Andrew L. MacKenzie
Aberdeen Proving Ground, Md 21005
AUTOVON: 283-2775/3286

COMMENTS: Operation, October 1978

TITLE: TACOS II (USAADS version)
TACOS II/AF2 (Air Force version)

PROPONENT: US Army Air Defense School, Directorate of Combat Developments (TRADOC version) USAF/SAGR and ADTC/XR (Air Force version)

DEVELOPER: US Army Air Defense School, Directorate of Combat Developments, USAMICOM, and BDM, Inc.

PURPOSE: The TACOS II and the TACOS II/AF2 versions of this model are computerized, analytical models designed to consider the effectiveness of ground/air defense and penetrating air forces accounting for air and ground damage, ordnance and missile stockage, command and control, ECM, etc. Both deal primarily with operational employment doctrine and concepts, and technical characteristics of the following: (1) force development, (2) deployments, (3) effectiveness, (4) weapons requirements, (5) command and control requirements, (6) doctrine development, (7) system parameters, and (8) ECM. In addition, the model considers organizational requirements, systems performance, and interface requirements for both ground and air forces.

GENERAL DESCRIPTION: Both TACOS II and TACOS II/AF2 are two-sided, stochastic models that simulate ground and air forces, using a digitized terrain model. Both versions are primarily designed to consider from 1 to 255 ground sites versus a large number of aircraft or ballistic missiles. Ground sites may range in size from a single gun to a missile launch complex, while aircraft may be aggregated up to the level of a penetrator wave. The simulation covers a 24-hour period and a 1600 km2 area. Simulated time is treated on an event store basis. The primary solution techniques used are game theory, queuing theory, probability, Newton-Raphson, Monte Carlo, and radar theory equations.

INPUT:

For TACOS II:

- o Ground system characteristics: e.g., reaction times, missile guidance parameters, radar power, damage criteria
- o Penetrator type characteristics: e.g., radar cross-section as a function of azimuth, elevation, radar frequency, jammer types, maneuver capability
- o Ground element characteristics: e.g., location, altitude, sector limits, ammunition (missile) stockage
- o Air element characteristics: e.g., flight profile, number in sortie, decoys, ARMS, ordnance

For TACOS II/AF2:

- o See "TACOS II, Input Variable Descriptions and Format, Fourth Edition," 1 November 1971; and BDM Memorandum, "Modifications to FRAG 3 (TACOS 2.4/AF1)," 14 January 1972

OUTPUT:

For TACOS II:
- o Complete time history of each engagement
- o Resources expended summaries by fire unit
- o Number of penetrators reaching objectives with summaries
- o Targets damaged by target type
- o Numbers of penetrators lost with summaries

For TACOS II/AF2:
- o Same as TACOS II plus detailed missile flyout parameters and probabilities of survival

MODEL LIMITATIONS:

- o Terrain limited to Germany, Korea, and Okinawa
- o 15 air defense system types
- o Cannot presently simulate aircraft interceptors, ground sites moving during battle, or moving support ECM aircraft
- o Maximum of 255 ground sites
- o Maximum of 2040 aircraft
- o Maximum of 255 threat paths

HARDWARE:

- o Computer:
  - TACOS II - CDC 6500/6600, UNIVAC 1100/83
  - TACOS II/AF2 - IBM S/360
- o Operating System: Both versions - OS/PCP/MFT/MVT; SCOPE
- o Minimum Storage Required:
  - TACOS II - 300K bytes, IBM/155K Octal, CDC
  - TACOS II/AF2 - 330K bytes
- o Peripheral Equipment: Both versions - one to two 2314 disk packs and/or one to two tape units, plus card reader and line printer or remote terminal to computer facility

SOFTWARE:

- o Programming Language: Both versions - UNIVAC and FORTRAN
- o Documentation: CDC TACOS II is fully documented

TIME REQUIREMENTS: Time requirements for TACOS II are based on a full-scale run (i.e., 255 sites, 15 AD systems, 100+ threat paths, etc.); TACOS II/AF2 requirements involve, at most, 50 sites (usually 2 or 3) against few threat paths. CPU requirements for TACOS II are based on IBM 360/50 CPU rates.

- o To acquire base data:
  - TACOS II - 1-3 man-months
  - TACOS II/AF2 - 1/2 man-day to 1 month
- o To structure data in model input format:
  - TACOS II - 1-2 man-months
  - TACOS II/AF2 - 1 man-week
- o CPU time per model cycle:
  - TACOS II - 1-10 hours
  - TACOS II/AF2 - 30 seconds to 1 hour
- o To analyze and evaluate results: TACOS II - 1 man-day

SECURITY CLASSIFICATION: UNCLASSIFIED (both versions)

FREQUENCY OF USE:

- o TACOS II (USAADS usage) - Only TACOS terrain analysis programs run continually
- o TACOS II (Air Force version) - 25-50 times
- o AF/2 version - 1 time (this version dates from December 1976)

USERS:

TACOS II:
- o Principal: TRADOC, Directorate of Combat Developments, USAADS
- o Other: US Army Missile Command

TACOS II/AF2:
- o Principal: USAF/ADTC(XR), USAF/SAGR, USAF/SAGF

POINT OF CONTACT: TACOS II: U.S. Army Air Defense School (ATSA-CDX-C)
Fort Bliss, Texas 79916
Telephone: 915/568-6702
Autovon 978-6702

TACOS II/AF2: Headquarters
Armament Developments and Test Center
(ADTC/XR)
Eglin Air Force Base, Florida 32542
Telephone: 904/882-5845
Autovon 872-5845

MISCELLANEOUS:

- o TACOS II/AF2:
  - TACOS supplies aircraft loss rates, ammunition, expenditure rates, etc
  - FAIRPASS provides gun aiming errors or Pk tables for TACOS
  - TACOS II/AF2 (developed in December 1976) supercedes TACOS II/AF1

KEYWORD LISTING: Analytical Model, Land Forces, Air Forces, Computerized, Two-Sided, Stochastic, Event Store

TITLE: Tactical Simulation 1 (TACSIM)

PROPONENT: USAICS

DEVELOPER: TRW Corporation

PURPOSE: The game is designed as a simulator test environment emphasizing the combat intelligence process and information flow.

GENERAL DESCRIPTION: The game is generally two-sided and consists of four integrated components: Battlefield environment, collection environment, processing environment, and force-on-force. Representation of the Blue force battlefield perception is included.

INPUT: Being developed

OUTPUT: Being developed

MODEL LIMITATIONS: Being developed

HARDWARE: VAX 11/780 computer

SOFTWARE:

- Programming language: FORTRAN IV
- Limited documentation available

TIME REQUIREMENTS: Being developed

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Being developed

USERS: CACDA, Fort Leavenworth

POINT OF CONTACT: Dr. Larry Pfortmiller
CACDA
Fort Leavenworth, Kansas 66027
Telephone: AUTOVON 552-5258

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TITLE: TACWAR - Tactical Warfare Model

PROPONENT: Organization of the Joint Chiefs of Staff; Studies, Analysis, and Gaming Agency (OJCS/SAGA)

DEVELOPER: Institute for Defense Analyses

PURPOSE: TACWAR is used as a theater-level model and is designed to evaluate the relative effectiveness of opposing combat forces employing conventional, nuclear, and chemical weapons which can be delivered by ground and air means.

GENERAL DESCRIPTION: The TACWAR model is a fully-automated combat simulation that can be used to assess the interactions of combat forces employing conventional, nuclear and chemical weapons in a theater-wide campaign. Duration of the war game is set by the user and is measured in fixed 12-hour cycles. The program incorporates facilities that enable the user to model a specific geographical structure for the theater. This structure is then used as the foundation for seven simulations: air combat, target acquisition, nuclear combat, chemical combat, ground combat, theater control, and supplies transportation.

INPUT: Approximately 6 man-months of effort are required to construct inputs for the model. Data is required for the theater geography, the conventional air and ground combat, supplies, and the theater control. The model has been designed so use of the chemical, nuclear, and/or target acquisition simulation is optional and if not used, that type of data is not required. The number of conventional weapon types, divisions, division types, and aircraft types are adjustable and not fixed to some limit.

OUTPUT: Most output of TACWAR is displayed by summary game tables. They provide end-of-day statistics aggregated to the sector level. The effectiveness of combat divisions is individually kept and the damage to individual targets from chemical or nuclear munitions. Summary game tables are used for output in each of the seven simulations mentioned in the general description. All output from the summary tables can be viewed graphically using a graphic display package (GIPSY).

MODEL LIMITATIONS:

- o Logistics aspects are very aggregated.
- o FEBA movement and attrition are determined by force ratios and lookup tables, so individual conventional weapons systems and their performance are not explicitly modeled.
- o Break through situation is represented by a modification to movement rates.
- o Command, control, communication, intelligence, and electronic warfare are not played.

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HARDWARE:

- o Computer: Honeywell 6080
- o Minimum Storage Required: 60K - 180K depending on adjustment of input array sizes

SOFTWARE: Programming Language: FORTRAN IV

TIME REQUIREMENTS: 6 to 30 CPU minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Expected 100 times per year

USER: OJCS/SAGA

POINT OF CONTACT: Studies, Analysis, and Gaming Agency
Organization of the Joint Chiefs of Staff
The Pentagon, Washington, D. C. 20301
Telephone: OX-57795

KEYWORD LISTING: Ground-Air Warfare, Nuclear Warfare, Chemical Warfare, Theater-Level Model, Ground Forces, Tactical Air Forces, Deterministic Computer Model

TITLE: TAFSM - Target Acquisition/Artillery Force System Model

PROPONENT: TRADOC Systems Analysis Activity

DEVELOPER: TRADOC Systems Analysis Activity

PURPOSE: TAFSM is a sensor/C3/artillery effectiveness simulation used as an analytical tool in support of COEAs and other studies in those areas.

GENERAL DESCRIPTION: TAFSM is a stochastic model of the interplay of opposing artillery systems. Level of model exercise is normally a US division slice vs a Combined Arms Army. The items modeled are: individual sensors, radios, fire direction centers, cannon and rocket launcher. Resupply and artillery effect are also modeled. Maneuver units are modeled as to movement and casualties. Emphasis was placed on the simulation of the fire direction center computers, software, and operations. Communications and radar jamming is played as well as dust and smoke.

INPUT:

- o Maneuver unit scenario
- o C3 structure
- o Artillery unit movements
- o Sensor movements
- o FEBA movement
- o Pre-assigned sensor reports if desired
- o Ammunition stockages
- o Reliability parameters

OUTPUT:

- o Artillery kills (personnel, tanks, etc.) broken down by
  - sensor type which called mission
  - gun-target range
  - distance from FEBA
  - type of mission (counterfire, direct support, etc.)
  - artillery system
  - ammunition expended with cost and weight
- o Ammunition expended with cost and weight
- o Sensor utilization
- o Communication statistics (percent success, etc.)

MODEL LIMITATIONS:

- o Maneuver forces are only played passively
- o Weather and smoke play are scenario independent
- o Limited number of scenarios are available
- o Meteorological and survey message traffic is not included

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: EXEC 1100
- o Minimum Storage Required: 160K words
- o Peripheral Equipment: Printer, Disk

SOFTWARE:

- o Programming Language: FORTRAN 77 with UNIVAC extensions
- o Documentation:
  - Analyst's Manual (updated)
  - User guides for part of preprocessors

TIME REQUIREMENTS:

- o Approximately 6 weeks to do a complete set-up assuming that a maneuver force scenario is available.
- o 8 minutes CPU time for 24 hour battle and stage one postprocessor.
- o Typically 10 replications required per run.

SECURITY CLASSIFICATION: UNCLASSIFIED

POINT OF CONTACT: US Army TRASANA
ATTN: ATAA-TEM
White Sands Missile Range
NM 88002

FREQUENCY OF USE: 75-100 runs (10-20 replications each)

USERS:

Principal: US Army TRASANA

MISCELLANEOUS: TAFSM is an outgrowth of the Target Acquisition Model (TAM) and the Artillery Force System Model (AFSM) originally developed by the US Army Materiel Systems Analysis Activity.

KEYWORD LISTING: Artillery; Combat; Simulation; Sensor

TITLE: TAGS - Tactical Air-Ground Warfare Model

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: TAGS is a highly aggregated, expected-value, ground-air conflict model developed for Rand studies of military conflict in the European theater; it is especially valuable for preliminary explorations of broad parametric variations prior to the use of more detailed and costly analytic aids. A special feature permits any model parameter to be specified as uncertain; when this is done, a series of trial combat simulations are computed, and the results include a statistical summary of the joint effect of the uncertain factors.

GENERAL DESCRIPTION: TAGS simulates ground and air activities on a day-to-day basis. The ground units in TAGS are defined in terms of homogeneous division equivalents. Reserve forces, individual and unit replacements, repair capabilities, prepared defenses, and several types of terrain may be represented. A major battle area may be represented as either one or several independent ground sectors, and the user controls the day-to-day allocation of close air support to the inividual sectors. The forward edge of the battle area (FEBA) moves as a unit and is viewed as the average movement of either the entire theater front or as that of one of a few major sectors. The air forces consist of several types of aircraft that are allocated among six different missions: air defense, airbase attack, interdiction, close air support, counter-SAM, and escort. This latest version of TAGS includes a variety of special provisions such as options for operating aircraft from sancturaries, for protecting aircraft in shelters, and for examining the operation of battlefield nuclear firing units.

INPUT: The input parameters fall into three categories:

- o Force size and effectiveness factors
- o Aircraft allocation by mission
- o A set of historically based empirical factors that characterize casualties and movement of ground warfare

Any of these factors can be changed as a function of the value of any other during the course of the conflict

- o A special feature is that any parameter can be specified as having an uncertain value; if this is done, a series of trial combat simulations is computed using sample values from specified probability distributions for each uncertain factor

OUTPUT: Daily battle results include (for each side):

- o The position of the FEBA
- o The number of divisions that are engaged, in reserve, and undergoing recuperation
- o The daily casualties
- o Aircraft losses, sorties, and survivors
- o When some of the planning factors have been represented as uncertain, the results include a statistical summary of the joint effect of those factors

MODEL LIMITATIONS:

- o Motion of FEBA is dependent on representing ground force strengths by an equivalent "fire power" score
- o All activities are aggregated into 24-hour periods
- o Only ten types of aircraft may be represented

HARDWARE: TAGS is not machine dependent and has operated on IBM and Honeywell systems and has exported for others

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:
  R-1242-PR, TAGS-V: A Tactical Air-ground Warfare Model, D.E. Emerson, June 1973

  R-1576-PR, The New TAGS Air-Ground Warfare Model (Incorporating Major Ground-Combat Revisions): A Description and Operating Instructions, D. E. Emerson, September 1974

TIME REQUIREMENTS: CPU time on an IBM 370/158 is about four seconds for single 30-day campaign

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: TAGS, in various versions, has been in use intermittently since the early 1950s at The Rand Corporation

USERS:

- o Principal: The Rand Corporation
- o Other: AF/SAGR, Air War College, Air University
  AFIT, AFSC/ASD
  ACDA, USA/CAA
  GD, Grumman, GRC, Ryan, SAI, Rockwell

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: D.E. Emerson

KEYWORD LISTING: Theater, Analytic, Two-sided, Air; Land Conventional/Nuclear; Computerized; Stochastic; Time/Event Mix

TITLE: TAGSEM II - Tactical Air-to-Ground System Effectiveness Model

PROPONENT: Aeronautical Systems Division (ASD), Air Force Systems Command

DEVELOPER: Deputy for Development Planning (ASD/XR), A. T. Kearney, Caywood-Schiller Division; and University of Dayton Research Institute

PURPOSE: TAGSEM is a computerized analytical, damage assessment/ weapon effectiveness model used to evaluate the relative effectiveness of prospective tactical air-to-ground systems. Systems evaluated range from manned and unmanned aircraft with their accompanying support aircraft, to standoff weapons and specific subsystems on each aircraft. Flights of aircraft, including support aircraft, are flown against opposing ground forces. TAGSEM assesses the damages imposed on the ground forces by each aircraft and in turn, the damage done to each aircraft by ground defenses as a function of time. The effectiveness of one specific system can be compared to the effectiveness of an alternative system.

GENERAL DESCRIPTION: TAGSEM is a two-sided, deterministic expected value model involving land and air forces. The level for which TAGSEM was primarily designed considers a single flight of aircraft attacking a target matrix. The range of possible manipulation extends from a single flight of aircraft to several wings of different type aircraft attacking a single target matrix to attacking several target matrices of different composition. Simulated time is treated on an event store basis. The primary solution techniques are simultaneous equations for computing expected values.

INPUT:

- Scenario description
- Airframe/engine performance
- Payload capabilities
- One-on-one system survivability against anti-aircraft artillery and surface-to-air missiles
- Navigation and target acquisition capabilities
- Weapon lethalities (which include delivery accuracies)
- Navigational accuracies
- Sortie rate and target description

OUTPUT: Computer printout stating as a function of time (cycles) the expected values of targets killed, aircraft killed, weapons delivered, sorties flown, air defense sites killed. Levels of output vary from one-page summaries for the entire conflict to detailed summaries of each event that occurred.

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MODEL LIMITATIONS:

- o No command and control network modeled
- o No air-to-air simulation
- o No ground-to-ground simulation
- o 20 aircraft types, 10 targets in each element array

HARDWARE:

- o Computer: 6600 CDC
- o Operating System: NOS/BE
- o Minimum Storage Required: 170K Octal segmented, 250K unsegmented
- o Peripheral Equipment: Printer

SOFTWARE:

- o Programming Language: FORTRAN IV Extended
- o Documentation: Programmer's Manual available, User's Manual complete.

TIME REQUIREMENTS:

- o 6-8 months to acquire base data
- o 5 days to structure data in model input format
- o ~4 hours to analyze output
- o ~4 months player learning time
- o 1 to 3 minutes CPU time

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Extensive (Daily)

USERS:

- o Principal: Deputy for Development Planning

POINT OF CONTACT: Mr. John Kurdik
Deputy for Development Planning (ASD/XROL)
Aeronautical Systems Division, AFSC
Wright-Patterson AFB, Ohio 45433
AV 785-6261

MISCELLANEOUS: There are five models which provide inputs for TAGSEM II:

(1) POO 1 - A one-on-one AAA model
(2) Various one-on-one SAM models
(3) TATAC - Tactical Target Acquisition
(4) Airframe/Engine Performance
(5) Munition Lethality Models.

TAGSEM II supersedes the Target Engagement Model (TEM) and the Mission Effectiveness Model (MEM)

KEYWORD LISTING: Analytical Model; Computerized; Damage Assessment/ Weapons Effectiveness; Land Forces; Air Forces; Two-Sided

TITLE: TALCS - Tactical Air Land Conflict Simulation

PROPONENT: IABG/SOP Ottobrunn, Germany

DEVELOPER: IABG/SOP Ottobrunn, Germay

PURPOSE: Theater level analysis and investigation of Air Force weapon systems, force structure and operational concepts. TALCS can also be used for the study of ground force organizational structure.

GENERAL DESCRIPTION: TALCS is a computer-assisted, two-sided theater level, mixed (stochastic-deterministic), event store simulation. Lanchester equations, queuing theory and probability theory are the primary solution techniques of the model.

OUTPUT: Printout of data describing progression of the land and air battles and outcome of the electronic warfare. Provides individual status of all units in game. Post-processor provides detailed game statistics for all game elements.

HARDWARE:

- o Computer: CDC CYBER 175
- o Operating System: NOS 1-0
- o Minimum Storage Required: 120,000 Octal words (COBIT)
- o Peripheral Equipment: Plotter

SOFTWARE:

- o Programming Language: FORTRAN, Assembler
- o Documentation: Model description and user documentation

TIME REQUIREMENTS:

- o To acquire Data Base: 2 months
- o To Structure Data in Model Input Format: 1 man-month
- o Player Learning Time: 2 days
- o Playing Time: 1 month
- o CPU Time per Cycle: 600-3000 seconds

SECURITY CLASSIFICATION: RESTRICTED

USERS: IABG/SOP

POINT OF CONTACT: IABG
Abteilung SOP
Einsteinstasse
D 8012 Ottobrunn, Germany

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TITLE: TANCO - Tank Counterfire Duel Model

PROPONENT: US Army DARCOM

DEVELOPER: Harry Diamond Laboratories, ERADCOM

PURPOSE: TANCO is a computerized analytic model which assesses the outcome of the duel between a ground laser designator directing a sequence of laser-guided rounds against up to a platoon of tanks counterfiring against the designator. Such duels are often analyzed in a higher-level battlefield context as the individual fixed-piece engagements in a force-on-force war game, played on real terrain which determines when and where the individual duel engagements occur. The model may also be used to test the significance of variations in the pertinent duel parameters.

GENERAL DESCRIPTION: TANCO is a two-sided, deterministic ground warfare model which analyzes the outcome of the duel between a laser-guided weapon system against a tank, or tank platoon, which counterfires against the designator directing the laser-guided rounds. This model can handle one designator directing from 1 to 5 laser-guided rounds against up to a platoon of 3 tanks, and the tanks can fire any number of shots against the designator, limited only by the time available in which to counterfire. Larger units, such as tank companies, can be treated by separation into platoons. The force-on-force exercises in which these duel assessments are usually embedded are time-stepped from duel engagement to duel engagement as the tanks advance. The development of the tank counterfire duel in closed form requires the solution of a series of complex probability formulas, and Markov chains are used to link the various duel engagements.

INPUT:

- o Tank counterfire response time distributions
- o Designator-on times
- o Tank-to-designator range
- o Laser-guided round single-shot kill probabilities
- o Tank round single-shot kill probabilities against the designator
- o Tank fire control errors
- o Designator posture (e.g., exposed, in bunker, in foxhole)
- o Ground slope at the designator
- o Laser-guided round flight times and rates of fire
- o Tank round flight times
- o User-determined special conditions, such as tank laser-ranging, offset designation of the target tank, or spoofers to distract tank counterfire

OUTPUT:

- o Probability of designator survival
- o Probability of n tanks killed, n=0,1,2,3
- o Expected number of tanks killed

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MODEL LIMITATIONS: Limitations on system performance (e.g., suppression, smoke) are not presently incorporated into the model; rather maximum effectiveness of systems on both sides is assumed in order to test designator survivability.

HARDWARE:

- o Computer: IBM 370/168
- o Operating System: OS/VS2
- o Minimum Storage Required: 5K
- o Peripheral Equipment: Printer, Card Reader

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation:
  - "Analysis of the Laser-Guided Missile/Projectile versus Tank Counterfire Duel," HDL-TR-1854, May 1978
  - "Final Report - Surviability Study Task Force for Ground Laser Designators," HDL-PRL-78-2, August 1978
  - "Development of a Model of the Laser-Guided Missile/Projectile versus Tank Counterfire Duel, HDL-TR-1883, December 1979
  - "Analysis of the Laser-Guided Maverick versus Tank Counterfire Duel," HDL-TR-1909, June 1980

TIME REQUIREMENTS:

- o Field tests are required to acquire the data base
- o 3 weeks are required to structure data in model input format, primarily in generating the tank response time distributions
- o 1 to 2 minutes running time per model cycle, which includes about 15 sec CPU time
- o 1 hour to analyze output

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Sporadic, on the average once a month

USERS: DARCOM, MICOM, University of New Mexico, AMSAA

POINT OF CONTACT: Mr. J. Michalowicz
Harry Diamond Laboratories
Attn: DELHD-NW-RA
Adelphi, MD 20783
Telephone: (301) 394-3100

MISCELLANEOUS: The duel engagements of this model have been embedded in an AMSAA manual map exercise depicting a Blue company on the defense against a Red tank threat.

KEYWORD LISTING: Analytical; computerized; duel; counterfire; tank warfare; laser-guided weapons; laser designator; survivability; land; two-sided

TITLE: TANDEM I

PROPONENT: DNA (NATD)

DEVELOPER: RAND/SAI (Modifications- TANDEM I)

PURPOSE: TANDEM I is a computerized, analytical, and damage assessment/weapons effectiveness model. It is primarily used for damage assessments to fixed targets with airfields as a special category and ground forces arrays.

GENERAL DESCRIPTION: TANDEM I is a two-sided, deterministic model which deals with land, air, sea, and paramilitary forces. It was designed for single units or installation for fixed targets or platoon level for ground force arrays. The model uses probability as a method of solution.

INPUT:

- o Specific weapon laydown or specific target categories to be attacked by classes of weapon
- o Target installation data base

OUTPUT:

- o Computer listing of expected target damage
- o Expected damage (by weapon) on all targets affected by each weapon
- o Compounded damage to all targets affected due to all weapons

MODEL LIMITATIONS:

- o Limit of 10,000 weapons

HARDWARE:

- o Computer: IBM 360, DEC 10
- o Minimum Storage Required: 230-250 K to operate unoverlayed

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Draft Users Guide
- o Programmer's manual not complete

TIME REQUIREMENTS:

- o 1-2 weeks required to acquire base data
- o 1 man-week required to structure data in model input format
- o 1 second per weapon target pair CPU time required per model cycle
- o 1-2 weeks (operational use only) learning time required for players
- o 1-2 days required to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 12 times per year (SAI only)

USERS:

- o SAI (modified version - TANDEM I)
- o CCTC (original version - TAMDEM)
- o Rand
- o Picatinny Arsenal
- o LASL

POINT OF CONTACT: E. J. Swick
Science Applications, Inc.
1200 Prospect Street
La Jolla, CA 92037
(714) 454-3811, Ext 2487

MISCELLANEOUS:

- o Model can be linked to DCAPS to provide an input DGZ list
- o Model supersedes TANDEM

KEYWORD LISTING: Analytical, Damage Assessment/Weapon Effectiveness, Land, Air, Sea, Paramilitary, Computerized, Two-sided, Deterministic

TITLE: Tank

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: To provide the capability to evaluate the contribution of airborne tankers to strategic bomber force capability and to all strategic forces in general.

GENERAL DESCRIPTION: Tank is a computerized, analytical deterministic model that provides the capability to evaluate the contribution of tankers to strategic bomber force capability as measured by the percent of target value destroyed by the bomber force. Additionally, the model can be used to compare various force mixes of bombers, weapons and tankers on a force effectiveness basis.

The model is highly user oriented, thereby enabling the user to exercise control over the degree of output fidelity desired. Temporary modifications to pre-stored data are easily accomplished facilitating rapid sensitivity analysis. The primary solution techniques used in bomber/ weapon allocation are LaGrange multipliers, linear programming and probability.

INPUT:

- o Number and type of tankers
- o Number and type of bombers
- o Number of weapons for bombers
- o Percent of tankers/bombers available for allocation
- o Variables for specifying tanker/bomber flight profiles and performance characteristics
- o Probability of bomber penetration
- o Variables controlling degree of output desired

OUTPUT:

- o Summarization of variable selected
- o Listing of strategies used in weapon allocation
- o Summaries of weapon allocation and value destroyed by bomber type and entry point area
- o Number of bombers, weapons and tankers used, by type
- o Output options allow a detailed description of the weapon allocation or aggregated summaries

MODEL LIMITATIONS:

- o Aggregated target data base
- o Aggregated weapon type

HARDWARE:

- o Computer: Honeywell
- o Operating System: MULTICS
- o Minimum Storage Required: N/A
- o Peripheral Equipment: Interactive I/O device

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision.

TIME REQUIREMENTS:

- o 10-60 seconds CPU time for one strike allocation
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION:

- o 10-60 seconds CPU time for one strike allocation
- o 1 hour or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED. Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year.

USERS: OASD(PA&E)

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, D. C. 20301
Telephone: OX-55587

KEYWORD LISTING: Analytical Model; Strategic Tanker/Bomber; Computerized; Deterministic; Linear Programming

TITLE: TANKWARS

PROPONENT: US Army Materiel Systems Analysis Activity (USAMSAA)

DEVELOPER: Ballistic Research Laboratory (BRL)

PURPOSE: TANKWARS is a computerized, analytic weapon system effectiveness model which provides the results of a duel between two armored forces. The model's chief focus is on weapon effectiveness within the classical attack/defense or meeting engagement situtins. TANKWARS is also used to address ammunition expenditures, acquisition, accuracy, vulnerability, lethality, rate of fire, and disengagement policies.

GENERAL DESCRIPTION: TANKWARS is a two-sided, event sequenced, stochastic model involving land forces only. The model considers individul weapon systems and simultes combat between twenty or fewer armored vehicles. TANKWARS employs Monte Carlo probability theory as its primary solution technique.

INPUT:

- o Force ratio
- o Exposure
- o Aspect angle
- o Range
- o Velocity
- o Size
- o Acquisition characteristics
- o Disengagement tactics
- o Ammunition
- o Rate of Fire
- o Accuracy
- o Vulnerability

OUTPUT:

- o Computer printout stating probability of duel outcome
- o Ammunition expenditures
- o Expected kills per stowed load
- o Exchange ratio

MODEL LIMITATIONS:

- o Maximum number of combatants is twenty
- o Continuous line of sight
- o All weapon systems on one side must be homogeneous
- o No geography
- o Suppression not modeled

HARDWARE:

- o Computer: CDC 7600
- o Operating System: NOS, NOS/BE
- o Minimum Storage Required: 64K

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: TANKWARS General Informatin Manual, October 1980, ARBRL-MR-03065

TIME REQUIREMENTS:

- o 2 weeks to acquire data base
- o 2 days to structure data in model input format
- o 1 day to analyze output
- o 10 seconds CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 2000 times per year

USERS: US Army Materiel Systems Analysis Activity (USAMSAA)

POINT OF CONTACT: Director
US Army Materiel Systems Analysis Activity (USAMSAA)
Mr. Comstock
ATTN: DRXSY-GS
Aberdeen Proving Ground, MD 21001
AUTOVON 283-2079

KEYWORD LISTING: Computerized, Analytical, Monte Carlo, Weapon effectiveness, Duel, Armor systems

TITLE: TAP - Target Analysis and Planning

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: Defense Nuclear Agency/BDM

PURPOSE: Model facilitates nuclear target analysis and planning for a corps area of influence.

GENERAL DESCRIPTION: TAP system provides for user defintion, storage, display, analysis, and planning of doctrine, order of battle, situation, targeting and weapon system required for corps nuclear target planning and analysis

INPUT:

- o Order of Battle
- o Kill probabilities

OUTPUT:

- o MAP building on video screen with ability to save display
- o Target analysis and damage assessment
- o Cross reference map sheet, photograph to video map
- o Intelligence update and display
- o Orders of battle display
- o Display library of map symbols used
- o Edit map data

MODEL LIMITATIONS: N/A

HARDWARE:

- o Computer: APPLE II
- o Operating System: PASCAL
- o Minimum Storage Required: 64K
- o Periphral Equipment: Curves hard disk system

SOFTWARE:

- o Programming Language: PASCAL
- o Documentation: BDM Target Analysis and Planning (TAP) System Field User's Manual, 1 June 1981

TIME REQUIREMENTS:

- o 3 man-months to acquire data base
- o 3 man-months to structure data in model input format
- o 2 man-weeks player learning time
- o Dedicated micro processor CPU time per cycle

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Presently used in demonstrations at Fort Leavenworth. Will be used at Fort Leavenworth in support of CGSC and CATTS exercises.

USERS: BSD

POINT OF CONTACT: Herb Westmorland
ACTD
Fort Leavenworth, Kansas 66027
AUTOVON 684-4528

MISCELLANEOUS: Target analysis conventional arty (in process). Integration of terrain data base.

KEYWORD LISTING: Computerized, Analytical, Nuclear, Damage Assessment, Tactical Nuclear Weapons, Target Analysis Planning

TITLE: TARTARUS

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Strategy and Tactics Analysis Group (STAG)

PURPOSE: TARTARUS is a computerized, analytical model designed to simulate movement and attrition of ground forces in contact. Externally derived effects of close air support and nuclear weapons can be applied in the model, if desired.

GENERAL DESCRIPTION: TARTARUS is a two-sided, deterministic model involving land forces only. It is primarily designed to consider units ranging in size from a battalion to a division (300 units). Simulated time is treated as series of nested time steps ranging from several minutes to several hours. The primary solution technique used is the numerical solution of a system of differential equations based on Lanchester's Linear Law.

INPUT:

- o Terrain data
- o Unit descriptions: Mission, location, and strength in personnel and weapons
- o Factors for weapon class versus weapon class effectiveness, attrition, movement, suppression
- o Air strike data
- o Fuel and ammunition distribution and consumption factors
- o Individual weapon FPPs (firepower potential)

OUTPUT:

- o Unit Status Report
- o Detailed Strength and Loss Report
- o Ammunition and Fuel Expenditure Reports
- o CALCOMP plots of terrain, strikes, unit locations, objectives, and frontages
- o All of the above are optional, except the Unit Status Report

MODEL LIMITATIONS: Limited number of units simulated.

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 Operating System
- o Minimum Storage Required: 56K words
- o Peripheral Equipment: 1 tape drive, FASTRAND format mass storage, CALCOMP plotter is optional

SOFTWARE:

- o Programming Languages: UNIVAC FORTRAN V, and Assembly Language
- o Documentation: "TARTARUS IV N/COCO Players and Technical Manual." (AD 829 5251)
- o Technical documentation is complete; user's documentation is not. The model has been modified since the above documentation was published and corrections have not been published.

TIME REQUIREMENTS:

- o 4 months to acquire base data
- o 2 man-months to structure data in model input format
- o Average of 1/2 hour CPU time per model cycle on a UNIVAC 1108 (4 hours real time)
- o 1 week learning time for users
- o 2 months to analyze and evaluate results of one study

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 5 studies

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Ms. P. M. Fleming
US Army Concepts Analysis Agency (CSCA-MCM)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-0529

KEYWORD LISTING: Analytical Model; Limited War; Land Forces; Computerized; Two-Sided; Deterministic; Time-Step

TITLE: TASSM - Tactical Airlift System Simulation Model

PROPONENT: HQ USAF/SAGM

DEVELOPER: HQ USAF/SAGM

PURPOSE: Computerized analysis of the number of aircraft required to meet a given intratheater airlift demand.

GENERAL DESCRIPTION: The model is a one-sided, deterministic, event-store, air movement simulation. It determines movement requirements from initial source to final bases based on troop strength, force posture, consumption rates, and estimated percentages of the amount of total cargo, and troops that will be airlifted to final destination. A portion of the movement requirements are directed from source to destination. The remaining demands are satisfied by solution of a transportation problem, minimizing the distances from sources to destinations using Vogel's Transportation Method. An aircraft performance module calculates the allowable cabin load for each source-destination pair. Pallet distributional data for the types of units located at each destination is then used to determine the amount of payload delivered on each mission.

INPUTS:

- o Aircraft performance data and cargo box characteristics
- o Base and route definitions
- o Pallet weight distributions
- o Cargo and troop movement requirements

OUTPUTS: Computer printouts showing the number of aircraft required to meet all airlift demands each day, the total tons hauled and fuel used to each base each day.

MODEL LIMITATIONS: The following parameter limitations apply to TASSM:

- o Five aircraft types
- o 200 bases
- o 50 days of simulation

HARDWARE:

- o Type computer: G-625
- o Operating system: GCOS
- o Minimum storage requirements: 65K words of core
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: User's Manual and Programmer's Manual are available in HQ USAF/SAMC and SAGM

TIME REQUIREMENTS:

- o 20-40 man-hours to prepare data base
- o One hour for a 20-day NATO contingency operation CPU time
- o 2-4 man-hours data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not used since 1979

USER: HQ USAF/SAGM

POINT OF CONTACT: AF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone: (202) 694-8144
AUTOVON 225-3379

MISCELLANEOUS: Uses the Effective Cabin Load Generator Model by McDonnel Douglas Corporation, and the Tactical Airlift Capacity Program by Boeing Computer Services, Inc., to provide initial data.

TITLE: TENOS - Test and Evaluation of National Operating Systems

PROPONENT: Federal Emergency Management Agency

DEVELOPER: Computer Management Office, Office of Information Resources Management, Federal Emergency Management Agency

PURPOSE: The TENOS is a computerized, analytical, damage assessment/ weapon effectiveness model. It was designed for use by analysts and planners to study the effects of large scale nuclear attacks on CONUS population. Special emphasis is placed upon the capability to vary shelter availability and use; and upon evacuation schemes. Its chief focus is on the relative life-saving potential of various alternative systems of public and private shelter usage, expedient shelter construction, and evacuation of high risk areas. The nuclear threat applied to these various systems may range from a single detonation to full-scale attack. It is used frequently to estimate casualties based upon a directd scenario of study. In such cases, the flexibility inherent to TENOS, in its sheltering alternative and evacuation simulation, is exploited.

GENERAL DESCRIPTION: The TENOS is a one-sided, deterministic model. It was designed for CONUS population, housing, and public shelter; aggregated to grids of size 2'x2' arc (about 115,000 grids). It could be aggregated to larger size grids, but at the risk of lower resolution in blast casualty estimation. TENOS was designed to deal mainly with units at the level of states, regions, and the entire CONUS. This model is event-store and deterministic estimation of free field weapon effects. The resulting overpressures and fallout doses are employed in appropriate casualty functions. Approximately thirty casualty functions are built in covering a wide range of hardnesses against blast overpressure.

INPUT:

- o Nuclear weapons data
- o A definition of "high risk" areas, for each 2-minute grid with population and/or shelter allocation to it
- o A plan regarding types of shelter to be used, and order of filling, for high-risk and low-risk areas
- o An estimate of evacuation percentage from high-risk areas

OUTPUT:

- o Casualty summaries
  - Blast and Fallout Casualties
  - Uninjured
  - High-risk and low-risk areas
  - State, country, minor civil division, urbanized area, and city

MODEL LIMITATIONS:

- o Rapid analyses of strategies and shelter usage
  - Not for analyzing many attack threats
  -- Fallout estimation for each chosen attack is very time consuming

HARDWARE:

- o Computer: UNIVAC 1100 system
- o Operating System: UNIVAC EXEC 8
- o Minimum Storage Required: 131K
- o Peripheral Equipment: Mass storage disk, high-speed printer, flat-bed plotter optional

SOFTWARE:

- o Programing Language: FORTRAN (ASCII)
- o Documentation: No formal documentation
- o User's and Programmer's manuals not complete

TIME REQUIREMENTS:

- o Less than 1 month to acquire base data
- o 1/2 man-months required to structure data in model input format

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 50 times per year

USERS: Federal Emergency Management Agency

POINT OF CONTACT: Dr. William I. Fehlberg
Computer Management Office
Office of Information Resources Management
Federal Emergency Management Agency
Washington, DC 20472
Telephone: (301) 926-5411

MISCELLANEOUS: This model supersedes DASH-III

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness; Computerized; One-sided; Deterministic; Event Store

TITLE: TEWTORIAL

PROPONENT: MA4 Branch, RARDE

DEVELOPER: As Above

PURPOSE: The game, or rather the technique, was designed to provide a means of taking a "quick and dirty" look at various concepts for an improved weapon or tactical approach. The concepts that do best in the TEWTORIAL study can then be gamed thoroughly in the Battle Group War Game or by other means.

GENERAL DESCRIPTION (As this technique was developed to be used with different weapon/tactical concepts, the level of aggregation and other details may vary between different applications.) The technique is usually used as an open two-sided game in which most events are stochastic (e.g., weapon effects, target acquisition, etc.) though some (max vehicle speeds, etc.) are deterministic. It works in a movement time slice of up to 5 minutes, but with acquisitions assessed on a short period, usually one minute, and shots assessed on a shorter period still. If used for an ATWGstudy, the smallest units used would usually be tank troops, infantry platoons and individual ATGW with their detachments. The level of play is usually a Blue battle group against a Red regiment. The game is designed to be taken to military units to be played.

INPUT:

- o Weapon characteristics (accuracy, lethality, response times, etc.)
- o Acquisition rules
- o Movement rules
- o ORBATS
- o Scenarios

OUTPUT:

- o Military judgment, from the control staff and players, of the worth of the various concepts played
- o Data on ranges of engagement, exchange ratios, target arrays, etc., can be recorded as required for the study

MODEL LIMITATIONS:

- o Lack of detail in the results because of the level of aggregation
- o Relatively crude differentiation of input data, because of manual play

HARDWARE:

- o The technique does not normally use computer support
- o Photographically enlarged maps mounted on steel sheets
- o Magnetic office symbols on which the conventional military symbols for the units represented have been drawn

SOFTWARE:

- o Manual "look-up tables" of the types of data needed for the concept being studied
- o Special data-recording performae appropriate to the type of data needed for the study

TIME REQUIREMENTS: Once the players have been briefed and had a short practice game (requiring about half a day), the same Blue player team can play between 1 and 2 battles a day, depending on the scenario.

SECURITY CLASSIFICATION: The details of the technique are not classified. Input and output data may be classified, depending on the concept being gamed.

FREQUENCY OF USE: As required. It has been used so far in two studies.

USERS:

- o MA4 Branch, RARDE
- o British aerospace, Stevenage

POINT OF CONTACT: PO/BGWG, MA4, RARDE

MISCELLANEOUS: A version of this technique, supported by a Sinclair ZX81 micro-computer, is in use to train officers and NCOs for ATGW units.

TITLE: TFG - Task Force Game

PROPONENT: LAI Division, DOAE, West Byfleet, England

DEVELOPER: As above.

PURPOSE: The game is being developed as an investigative tool to be used along side other existing computer based combat models in force mix studies.

GENERAL DESCRIPTION: TFG is a two-sided, computer assisted, open game currently being played at a small task force level (two Blue battle-groups). The samllest units represented are Blue infantry platoons and tank troops and Red infantry and tank companies. The game progresses in time slices whose duration can be varied (typically 5 or 10 minutes). All rules are currently deterministic and casualty assessments are made by an on-line routine which uses data generated by the DOAE Battlegroup Model (BGM, q.v.). The terrain model is an enlarged (by a factor of 3) 1:50,000 scale map. Average line of sight probability is included in the casualty assessment routine, with the exception of forested and urban areas whose interference with line of sight is considered explicitly.

INPUT:

- o Scenario
- o ORBATs
- o Movement rules
- o Force on force attrition data, at the level of resolution described above. (This data is generated by the BGM)

OUTPUT: Battle statistics: typically, the frequency of occurrence of low level tactical situations, casualties and battle duration

MODEL LIMITATIONS:

- o Absence of command and control
- o Deterministic casualty assessment places a lower limit on resolution

HARDWARE: Table mounted map

SOFTWARE: Casualty assessment program written in FORTRAN and occupies 500 kilobytes on an ICL 2900 Series computer

TIME REQUIREMENTS:

- o One week to start a series, 1-3 hours for a single game
- o Game time varies between 1 and 2 days

SECURITY CLASSIFICATION: Methodology: This description UNCLASSIFIED; more detailed description UK RESTRICTED. Database: usually UK SECRET.

FREQUENCY OF USE: Still being developed

USERS: LAI Division, DOAE

POINT OF CONTACT: LAI Division, DOAE
West Byfleet
Surrey, England
Byfleet (09323) 41199

TITLE: TLS - Training Line Simulator

PROPONENT: Air Force Human Resources Laboratory, Manpower and Force Management Systems Branch, Decision Models Function (AFHRL/MOM) (AFHRL/ORS)

DEVELOPER: Decision System Associates, Inc.

PURPOSE: The Training Line Simulator is a computerized, analytical model that games the interaction of policy decisions impacting on Basic Military Training and Entry-level Technical Training. The model assesses policy alternatives with respect to training school prerequisites, weekly requirements mix, wash-out, wash-ahead and wash-back rates, application of fill priorities and desirable prerequisites to selected assignments, etc. In addition, it investigates the effects of changing the quality of enlisted input with respect to fulfilling training objectives.

GENERAL DESCRIPTION: The Training Line Simulator is a one-sided model having both deterministic and stochastic elements. Only Air Force personnel are considered, consisting of the weekly input of non-prior service enlisted personnel into the Air Force. Simulated time is treated on a weekly time-step basis. The primary solution technique is a modified Ford-Fulkerson optimal assignment algorithm.

INPUT:

- Mandatory and desirable prerequisites for each technical training course
- Weekly quotas for each course
- Wash-out, wash-ahead and wash-back policies, optimal classload, etc., for Basic Military Training and for each training course
- Records of hypothetical Air Force enlisted input

OUTPUT:

- Weekly summary of number of inductees, number in Basic Military Training and in Technical schools, graduates from BMT and Tech schools, wash-backs, wash-aheads, wash-outs, casual pools, etc.
- Output tape of airman records with disposition codes, etc.

MODEL LIMITATIONS:

- Maximum of 4,000 inductees per week
- 255 weeks
- 250 individual training courses

HARDWARE:

- Computer: UNIVAC 1108
- Operating System: Standard

- o Minimum Storage Required: 44K words (36 bits/word) plus operating system
- o Peripheral Equipment: 2 tape drives, 6 mass storage files (approximately 229K words depending on application), card reader, printer

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation:
  - Training Line Simulator (Enhanced Version)
  - AFHRL-TR-73-50(I) User's Manual
  - AFHRL-TR-73-50(II) Training Line Simulator (Enhanced Version)

TIME REQUIREMENTS:

- o 1 week to 3 months to acquire and structure base data, depending upon the specific application
- o 1-15 seconds CPU time per model cycle
- o Less than 1 month to analyze and evaluate results

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o Principal: AFHRL/MOM
- o Other: HQ Air Training Command

POINT OF CONTACT: Air Force Human Resources Laboratory
Decision Models Function
Manpower and Personnel Division
Brooks AFB, Texas 78235
Telephone: AUTOVON 240-3648
Commercial 536-3648

MISCELLANEOUS: N/A

KEYWORD LISTING: Analytical Model, Ford-Fulkerson, Training Model, BMT Model

TITLE: TOPOPS - Total Objective Plan for the Officer Procurement System

PROPONENT: Air Force Human Resources Laboratory, Manpower and Force Management Systems Branch, Decision Models Function (AFHRL/MOM)

PURPOSE: TOPOPS is a computerized optimization model to allow the analysis of various officer procurement scenarios for planning purposes.

GENERAL DESCRIPTION: TOPOPS is an aggregate optimization model that uses a linear programming algorithm to program a scheme of officer procurement to either minimize cost or maximize quality. Constraints on optimization include production requirements by officer type (pilot, navigator, etc.), policy restrictions, specific characteristics of various commissioning sources and training programs (including attrition rates, type crossflows, and career turnover). The model works on a 5-year procurement lead time to optimize a 5-year schedule of accessions.

INPUT: Inputs into the model are flexibly arranged to allow different procurement scenarios to be examined by modifying both the objective function and the constraint set by choosing particular members of classes of available constraints and objective functions. Numerical data inputs include such things as procurement requirements by officer type for the next 5 years; turnover rates by type of officer and training agency; training agency crossflow rates; maximum production limits for training agencies; limitations on supply pools of officers; quality distributions of various supply pools; inflation rates; and training agency and commissioning source costs, capacities, and attrition rates.

OUTPUT: Model output includes a schedule of officer recruitment requirements to meet the accession requirements by type, supply pool, and commissioning source for the next 5 years. Also, the model gives a program cost analysis and officer quality profile, and a sensitivity and parametric analysis of the objective function and constraint set.

MODEL LIMITATIONS: The model is currently limited by the linear programming algorithm available to 8200 constraints and 6100 structural variables. This allows only twenty officer types, twenty commissioning sources, twenty supply pools, 10 procuring years, and a 5-year procurement scenario to be considered.

HARDWARE: The TOPOPS model was designed and programmed to run on the UNIVAC 1108.

SOFTWARE: The UNIVAC FMPS linear programming package is called by the source program to perform the optimization routines. The model itself has three distinct modules: The Data Initializer Module, the Flow Module, and the Report Processor Module. The first translates the

user-specified problem definition into specifications for the linear programming algorithm. The second module inputs the matrix entries of the initial tableau until it locates an optimal solution, if one exists. The third module writes user-oriented reports.

TIME REQUIREMENTS:

- o 1 week to prepare data for input
- o 5 minutes of CPU time to run (depending on size of specified problem)

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: As required

USERS:

- o AFHRL for development
- o HQ USAF/MP

POINT OF CONTACT: Air Force Human Resources Laboratory
Decision Models Function
Manpower and Personnel Division
Brooks AFB, Texas 78235
Telephone: AUTOVON 240-3648
Commercial 536-3648

KEYWORD LISTING: Analysis and Planning Model, Personnel Procurement Model, Officer Selection Model

TITLE: TOW - Missile Systems Simulations

PROPONENT: US Army Materiel Systems Analysis Activity (AMSAA)

DEVELOPER: USAMSAA, Aberdeen Proving Ground, MD 21005

PURPOSE: The TOW Missile Systems Simulations are computerized, analytical models that simulate the Infantry TOW and TOW-2 Missile Systems. These simulations are used primarily to compute the accuracy of the TOW Missile Systems using gunner aiming error and target motions as input.

GENERAL DESCRIPTION: The TOW simulations include the missile's 6 degree-of-freedom equations of motion, mathematical models of the guidance equations and uncertainties associated with certain parameters. The simulations are run in a Monte Carlo fashion to obtain performance estimates.

INPUT:

- o Gunner Aiming Error
- o Target Velocity

OUTPUT: User selectable including means and standard deviations of the missile's position as a function of time.

MODEL LIMITATIONS: One-on-one model

HARDWARE:

- o Type of Computer: CDC 176
- o Operating Systems: Scope
- o Minimum Storage Required: 32K OCTAL
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: AMSAA TR 293, Simulation and Analysis of the Training Effectiveness Analysis-TOW (TEA-TOW) Flight Data, Patrick E. Corcoran, April 1980, other documentation incomplete.

TIME REQUIREMENTS:

- o CPU Time per cycle, 5 seconds
- o To Analyze Output, Immediate

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Variable, Daily, Monthly

USERS: AMSAA

POINT OF CONTACT: Director
USAMSAA
Attn: DRXSY-CS/Mr. P.E. Corcoran
Aberdeen Proving Ground, MD 21005
Telephone: Commercial (301) 278-2611
AUTOVON 283-2611

KEYWORD LISTING: Analytic; Computerized; TOW; TOW-2; 6 Degree-of-Freedom

TITLE: TRACE

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: TRACE is a simulation model which addresses the capability of an air force against ground targets. The model is designed for the evaluation of the force given the limitations of airbases to support the air operations. The model can be used for interactive operation. It can be run for a finite period of days of combat operations, conducted interactively and may subsequently be run as a batch job to perform sensitivity excursions.

GENERAL DESCRIPTION: TRACE is a one-sided, expected-value model that simulates the allocation and consumption of resources from a set of airbases in a combat environment. It estimates the results of applying a given set of tactical aircraft and air-to-ground munitions against a specified array of enemy targets. The output indicates the expected number of targets destroyed, number of aircraft remaining, and the amount of munitions remaining. The model will also show the effects of weather forecasting accuracy.

INPUT: The following are the main inputs to the models:

- o Aircraft data including numbers of each type at various bases, their performance, and sortie rates
- o Airbase data including quantity and type of munitions
- o Target data
- o Allocation of sorties (close air support, interdiction, and defense suppression)
- o Attrition data
- o Weather data including forecasting accuracy

OUTPUT:

- o Aircraft of each type remaining
- o Targets of each type destroyed
- o Munitions of each type remaining at each base

MODEL LIMITATIONS:

- o 20 airbases
- o 25 munition types
- o 12 aircraft types
- o 35 target types
- o 90 days of simulated air operations

HARDWARE:

- o Computer: IBM 370/158
- o Operating Systems: OS with MVT, VS

- o Storage Requirements: 270 K bytes
- o Peripheral Equipment: Line printer, disks for 3 data sets

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:
  - R-1733-PR, An Improved Version of the Tactical Resources of Combat Effectiveness (TRACE) Model, L. Cutler, D.E. Lewis, G.F. Mills, May 1975
  - R-1734-PR, Program Listing for an Improved Version of the TRACE Model, L. Cutler, D.E. Lewis, G.F. Mills, May 1975

TIME REQUIREMENTS:

- o The acquisition of a data base can be fairly time consuming. The coding of input data in the format required by the model should not take more than 1 to 2 weeks
- o CPU time required is data dependent, typically 30-50 seconds for a 20 day run using two air bases

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: In regular use

USERS:

- o Principal: The Rand Corporation
  The Air University
  The Air Weather Service

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406

KEYWORD LISTING: Base; Damage Assessment; Logistics; Tactical Air; Weather

TITLE: TRANSMO - Transportation Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: TRANSMO is a computerized, analytical, logistics model whose purpose is to determine the arrival time of US Forces in overseas theaters of operations. The model determines deployment schedules with specified lift assets, or determines a lift system to meet the required deployment schedule through iteration of the model.

GENERAL DESCRIPTION: TRANSMO is a single-sided, deterministic model. It is designed to consider units generally aggregated to brigade and division level in multiple theater operations. Simulated time is treated on a time step basis.

INPUT:

- o Force characteristics: Troop strengths, weights, origin, destination, resupply, consumption, type cargo
- o Lift vehicle characteristics: Speed, load and unload times, capacity for each cargo type
- o General characteristics: Port restrictions, distances between ports, attrition factors

OUTPUT: Detailed and summary printouts showing deployment schedules and/or lift and force structure.

MODEL LIMITATIONS: Resolution of model inputs

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 operating system
- o Minimum Storage Required: 67K words

SOFTWARE:

- o Programming Language: ASCII FORTRAN
- o Documentation: Technical documentation and user's manual available at CAA

TIME REQUIREMENTS:

- o 1/4 month to acquire base data
- o 1/2 man-month to structure data in model input format
- o 1/4 hour CPU time per model execution on a UNIVAC 1100/82
- o 1/4 month to analyze and evaluate results

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Ms. R.H. Brown
US Army Concepts Analysis Agency (CSCA-MCM)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-5247

MISCELLANEOUS: TRANSMO provides unit arrivals to the ATLAS, CEM and FASTALS models when used in support of force planning studies.

KEYWORD LISTING: Analytical Model, Logistics; Land Forces, Computerized; Deterministic, Mobility; Strategic Deployment; Force Planning

TITLE: TREND

PROPONENT: IABG/SOP Ottobrunn, Germany

DEVELOPER: IABG/SOP Ottobrunn, Germay

PURPOSE: Analysis of theater level, non-nuclear, air/land combat to support investigation of force structure requirements and operational concepts.

GENERAL DESCRIPTION: TREND is a computerized, three-sided, deterministic, event store simulation employing game theory, network theory and statistics.

OUTPUT: Computer printout of history of each combat unit. User specified statistics and function plots.

HARDWARE:

- o Computer: CDC 6500
- o Operating System: SCOPE
- o Minimum Storage Required: 130,000 Octal words (COBIT)

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation: Available

TIME REQUIREMENTS:

- o To acquire Data Base: 6 months
- o To Structure Data in Model Input Format: 5-10 hours

SECURITY CLASSIFICATION: SECRET, RESTRICTED

USERS: IABG/SOP

POINT OF CONTACT: IABG
Abteilung SOP
Einsteinstasse
D 8012 Ottobrunn, Germany

TITLE: TRIAD

PROPONENT: AMSAA, Aberdeen Proving Ground, MD

DEVELOPER: Falcon R&D Company, Baltimore, MD

PURPOSE: Effectiveness and survivability of aircraft and air defense systems.

GENERAL DESCRIPTION: Deterministic model that plays one helicopter vs one passive target and one active AD weapon system.

INPUT:

- o Ground weapon characteristics and location
- o Helicopter characteristics (flight path, weapon systems, vulnerable area, etc.)

OUTPUT:

- o Time sequences table of firings and subsequent effects (kill, damage, etc.)
- o Probability of kill or damage as function of time
- o Number of rounds fired

MODEL LIMITATIONS:

- o Fixed flight paths
- o One helicopter
- o One AD weapon system
- o One target for helicopter weapon
- o No continuous movement of ground systems

HARDWARE: CDC 6600

SOFTWARE: Program in FORTRAN and sufficiently documented

TIME REQUIREMENTS:

- o 1 day to 1 week to prepare, dependent on availability of input data and quality of data banks
- o Less than 10 minutes play time
- o 5 minutes to 5 hours for analysis, depending on level of analysis and number of parmetric runs

SECURITY CLASSIFICATION: UNCLASSIFIED

USER: AVRADCOM, St. Louis, MO

POINT OF CONTACT: AMSAA
Aberdeen Proving Ground, MD

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TITLE: TRM - Theater Rates Model

PROPONENT: US Army Concepts Analysis Agency

DEVELOPER: US Army Concepts Analysis Agency

PURPOSE: The Theater Rates Model is a computerized model used for analysis. It simulates theater level combat over a predetermined span of time.

GENERAL DESCRIPTION: The Theater Rates Model is a two-sided deterministic model. It simulates theater level conflict on a day-by-day basis in order to determine ammunition expenditures of all Army weapons engaged in conflict. Its primary solution technique is that of a computer simulation algorithm.

INPUT:

- o Personnel casualties and armor losses from all forms of combat
- o Red and Blue force deployment schedule
- o Scenario of combat activity

OUTPUT:

- o Computer printout of day-by-day ammunition expenditures
- o Status of both Red and Blue forces in the theater

MODEL LIMITATIONS:

- o Combat activity is dictated by a scenario
- o Blue and Red deployed units are aggregated

HARDWARE:

- o Computer: UNIVAC 1100 series
- o Operating System: UNIVAC 1100 operating system
- o Minimum Storage Required: 40K Words
- o Peripheral Equipment: Data entry device and printer

SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Theater Rates Model, December 1974, USACAA.
- o Preceding publication represents complete user's and technical documentation

TIME REQUIREMENTS:

- o Approximately 2 months to acquire basic data
- o 2 weeks to structure data in model input format
- o 5 minutes CPU time per model execution on a UNIVAC 1100/82

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SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 3 times per year

USERS: US Army Concepts Analysis Agency

POINT OF CONTACT: Mr. C. E. Van Albert
US Army Concepts Analysis Agency (CSCA-RQ)
8120 Woodmont Avenue
Bethesda, MD 20814
Telephone: (202) 295-1696

KEYWORD LISTING: Analytical Model; General War (Nonnuclear); Theater Level Conflict; Two-Sided; Deterministic

TITLE: TSAR - Theater Simulation of Airbase Resources

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: TSAR simulates a system of interdependent theater airbases, supported by shipments from CONUS and by intratheater transportation, communication, and resource management systems. This simulation model captures the interdependencies among 11 classes of resources, thereby permitting the implications of a broad spectrum of possible airbase improvements to be examined in terms of their impact upon the sortie generation capabilities of a system of airbases. The simulation also allows examination of the effects of damage inflicted by enemy airbase attacks and by efforts to restore operations.

GENERAL DESCRIPTION: TSAR is a large Monte Carlo event-simulation model. It is readily adaptable to problems across a broad range of complexity. It permits one to represent either a single base, a set of independent airbases, or a set of interdependent airbases (including centralized repair facilities), without any adjustment or modification of the program. Similarly, the user may not wish to examine the effects of airbase attacks, or may wish to ignore the possible restraints imposed by shortages of aircrews, shelters, ground personnel, AGE, aircraft parts, munitions, and TRAP or fuel. TSAR adapts automatically to all such problem representations.

The 11 classes of resources treated in TSAR are the aircraft, the aircrews, the ground personnel, AGE and equipment, aircraft parts, aircraft shelters, munitions, TRAP, POL, building materials, and airbase facilities. Many different types of each class of resource may be distinguished. On-equipment maintenance tasks, parts, and equipment repair jobs, munitions assembly, and facilities repair tasks are simulated for each of the several airbases.

The effects of damage due to airbase attacks may be simulated. The TSARINA version of the AIDA (Airbase Damage Assessment) computer model generates and stores airbase damage data in the exact format required by TSAR. After an airbase attack, civil engineering personnel, equipment, and building materials may be allocated, according to a priority system, to commence the repair or reconstruction of the damaged facilities. Operation of those facilities is resumed when they once again are functional.

Manipulation of theater management rules permits the user to invoke a variety of management algorithms, not only for selecting what to repair and how to dispose of parts when they have been repaired, but for reallocating personnel, equipment, and parts among the several operating bases.

Theaterwide management of the various resources is supported by a user-specified scheduled transportation system that may be subjected to delays,

cancellations, and losses and by a theaterwide reporting system that can be used to provide the central management authority with periodic resource status reports from the several operating bases; these reports may be delayed, incomplete, or lost. When these transportation and communication systems are coupled with the sets of rules for distributing and redistributing resources among the operating bases, various concepts of theater resource management may be represented and examined in the context of realistic transportation and communication imperfections. In its current formulation, TSAR includes certain alternatives for the theater management rules and it has been designed to permit additions or modifications to be readily accommodated.

INPUT:

- Descriptions of the personnel, equipment, spares, and time needed for each type of task to be simulated
- Quantities of each type of resource available at zero time at each airbase, and schedules for subsequent deliveries
- The schedule of sorties to be demanded at each airbase
- A schedule of airbase attacks, and detailed percentage damage estimates for each attack
- Specification of intratheater transportation and communication characteristics

OUTPUT:

- Daily record of sorties flown by hour, by day, by mission, by priority, and by base
- Periodic reports of tasks waiting by shop, damaged aircraft, NORS aircraft, and lost and transferred aircraft, etc.
- Daily summary of on-equipments tasks, parts and equipment repairs, manhour expenditures, etc.
- Summary task statistics by shop, and statistics for each type of resource causing an aircraft delay

HARDWARE:

- TSAR is not machine-dependent
- It is a large model designed to operate efficiently with a relatively large core
- The bulk of the data are stored as half-word integers, and an inability to address half-words would nearly double the number of words required for data storage

SOFTWARE:

- TSAR was written in FORTRAN-IV (and is now also consistent with ANSI-FORTRAN 77). It is composed of about 120 subroutines and 35,000 source statements

- Documentation:
  - An Introduction to the TSAR Simulation Program: Model Feature and Logic, D.E. Emerson (in preparation)
  - TSAR User's Manual: Vol I: Program Features, Logic, and Interactions, D.E. Emerson (in preparation)
  - TSAR User's Manual: Vol II: Data Input, Program Operation, and Modifications, D.E. Emerson (in preparation)

TIME REQUIREMENTS:

- On an IBM 370, TSAR instructions require about 400K bytes of core and the data requires an additional 50K to 1000K bytes, depending upon problem complexity
- CPU requirements have varied between 0.02 to 0.08 CPU seconds per simulated sortie, depending upon the complexity of the representation
- A recent five-base simulation of 216 aircraft required about 10 CPU minutes for 10,000 sorties; the aircraft were represented by 300+ on-equipment tasks and 400+ parts repair procedures, and many of the parts were repaired at a central repair facility

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: TSAR is in regular use at The Rand Corporation

USERS:

- Principal: The Rand Corporation
- Installed: HQ, AF/Studies and Analysis; AFSC/ASD and AFSC/AD; AFLMC (near future)

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: D.E. Emerson

KEYWORD LISTING: Theater; Damage Assessment/Weapons Effectiveness; Sortie Generation; Monte Carlo; Event Simulation

TITLE: TSARINA - TSAR Inputs using AIDA

PROPONENT: The Rand Corporation

DEVELOPER: The Rand Corporation

PURPOSE: TSARINA is a specialized Monte Carlo computer model that has been developed to generate estimates of the losses and damage to facilities and to various categories of on-base resources for a campaign of air attacks, and to organize those results for direct entry into the TSAR (Theater Simulation of Airbase Resources) sortie generation model, where the impact of the destructive effects of attacks can be assessed. TSARINA was developed for use with TSAR for studying means of sustaining and improving wartime sortie generation capabilities, despite unexpected demands and sudden unpredictable resource shortages imposed by air attack.

GENERAL DESCRIPTION: TSARINA is a special purpose model, designed to support the TSAR simulation; however, as with the predecessor AIDA model, any complex target could be treated if TSAR were not to be used. When used with TSAR, multiple trials of a multi-base airbase attack campaign can be asessed with TSARINA and, in a continuous computer operation, the impact of those attacks on sortie generation can then be derived using the TSAR simulation model. If desired, TSARINA may be used independently from TSAR for generating damage estimation for the various targets and resources.

The on-base location of resources can be associated with various targets, and mean areas of effectiveness or kill probabilities can be defined to each of six different classes of resources. Furthermore, the effectiveness values may be different for direct hits and for near misses. With these data, TSARINA generates estimates of the losses among the various on-base resources.

INPUT:

- The user may specify the size, location, and nature of several hundred rectangular targets, and the characteristics of up to 50 weapon-delivery passes
- Targets can be categorized into as many as 20 vulnerability classes
- Up to 10 types of weapons may be employed in any given attack
- Both point-impact and CBU munitions may be tested, as well as controlled patterns of runway attack sub-munitions
- Weapon effects data are required for each weapon/target combination and for each type of resource considered

OUTPUT:

- The trial results include the numbers of direct hits and near misses on each target, the fraction of each target that is damaged, and the percent damage for each of the six classes of resources that may be associated with each target

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- o The trial results also include the estimated overall damage to each type of on-base resource
- o The repair requirements for runways and the graphical presentation thereof also are generated as in AIDA
- o Statistical results from multiple trials include the fraction of trials in which at least one hit was sustained as well as the average values for the various damage levels

HARDWARE: TSARINA is not machine-dependent

SOFTWARE:

- o Programming Language: FORTRAN IV (now consistent with ANSI FORTRAN 77)
- o Documentation: N-1460-AF, "SARINA--User's Guide to a Computer Model for Damage Assessment of Complex Airbase Targets, D.E. Emerson

TIME REQUIREMENTS: A typical analysis using 300 targets and 450 bombs consumed 80-CPU seconds on an IBM 370/3032 for 25 trials

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: TSARINA is in regular use at The Rand Corporation

USERS:

- o Principal: The Rand Corporation
- o Others: AF/SAC, USAFE/DOA, PACAF/DOA/
  Wright-Patterson, Eglin and Tyndall Air Force Bases
  Boeing, General Dynamics, BDM

POINT OF CONTACT: The Rand Corporation
1700 Main Street
Santa Monica, CA 90406
Attn: Don E. Emerson

KEYWORD LISTING: Theater; Campaign; Airbase; Damage Assessment/Weapons Effectiveness; Sortie Generation; Computerized; Resources; Logistics; Event Simulaiton

TITLE: TVEM - Tactical Vehicle Evaluation Model

PROPONENT: US Army Materiel Systems Analysis Activity

DEVELOPER: US Army Materiel Systems Analysis Activity

PURPOSE: To evaluate the capabilities of a tactical vehicle, cargo hauling fleet in an operational context. TVEM combines vehicle performance factors with scenario-related information in order to describe the performance of a vehicle fleet mix.

GENERAL DESCRIPTION: TVEM is a one-sided, event-sequenced, deterministic computer model which simulates the performance of a set of cargo delivery missions by a vehicle fleet. The fleet is organized into vehicle pools, each consisting of a specified number of vehicles operating from a given location. The vehicles in a pool must be identical in terms of essential operating characteristics and for each pool a list of supply missions is specified.

INPUT:

- Vehicle performance factors and cargo capacities
- Schedule of supply missions, to include the weight and cube of the cargo and the route to be taken
- Mission routes and vehicle travel times over the routes
- Cargo loading and unloading times

OUTPUT: TVEM outputs the simulation results by vehicle pool. The output includes, but is not limited to, measures of efficiency such as:

- Number of missions completed
- The tonnage and cube of caro delivered
- The number of assigned vehicles used
- The percentage of unused vehicle capacity
- The percentage of assigned cargo delivered

MODEL LIMITATIONS:

- TVEM does not account for vehicles being out of service due to scheduled or unscheduled maintenance
- The model does not account for the direct effects of enemy action on the vehicles
- The model does not simulate the negotiation of mission transfers. Once an additional mission is assigned to a pool as a result of a mission transfer, it cannot be returned to the pool from which it was transferred.
- The missions assigned to a pool have no associated priorities. Moreover, originally assigned missions have no priority over additionally assigned (transferred) missions or vice-versa.
- Currently, TVEM accumulates and outputs statistics by individual pool. A fleet-wide statistical summary would also be quite informative.

HARDWARE:

- Computer: Can be adapted to any large main-frame computer
- Operating System: Can run on any, with little modification
- Minimum Storage Required: 100K words
- Peripheral Equipment: Card reader, line printer, etc.
- Optional Equipment: Calcomp Plotter required if the model plotting routines are optionally activated

SOFTWARE:

- Program Language: FORTRAN IV
- Documentation: TVEM is documented in AMSAA Technical Reports TR-311 and TR-317

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Little experience in using the TVEM for studies makes it impossible to estimate the preceding three factors

TITLE: UNICORN - Conventional/Nuclear Weapon Allocator Model

PROPONENT: Office of the Assistant Secretary of Defense, Program Analysis and Evaluation (PA&E)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: UNICORN is a conventional/nuclear weapon allocator that addresses those kinds of issues revolving around the employment capabilities of a conventional/nuclear arsenal against a snapshot target array, which may consist of fixed targets or operating areas of troop units. The target array can be of arbitrary size, ranging from division or less through theater. Weapons can be any conventional or nuclear indirect fire weapons, ranging from tactical through strategic. The model optimally allocates weapons of varying characteristics against targets of various types. Each weapon and target location can be explicitly defined, and the weapon-target range considered in determining weapon impact error estimates. The model can allocate both nuclear and conventional weapons as a function of range, survivability estimates, weapon effectiveness, target acquisition capability, and various constraints. For nuclear attack, either a radiation or a blast criteria may be specified. The user has the option of specifying an upper limit for blast and radiation levels. In addition to the damage limitation consideration, the model can guarantee a least cost allocation which achieves user specified levels of firepower and mobility damage. User specified levels of target damage in a number of user-defined target categories can also be guaranteed. A weapon effectiveness drawdown can be readily determined, including optimal weapon deployment. The program also considers the effects of rate of fire limitations caused by weapons systems rates of fire, target acquisition, tactical and strategic C3, and weapon survivability estimates.

GENERAL DESCRIPTION: The model uses generalized linear programming to efficiently enumerate all of the possible assignments of weapons to targets. The method of solution is an iterative process, with a small number of possible assignments considered at each step. The best subset of assignments at each step is chosen by a linear program. The process ends when no new assignments can be made or when the potential improvement in the objective function value falls below a specified level. The objective function is a sum of values from concave nonlinear functions, each reflecting the expected damage of the particular weapon-target combination.

INPUT:

- o Scenario variables
- o Weapon variables
- o Target variables
- o Colateral radiation and blast restriction variables
- o Weapon and target hedge variables
- o Force design constraint variables
- o Optimal deployment variables

OUTPUT:

- o Summaries in terms of the weapon allocation and targets and value destroyed
- o Extensive summary of input data
- o Output options allow detailed output or highly aggregated summaries

MODEL LIMITATIONS:

- o The model is basically one-sided, and considers estimates of opponent responses rather than dynamically calculating which might happen over time
- o Expected value calculations are generally performed
- o Targets defined in the target array structure are considered to be independent
- o A flat-earth calculator is used to compute weapon to target ranges
- o Direct fire attrition to troop units is not considered

HARDWARE:

- o Computer: GE/Honeywell 645, IBM 370/145, Honeywell 6080, IBM 360
- o Operating System: MULTICS (MIT), 360 (IBM)
- o Minimum Storage Required: Honeywell-71k bytes, IBM-284K bytes
- o Peripheral Equipment: Standard scratch disk plus permanent disk

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation is available. The model is dynamic and under constant revision. Documentation is updated periodically.

TIME REQUIREMENTS:

- o 1 day or less to acquire and structure base data in mode input format
- o 10-60 seconds CPU time
- o 1 day or less to analyze and evaluate results

SECURITY CLASSIFICATION: The model is UNCLASSIFIED. Data is up to TOP SECRET.

FREQUENCY OF USE: Several hundred times per year

USERS:

- o Principal: OASD(PA&E)
- o Other: CIA, CCTC

POINT OF CONTACT: OASD(PA&E)
Strategic Programs
The Pentagon, Washington, DC 20301
Telephone: OX-59180

KEYWORD LISTING: Analytical Model; Theater War; Land Forces; Air Forces; Sea Forces; Computerized; Linear Programming; Nuclear Weapons

TITLE: UNREP - Underway Replenishment Model

PROPONENT: Chief of Naval Operations, OP-964

DEVELOPER: MATHTECH, Inc.

PURPOSE: UNREP is a computerized, analytical, logistics model used to determine the size and global distribution of the Navy's fleet of underway replenishment ships. The model's chief focus of concern is to determine cost-effective underway replenishment groups (URGs) which are able to support a naval task force at the theater level.

GENERAL DESCRIPTION: This one-sided deterministic model deals with sea forces only. UNREP was primarily designed to consider Naval Task Groups. Each task group may consist of one to ten different ship types, with one to nine ships of each type. UNREP also considers Naval Task Forces. A task force may be specified as a combination of one to ten task group types with one to nine groups of each type. Simulated time is treated on a time step basis. The primary solution technique used is network analysis.

INPUT:

- o Task force composition
- o Tempo of operations
- o Distance from resupply point and the number of on-station unrep ships

OUTPUT:

- o Computer printout listing various feasible mixes of UNREP ships which can meet calculated requirements
- o Feasible solutions are ranked according to life-cycle cost
- o There are 11 output reports available which provide the user with various levels of detailed and summary information

MODEL LIMITATIONS:

- o The model requires that an input task force be resupplied from a single base
- o The model's fixed data base currently contains capacity and consumption figures for two types of fuel and bulk ordnance
- o No data is included for other products, e.g., missiles, provisions and stores

HARDWARE:

- o Computer: Current operating on IBM 370/168
- o Operating System: VOS
- o Minimum Storage Required: 64K
- o Peripheral Equipment: Features are available for interactive use

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SOFTWARE:

- o Programming Language: FORTRAN
- o Documentation: Complete model documentation with sample input and output is available
- o Both User's documentation and technical documentation are complete

TIME REQUIREMENTS:

- o 2 man-weeks to acquire base data
- o 1 man-week to structure data in model input format
- o 5 minutes CPU time per model cycle
- o 1 hour to analyze and evaluate results

SECURITY CLASLSIFICATION: Up to CONFIDENTIAL, depending on version

FREQUENCY OF USE: Annually

USERS:

- o Principal: OPNAV
- o Other: Naval Postgraduate School
  Naval War College

POINT OF CONTACT: Chief of Naval Operations, OP-964C
Room 4A538
The Pentagon
Washington, DC 20350
Telephone: 202/697-5675

KEYWORD LISTING: Computerized; Analytical; Logistics; One-sided; Deterministic; Sea Forces; Time Step

TITLE: VALIMAR

PROPONENT: Organization of the Joint Chiefs of Staff, J-5 and Studies, Analysis, and Gaming Agency

DEVELOPER: Defense Communications Agency, Command and Control Technical Center and The Lambda Corporation

PURPOSE: VALIMAR is a computerized, analytic model designed to assess the damage effected by the offensive forces of each of two opposing sides attacking, successively, the target base of the others. In so doing, the model addresses the problem of allocation of weapons to targets.

GENERAL DESCRIPTION: VALIMAR is a highly aggregated, expected value, nuclear exchange model designed to evaluate the destructive capability of two strategic forces. This is accomplished by selecting a subgrouping of the targets as "preferred" targets, then constructing an allocation to achieve a specified fraction of damage of this subgrouping. The allocation itself uses lagrange multipliers to achieve maximum real buy (difference between target value destroyed and weapon value expended).

INPUT: Target characteristics, weapon characteristics (yield, CEP, HOB, survival expectancy, vulnerability and penetration expectancy) and attack strategies (optional).

OUTPUT: Consists primarily of computer printout, reporting on both input items and results of the scenario. Data base input can be checked in two formats, one of which permits an easy comparison of different data bases. A target destruction summary is produced as well as target-by-target breakdowns and a brief allocation summary. Customized reports may be generated, from input and results, according to user-designed formats.

MODEL LIMITATIONS:

- o A maximum of 63 weapons and 255 target classes
- o Individual target and weapon units are not identified (they are aggregated)
- o Time, geography, and physical movement are not simulated

HARDWARE:

- o Computer: HIS 6000
- o Operating System: GCOS
- o Minimum Storage Required: 70K
- o Peripheral Equipment: 540 links of disc storage

SOFTWARE:

- o Programming Language: FORTRAN and GMAP
- o Documentation: User's manual, TM94-75, available from Commander, CCTC, C313, The Pentagon, Washington, DC

TIML REQUIREMENTS:

- o Prepare Data Base: 5 hours
- o CPU Time: 15 minutes
- o Analyze Output: 10 hours

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 100 times per year

USERS: Organization of the Joint Chiefs of Staff, J-5, and Studies, Analysis, and Gaming Agency

POINT OF CONTACT: Command and Control Technical Center
C313
The Pentagon
Washington, DC 20301
Telephone: (202) 695-0258

MISCELLANEOUS: Portions of VALIMAR's data base consist of data which is related to vulnerability of targets. These numbers can be calculated by the integrated response parameter system (IRS). The model is under examination for new allocation methodologies.

KEYWORD LISTING: Aggregated; Lagrange; Allocator; Damage Assessment; Analytical Model; General War; Land Forces; Air Forces; Sea Forces; Computerized; Two-sided; Deterministic

TITLE: VECTOR-2 - A Theater Battle Model

PROPONENT: Command and Control Technical Center, Defense Communications Agency (CCTC/DCA)

DEVELOPER: Vector Research, Incorporated

PURPOSE: VECTOR-2 is a computerized, analytical, midintensity, nonnuclear warfare model developed for use in estimating net assessments, performing force deployment studies and generating information for performing trade-offs among weapon systems. The outcome of force interactions is determined in terms of FEBA movement and the attritions of personnel and individual weapon systems.

GENERAL DESCRIPTION: The VECTOR-2 model is a two-sided deterministic simulation of integrated land and air combat. The level of aggregation is the maneuver battalion or its equivalent. It is a theater-level model, but may be applied without modification to corps-level model or corps-level engagements. Employing small time steps, modified differential equations of combat are used to compute dynamically the outcome of attacks involving maneuver battalions. Other model activities are performed using larger time steps, e.g., 1 day. Tactical decision rules supplied by the user provide for flexibility in controlling model decision processes. A variable number of maneuver battalions or the equivalent may be played for each side. Each side may employ maneuver unit weapon systems and weapons types of tactical aircraft, as well as artillery, mines, helicopters, air defense artillery systems, and aircraft shelters. The VECTOR-2 system of programs includes a program known as the Program Change Monitor, which assists the user in altering the dimensionality of variables used in the structuring of his problem constraints (i.e. eleven maneuver unit weapon types and eight aircraft types).

INPUT:

- o Initial forces and supply inventories, and a schedule of weapon, personnel, and supply arrivals in the theaters
- o Basic weapons performance data (not aggregated into a form such as firepower scores)
- o Geographic and terrain data
- o Tactical decision rules

OUTPUT: Daily and cumulative casualties and weapon system losses, by type, are provided, and supply consumption data are given by type of supply. Current inventories of weapons, personnel and supplies are also listed. All of these data are given for individual battalions (if applicable), and are also presented as sector (corps) and theater totals. Reserve forces are explicitly accounted for. Numbers of sorties flown on each mission are given for each aircraft type. The daily activity of each battalion is shown, along with its daily FEBA position. Attributions of casualties and weapon system losses to the enemy system type which inflicted the attrition are presented.

HARDWARE: The model has been successfully exercised on AMDAHL and Honeywell 6000 computers. The minimum storage requirement is approximately 120K. Peripheral equipment requirements include disk pack and tape drives

SOFTWARE:

- o Programming Language: ANSI FORTRAN
- o Documentation:
  - Command and Control Technical Center (DCA), VECTOR-2 System for Simulation of Theater-Level Combat
  - Computer Systems Manual CM 244-78
  - Technical Memorandum TM 201-79

TIME REQUIREMENTS: Six man-months are required to acquire base data and structure it in model input format. This time can be reduced considerably for other than the initial utilization of the model, since few changes to much of the data (e.g., basic weapon system performance data) would be expected for subsequent studies. Also, data preprocessors are available which provides an interface with automated data files described in computer system manuals allowing model users with access to this file to reduce substantially the required data preparation time. For typical games, the model requires approximately 11 seconds CPU time per combat day. The time required to analyze and evaluate results is dependent upon the range and depth of the analysis; however, the level of detail available in the output facilitates efficient analysis and evaluation.

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: US Army Concepts Analysis Agency, Institute for Defense Analyses, TRASANA, SHAPE Technical Center

POINT OF CONTACT: Command and Control Technical Center
C315
The Pentagon
Washington, DC 20301
Telephone: OX 52521

KEY WORDING: Analytical Model; General War; Land Forces; Air Forces; Computerized; Two-sided; Deterministic; Time Step

TITLE: VIBAS II - Village Battle Simulation

PROPONENT: MA Department, RARDE, Sevenoaks, Kent

DEVELOPER: Operational Research Branch
Royal Military College of Science
Shrivenham, Swindon SN6, 8LA, UK

PURPOSE: VIBAS II was designed for use in support of the RARDE Divisional and Battlegroup Wargames to assess combat in villages

GENERAL DESCRIPTION: VIBAS II is a highly aggregated computer simulation of a battle in which an infantry platoon with an option to add engineer and tank support are defending a village against an attack by a Motor Rifle Company. The model represents only the battle within the village, the preliminary exchanges in the engagement being modelled in the wargames which VIBAS is designed to support. The village is represented in schematic form as a series of 100m x 100m squares, and the battle is fought through the village square by square. It is also possible to represent attacks on several fronts, and for the user to interact with the computer to select the route (or routes) of the attacking forces as the battle progresses. Within each square VIBAS assesses all the interactions which occur as the attackers encounter defensive devices and the defending forces. The assessment procedure is highly aggregated and based on sampling from a number of simplified probability distributions.

INPUT:

- Main terrain characteristics (village shape, woods buildings and rivers)
- Force strengths and equipments
- Force tactics and deployments

OUTPUT: Square by square computer printout of current force levels, elapsed time and details of force casualties and movement. There is an option which gives in addition a graphical representation of these data.

MODEL LIMITATIONS: VIBAS II was designed as a model to support the RARDE wargames, and as such is capable of representing only conventional warfare in a limited number of village scenarios to produce aggregated data on casualties and time delays.

HARDWARE:

- Computer: Hewlett-Packard 9835A
- Minimum storage required: 150K bytes
- Peripheral equipment: disk drive, printer and graph plotter (optional)

SOFTWARE: Programming language: HP extended BASIC

TIME REQUIREMENTS:

- 4 man-hours to extract data and create a data file for a new village
- ½ man-hour to enter remaining data
- Run time: 30 seconds to 30 minutes per battle. The longer times are for those battles when the user selects the attack route, graph plotter output is selected and it is a long battle.

SECURITY CLASSIFICATION: RESTRICTED

POINT OF CONTACT: Head of OR Branch
RMCS
Shrivenham
SWINDON SN6 8LA, UK
Telephone: 0793-782551 Ext 409

MISCELLANEOUS: Work is currently in progress to develop models capable of being used independently of wargames with the ability to represent all types of urban terrain.

TITLE: VLM - Vehicle Loading Model

PROPONENT: HQ USAF/SAGM

DEVELOPER: Douglas Aircraft Company, 3855 Lakewood Boulevard Long Beach, CA 90846

PURPOSE: The VLM was developed to provide the means to quickly analyze the interactions of unique aircraft loading characteristics with diverse movement conditions, fleet mixes, load strategices, and movement requirements.

GENERAL DESCRIPTION: The VLM is a computerized model for loading military units consisting of men, vehicles, and non-mobile equipment on airlift aircraft. VLM is a deterministic, discrete event orientation model. The VLM user has the capability of controlling the loading process to any level of detail desired via multi-dimensional loading rules which identify vehicles by their generic dimensional characteristics. The model may be used to determine the requirements for new aircraft designs. The primary solution technique, using user input criteria, classifies or partitions the vehicles in a military unit into pre-determined categories. These groups are then arranged in a list which specifies the sequence that vehicles will be tested for loading (an attempt is made to load any possible way a vehicle belonging to the first group before attempting to load a vehicle in a second group). Additional parameters, options, and priorities can further refine the loading process.

INPUTS:

- The data requirements are a vehicle characteristics data base and a hierarchically structured Table of Equipment data base for all vehicles and units loaded.
- Airlift fleet composition must also be identified and loading rules must be defined.

OUTPUTS: There are three basic output reports which fit an 8 1/2 x 11 inch format, a force generation report, a fleet definition report, and a load generation report. Force generation reports show statistically the percent of each class of vehicles loaded. The fleet definition output report shows the number of aircraft loads required to move the force described. The load generation report provides a summary of all loading parameters. Embellishments on the basic reports are easily obtainable.

MODEL LIMITATIONS: The model is currently limited to loading ten different aircraft types and up to thirty separate military units.

HARDWARE:

- o Type Computer: IBM 360/370
- o Operating System: OS 360/370 or its equivalent
- o Minimum Storage Requirements: <50K
- o Peripheral Equipment: None

SOFTWARE:

- o Programming Language: FORTRAN IV
- o Documentation:
  - Vehicle Loading Model (VLM) User's Guide, (Dec 76) MDC-J-7427
  - Vehicle Loading Model (VLM) Programmer's Guide

TIME REQUIREMENTS:

- o 1-2 days to prepare data base
- o Approximately 15 CPU to load a mechanized division on a 3-6 aircraft fleet with a full sortie print
- o Variable data output analysis

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Not in current use

USER: AF/SAGM

POINT OF CONTACT: HQ USAF/SAGM
The Pentagon
Washington, D.C. 20330
Telephone: (202) 694-8155
AUTOVON 224-8155

MISCELLANEOUS: This model has been superseded by the Airlift Loading Model (ALM) currently in use by HQ USAF/SAGM and OSD/PA&L.

TITLE: VOCAB

PROPONENT: Aeronautical Systems Division, Air Force Systems Command

DEVELOPER: Aeronautical Systems Division, Air Force Systems Command

PURPOSE: Model is designed to compute vulnerability to external blast from nonnuclear threats of conceptual aircraft.

GENERAL DESCRIPTION: VOCAB is a program for assessing the vulnerabilities of conceptual aircraft to nonnuclear external blast waves from SAM or AAM threats. For each aircraft/missile warhead orientation the program calculates responses for decreasing detonation distances until the kill probability equals 1.0.

INPUT:

- o aircraft structural properties
- o threats to be analyzed
- o encounter conditions

OUTPUT: Outputs are lethal radii for sure kill for various aircraft - threat orientations

HARDWARE:

- o Computer: CDSC CBYER 74 & 750
- o Operating System: 95K8

SOFTWARE: Programming Language: FORTRAN IV

TIME REQUIREMENTS:

- o 1-2 weeks to model and debug
- o 1-2 days to run 10 threats, 3 altitudes, 15 orientations

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: 30 times a year

USERS: Pratt & Whitney, BRL, ASD

POINT OF CONTACT: Mr. Roy Hilbrand (ASD/ADDP) AV 785-5897
Mr. Gerald Bernett (ASD/XRM) AV 785-6395
Wright-Patterson AFB, OH 45433

MISCELLANEOUS: Model is now being upgraded

KEYWORD LISTING: Blast vulnerability; vulnerability; conceptual aircraft analysis

TITLE: VONSIM-AUTOVON Simulation

PROPONENT: Defense Nuclear Agency (DNA)

DEVELOPER: The BDM Corporation

PURPOSE: This model was developed to assess AUTOVON system performance as it relates to the support of critical command and control communications during periods of both benign and stressed operating environments. Transient/permanent component upset and functional impairment of network assets due to the EMP illumination are addressed in detailed.

GENERAL DESCRIPTION: The AUTOVON system simulation is a dynamic, event stepped digital computer model employing both deterministic and stochastic solution techniques. All message traffic is discretely modeled on a call-by-call basis. C2 call interdependencies are permitted including message aggregation, alternate destinations and dependency chains. Network switching centers are modeled at a functional level whereby calls are processed through distinct operational classes where each class typically requires a unique type of switch resource. All logical processes performed by the switches are represented in detail which accommodates variations in hardware/software/procedures among the switches. Temporal/spacial variations in EMP illuminations are translated into functional impairments, including call dropping and misrouting, switch and link outages, increased processing time and erroneous induced service requests.

INPUT:

- o Network configuration (number and type of switches, interconnectivity, multi-homed subscribers of interest)
- o Representative traffic sample of day-to-day operations
- o Attack scenario (time and location of bursts)
- o Casual message scenario (C2 traffic)
- o Control parameters

OUTPUT: A file of all events processed by the simulation is generated to provide for complete flexibility in game outcome recapitulation and analysis.

- o The main game itself provides aggregate statistics of performance for the C2 and routine traffic classs such as blocking probabilities and speed of service.
- o A summary of the processing of each distinct C2 call is available
- o The set of C2 calls can be sorted into various subclasses dependent on user needs
- o Specific point-to-point performance statistics can be generated

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MODEL LIMITATIONS:

- o Addresses only EMP caused impairments, although other types can be treated parametrically
- o Routing procedures are limited to those currently employed by AUTOVON. (All routing logic is contained in a replaceable submodel.)

HARDWARE:

- o Computer: CDC 6000-/000 systems
- o Operating System: SCOPE
- o Storage Required: 120-150K Octal
- o Peripheral Equipment: Disk storage for five files and one tape drive

SOFTWARE: Programming language is CSC FORTRAN IV extended

TIME REQUIREMENTS:

- o Data Base: The network configuration is provided by AT&T on magnetic tape from which the VONSIM data base is generated in one 3 minute computer run. No experience is available for other networks.
- o Burst and message scenarios can require from 1 to 8 man-weeks of effort depending on size, complexity and starting point
- o The model executes at 2-2 1/2 times real time for busy hour traffic loads
- o Run preparation including input of control parameters requires 1/2 to 1 hour
- o Rigorous run analysis is typically done in less than a day

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: On a continuing basis in support of DNA ongoing EMP testing and anlysis.

USERS: The BDM Corporation for DNA

POINT OF CONTACT: Mr. J. P. Riceman
Mr. R. H. Schmidt
The BDM Corporation
1920 Aline Avenue
Vienna, VA 22180
Telephone: /03/893-0750

KEYWORDS: Digital Computer Simulation; Electromagnetic Pulse; Communications Analysis, Network Analysis, AUTOVON

TITLE: V2S1 - Two-variable, Single-station Weather Simulation Model

PROPONENT: United States Air Force Environmental Technical Applications Center (USAFETAC)

DEVELOPER: USAFETAC

PURPOSE: The V2S1 model generates a synthetic time series of two weather variables such as ceiling and visibility at a single location. V2S1 is a computerized submodel designed to generate synthetic weather observations for input to combat doctrine, strategy and tactics development simulations, force mix studies, war game and other user applications.

GENERAL DESCRIPTION: Two Ornstein-Ulenbeck stochastic processes--one in the first variable and other in the second--are linked through the cross correlation between variables, forming a three-equation model. The model preserves the marginal probability distributions of the two variables, as well as the serial (time) correlation of each variable and the cross correlation between the variables. In typical design, the V2S1 model would be incorporated as a subroutine or procedure within the user's larger model, producing a single synthetic weather observation in two variables each time the user calls the weather model. The user specifies the time of day, so the diurnal varibility of the weather can be taken into account. The V2S1 model is best categorized as a continuous stochastic process model.

INPUT:

- o Climatology, especially processed to estimate the parameters of the model
- o Past value of variable 1 at some earlier date/time
- o Past value of variable 2 at that earlier date/time
- o Earlier date/time
- o Current date/time

OUTPUT:

- o Value of weather variable 1 for current date/time requested
- o Value of weather variable 2 for current date/time requested

MODEL LIMITATIONS:

- o Model is difficult to extend to more than two variables; impssible to extend to more than one location.
- o The Ornstein-Ulenbeck process is first-order Markov, but this is not too restrictive for weather.
- o The two variables, one individually transformed to the normal probability distribution, are assumed jointly distributed according to the bivariate normal distribution; for ceiling and visibilty, tests have shown this is a good assumption.

- Mathematics of the model produces an upper limit on the cross correlation that can be modeled; this is not usually a problem for weather variables.

HARDWARE:

- Type Computer: IBM 360, 370, 4341; DECSystem 10; PDP 11/45; easily adaptable to others
- Operating Systems: IBM VM/370 DOS; TENEX; RSX-11M
- Minimum Storage Required: 5 K words
- Peripheral Equipment: None

SOFTWARE:

- Programming Language: FORTRAN IV less all vendor-unique features
- Documentation: USAFETAC Technical Note, to be published 1981

TIME REQUIREMENTS:

- Assuming no additional techniques development is needed (such as changing from ceiling and visibility to other variables), and assuming suitable climatological data are available, preparation of the data base, fitting the model and testing it against independent climatological data requires 1-2 months for a one-station effort. This is generally done by USAFETAC.
- 0.1 milliseconds CPU time on a DECSystem 10 computer are required to generate each synthetic two-variable weather observation.
- Output weather is not analyzed in its own right, but rather is played directly into the user's simulation or game; so no time is required for analysis of output.

SECURITY CLASSIFICATION: UNCLASSIFIED

DISPOSITION: As required by the end user, in that the weather model is executed every time the user's model or simulation is run.

USERS: USAFETAC, HQ Military Airlift Command

POINT OF CONTACT: Maj Roger C. Whiton
USAFETAC/DNS
Scott AFB, IL 62225
Telephone: AUTOVON 638-5412
Commerical (618) 256-5412

MISCELLANEOUS: A single-variable, single-station version of this model, called V1S1, exists but is so similar that it is not described separately in this catalog. USAFETAC will adapt this model to meet the user's specific needs, making such changes in the FORTRAN code as are necessary to satisfy user's specific requirements regarding variables and locations to be simulated, inputs/outputs/interfaces desired, computer environment restrictions to be met.

KEYWORD LISTING: Bivariate normal; climatology; computerized; continuous; cross correlation, environmental simulation; meteorology; normal distribution; Ornstein-Uhlenbeck process; serial correlation; stochastic process; weather; weather observation

TITLE: WAAM (WWMCCS Allocation and Assessment Model)

PROPONENT: HQ DCA/WSE (SD&A/Code 930)

DEVELOPER: TRW, 7600 Colshire Drive, McLean, Virginia.

PURPOSE: WAAM is a computer assisted model designed to extend the analyst's ability to evaluate strategic C3 systems in a general nuclear war. The model also provides a methodology for designing a RISOP-like laydown and evaluating the damage to C3 systems for the specified attack.

GENERAL DESCRIPTION: WAAM is an event-stepped stochastic simulation that uses network analysis and mathematical programming solution techniques to evaluate strategic C3 systems in a general nuclear war environment.

INPUT:

(1) Command Center

- procedures
- capabilities
- communications
- vulnerability

(2) Communication Systems

- delays
- CER vs S/N response
- TX/RX antenna gains
- connectivity

OUTPUT:

- o Detailed event histories
- o Color graphics of scenarios
- o Probability of message receipt as function of time
- o Path routing plots

MODEL LIMITATIONS:

- o Designed for architectual analyses and not detailed link calculations.

HARDWARE:

- o Type of Computer: IBM 4341
- o Operating System: CMS
- o Minimum Storage Required: 600K
- o Peripheral Equipment: Tektronix graphics terminal

SOFTWARE:

- o Programming Language: FORTRAN and IBM 370 Assembly
- o Documentation:
  (1) WAAM Overview and User's Guide, 30 Sep 81, DCA
  (2) WAAM Subroutine Documentation, 30 Sep 81, DCA

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TIME REQUIREMENTS:

- To acquire Data Base: 2 man-years
- To Structure Data in Model Input Format: 1 man-month
- To Analyze Output: 2 man-weeks
- Player Learning Time: 1 man-year of relevant experience
- Playing Time per Cycle: 3 hours
- CPU Time per Cycle: 2 minutes

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: 2 times per month

USERS:

- DCA, OJCS/SAGA

POINT OF CONTACT: Dr. Y. S. Fu
Hq Defense Communications Agency
WSE (SD&A/Code 930)
Washington, DC 20305
Telephone: (202) 692-2487

KEYWORD LISTING: Strategic C3; System Analyses; Nuclear War; Missiles; Damage-assessment; Computerized; Two-way Communications

TITLE: Warsaw Pact Ammunition Resupply Model

PROPONENT: U.S. Army Combined Arms Studies and Analysis Activity

DEVELOPER: U.S. Army Combined Arms Studies and Analysis Activity

PURPOSE: The Warsaw Pact Ammunition Resupply Model is designed to simulate those activities associated with ammunition resupply to a combined arms army or Front. It portrays threat capabilities in such a manner that resupply activities are allowed to impact on war gaming efforts, and it provides an analytical tool with which to evaluate the Warsaw Pact ability to support its desired pace of battle.

GENERAL DESCRIPTION: The Warsaw Pact Ammunition Resupply Model is a computerized primarily deterministic model that processes ammunition expenditure data output from a force-on-force war game and allows for the evaluation of the degree to which those expenditures might have been constrained because of the logistic system. Considered in the model are all ammunition planning and handling activities from Front to individual battery or company, as well as the transportation assets assigned to each echelon. Interactive command decisions and tactical realism may be incorporated during model runs. Interdiction and equipment operational availability are also considered.

INPUT:

- Location, ammunition stocks, transportation assets, and queuing characteristics for ammunition supply points at each echelon within a Warsaw Pact Front.
- Location and weapon/ammunition types and amounts for all artillery batteries and ground maneuver units within a Warsaw Pact division.
- Capacity, speed, failure and repair rates, for Warsaw Pact ammunition resupply vehicles gamed.
- Ammunition expenditure, trucks interdicted, and surviving firing weapons from a force-on-force war game.

OUTPUT:

- Ammunition status for all supply points, batteries, and ground maneuver units gamed.
- Simulated historical performance data on capabilities and effectiveness of the Warsaw Pact Ammunition Resupply System for the scenario gamed.

MODEL LIMITATIONS:

- Small arms ammunition is not considered.
- Model is currently limited to one division.
- A maximum of 75 units, 25 ammunition types, and 7 weapon types per battery may be played.
- Only one type of ammunition resupply vehicle is considered.

HARDWARE:

- Computer: VAX 11/780
- Minimum storage required: 150K bytes virtual memory
- Peripheral equipment: interactive terminal, disk storage, and printer

SOFTWARE:

- Programming language: VAX/VMS FORTRAN

STAFF:

- 1 user/analyst

TIME REQUIREMENTS:

- One-half man month to acquire, structure, and input base data in model format.
- Up to one minute of computer time for each four hours gamed time.

SECURITY CLASSIFICATION: The model itself is UNCLASSIFIED; however, in most cases the data used is SECRET.

FREQUENCY OF USE: Continuously

USERS: U.S. Army Combined Arms Studies and Analysis Activity

POINT OF CONTACT:

MAJ Henry W. Wier or Mr. Clyde E. Harris, II
U.S. Army Combined Arms Studies and Analysis Activity
ATZL-CAS-FS
Fort Leavenworth, KS 66027
AV 552-2955

MISCELLANEOUS: The model can also be run in a stand-alone mode when provided with ammunition expenditure data from any source. It is subject to frequent review to upgrade and enhance its current capabilities.

TITLE: WASGRAM - War-at-Sea Graphical Analysis Model

PROPONENT: Chief of Naval Operations, OP-96

DEVELOPER: Planning Analysis Group, Johns Hopkins Applied Physics Laboratory and Strategic Analysis Support Group

PURPOSE: WASGRAM is an interactive, computer-assisted graphics model used for both analysis and training. It is designed to simulate carrier task group operations in a multi-threat environment.

GENERAL DESCRIPTION: WASGRAM is an interative, time-step dynamic simulation. The model considers friendly carriers, surface ships, submarines, VP aircraft, VS aircraft, AEW aircraft, helicopters, interceptors, attack aircraft and enemy surface ships, submarines, and air raids on an individual basis with a maximum of approximaely 1,000 units interacting together. Simulated time is treated on a selectable time-step basis. The ratio of game time to approximately 1:5 if the maximum number of units is used. The primary solution technique is kinematic with probabilistic assessment of interactions between RED and BLUE forces.

INPUT:

- o Unit positions
- o Detection ranges and probabilities
- o Enemy air, surface, and subsurface tracks
- o Weapon types and characteristics
- o Various probabilistic assessment factors
- o Communications and radar jamming factors

OUTPUT:

- o Event-by-event chronology
- o Engagement summary
- o Damage assessment

MODEL LIMITATIONS:

- o 1,000 units
- o Because the game is interactive, the time to complete a single replication will depend directly on the number of units and the games scenario

HARDWARE:

- o Computer: IBM 360/91, 370/158
- o Operating System: Time sharing option

SOFTWARE:

- o Programming Language: PL/1
- o Documentation: "An Introduction to the War-at-Sea Graphical Analysis Model (WASGRAM), APL/JHU/PAG No. 62-75, CNO/OP-96-CM-3300, October 1975 (Version II to be published late 1977)

TIME REQUIREMENTS:

- o 4 man-days to prepare input
- o 2 hours per 15 game hours playing time
- o Approximately 30 seconds CPU time per model cycle
- o 16 hours training time for players
- o 4 hours to analyze and evaluate results

SECURITY CLASSIFICATION: SECRET

FREQUENCY OF USE: Used extensively by OP-604 for CVTG Gaming to support SIOP/RISOP Studies (Analysis)

USERS:

- o Principal: OP-604 (Analysis)
  US Naval Academy (Training)

POINT OF CONTACT: Mr. Thomas P. Modelski
Mr. Jen-yih Wang
Planning Analysis Group
Johns Hopkins Applied Physics Laboratory
Laurel, Maryland 20810
Telephone: 953-7100

KEYWORD LISTING: Analytical; Training; General War; Limited War; Air Forces; Sea Forces; Computer Assisted; Deterministic; Time Step; Graphics; War-at-Sea

TITLE: Exercise "Water Buffalo"

PROPONENT: Central Studies Establishment

DEVELOPER: As above

PURPOSE: Exercise "Water Buffalo" is a tactical war-game designed to illustrate the type of problems encountered by a Divisional Headquarters with a division plus an Armoured brigade in combat. These problems are as follows:

The functioning of the HQs and the allocation of tasks to all personnel on the HQ.

The deployment of forces to meet an invasion threat.

The preparation of Operation Orders.

Planning activities concurrently with controlling operations.

Logistic Support.

GENERAL DESCRIPTION: Exercise Water Buffalo is a closed tactical two-sided war-game at Divisional level designed to exercise a Divisional Headquarters staff in the production of an Operational and an Administration Plan for all the phases of war. The game also provides a training facility for Divisional Commanders and their staff in the execution of operational plans. The game may be played employing the major elements of a Divisional Headquarters or with Operational Orders provided employing small player groups of five to seven. The enemy teams will be in the order of five to eight players for both the above types of play. The enemy will commence the game with a prepared set of plans but will have freedom of action during game play. The relationship between game play time and real time varies throughout play with 7 days of actual war being played in three days.

INPUT:

- Operational Orders

OUTPUT:

- A measure of the level of training of a Divisional HQ together with the experience gained by the execution of Operation Orders at Division level

MODEL LIMITATIONS:

- Resolution not below Battalion level

HARDWARE:

- Handbook

SOFTWARE:

- Manual war-game

STAFF:

- Control team five officers and four NCOs
- Player teams
  Blue 100 all ranks
  Red 12 all ranks

TIME REQUIREMENTS:

Preparation:	Between one and two days, depending on the level of experience
Play	Two to three days
Analysis	Two to three days

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Twice a year

USERS: Field Force Command, 1 Division, 2 Division

MISCELLANEOUS: Work has commenced on the development of a Communication Zone. Corps HQ and Main Support area series of war-games to support Water Buffalo.

TITLE: WEBS - Weapons Effectiveness Battle Simulations

PROPONENT: MA4 Branch, RARDE, Sevenoaks, England

DEVELOPER: MA4 Branch in conjunction with SCICON Consultancy International Ltd, Computer Contractors

PURPOSE: The simulation is designed to assess DF Weapons Effectiveness Comparison problems using a Blue Battle Group/Red Regiment scale of battle. The simulation is wholly computerised.

GENERAL DESCRIPTION: WEBS is an event sequenced DF battle simulation. Resolution is to individual tanks or GW teams, 1 metre of distance and 1 second of time. Up to 80 Blue units and 120 Red units. Terrain is stochastic, using statistics gathered from runs of BGWG(qv) or other sources. Most effects are stochastic (weapon effects, time to detect) but some are deterministic (vehicle speeds, time of flight of a round). WEBS has both a simple Minefield Model and a simple Artillery Model. A variance reduction techique (Controlled Random Numbers) is employed.

INPUT:

- Weapons Characteristics (response time, SSKP vs Range, etc.)
- Times to detect by range
- Tactics
- Terrain statistical data
- ORBAT
- Scenario

OUTPUT:

- Assessment of each event
- Table of shots fired and kills achieved by range vs time for each replication
- As above averaged across replication
- Positions of units and other status at regular times through each replication

MODEL LIMITATIONS: Restricted ability to update tactics within a run. No representation of Infantry, Barriers or Fighter Ground Attack

HARDWARE: Mainframe Computer: MA4 uses RARDE's ICL 1906A - or VAX 11/780

SOFTWARE: WEBS is written in NSI FORTRAN. Present size is 140K words on the ICL 1906A and 500 Kybtes on the VAX 11/780.

STAFF:

- 1 SCICON programmer for development and debugging
- + analysts as required for studies
- + military advisers as required

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Continuously

USERS: MA4 Branch, RARDE, Sevenoaks, England

TITLE: Weapon Radius of Effects (WEPROE)

PROPONENT: Defense Nuclear Agency (NATD)

DEVELOPER: Science Applications, Inc. (SAI)

PURPOSE: WEPROE is an analytical, damage assessment/weapons effectiveness model. It assesses the damage to both fixed and mobile targets from nuclear weapons using the methodology contained in FM 101-31-1/2 and the physical vulnerability system. WEPROE was primarily designed when given a weapon and its DGZ, calculate the probability of damage to mobile targets using the methodology contained in FM 101-31-1/2.

GENERAL DESCRIPTION: None.

INPUT:

- o Weapon system, yield, DGZ along with target type and location are required
- o Weapons and targets specified in FM 101-31-2 can be specified

OUTPUT:

- o Computer printout giving the radius of damage (RD), damage, LSD, MSD and CDD
- o Plot of RD, LSD, MSD, and CDD for overlay on 1:50,000 maps

MODEL LIMITATIONS:

- o Does not currently read a strike file or target data base

HARDWARE:

- o Computer: Major Mainframe
- o Operating System: Any
- o Minimum Storage Required: 51K batch, 61 K interctive

SOFTWARE:

- o Programming Language: FORTRAN V
- o Documentation: User's guides for both versions
- o Programmer's manual not completed
- o Maintenance manual being written

CLASSIFICATION: CONFIDENTIAL FRD

FREQUENCY OF USE: Daily

USERS:

- o USEUCOM
- o USAFE
- o SHAPE
- o CCTC

POINT OF CONTACT: Defense Nuclear Agency
ATTN: NATD
Washington, DC 20305

KEYWORD LISTING: Analytical; Damage Assessment/Weapons Effectiveness

TITLE: WIM - World Integrated Model

PROPONENT: Defense Communications Agency, Command and Control Technical Center

DEVELOPER: SACI

GENERAL DESCRIPTION: The World Integrated Model is a computer model of the world system, developed to facilitate exploration of solutions to major global problems and crises, rather than only indicating the possibility for their occurrence. At the same time, the model is designed to recognize explicity, diversity and disparities in the global system which go hand in hand with increased interdependence (such as the gap in development between north and south, the gap between resource rich and resource poor countries, the gap between countries with exploding populations and countries with population decline, etc.).

INPUT:

- o Mortality, fertility rates
- o Trade options
- o Population (control) options

OUTPUT: Computer output organized by year from 1975 to 2025, the output consists of values of variables requested (for viewing) in a 12-column per page format.

MODEL LIMITATIONS:

- o 50 years
- o 14 regions for entire world

HARDWARE:

- o Computer: H6000
- o Operating System: GCOS
- o Minimum Storage Required: 6,000 LL
- o Peripheral Equipment: Disk pack

SOFTWARE:

- o Programming Language: FORTRAN, GMAP
- o Documentation:
  - WIM Applications Guide, 31 March 1981
  - PSALM Applications Guide (Draft)

TIME REQUIREMENTS:

- o Update requires 2-3 staff-years
- o To structure data in model input format, minutes
- o To analyze ouput varies greatly

- o Player learning time, one week
- o Playing time per cycle, 5 minutes
- o CPU time per cycle, 3 minutes

SECURITY CLASSIFICATION: UNCLASSIFIED

FREQUENCY OF USE: Once a month

USERS: J-5

POINT OF CONTACT: Defense Communications Agency
Command and Control Technical Control (C313)
The Pentagon, Washington, DC 20301
Telephone: AUTOVON: 227-4421
Commercial: (202) 697-4421

KEYWORD LISTING: Forecast; trend; futures, computerized, simulation; dynamic; stratified; regionalized

TITLE: Worldwide UTM to Lat/Lon Coordinate Conversions

PROPONENT: AFEWC

DEVELOPER: AFEWC

PURPOSE: To convert Universal Trans Mercader (UTM) coordinates to latitude/longitude coordinates

GENERAL DESCRIPTION: Since UTM coordinates vary according to the spherical location, it was necessary to advise tables that are zone number and zone letter corrected for spherical; i.e., the UTM method is based on distance from the equator and has artificial distances inserted for spherical line crossings. This program uses the tables for correct meters from the equator and then converts the distances to latitude/longitude.

INPUT: Complete UTM numbers (up to 15 max)

OUTPUT: A CRT screen of answers in lat/lon

MODEL LIMITATIONS: Since most Army units use only the last portion of the UTM, the zone letter and number must be prefixed to identify area of the world.

HARDWARE:

Computer: UNIVAC 494

Operating System: Real Time TPS-65

Peripheral Equipment: UNISCOPE 300

SOFTWARE: See TPS-65

TIME REQUIREMENTS: Minutes from start to finish

SECURITY CLASSIFICATION: UNCLASSIFIED

USERS: AFEWC/EWI

POINT OF CONTACT: AFEWC/SAA
Mr. Dave Crawford
San Antonio, TX 78243
Telephone: 512/925-2938/AUTOVON: 945-2938

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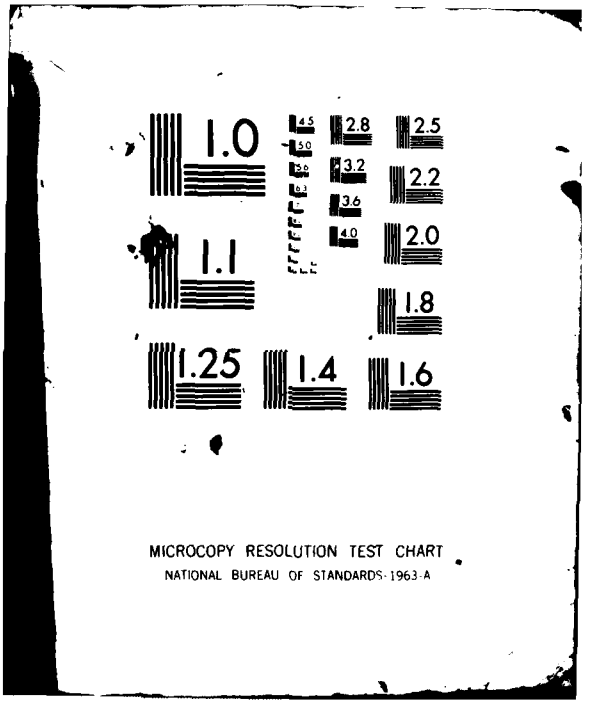
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DEVELOPER: (Organization/Corporation which developed current version of the model)

PURPOSE: (Analysis/Training) (Manual/computerized/computer assisted) (general or limited war/politico-military/logistics/damage assessment)

(This section should contain a brief narrative covering the above, the role the model plays and the primary and secondary problem the model addresses.)

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(This section is a brief narrative covering the above, level of unit/ personnel/ equipment/target aggregation, level of exercise, ratio of game time to real time and primary solution techniques.)

INPUT: (For example, scenario, weapons characteristics, troop unit size, arrival dates)

OUTPUT: (Computer printout, plots, raw data, statistically analyzed data)

MODEL LIMITATIONS: (e.g., number of targets, no geography)

HARDWARE:

- o Type Computer:
- o Operating System:
- o Minimum Storage Required:
- o Peripheral Equipment:

SOFTWARE:

- o Programming Language:
- o Documentation Identification:
- o Documentation Availability: (Include DDC accession numbers if assigned)

TIME REQUIREMENTS:

- o Prepare Data Base:
- o CPU Time per Cycle:
- o Data Output Analysis:

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MISCELLANEOUS: (Supercessions, planned enhancements, linkage of this model to other models, etc.).

KEYWORD LISTING: (String of single words appropriate for indexing the model in an automated system, e.g., computerized, analytical, nuclear, damage-assessment, missiles, strategic)

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The 9th Edition of the Catalog of Wargaming and Military Simulation Models lists the descriptions of 363 simulations, war games, exercises, and models in general use throughout the Department of Defense and in the defense establishments of Australia, Canada, England, and Germany. The entries in the catalog are listed alphabetically by acronym and long title. A second index categorizes the entires by type and application. The description of each model includes: Proponent, developer, purpose, general description,

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