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9. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report consolidates the Structured Analysis and Structured Design for the Logistic Support Analysis (LSA) Tasks. Included are the Data Flow Diagrams (DFDs) for the LSA Subtask 303.2.10, "Select System/Equipment Alternatives", with the corresponding descriptions of the processes, data flows, data stores, and external entities identified on each DFD. The DFDs are further developed into procedures which identifies how to use the data to carry out the processes and accomplish the LSA Subtask. Venture Evaluation Review Technique (VERT) Batch Input files are also provided to assist, as tools, giving both technical and managerial aspects of a task.

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STRUCTURED ANALYSIS/DESIGN

LSA TASK 303

EVALUATION OF ALTERNATIVES AND TRADE-OFF ANALYSIS

SUBTASK 303.2.10

EVALUATION AND TRADE-OFFS BETWEEN SYSTEM/EQUIPMENT ALTERNATIVES AND ENERGY REQUIREMENTS

APJ 966-252

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STRUCTURED ANALYSIS/DESIGN

LSA TASK 303

EVALUATION OF ALTERNATIVES AND TRADE-OFF ANALYSIS

SUBTASK 303.2.10

EVALUATION AND TRADE-OFFS BETWEEN SYSTEM/EQUIPMENTALTERNATIVES AND ENERGY REQUIREMENTS

under

CONTRACT DAAA21-86-D-0025

for

HQ US AMCCOM

INTEGRATED LOGISTIC SUPPORT OFFICE
AMSMC-LSP
ROCK ISLAND, IL

by

AMERICAN POWER JET COMPANY

RIDGEFIELD, NJ ARLINGTON, VA

WILLIAMSBURG, VA ST. LOUIS, MO

January 1991

FOREWORD

APJ, under contract to HQs, AMCCOM, has initiated the automation of the LSA Tasks (MIL-STD-1388-1) and the assessment of the ILS elements (AR 700-127). A major goal is to unify military and contractor approach to the performance of ILS and LSA.

Detailed to meet all requirements of ILS and LSA, the automated process will continue to provide the flexibility in selecting tasks and elements to be addressed at each life cycle stage. A major advantage of this approach is to insure that the application of each task element is consistent with prescribed Army policies and procedures.

This report consolidates the Structured Analysis and Structured Design under one cover for the respective LSA Task. Structured Analysis provides a logical model of the method to perform an LSA Task. This logical model facilitates the development of a Structured Design that provides the detailed procedures to perform the analysis. Both the logical model and detailed procedures are used to develop the application software programs which will be provided to Government and contractor personnel to assist in the performance of the LSA Task.

Included in this report are the Data Flow Diagrams (DFDs) for LSA Subtask 303.2.10, "Select System/Equipment Alternatives" and the corresponding descriptions of the processes, data flows, data stores, and external entities identified on each DFD (Annex B). In addition, the DFDs are further developed into step-by-step procedures (Annex C) which identify how to use the data to carry out the processes which ultimately lead to accomplishing the LSA Subtask.

To assist managers in planning and controlling this task, Venture Evaluation Review Technique (VERT) Batch Input files are provided (Annex D). These VERT tools provide government agencies with complete packages to give contractors that cover both technical and managerial aspects of a task. This approach establishes a standardized form of communication and management between contractors performing the task and government personnel reviewing the task.

To view this work in context, this report also presents a brief overview of Structured Analysis and its place in the overall systems development process. Additionally, Annex E provides a brief working description of Structured Systems Analysis fundamentals. The overview and certain portions of the introductory text are repeated verbatim in every report in this series so that each report is free standing.

EXECUTIVE SUMMARY

LSA SUBTASK 303.2.10
EVALUATION AND TRADE-OFF BETWEEN SYSTEM/EQUIPMENT ALTERNATIVES AND ENERGY REQUIREMENTS

The American Power Jet Company (APJ) is under contract to the Army Armament Munitions and Chemical Command (AMCCOM) to provide "how to" procedures for selected ILS and LSA tasks. Accordingly, this effort requires the formalization of processes which are frequently ill defined and produce diverse and varied outputs. The results of this effort are a series of Structured System Analysis and Structured System Design reports which set forth a generic approach to each task which may be tailored to specific weapon system characteristics and life cycle stage.

The intent of this work is to be compatible with CALS, LOGPARS, and other similar efforts to enhance performance, training, and automation, Our basic structure facilitates the downstream application of Artificial Intelligence and streamlining of these critical functions.

STRUCTURED SYSTEM ANALYSIS

Excelerator, a Computer Aided Software Engineering (CASE) tool, was used to prepare the Structured System Analysis. Each LSA Task is modeled by a series of Data Flow Diagrams (DFDs), depicting activities and accompanying data flows needed to produce intermediate or final products. Complex activities are "broken down" or "exploded" into lower level data flow diagrams.

Each DFD can contain four types of objects:

- **Processes** or activities
- **Data Flows** - inputs to a process or data output generated from a process
- **Data Stores** - identifies sources for the data
- **External Entities** - indicates who to contact for guidance.

Each object is described either by developing detailed procedures or identifying its data content. The object descriptions are placed in a Data Dictionary which is built-up as the Data Flow Diagrams are expanded, detailed, and eventually completed.

STRUCTURED SYSTEM DESIGN

The Structured Design amplifies the processes and data flows developed in the Structured Analysis into procedures used to accomplish the LSA Tasks and Subtasks. The Analysis provides the method and the Design implements it.

In addition to the narrative portions of the structured Design, "Input Screens" are developed for each process or set of processes. The charts structure and organize the data needed to perform a LSA task and make decisions on Weapon System supportability. By formalizing the data requirements in this manner, a standard set of output reports can be specified.

AUTOMATION

The Structured Design material can of course be used in a manual fashion. However, automation of the task achieves several objectives:

The analyst performing the LSA Task is taken through a series of automated steps leading to a successful result. Help is available at every step to guide the analyst through the task.

Information is organized, so that productivity improves because more time is spent gathering, analyzing, and interpreting the data instead of tedious record keeping. This structure allows the data to be easily retrieved, edited, and added to.

Output reports are standardized through a report generation facility using preprogrammed report formats.

A significant volume of data will be captured and stored over a period of time, creating a large "knowledge base". This knowledge base provides a body of procedures, sources, data, and lessons learned for an analyst to query and apply against a new or update analysis effort. This available information forms the ob basis an Artificial Intelligence (AI) expert system.

Automation of selected LSA subtasks is being prototyped to demonstrate the principles involved and gain user experience. Although fully general, all prototypes are designed for ready development and adaptation to specific weapon systems.

LSA SUBTASK 303.2.10 - DESCRIPTION

To place this LSA Subtask in context, it is one of 13 subtasks of LSA Task 303, "Evaluation of Alternatives and Trade-Off Analysis", and deals with evaluating the energy requirements for each system/equipment alternative against program constraints. The input for this subtask comes from LSA Task 205 and 302.

LSA Subtask 303.2.10 examines the energy requirements for each alternative system/equipment under analysis. The energy requirements are used to determine the system/equipment that most efficiently utilizes the energy resources within established program constraints.

The analysis is done by selecting a system/equipment and analyzing required energy sources. Energy requirements should be quantified as well as their transportability, storage, and availability characteristics. Relationships and trade-off criteria are established for the energy characteristics. These relationships are used to model the energy source characteristics for the selected system/equipment.

Results are used to determine the system that meets all energy resource constraints while still fulfilling mission requirements. Finally, POL cost sensitivity is reviewed for the selected system/equipment.

The output of this subtask is used to feed LSA Tasks 401 and 402.

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INTRODUCTION

PURPOSE

The purpose of this report series is to present the results of the APJ Structured Analysis is/Design under Contract DAAA21-86-D-0025 for coordination with the AMCCOM Program Manager prior to in-depth programming of ILS and LSA functions and processes. LSA Task 303 "Trade-Off Between System/Equipment Alternatives and Energy Sources", (LSA SUBTASK 303.2.10" Select System/Equipment Alternatives") is addressed in this report.

BACKGROUND

The Department of the Army has a requirement for management control over contractor and Government agency response to the requirements of AR 700-127, "Integrated Logistic Support", and MIL-STD-1388-1, "Logistic Support Analysis". HQs AMCCOM has initiated action to structure each of the LSA tasks, the assessment of each ILS element, the form of the results, and the detailed processes to insure consistency with current Army policies, procedures, and techniques.

This approach (undertaken by AMCCOM and APJ) will insure uniformity in efforts and products, reproducibility of analyses, and a well-defined structure which can be coordinated among all participants in the logistic process to arrive at common understanding and procedures.

SCOPE

This report summarizes the results of the Structured Analysis of the identification of LSA Task 303 "Evaluation and Trade-Offs System/Equipment Alternatives and Energy Requirements", LSA Subtask 303.2.10, "Select System/Equipment Alternatives", and presents the associated Data Flow Diagrams (DFDs) developed from the Structured Analysis and the corresponding procedures developed in the Structured Design. The portions of the Data Dictionary relating to the DFDs for this LSA Subtask include the labels, names, descriptions, processes, data flows, data stores, and external entities. (The Data Dictionary is a "living document" that evolves through the analysis and design process).

The Data Dictionaries developed for each of the individual LSA Subtasks are integrated together into a Master Data Dictionary. Integration of the individual Data Dictionary involves the combination of similar Data Flows, Data Stores, and External Entities. The resulting Master Data Dictionary may well contain some minor differences from the definitions that appear in this report. All processes, and of course, the content of the Structured Design will remain identical.

The Structured Design portion of this report develops the processes and data flows developed in the DFDs into procedures which are used to accomplish the LSA Tasks. The DFDs provide the method and the Design implements it, by formulating a guide for programmers to write software applications.

This report presents a brief overview of Structured Analysis and its place in the overall systems design process to assist the reader who may not be fully briefed on the symbols and conventions used. It is supported by Annex E, which defines each element in Structured Analysis.

LSA SUBTASK 303.2.10 - DESCRIPTION

To place this LSA Subtask in context, it is one of 13 subtasks of LSA Task 303, "Evaluation of Alternatives and Trade-Off Analysis", and deals with evaluating the energy requirements for each system/equipment alternative against program constraints. The input for this subtask comes from LSA Task 205 and 302.

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The analysis is done by selecting a system/equipment and analyzing required energy sources. Energy requirements should be quantified as well as their transportability, storage, and availability characteristics. Relationships and trade-off criteria are established for the energy characteristics. These relationships are used to model the energy source characteristics for the selected system/equipment.

Results are used to determine the system that meets all energy resource constraints while still fulfilling mission requirements. Finally, POL cost sensitivity is reviewed for the selected system/equipment.

The output of this subtask is used to feed LSA Tasks 401 and 402.

The LSA Task Description with associated task inputs and outputs is extracted from MIL-STD-1388-1A and is included as Annex A.

APPROACH

The APJ approach to Structured Analysis and Structured Design of an LSA Subtask is:

1. Scope the Subtask defined in MIL-STD-1388-1A with the overall task and determine its relationship with other LSA Tasks.

2. Review all pertinent documentation (e.g., ARs, MIL-STDs, etc.) applicable to the specific topic.

3. Prepare the Top Level DFDs in context of the Subtask, and develop lower level DFDs to further quantify any complex process identified in the top level DFD.

4. Complete the Data Dictionary portion of the Analysis by describing all processes, data flows, data stores and external entities.

5. Apply staff experience in logistic support analysis to assure that the topic has been exhaustively addressed.

6. From the completed DFDs, prepare the step-by-step procedures that form the structured design.

7. Review Data Item Description and other applicable material to develop output reports.

8. If required, revise DFDs and Data Dictionary based on preparation of detailed procedures.

9. Validate results in discussions with Army activities and personnel directly involved in the applicable or related LSA tasks.

NOTE: Structured Analysis and preparation of Data Flow Diagrams (DFDs) was further assisted by the application of Structured Analysis software. Licensed by Index Technology Corporation, Excelerator provides for automated tracking of names, labels, descriptions, multiple levels of detail in the data flow diagrams, and industry standards in symbols and diagramming practices.

LSA SUBTASK 303.2.10 - SELECT SYSTEM/EQUIPMENT ALTERNATIVES

The Data Flow Diagram is a tool that shows the flow of data, (i.e., data flows from sources) and is processed by activities to produce intermediate or final products.

The DFD provides a useful and meaningful partitioning of a system from the viewpoint of identification and separation of all functions, actions, or processes so that each can be introduced, changed, added, or deleted with minimal disruption of the overall program, i.e., it emphasizes the underlying concept of modularity and identifiable transformations of data into actionable products.

A series of three (3) DFDs have been developed to structure the LSA subtask relative to operations and other support functions:

1. 303.2.10 System/Equipment Energy Requirements Trade-Off Overview

2. 303.2.10.2A Energy Requirements Identification

3. 303.2.10.4A Trade-Off Analysis

Each DFD is keyed to the specific task through the identification number assigned in the lower right hand box. The Alpha codes indicate the level of indenture or explosion below the top level, i.e.,:

Top Level.....LSA DFD 303.2.10
First Indenture.....LSA DFD 303.2.10.2A

Each DFD makes reference to the basic LSA task it addresses, as well as the level of indenture (explosion) of the DFD. For example, the first or top level DFD, "303.2.10", refers to the section in MIL-STD-1388-1A which describes the review items. One of the processes (bubbles) on the top level diagram (303.2.10.2) is expanded and identified as "303.2.10.2A", a second level of "303.2.10.2" (Alpha "A" indicates the second level).

Four standard symbols are used in the drawing of a DFD (see Annex E - Figure 1).

A copy of each DFD is presented in Annex B, accompanied by the Data Dictionary process elements. Each entry made in the DFDs has a corresponding entry in the Data Dictionary.

This presents only those Data Dictionary entries necessary for the coordination of the overall concept and details of the processes. To facilitate review of the diagrams, data flow identifications, process, an data store descriptions are provided.

As noted above, they will continue to evolve and be expanded in the System Design phase.

VERT DIAGRAMS

The Venture Evaluation Review Technique (VERT) was developed as a network analysis technique to facilitate management decision making. It allows systematic planning and control of programs and enables managers to find solutions to real life managerial problems. The VERT Diagrams and Input Files for this task can be found in Annex D. In order to understand how these Input Files were developed, a brief discussion of the methodology used is provided. The same explanation is repeated verbatim in every report.

ANNEX A

—

LSA TASK 303
EVALUATION OF ALTERNATIVES AND TRADE-OFF ANALYSIS

ANNEX A
LSA TASK 303
EVALUATION OF ALTERNATIVES AND TRADE-OFF ANALYSIS 1/

303.1 **PURPOSE** To determine the preferred support system alternative(s) for each system/equipment alternative and to participate in alternative system trade-offs to determine the best approach (support, design, and operation) which satisfies the need with the best balance between cost, schedule, performance, readiness, and supportability.

303.2 **TASK DESCRIPTION**

303.2.10 Conduct evaluations and trade-offs between system/equipment alternatives and energy requirements. Identify the petroleum, oil, and lubricant (POL) requirements for each system/equipment alternative under consideration and conduct sensitivity analyses on POL costs.

303.3 **TASK INPUT**

303.3.1 Delivery identification of any data item require.

303.3.2 Method of review and approval of identified evaluations and trade-offs to be performed, evaluation criteria, analytical relationships and models to be used, analysis results, and the sensitivity analyses to be performed.

303.3.3 Specific evaluations, trade-offs, or sensitivity analyses to be performed, if applicable.

303.3.4 Specific analytical relationships or models to be used, if applicable.

303.3.5 Any limits (numbers or skills) to operator or support personnel for the system/equipment.

303.3.6 Input not applicable to this subtask.

303.3.7 Support alternatives for the new system/equipment from Task 302.

303.3.8 Description of system/equipment alternatives under consideration.

303.3.9 Supportability and supportability related design objectives, goals and thresholds, and constraints for the new system/equipment from Task 205.

303.3.10 Historical CER/PER that exist which are applicable to the new system/equipment.

303.3.11 Input not applicable to this subtask.

303.4 **TASK OUTPUT**

303.4.1 For each evaluation and trade-off performed under this task:

a. Identification of the evaluation criteria, analytical relationships and models used, selected alternative(s), appropriate sensitivity analysis results, evaluation and trade-off results, and any risks involved.

b. Trade-off and evaluation updates, as applicable.

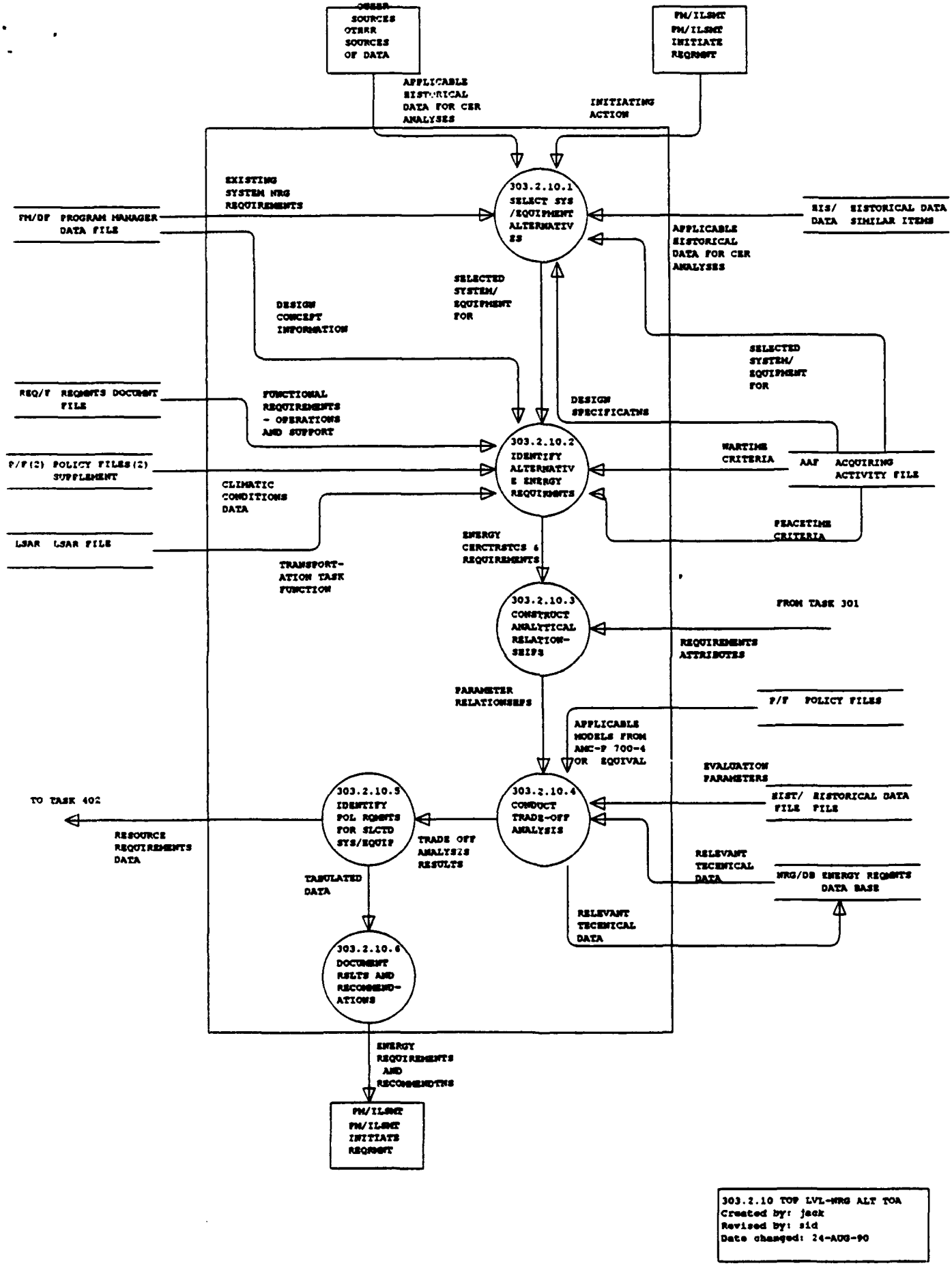
303.4.10 Trade-off results between system/equipment alternatives and energy requirements. (303.2.10)

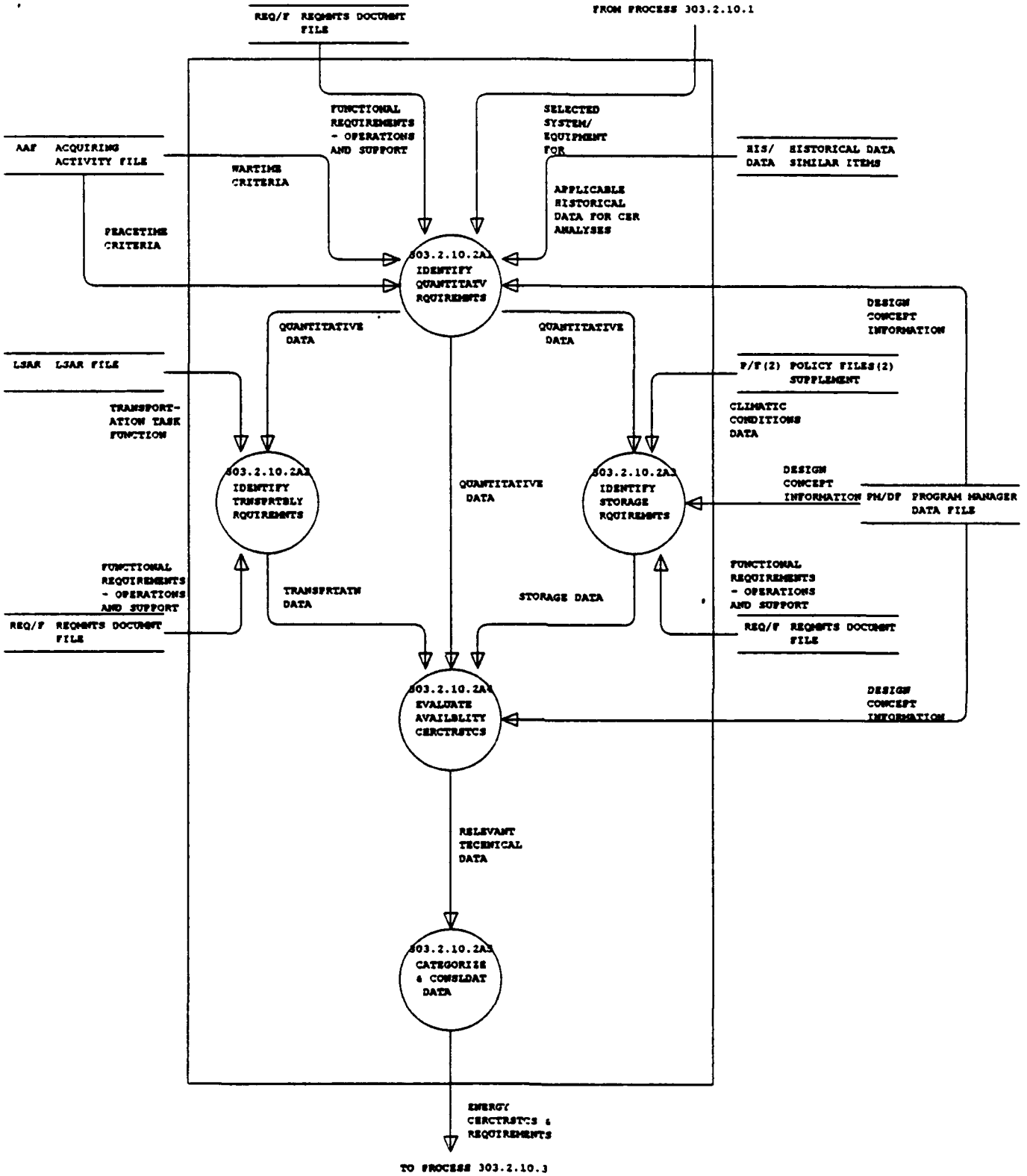
1/ Abstracted verbatim from MIL-STD-1388-1A, April 11, 1983, Pages 36 and 37.

ANNEX B

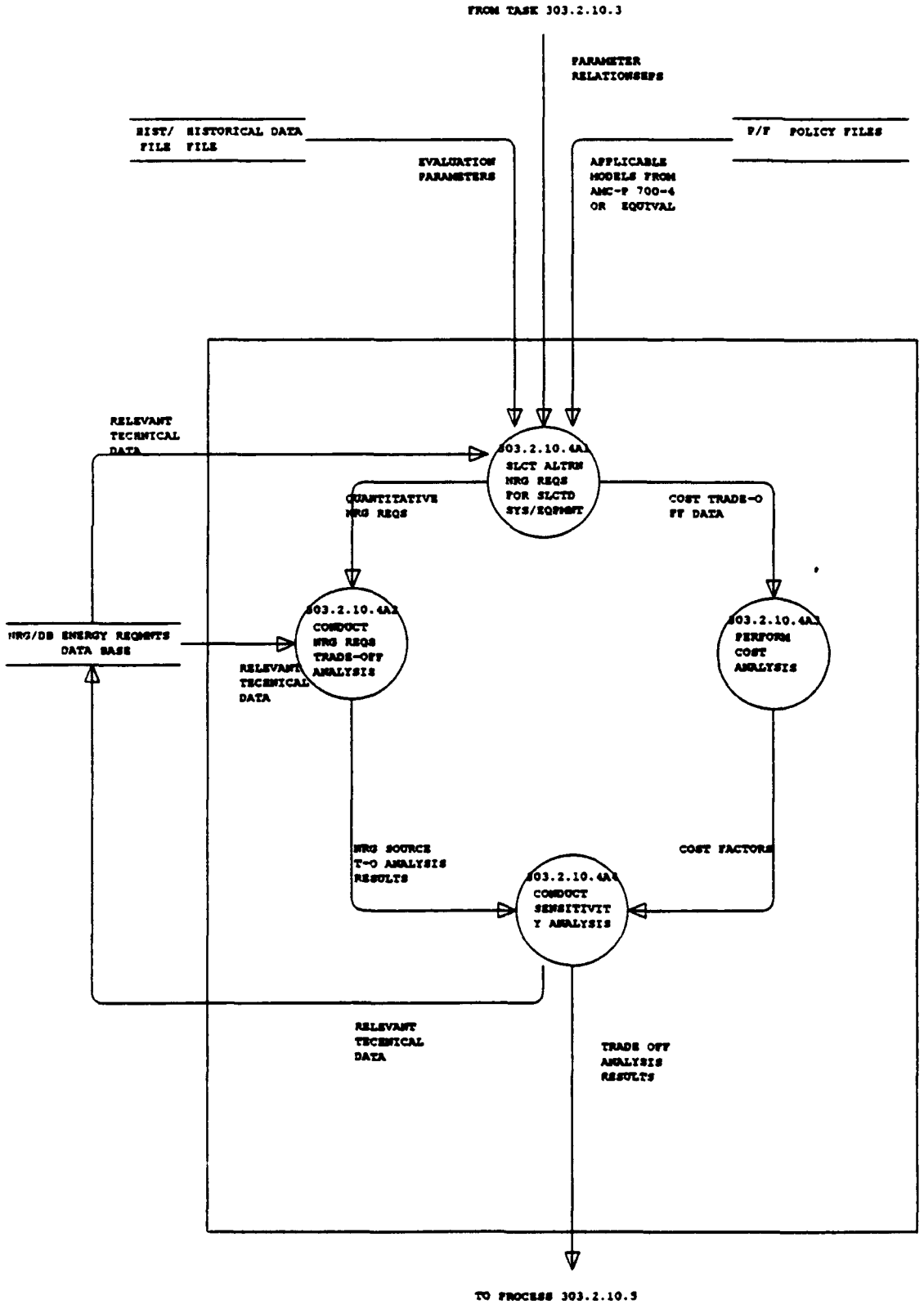
—

SUBTASK 303.2.10
EVALUATION AND TRADE-OFF BETWEEN SYSTEM/EQUIPMENT ALTERNATIVES AND ENERGY REQUIREMENTS
DATA FLOW DIAGRAMS AND PROCESS DATA DICTIONARY


OTHER SOURCES OTHER SOURCES OF DATA
PM/ILSMT PM/ILSMT INITIATE REQMSMT
APPLICABLE HISTORICAL DATA FOR CER ANALYSES
INITIATING ACTION
EXISTING SYSTEM NRG REQUIREMENTS
303.2.10.1 SELECT SYS /EQUIPMENT ALTERNATIVES
HIS/ HISTORICAL DATA DATA SIMILAR ITEMS
PM/DF PROGRAM MANAGER DATA FILE
APPLICABLE HISTORICAL DATA FOR CER ANALYSES
SELECTED SYSTEM/ EQUIPMENT FOR
DESIGN CONCEPT INFORMATION
SELECTED SYSTEM/ EQUIPMENT FOR
REQ/F REQMTS DOCUMNT FILE
FUNCTIONAL REQUIREMENTS - OPERATIONS AND SUPPORT
DESIGN SPECIFICATNS
303.2.10.2 IDENTIFY ALTERNATIVE ENERGY REQUIREMENTS
WARTIME CRITERIA
AAF ACQUIRING ACTIVITY FILE
P/F(2) POLICY FILES(2) SUPPLEMENT
CLIMATIC CONDITIONS DATA
PEACETIME CRITERIA
LSAR LSAR FILE
ENERGY CHRCTRSTCS & REQUIREMENTS
TRANSPORT-ATION TASK FUNCTION
303.2.10.3 CONSTRUCT ANALYTICAL RELATION-SHIPS
FROM TASK 301
REQUIREMENTS ATTRIBUTES
PARAMETER RELATIONSHIPS
P/F POLICY FILES
APPLICABLE MODELS FROM AMC-P 700-4 OR EQUIVAL
EVALUATION PARAMETERS
303.2.10.5 IDENTIFY POL RQMTS FOR SLCTD SYS/EQUIP
303.2.10.4 CONDUCT TRADE-OFF ANALYSIS
HIST/ FILE HISTORICAL DATA FILE
TO TASK 402
RESOURCE REQUIREMENTS DATA
TRADE OFF ANALYSIS RESULTS
RELEVANT TECHNICAL DATA
NRG/DB ENERGY REQMTS DATA BASE
TABULATED DATA
RELEVANT TECHNICAL DATA
303.2.10.6 DOCUMENT RSLTS AND RECOMMEND-ATIONS
ENERGY REQUIREMENTS AND RECOMMENDTNS
PM/ILSMT PM/ILSMT INITIATE REQMSMT
303.2.10 TOP LVL-NRG ALT TOA
Created by: jack
Revised by: sid
Date changed: 24-AUG-90



303.2.10.2A POTENTIAL SOURCES
Created by: jack
Revised by: jack
Date changed: 13-AUG-90



303.2.10.4A TRADE-OFF ANALYSIS
Created by: jack
Revised by: jack
Date changed: 22-AUG-90

Name	Label	Description
303.2.10.1	SELECT SYS /EQUIPMENT ALTERNATIV ES	SEVERAL ALTERNATIVE SYSTEM/EQUIPMENTS HAVE BEEN SELECTED AS POTENTIAL CANDIDATES FOR MEETING THE MATERIEL NEEDS OF A SPECIFIC MILITARY REQUIREMENT OR TO OVERCOME A DEFICIENCY IN MEETING A SPECIFIC THREAT. THIS PROCESS SELECTS THE ALTERNATIVES ONE AT A TIME FOR AN IN-DEPTH EVALUATION OF THE ENERGY REQUIREMENTS AND TO IDENTIFY THE PETROEUM, OIL AND LUBRICANT (POL) REQUIREMENTS OF EACH SYSTEM/EQUIPMENT ALTERNATIVE UNDER CONSIDERATION.
303.2.10.2	IDENTIFY ALTERNATIV E ENERGY REQUIRMNTS	IDENTIFY THE ENERGY REQUIREMENTS AND CHARACTERISTICS OF EACH OF THE SYSTEM/EQUIPMENT UNDER CONSIDERATION INCLUDING FUEL REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT AND POL REQUIREMENTS FOR EACH APPLICABLE COMPONENT. TRANSPORTATION AND STORAGE REQUIREMENTS FOR REQUIRED POL ARE ALSO IDENTIFIED.
303.2.10.2A1	IDENTIFY QUANTITATV RQUIREMNTS	BASED UPON THE OPERATIONAL REQUIREMENTS, ESTIMATE THE POL CONSUMPTION AND MANHOURS REQUIRED TO ADMINISTER POL SERVICING (INCLUDING INSPECTIONS) FOR ONE MISSION, OR FOR A SPECIFIC TIME PERIOD, WHICHEVER OFFERS THE HIGHEST ACCURACY. BOTH PEACETIME AND WARTIME CONDITIONS MUST BE CONSIDERED. IT CAN BE BASED UPON THE REQUIREMENTS OF A SPECIFIC SYSTEM/EQUIPMENT OR FOR A SPECIFIC NUMBER OF SYSTEMS/EQUIPMENTS.
303.2.10.2A2	IDENTIFY TRNSPRTBLY RQUIREMNTS	BASED UPON THE QUANTITIES ESTIMATED IN PROCESS 303.2.10.2A1, DETERMINE TRANSPORTABILITY CHARACTERISTICS OF THE FUEL FOR EACH POTENTIAL SYSTEM/EQUIPMENT. 1. TYPES OF TRANSPORTATION AVAILABLE 2. REQUIREMENTS FOR DEDICATED VEHICLES. 3. ANY SPECIAL SAFETY REQUIREMENTS REQUIRED FOR EACH TRANSPORT MODE.
303.2.10.2A3	IDENTIFY STORAGE RQUIREMNTS	BASED ON THE QUANTITIES ESTIMATED IN PROCESS 303.2.10.2A1, DETERMINE THE STORAGE REQUIREMENTS FOR THE FUEL FOR EACH POTENTIAL SYSTEM/EQUIPMENT. THE FOLLOWING FACTORS SHOULD BE CONSIDERED: 1. THE PERFORMANCE AND STORAGE LIFE SHOULD NOT BE DEGRADED WHEN IN STORAGE AND EXPOSED TO CLIMATIC CONDITIONS PER AR 70-38 CATEGORIES SPECIFIED BY THE REQUIREMENTS DOCUMENTS. 2. IF PACKAGED IN CONTAINERS, THEY SHOULD BE STACKABLE FOR STORAGE. 3. IDENTIFY ANY NEW STORAGE FACILITIES REQUIRED EITHER AT THE UNIT OR DEPOT LEVEL.
303.2.10.2A4	EVALUATE AVAILBLITY CHRCTRSTCS	THIS PROCESS STUDIES THE AVAILABILITY OF THE POL TO MEET PLANNED DEPLOYMENT OF THE SYSTEM/EQUIPMENT. DATA GENERATED IN PROCESSES 303.2.10.2A1, 2A2 AND 2A3 WILL BE UTILIZED. THE FOLLOWING PARAMETERS WILL BE INCLUDED IN THE STUDY 1. PRODUCTION CAPACITY VS. AMOUNTS REQUIRED. 2. PRODUCTION SCHEDULE OR RATE. 3. EFFECTS ON EXISTING SYSTEM/EQUIPMENT. 4. CLIMATIC CONSTRAINTS. 5. POLITICAL CONSIDERATIONS.

	Name	Label	Description
	303.2.10.2A5	CATEGORIZE & CONSLDAT DATA	THE PURPOSE OF THIS PROCESS IS TO ORGANIZE AND CONSOLIDATE THE EVALUATED CHARACTERISTIC DATA OF THE ENERGY REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT INTO A COMPREHENSIVE FILE. IN THIS FILE, THE CHARACTERISTICS WILL HAVE RELATIONSHIPS TO EACH OTHER. THESE RELATIONSHIPS MUST BE IDENTIFIED (I.E., PERSONNEL SAFETY REGARDING TRANSPORTATION OF THE FUEL, STORAGE OF A HAZARDOUS ENERGY SOURCE VS.SAFETY OF PERSONNEL AND SURROUNDING AREAS, ETC.). THIS INTERRELATIONSHIP WILL HELP WHEN PROCESSING THE TRADE-OFF AND SENSITIVITY ANALYSES. DEVELOP A DATABASE TO STORE THIS INFORMATION, SO THAT IT MIGHT BE VIEWED IN SEVERAL WAYS FOR FUTURE PROCESSING.
	303.2.10.3	CONSTRUCT ANALYTICAL RELATION-SHIPS	THIS PROCESS WILL REVIEW THE CHARACTERISTICS OF THE ENERGY REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT. IT THEN CONSTRUCTS ANALYTICAL RELATIONSHIPS BETWEEN QUANTITATIVE REQUIREMENTS, TRANSPORTABILITY, STORAGE, AVAILABILITY AND ANY OTHER PARAMETERS CONSIDERED IMPORTANT FOR THE EVALUATION CRITERIA. IN MANY CASES THE SAME MODEL OR RELATIONSHIP MAY BE APPROPRIATE TO PERFORM A NUMBER OF EVALUATIONS AND TRADE-OFFS.
	303.2.10.4	CONDUCT TRADE-OFF ANALYSIS	THIS PROCESS WILL CONDUCT A TRADE-OFF ANALYSIS, USING DATA FROM PROCESS 303.2.10.3, AND AN APPLICABLE MODEL FROM AMC-P 700-4. IT WILL DETERMINE THE VALUES THAT ARE TO BE USED IN SELECTING THE SYSTEM/EQUIPMENT ALTERNATIVE AND ENERGY REQUIREMENTS THAT WILL BEST MEET THE SUPPORT, PERFORMANCE, LOGISTICS, FIELDING AND COST REQUIREMENTS WITHIN THE MILITARY MISSION OBJECTIVES. THERE WILL BE MULTIPLE ITERATIONS OF THIS PROCESS AS THE SYSTEM/EQUIPMENT PROGRESSES THROUGH ITS LIFE CYCLE. WHEN THIS OCCURS, A COMPLETE REVIEW OF INPUT AND OUTPUT DATA, PROCESSES AND DATA FLOWS IS NECESSARY AS SOME OF THE ATTRIBUTES WILL HAVE CHANGED IN VALUE CAUSED, GENERALLY, BY DESIGN CHANGES. RECOMMENDATIONS WILL BE MADE, BASED ON THE TRADE-OFFS MADE AS TO THE BEST STATE-OF-THE-ART CONCEPT FOR SATISFYING THE SYSTEM/EQUIPMENT MILITARY REQUIREMENTS.
	303.2.10.4A1	SLCT ALTRN NRG REQS FOR SLCTD SYS/EQPMNT	THIS PROCESS WILL BE USED TO SELECT THE ALTERNATIVE ENERGY REQUIREMENTSFOR EACH SYSTEM/EQUIPMENT ALTERNATIVE SELECTED FROM PROCESS 303.2.10.1. IT WILL REVIEW EACH ALTERNATIVE ENERGY REQUIREMENT EVALUATED IN PROCESS 303.2.10.3 AND DETERMINE THE ALTERNATIVE THAT MEETS THE PERFORMANCE REQUIREMENTS, WHILE HAVING THE BEST BALANCE BETWEEN QUANTITATIVE REQUIREMENTS, TRANSPORTABILITY, STORAGEABILITY AND AVAILABILITY.
	303.2.10.4A2	CONDUCT NRG REQS TRADE-OFF ANALYSIS	THIS PROCESS WILL PERFORM A TRADE-OFF OF THE POTENTIAL ENERGY REQUIREMENTS PARAMETERS AGAINST THE "BASELINE" THAT WILL BEST ALLOW THE SYSTEM/EQUIPMENT TO MEET THE PERFORMANCE, SUPPORT, LOGISTICS AND FIELDING REQUIREMENTS OF THE REQUIRED MILITARY MISSIONS AND THE QUANTITATIVE MATERIEL REQUIREMENTS (QMR).
	303.2.10.4A3	PERFORM COST ANALYSIS	THIS PROCESS WILL ESTABLISH A RELATIONSHIP BETWEEN THE COST OF EACH SYSTEM/EQUIPMENT ENERGY REQUIREMENT PARAMETERS AND THE COST OF ENERGY REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT UNDER ANALYSIS TO IDENTIFY THE MOST ECONOMICAL ENERGY REQUIREMENTS.

	Name	Label	Description
	303.2.10.4A4	CONDUCT SENSITIVITY ANALYSIS	THIS PROCESS IDENTIFIES THOSE AREAS IN THE POTENTIAL ENERGY REQUIREMENTS, WHERE SIGNIFICANT CHANGES IN ANY OF THE ATTRIBUTES CAUSES MAJOR CHANGES IN QUANTITY, TRANSPORTABILTIY, STORAGE, AVAILABILITY AND/OR COST OF THE SYSTEM/EQUIPMENT.
	303.2.10.5	IDENTIFY POL RQMNTS FOR SLCTD SYS/EQUIP	THIS PROCESS WILL CONSOLIDATE TRADE-OFF RESULTS AND THE DATA IDENTIFYING ALL ITEMS ASSOCIATED WITH THE PETROLEUM, OIL AND LUBRICANT REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT ALTERNATIVE UNDER CONSIDERATION. A COST SENSITIVITY ANALYSIS WILL THEN BE PERFORMED AND THE SYSTEM/EQUIPMENT HAVING THE BEST COST, QUANTITY REQUIREMENTS, TRANSPORTABILITY, STORAGEABILITY AND AVAILABILITY BALANCE WILL BE SELECTED.
	303.2.10.6	DOCUMENT RSLTS AND RECOMMEND-ATIONS	THIS PROCESS WILL DOCUMENT IN NARRATIVE FORMAT, THE POL REQUIREMENTS DETERMINED TO BE THE OPTIMUM BASED ON THE TRADE-OFFS MADE. THE RESULTS WILL INCLUDE RECOMMENDATIONS FOR THE SYSTEM/EQUIPMENT SELECTED AND EXPLANATIONS OF THE EFFECT OF THE TRADE-OFF RESULTS.

Name	Label	Description
AMC-P 700-4	APPLICABLE MODELS FROM AMC-P 700-4 OR EQUIVAL	PURPOSE: * APPLICABLE MODELS USED AS A GUIDE FOR CONSTRUCTING AN ANALYTICAL MODEL IN DETERMINING THE MOST FEASIBLE MANPOWER/PERSONNEL REQUIREMENTS FOR THE ALTERNATE SYSTEM/EQUIPMENT UNDER ANALYSIS. * MODEL MUST BE TAILORED TO THE SYSTEM/EQUIPMENT UNDER ANALYSIS (i.e., HARDWARE/MANPOWER INTEGRATION (HARDMAN), PERSONNEL AVAILABLITY MODEL (PAM), PERSONNEL REQUIREMENTS ANALYSIS MODEL (PRAMOD) ETC.). SOURCE OF DATA: AMC-P 700-4 (LOGISTIC SUPPORT ANALYSIS TECHNIQUES GUIDE)... AND EQUIVALENT DOCUMENTATION ON FILE.
CLIMT/COND	CLIMATIC CONDITIONS DATA	CLIMATIC CONDITIONS DATA SHOULD INCLUDE THOSE DATA PRESENTED IN: 1. MIL-STD 810, "ENVIRONMENTAL TEST METHODS & ENGINEERING GUIDELINES" 2. MIL-STD 210, "CLIMATIC EXTREMES FOR MILITARY EQUIPMENT" 3. AR 70-38, "R&D & ACQUISITION - RESEARCH, DEVELOPMENT, TEST & EVALUATION OF MATERIEL FOR EXTREME CLIMATIC CONDITIONS"
COST FACTORS	COST FACTORS	THIS DATA FLOW CONTAINS ACCURATE COST DATA ASSOCIATED WITH THE SELECTED ENERGY REQUIREMENTS FOR EACH OF THE SELECTED SYSTEM/EQUOPMENTS. IT INCLUDES COSTS FOR STORAGE, TRANSPORTATION, MANPOWER, SERVICING UNIT AND TOTAL ESTIMATED COST OF THE POL REQUIRED.
DES/CON/INF	DESIGN CONCEPT INFORMATION	ACRONYMS: PURPOSE: THIS DATA FLOW DESCRIBES THE CONCEPT AND DESIGN FORMULATION OF THE SYSTEM/EQUIPMENT. THE INFORMATION INCLUDES ITEM/EQUIPMENT SPECIFICATIONS, MISSIONS AND FUNCTIONS.
DES/SPECS	DESIGN SPECIFICATNS	THIS DATA FLOW CARRIES THE DESIGN SPECIFICATIONS UPON WHICH THE REQUIREMENTS CHARACTERISTIICS WILL BE BASED FOR THE SELECTED SYSTEM/EQUIPMENT UNDER REVIEW.
EVAL/PARAMS	EVALUATION PARAMETERS	THIS DATA FLOW CARRIES INFORMATION FROM A BASELINE CONFIGURATION AND THE SELECTED ALTERNATE SYSTEM/EQUIPMENT BEING REVIEWED, RELATING TO PERFORMANCE, RELIABILITY, MAINATAINABILITY, SUPPORTABILITY, PRODUCIBILITY AND COST, THAT MUST BE CONSIDERED PRIOR TO PERFORMING A TRADE-OFF-ANALYSIS. IT ALSO PROVIDES THE ATTRIBUTES NEEDED FOR THE VARIOUS TRADE-OFF-ANALYSES THAT MUST BE PERFORMED AND THE NECESSARY DATA FOR COMPARATIVE ANALYSIS OR GRAPHIC PREPARATION IN ORDER TO SHOW VARIATIONS IN THE TRADE-OFF ATTRIBUTES. THE SPECIFIC TRADE-OFF THAT THIS DATA WILL BE USED IN, WILL DETERMINE THE SPECIFIC DATA THAT THIS DATA FLOW CARRIES. REVIEW THE ENTITY FROM WHICH THIS FLOW OCCURS AND THE ENTITY TO WHICH IT FLOWS.
EXIST SYS NRG REQS	EXISTING SYSTEM NRG REQUIREMENTS	THIS DATA FLOW CONTAINS ENERGY REQUIREMENTS CHARACTERISTICS FOR SIMILAR SYSTEMS/EQUIPMENTS THAT CAN BE TAILORED TO THE SYSTEM/EQUIPMENT BEING EVALUATED.

Name	Label	Description
FUNC/RQRD	FUNCTIONAL REQUIREMENTS - OPERATIONS AND SUPPORT	PURPOSE: IDENTIFICATION OF THE OPERATIONS AND SUPPORT FUNCTIONS THAT MUST BE PERFORMED FOR EACH SYSTEM/EQUIPMENT ALTERNATIVE UNDER CONSIDERATION AND THEN IDENTIFICATION OF THE TASKS THAT MUST BE PERFORMED IN ORDER TO OPERATE AND MAINTAIN THE NEW SYSTEM/EQUIPMENT IN ITS INTENDED ENVIRONMENT THESE FUNCTIONS SHALL BE IDENTIFIED TO A LEVEL COMMENSURATE WITH DESIGN AND OPERATIONAL SCENARIO DEVELOPMENT, AND SHALL INCLUDE BOTH PEACETIME AND WARTIME FUNCTIONS. THESE DATA WILL BE AVAILABLE FROM THE CONCEPT FORMULATION PACKAGE WHICH WILL INCLUDE A FEASIBILITY STUDY AS WELL AS ADVANCE PRODUCT PLANNING. THE FEASIBILITY STUDY FROM THE CONCEPT FORMULATION PACKAGE WILL CONSIST OF A NEEDS ANALYSIS, THE SYSTEM OPERATIONS REQUIREMENTS, AND THE SYSTEM MAINTENANCE CONCEPT. ADVANCE PRODUCT PLANNING IS CONCERNED WITH PLANS AND SPECIFICATIONS OF THE EQUIPMENT/SYSTEM. DESCRIPTIVE DATA REQUIRED FOR PROPER ANALYSIS WILL INCLUDE-- 1. WHAT THE NEW SYSTEM/EQUIPMENT MUST DO IN ORDER TO ACCOMPLISH INTENDED MISSION OR TASKS. 2. UNIQUE FUNCTIONS DUE TO NEW TECHNOLOGY IN THE DESIGN OR NEW OPERATIONAL CONCEPTS. 3. IDENTIFICATION OF RISKS INVOLVED WITH THE SUPPORTABILITY OF THE SYSTEM/EQUIPMENT DUE TO FUNCTIONAL REQUIREMENTS. 4. OPERATION AND MAINTENANCE TASKS THAT MUST BE PERFORMED IN ORDER FOR THE NEW SYSTEM/EQUIPMENT TO BE ABLE TO ACCOMPLISH THE IDENTIFIED FUNCTIONS. THE FUNCTIONAL DATA SHOULD CONTAIN AS A MINIMUM: 1. FUNCTIONS REQUIREMENTS - EXAMPLES A. TAKE OFF, FLY, LAND B. MILES PER HOUR - AS IN MINIMUM SPEED C. PROVIDE LIFE SUPPORT TO CREW D. NAVIGATE, USE RADAR E. MAXIMUM/MINIMUM LOAD, ETC. 2. MAINTENANCE SUPPORT REQUIREMENTS - EXAMPLES A. SCHEDULED/UNSCHEDULED TASKS (1. SERVICE/REPAIR (2. OVERHAUL (3. REPLACE/DISCARD, ETC. SOURCE OF DATA: FUNCTIONAL REQUIREMENTS IDENTIFICATION IN SUBTASKS-- 301.2.1 301.2.2 301.2.3 303.2.5.2 401.2.4
HIS/DATA	APPLICABLE HISTORICAL DATA FOR CER ANALYSES	HISTORICAL DATA INCLUDES OPERATION AND SUPPORT COSTS, LOGISTIC SUPPORT RESOURCE REQUIREMENTS, RELIABILITY AND MAINTAINABILITY AND READINESS VALUES, AND QUALITATIVE SUPPORTABILITY PROBLEMS WHICH SHOULD BE PREVENTED ON THE NEW SYSTEM/EQUIPMENT.

Name	Label	Description
INIT/ACT	INITIATING ACTION	PURPOSE: THE REQUIRED ACTIONS OF THOSE (IF MORE THAN ONE) ACTIVITIES NECESSARY TO ACTUATE AN ILS ELEMENT ASSESSMENT FOR A SYSTEM AND/OR EQUIPMENT WHICH PROVIDES THE FORMAL AUTHORIZATION FOR THE PERFORMANCE OF AN ILS EFFORT. THESE INITIATING ACTIONS ARE NORMALLY PERFORMED BY THE ILSMT AND/OR THE PROGRAM MANAGER. WILL INCLUDE DATA IDENTIFYING THE NEED FOR ASSESSING AN ALTERNATIVE SYSTEM/EQUIPMENT AS APPLICABLE. THIS NEED MAY BE BASED ON AN EVALUATION OF THE EXISTING REQUIREMENTS ON THE BASELINE SYSTEM/EQUIPMENT. THIS DATA MAY: 1. ESTABLISH MISSION PROFILE 2. IDENTIFY THE RESOURCES THAT EXIST AND/OR MUST BE DEVELOPED 3. ESTABLISH PRIORITIES SOURCE OF DATA: PROGRAM MANAGER OR ILSMT
NRG CHRSTCS/REQS	ENERGY CHRCTRSTCS & REQUIREMENTS	THIS DATA FLOW CARRIES POL REQUIREMENTS DATA INCLUDING TRANSPORTATION AND STORAGE FOR EACH SELECTED SYSTEM/EQUIPMENT. THE DATA HAS BEEN CONSOLIDATED WITH RELATIONSHIPS AND EVALUATIONS DOCUMENTED. SOURCE OF DATA: 1. APPLICABLE HISTORICAL DATA FROM SIMILAR ITEMS. 2. SYSTEM/EQUIPMENT FUNCTIONAL REQUIREMENTS FROM THE REQUIREMENTS DOCUMENT FILE. 3. TRANSPORTATION SOURCE FUNCTIONS FROM THE LSAR FILE.
NRG REQS & RCMNDTNS	ENERGY REQUIREMENTS AND RECOMMENDTNS	THIS DATA FLOW CARRIES THE ENERGY REQUIREMENTS AND RECOMMENDATIONS FROM THE ENERGY REQUIREMENTS TRADE-OFF ANALYSIS. THEY WILL BE USED TO IDENTIFY NEW OR CRITICAL SUPPORT REQUIREMENTS FOR THE SYSTEM/EQUIPMENT BASED UPON THEIR ENERGY REQUIREMENTS AND THOSE OF THE SYSTEM/EQUIPMENT ALREADY FIELDED.
NRG TOA RSLTS	NRG SOURCE T-O ANALYSIS RESULTS	THIS DATA FLOW CONTAINS THE DATA RELATED TO ENERGY REQUIREMENTS HAVING THE LEAST QUANTITATIVE REQUIREMENTS OF POL AND MANPOWER INPUT AND THE BEST POL TRANSPORTABILITY, STORAGEABILITY AND AVAILABILITY CHARACTERISTICS FOR ONE OF THE SELECTED SYSTEM/EQUIPMENTS. COST FACTORS HAVE NOT BEEN INCLUDED AND A SENSITYIVITY ANALYSIS HAS NOT BEEN CONDUCTED. SOURCE OF DATA: 1. QUANTITATIVE DATA FROM PROCESS 303.2.10.2A1 2. AMC-P 700-4, OR EQUIVALENT FOR EXISTING MODELS.
PARAM REL	PARAMETER RELATIONSHPS	THIS DATA FLOW CONTAINS THE ENERGY REQUIREMENTS AND CHARACTERISTICS IN A CONSOLIDATED FORMAT WITH RELATIONSHIPS CONSTRUCTED FOR THE PARAMETERS OF EACH SYSTEM/EQUIPMENT. THE RESULTS OF THE ANALYTICAL MODELS WILL PROVIDE INPUT TO THE TRADE-OFF ANALYSIS.
PEACETIME	PEACETIME CRITERIA	PURPOSE: DATA IDENTIFYING PEACETIME STANDARDS THAT MUST BE APPLIED TO THE SELECTED ALTERNATIVE. THIS DATA CONTAINS: - STANDARDS FOR STORAGE (TIME, LOCATION, ETC.). - READINESS (PREPARATION TIME TO USE). SOURCE OF DATA: ACQUIRING ACTIVITY FILE.

	Name	Label	Description
	QUAN DATA	QUANTITATIVE DATA	THIS DATA FLOW CARRIES THE ENERGY RELATED REQUIREMENTS THAT CAN BE USED TO MEASURE QUANTITATIVE REQUIREMENTS, TRANSPORTABILITY, STORAGE, AND AVAILABILITY FOR EACH OF THE SELECTED SYSTEM/EQUIPMENTS. SOURCE OF DATA: 1. APPLICABLE HISTORICAL DATA FRO SIMILAR ITEMS. 2. SYSTEM/EQUIPMENT FUNCTIONAL REQUIREMENTS FROM REQUIREMENTS DOCUMENT FILE.
	QUANT/NRG REQS	QUANTITATIVE NRG REQS	THIS DATA FLOW CONTAINS THE QUANTITATIVE REQUIREMENTS FOR POL, STORAGE AND TRANSPORTABILITY FOR EACH ALTERNATIVE ENERGY REQUIREMENT UNDER CONSIDERATION.
	REL/TECH/DTA	RELEVANT TECHNICAL DATA	PURPOSE: THE TECHNICAL CONTENT OF THIS DATA FLOW IS DETERMINED BY THE ENTITIES BETWEEN WHICH IT FLOWS. TO ESTABLISH THIS CONTENT, REVIEW BOTH ENTITIES FOR SOURCE AND REQUIREMENTS INFORMATION.
	RES/REQ/DATA	RESOURCE REQUIREMENTS DATA	THIS DATA FLOW DEFINES THE COMBAT RESOURCE REQUIREMENTS FOR THE SYSTEM BEING EVALUATED.
	SEL/SYS/EQPT	SELECTED SYSTEM/ EQUIPMENT FOR ANALYSIS	PURPOSE: THIS DATA FLOW CONTAINS THE SPECIFIC SYSTEM/EQUIPMENT SELECTED FOR IN-DEPTH ANALYSIS/EVALUATION. THIS IS PART OF THE OVERALL EFFORT TO ANALYZE SEVERAL SYSTEM/EQUIPMENT CONCEPTS, LEADING TO A TRADEOFF EVALUATION OR OTHER RELATIONAL COMPARISONS, AS A BASIS FOR THE SELECTION OF A DESIREABLE SYSTEM/EQUIPMENT. SOURCE:
	STOR/DAT	STORAGE DATA	THIS DATA FLOW CONTAINS THE STORAGE CHARACTERISTICS AND REQUIREMENTS FOR THE POL USED FOR EACH SYSTEM/EQUIPMENT. SOURCE OF DATA: 1. APPLICABLE HISTORICAL DATA FOR SIMILAR ITEMS. 2. SYSTEM/EQUIPMENT FUNCTIONAL REQUIREMENTS FROM THE REQUIREMENTS DOCUMENT FILE.
	TAB/DATA	TABULATED DATA	THIS DATA FLOW CONTAINS INFORMATION REGARDING THE OPTIMUM BALANCE BETWEEN THE APPLICABLE ENERGY SOURCE ATTRIBUTES USED AND THOSE CONTAINED IN EACH ALTERNATIVE SYSTEM/EQUIPMENT. SOURCE: 303.2.10.6 - IDENTIFY POL REQUIREMENTS FOR EACH SYSTEM/EQUIPMENT.
	TOA RESULTS	TRADE OFF ANALYSIS RESULTS	RESULTS FROM CONDUCTING THE TRADE-OFF ANALYSIS CONSIST OF A SET OF RELATED VALUES AND FEATURES WHICH REFLECT THE SELECTED ALTERNATIVES AND ARE USED AS INPUT TO DETERMINE THE OPTIMUM SOLUTION. THE SPECIFIC TRADE-OFF ANALYSIS CONDUCTED WILL REFLECT THE RESULTS THAT ARE CARRIED IN THIS FLOW.

Name	Label	Description
TRANS DATA	TRANSPRTATN DATA	THIS DATA FLOW CARRIES TRANSPORTATION CONSTRAINTS AND REQUIREMENTS (BOTH PHYSICAL AND REGULATORY) FOR THE POL IDENTIFIED FOR USE WITH EACH SELECTED SYSTEM/EQUIPMENT. SOURCE OF DATA: 1. APPLICABLE HISTORICAL DATA FROM SIMILAR ITEMS 2. SYSTEM/EQUIPMENT FUNCTIONAL REQUIREMENTS FRO THE REQUIREMENTS DOCUMENT FILE. 3. TRANSPORTATION TASK FUNCTIONS FROM THE LSAR FILE.
TRANS/TASK	TRANSPORT-ATION TASK FUNCTION	The transportation task function identified in data record J are used to develop transportability characteristics of the system. Reference DED 467 of MIL-STD-1388-2A for further definition of this data.
WARTIME	WARTIME CRITERIA	PURPOSE: DATA IDENTIFIES WARTIME ENVIRONMENTS IN WHICH THE SELECTED ALTERNATIVE MUST OPERATE INORDER TO ACCOMPLISH ITS INTENDED MISSION(S). DATA INCLUDES CLIMATIC CONDITIONS AS DESCRIBED IN MIL-STD-210C. SOURCE OF DATA: ACQUIRING ACTIVITY FILE.

Name	Label	Description
AAF	ACQUIRING ACTIVITY FILE	CONTAINS THOSE RECORDS, DOCUMENTS, DECISION PAPERS, SCHEDULES THAT WERE PREPARED AS PART OF THE ACQUISITION INITIATION, JUSTIFICATION, AND PLANNING PRIOR TO THE ASSIGNMENT OF A PROGRAM MANAGER. THE ITEMS IN THIS DATA STORE INCLUDE: A. THREAT ANALYSIS DATA B. O&O PLAN C. READINESS OBJECTIVES DATA D. FUNTIONAL REQUIREMENTS DATA E. PROJECTED SCHEDULE DATA F. LOGISTICS RESOURCES DATA G. DESIRED R & M PARAMETERS H. TOA I. TOD J. COST & OPERATIONAL EFFECTIVENESS ANALYSIS (COEA) DATA K. PROJECTED COST DATA L. JUSTIFICATION OF MAJOR SYSTEM NEW START (JMSNS) DATA M. REQUIRED OPERATIONAL CAPABILITY (IF PREPARED PRIOR TO ASSIGNMENT OF PROGRAM MANAGER - ELSE FOUND IN PM FILES)
HIS/DATA	HISTORICAL DATA SIMILAR ITEMS	REPRESENTS CHARACTERISTICS OF THE NEW SYSTEM/EQUIPMENT BASED ON EXISTING SYSTEMS AND SUBSYSTEMS INCLUDING HARDWARE DESIGN AND OPERATION AND SUPPORT CONCEPTS TO PROJECT SUPPORTABILITY RELATED PARAMETERS, IDENTIFY TARGETS FOR IMPROVEMENT, AND DETERMINE SUPPORTABILITY, COST AND READINESS DRIVERS CAN BE OBTAINED FROM LSA TASK 203, COMPARATIVE ANALYSIS, OF MIL-STD-1388-1A.
HIST/FILE	HISTORICAL DATA FILE	CONTAINS DATA PREVIOUSLY ACQUIRED ON THE ITEM UNDER INVESTIGATION OR SOME SIMILAR SYSTEM AND MAY ADDRESS THE FOLLOWING AREAS (TO BE TREATED SEPARATELY): 1. RELIABILITY DATA 2. FAILURE RATE DATA 3. SPARES AND SPARE FUNDING DATA
IND/SURV	INDUSTRY SURVEY	Since systems/equipments are designed by contractors(developers) and not in-house, briefings or industry surveys should be requested from all major system/equipment developers to learn what they know concerning present and future technologies that could be applied to the proposed system/equipment including the developers cost effectiveness analysis of his state-of-the-art technology. Each developers presentation or survey should be assessed in terms of general principles (is it applicable to meeting the military requirement?) and what influence each proposed configuration exhibits that influences or contributes to state-of-the-art technology. Estimated/predicted attributes(parameters) are obtained for each proposed development.
IND/SURVEY	INDUSTRY SURVEY	

	Name	Label	Description
	LSAR	LSAR FILE	LOGISTICS SUPPORT ANALYSIS RECORD FILE. PURPOSE OF DATA STORE: THIS FILE OR RECORDS HOLDING AREA CONTAINS LSA TASK REPORTS OR THEIR EQUIVALENT; LSAR MASTER RECORD SHEET INFORMATION; LSAR REPORTS WHEN SYSTEM IS AUTOMATED. IT CONTAINS LOGISTICS DATA WHICH CAN BE USED TO ASSESS VARIOUS ILS ELEMENTS. MIL-STD 1388-1A AND 1388-2A SHOULD BE LOOKED AT FOR COMPLETE OUTPUTS AVAILABLE.
	NRG/DB	ENERGY REQMNTS DATA BASE	THIS DATA STOE SHALL BE A REPOSITORY OF INFORMATION CONCERNING ALTERNATIVE ENERGY SOURCES FOR A SELECTED SYSTEM/EQUIPMENT. AS DATA IS GATHERED, IT WILL ORGANIZED FOR STORAGE WITHIN THIS BASE AND WILL BE UPDATED AS DECISIONS/EVALUATIONS ARE MADE AND THEIR RESULTS ARRIVED AT. THIS BASE CAN BE USED TO DEVELOP REPORTS AS WELL.

Name	Label	Description
P/F	POLICY FILES	CONTAINS THOSE MILITARY PUBLICATIONS, DECISION PAPERS, MISSIONS & FUNCTIONS, etc, WHICH ARE NEEDED TO ESTABLISH THE LOGISTICAL SUPPORT AND REVIEW REQUIREMENTS OF THE ITEM/EQUIPMENT DEVELOPMENT PROGRAM. THIS DATA STORE INCLUDES: 1. AR 12-16, "MUTUAL LOGISTICS SUPPORT BETWEEN THE U.S. AND OTHER NORTH ATLANTIC TREATY ORGANIZATION FORCES" 1a. AR 70-1, "SYSTEMS ACQUISITION POLICY AND PROCEDURES" 1b. AR 70-2, "RESEARCH, DEVELOPMENT, & ACQUISITION MATERIEL STATUS RECORDING" 1c. AR 70-10, "R&D - TEST & EVALUATION DURING DEVELOPMENT AND ACQUISITION OF MATERIEL" 1d. "AR 570-9, "MANPOWER AND EQUIPMENT CONTROL - HOST NATION SUPPORT" 2. AR 700-9, "POLICIES OF THE ARMY LOGISTIC SYSTEM" 3. AR 700-82, "JOINT REGULATION GOVERNING THE USE AND APPLICATION OF UNIFORM SOURCE MAINTENANCE AND RECOVERABILITY CODES" 4. AR 700-127, "INTEGRATED LOGISTICS SUPPPORT" 5. AR 725-50, "REQUISITIONING, RECEIPT AND ISSUE SYSTEM" 6. AR 750-1, "MAINTENANCE OF SUPPLIES & EQUIPMENT - ARMY MATERIEL MAINTENANCE CONCEPTS & POLICIES" 7. AMC-R-700-27, "LEVEL OF REPAIR ANALYSIS (LORA) PROGRAM" 8. AMC-R-750-10, "DEPOT MAINTENANCE INTERSERVICE" 9. DA PAM 700-4 10. DA PAM 700-28, "INTEGRATED LOGISTIC SUPPORT PROGRAM ASSESSMENT ISSUES AND CRITERIA" 11. DA PAM 700-50, "INTEGRATED LOGISTIC SUPPORT - DEVELOPMENTAL SUPPORTABILITY TEST AND EVALUATION GUIDE" 12. DA PAM 700-55, "INSTRUCTIONS FOR PREPARING THE INTEGRATED LOGISTIC SUPPORT PLAN" 12a. DA PAM 738-750, "THE ARMY MAINTENANCE MANAGEMENT SYSTEMS (TAMMS)" 13. DA PAM 750-21, "LOGISTIC SUPPORT MODELLING" 14. AMC PAM 700-4, "LOGISTICS SUPPORT ANALYSIS TECHNIQUES GUIDE (WITH PALMAN)" 14a. AMC PAM 700-11, "LOGISTICS SUPPORT ANALYSIS REVIEW TEAM GUIDE" 15. AMC PAM 750-2, "MAINTENANCE OF SUPPLIES AND EQUIPMENT GUIDE TO RELIABILITY CENTERED MAINTENANCE" 16. MIL-STD-152, "TECH REVIEW GUIDELINES" 17. MIL-STD-210A, "CLIMATIC EXTREMES FOR MILITARY EQUIPMENT" 18. MIL-STD-470, -471, "MAINTAINABILITY STANDARDS" 19. MIL-STD-756, "RELIABILITY MODELLING & PREDICTIONS" 20. MIL-STD-780, "MAINTENANCE ENGINEERING ANALYSIS CONTROL NUMBER (MEACNS) FOR AERONAUTICAL EQUIPMENT, UNIFORM NUMBERING SYSTEM 21. MIL-STD-781, "RELIABILITY DESIGN QUALIFICATION AND PRODUCTION ACCEPTANCE TESTS: EXPONENTIAL DISTRIBUTION 22. MIL-STD-785B, "RELIABILITY PROGRAM FOR SYSTEMS AND EQUIPMENT DEVELOPMENT & PRODUCTION" 23. MIL-STD-810, "ENVIRONMENTAL TEST METHODS & ENGINEERING GUIDELINES" 24. MIL-STD-881, "WORK BREAKDOWN STRUCTURES FOR DEFENSE MATERIEL ITEMS 25. MIL-STD-882, "SYSTEM SAFETY PROGRAM REQUIRMENTS" 26. MIL-STD-965, "PARTS CONTROL PROGRAM" 27. MIL-STD-1369A, "INTEGRATED LOGISTIC SUPPORT PROGRAM REQUIREMENTS" 28. MIL-STD-1388-1A, "LOGISTICS SUPPORT ANALYSIS" 29. MIL-STD-1388-2A, "LOGISTICS SUPPORT ANALYSIS RECORD" 30. MIL-STD-1629, "PROCEDURES FOR PERFORMING A FAILURE MODE, EFFECTS

Name	Label	Description
		& CRITICALITY ANALYSIS" 31. MIL-HDBK-472, "MAINTAINABILITY PREDICTION" 32. MIL-M-24100B, "FUNCTIONALY ORIENTED MAINTENANCE MANUALS (FOMM) FOR EQUIPMENT & SYSTEMS"
P/F(2)	POLICY FILES(2) SUPPLEMENT	THIS DATA STORE SUPPLEMENTS THE ITEMS LISTED IN P/F (POLICY FILES). THIS IS NECESSARY ONLY BECAUSE OF THE LIMITATIONS OF THE SOFTWARE THAT LIMITS THE TOTAL NUMBER OF LINES THAT MAY BE RECORDED IN ANY ONE FILE: 1. AR 70-38, "RESEARCH, DEVELOPMENT, TEST & EVALUATION OF MATERIEL FOR EXTREME CLIMATIC CONDITIONS" 2. AR 570-2, "MANPOWER REQUIREMENTS CRITERIA (MARC) - TABLES OF ORGANIZATION AND EQUIPMENT". 2. AR 602-1, "PERSONNEL-MATERIEL SYSTEMS - HUMAN FACTORS ENGINEERING PROGRAM" 3. AR 602-2, "MANPOWER AND PERSONNEL INTEGRATION (MANPRINT) IN MATERIEL ACQUISITION PROCESS" 4. AR 700-47, "LOGISTICS - DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM" 5. AR 700-60, "LOGISTICS - DEPARTMENT OF DEFENSE PARTS CONTROL PROGRAM" 6. AR 700-129, "MANAGEMENT AND EXECUTION OF INTEGRATED LOGISTIC SUPPORT (ILS), PROGRAMS FOR MULTISERVICE ACQUISITIONS" 7. MIL-STD-1366B, "MATERIEL TRANSPORT. SYS DIMENSIONAL AND WEIGHT CONSTRAINTS, DEFINITION OF" 8. MIL-STD-1367 "PACKAGING, HANDLING, STORAGE, AND TRANSPORTABILITY CRITERIA" 9. MIL-HDBK-157 "MILITARY HANDBOOK TRANSPORTABILITY CRITERIA"
PM/DF	PROGRAM MANAGER DATA FILE	CONTAINS THOSE FILES AND DATA WHICH ARE NORMALLY DEVELOPED BY AND/OR RETAINED BY THE PROGRAM MANAGER FOR PROPER MANAGEMENT OF THE DEVELOPMENT PROGRAM. THESE FILES INCLUDE: 1. ENGINEERING DRAWINGS 2. ENGINEERING CHARACTERISTICS 3. DT/OT RESULTS 4. CONCEPT FORMULATION PACKAGE (CFP) 5. DESIGN CONCEPT PAPER (DCP) 6. TYPE TECHNICAL REVIEWS REQUIRED 7. MILESTONE SCHEDULES 8. FUNDING PROFILES 9. REQUIRED OPERATIONAL CAPABILITIES (ROC) 10. ITEM/EQUIPMENT SPECIFICATIONS 11. ITEM/EQUIPMENT MISSIONS & FUNCTIONS 12. EQUIPMENT, MANPOWER, AND TECHNICAL RISK ASSESSMENTS (FROM LSA TASK 301.2.3 13. TRADE OFF DETERMINATION ANALYSIS (TOD) 14. TRADE OFF ANALYSIS (TOA) 15. BEST TECHNICAL APPROACH ANALYSIS (BTA) 16. COST AND OPERATIONAL-EFFECTIVENESS ANALYSIS (COEA) 17. HARDWARE SPECIFICATIONS 18. RAM REQUIREMENTS 19. BASELINE COST ESTIMATE (BCE)

	Name	Label	Description
	REQ/F	REQMNTS DOCUMNT FILE	REQUIREMENTS (DOCUMENTS) FILE ACRONYMS : JSOR - Joint Services Operational Requirements O&O - Operational and Organizational ROC - Required Operational Capabilities PURPOSE OF DATA STORE : This data store contains information on the stated RSI requirements which the system must or should meet. SOURCE OF DATA : Requirements documents (JSOR's, ROC's, multinational development agreements), O&O plans, Mission Profile documents, and systems or equipment specifications.

	Name	Label	Description
	OTHER SOURCES	OTHER SOURCES OF DATA	THIS ENTITY IS COMPRISED OF OTHER SOURCES OF INFORMATION AND DATA NOT AVAILABLE ELSEWHERE. IT INCLUDES POINTS OF CONTACT LOCATED IN UNIVERSITIES, COLLEGES, RESEARCH LABS, DEFENSE CONTRACTORS, THE STAFFS AND AGENCIES OF ALLIED NATIONS AND OTHER ORGANIZATIONS AND AGENCIES CAPABLE OF PROVIDING INFORMATION INDICATED BY THE DATA FLOW COMING FROM THIS ENTITY.
	PM/ILSMT	PM/ILSMT INITIATE REQRMNT	THE PROGRAM MANAGER OR THOSE ACTIVITIES, AGENCIES, OR AUTHORITIES THAT ARE RESPONSIBLE FOR THE INITITATION OF THE REQUIREMENT FOR AN ILS ELEMENT ASSESSMENT DURING A DEVELOPMENT PROGRAM FOR A SYSTEM AND/OR EQUIPMENT IN ACCORDANCE WITH AR 700-127. THE KEY ACTION (OUTPUT) REQUIRED OF THIS EXTERNAL ENTITY IS THE DIRECTIVE, AUTHORITY, OR OTHER DOCUMENTATION THE INITIATES THE REQUIREMENT FOR THE APPLICATION OF THIS ILS ASSESSMENT TO A SPECIFIC SYSTEM/EQUIPMENT DEVELOPMENT PROGRAM AT A SPECIFIED POINT IN ITS LIFE CYCLE.

ANNEX C

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LSA TASK 303
EVALUATION AND TRADE-OFF BETWEEN SYSTEM/EQUIPMENT ALTERNATIVES AND ENERGY REQUIREMENTS

ANNEX C
LSA SUBTASK 303.2.10
EVALUATION AND TRADE-OFF BETWEEN SYSTEM EQUIPMENT ALTERNATIVES AND ENERGY REQUIREMENTS

PROCESS 303.2.10.1 - SELECT SYSTEM/EQUIPMENT ALTERNATIVES

PURPOSE:

To select new system/equipment alternatives, one at a time, for in-depth evaluation of the relative energy requirement characteristics. Perform a trade-off evaluation to select the candidate systems/equipment having the optimum energy requirements characteristics.

PROCEDURES:

1. Select the first alternative system/equipment from the candidates, and then perform all processes of this 303.2.10.2 for each candidate.

2. Obtain the following information from the appropriate sources:

   a. Program documentation
   b. Similar systems information
   c. Design specifications that establish energy requirement characteristics associated with the selected system/equipment.

3. Review existing similar systems energy requirements data from historical data file and obtain the existing baseline comparison systems documents representing these systems. If similar energy requirements for a particular system is non-existent, obtain from appropriate points of contact the baseline comparison system documentation representing a composite of elements from various systems that can be assembled to most closely resemble the energy requirement characteristics of the candidate system/equipment being evaluated.

REFERENCES:

1. Project Managers Data File
2. Acquiring Activity File
3. Historical Data File
4. Outside Sources

SELECT SYSTEM/EQUIPMENT ALTERNATIVES
(PROCESS 303.2.10.1)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

Identify the alternative System/Equipment to be analyzed:

a.
b.
c.
d.

Identify energy requirement characteristics:

a. Operating range
b. Maximum speed
c. Weight
d. Operating environment (peacetime, wartime).

IDENTIFY QUANTITATIVE REQUIREMENTS
(PROCESS 303.2.10.2A1)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

1. Mission duration (hrs):

2. Operating time of energy source per mission (hrs):

3. Number of missions per month (or year):

4. Fuel consumption rate per system/equipment (gal/hr):

5. Lubrication requirements per system/equipment:

   a. Type:_____ Quant:_____
   b. Type:_____ Quant:_____
   c. Type:_____ Quant:_____

6. Number of system/equipment fielded:

7. Total fuel requirements:

8. Total lubricant requirements:

9. Manhours required to service energy requirements:

   a. MOS:_____ Grade:_____ MH's:_____

   b. MOS:_____ Grade:_____ MH's:_____

   c. MOS:_____ Grade:_____ MH's:_____

PROCESS 303.2.10.2 - IDENTIFY ALTERNATIVE ENERGY REQUIREMENTS

PURPOSE:

To identify the energy requirements and characteristics of each of the candidate systems/equipment.

PROCESS 303.2.10.2A1 - Identify Quantitative Requirements

PURPOSE:

To estimate the POL requirements and manhours expended in support of the energy requirements for the candidate systems/equipment, using both peacetime and wartime criteria.

PROCEDURES:

1. Using information from the Requirements Document File, estimate monthly or annual operating hours of the systems/equipment. Determine if the energy source is operated at a different operating time than the mission time of the systems/equipment. Use the operating time of the energy source if they are different. Use both peacetime and wartime criteria.

2. From the design concepts information and from historical data, determine the fuel consumption rate and lubrication requirements for the system/equipment.

3. From the data developed in steps 1 and 2, calculate the POL requirements for each candidate system/equipment.

4. Using information from the requirements document file, determine the manhours and personnel (MOSs and grades) required to service the energy requirements of each system/equipment, and PMCs of the power plant and lubricated components of the systems/equipment.

REFERENCES:

1. Requirements File
2. Acquiring Activity File
3. Historical Data of Similar Items
4. Project Managers File

IDENTIFY TRANSPORTATION REQUIREMENTS
(PROCESS 303.2.10.2A2)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

1. Quantity (per month or year) of POL shipped from producer to:

   a. Depot A:
   b. Depot C:
   c. Depot D:

2. Transportation required (per month or year) from producer to:

	Road	Rail	Sea	Air	Other (Pipe, etc.)
Depot A					
Depot B					
Depot C					

3. Quantity of POL (per month or year) shipped from:

   a. Depot A to Europe:
   b. Depot B to Pacific:
   c. Depot C to CONUS camps, ports and stations:

4. Transportation required (per month or year) from:

	Road	Rail	Sea	Air	Other (Pipe, etc.)
Depot A					
Depot B					
Depot C					

5. Quantity of POL (per month or year) shipped from staging area in:

	Road	Rail	Sea	Air	Other (Pipe, etc.)
Europe to:					
Unit A					
Unit B					
Pacific to:					
Unit A					
Unit B					
CONUS to:					
Unit A					
Unit B					

IDENTIFY TRANSPORTATION REQUIREMENTS
(PROCESS 303.2.10.2A2)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

6. List any special handling equipment or techniques for any of the above:

   a.
   b.
   c.

PROCESS 303.2.10.2A2 - Identify Transportation Requirements

PURPOSE:

To determine the types and quantity of transportation that must be made available for the fuel requirements of each candidate system/equipment, and to determine safety restrictions that may apply to each mode of transportation.

PROCEDURES:

1. Using the data calculated in step 3 of Process 303.2.10.2A1 and POL distribution table in the requirements documents for each candidate system/equipment, determine the wholesale POL quantities that must be shipped from producers to depots, from depots to theaters of operation, and retail quantities that must be shipped from staging areas to using units.

2. Using data available in the LSAR files, evaluate the following POL transportation requirements for each candidate system/equipment:

    a. Requirements for dedicated vehicles that are not present in the inventory or are being utilized for other purposes
    b. Type of transportation available for transporting the POL (i.e., air, sea, rail and road).
    c. Identify any needs for special handling equipment or unique handling techniques.
    d. Ensure that all design details related to transportation are addressed, such as, over-pressure release devices, lifting/tie-down requirements, etc.

REFERENCES:

1. LSAR data record J for transportability characteristics of required POL.
2. Requirements Document File.

PROCESS 303.2.10.2A3 - Identify Storage Requirements

PURPOSE:

To determine the type and quantity of storage facilities that must be made available for the fuel requirements of each candidate system/equipment.

IDENTIFY STORAGE REQUIREMENTS
(PROCESS 303.2.10.2A3)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

1. Storage facilities required:

	Temperate	Cold	Hot/ Dry	Hot/ Wet
Depot A				
Depot B				
Depot C				
Europe Staging Area				
Unit A				
Unit B				
Pacific Staging Area				
Unit A				
Unit B				
CONUS				
Unit A				
Unit B				

2. Storage temperature range and storage life:

   a. Fuel:
   b. Lubricant:

3. Additional or new storage facilities required:

IDENTIFY AVAILABILITY CHARACTERISTICS
(PROCESS 303.2.10.2A4)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

1. Present production rate:

2. Consumption rate:

   a. Per system/equipment:
   b. Number of system/equipment per unit:
   c. Number of system/equipment in CONUS:
   d. Number of system/equipment in Europe:
   e. Number of system/equipment in Far East:

3. Production base:

   a. Percent produced in CONUS:
   b. Percent produced in foreign countries:

4. Production loss due to climatic conditions:

   a. Hot: _____ %
   b. Cold: _____ %
   c. Wet: _____ %.

5. List other systems/equipment using energy source:

SYS/EQPMNT	NUMBER OF SYS/EQPMNT	CONSUMPTION RATE FOR SYS/EQPMNT	TOTAL CONSUMPTION RATE

PROCEDURES:

1. Using the data calculated in step 3 of Process 303.2.10.2A1 and the distribution table in the requirement documents of each candidate system/equipment, determine the type and quantity of storage facilities required at depots, theater staging areas and using units. Consideration must be made for various climatic conditions.

2. From the design concepts information, determine the storage temperature range and any storage life limitations for the POL being evaluated.

3. From the data developed in steps 1 and 2, identify any additional or new type of storage facilities required at any of the locations where the POL is stored.

REFERENCES:

1. Requirements File
2. Program Manager Data File
3. Policy File Supplement

PROCESS 303.2.10.2A4 - <u>Evaluate Availability Characteristics</u>

PURPOSE:

To assure that sufficient amounts of fuel, associated with each candidate system/equipment is available where the systems/equipment is deployed. All operating environments and mission requirements must be considered.

PROCEDURES:

1. Using the Program Manager's Data File, determine an accurate forecast of the associated fuel production capacity. Determine if there is a need and, if so, the ability to increase present production in order to meet the requirements of the new system/equipment.

2. Determine if production schedules are adaptable to meet peak utilization periods.

3. Indicate if a foreign source involved that could be affected by a change in political relationships with this country.

CATEGORIZE & CONSOLIDATE DATA
(PROCESS 303.2.10.2A5)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

1. Alternative Energy Requirements:

	Quant. Req's	Trans Req's	Storage Req's	Availability Characteristics
Sys/Equip A				
Sys/Equip B				
Sys/Equip C				

2. Alternative Energy Characteristics:

	Quant	Trans	Storage
Sys/Equip A			
Sys/Equip B			
Sys/Equip C			

3. Alternative Energy Problem Areas:

	Quant	Trans	Storage	Availability
Sys/Equip A				
Sys/Equip B				
Sys/Equip C				

CONSTRUCT ANALYTICAL RELATIONSHIPS
(PROCESS 303.2.10.3)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

CHARACTERISTIC NAME	CONSTRAINT

Describe Model/Rating System Selected:

4. Determine if climatic conditions or seasonal changes will adversely affect the production, transportation or operation of the energy source.

5. Determine if production rate and available transportation and storage facilities adversely affect the utilization of the energy source by any existing systems/equipment.

REFERENCE:

1. Program Manager Data File

PROCESS 303.2.10.2A5 - <u>Categorize and Consolidate Data</u>

PURPOSE:

To organize and consolidate the evaluated energy requirements characteristics data into a comprehensive file.

PROCEDURES:

1. Assemble all the data developed during processes 303.2.10.2A1 thru 303.2.10.2A4.

2. Identify those characteristics which have a relationship between them.

   a. Availability vs Storage Requirements
   b. Availability vs Transportation Requirements
   c. Availability vs Personnel Requirements

REFERENCE:

1. Data developed in Process 303.2.10.2A1 thru 303.2.10.2A4.

PROCESS 303.2.10.3 - CONSTRUCT ANALYTICAL RELATIONSHIPS

PURPOSE:

To construct analytical relationships or models between quantitative requirements, transportability, availability, and any other parameters considered important for evaluation.

PROCEDURES:

1. Using the results of Processes 303.2.10.2A1 through 303.2.10.2A5, construct a set of energy characteristics for use in the trade-off analysis.

2. Select the characteristics from the POL requirements, transportation, storage, and availability areas.

3. For each identified characteristic, establish an upper-limit constraint on the amount of resources that can be used. Constraints of logistics resources are specified in the O&O Plan, ROC, and other requirements documents.

   NOTE: Try to establish a set of energy characteristics that are applicable to all systems/equipments under analysis. However, in cases where characteristics pertain to only a specific system it may be used if it has an overall effect on the trade-off determination. (e.g., A system requires a new fuel vehicle for resupply. A large number of the resupply vehicles would be required to sustain operations).

4. Using the characteristics and the constraint data, develop a model to perform the trade-off analysis. The model can either be manual or automated.

5. One method that may be used is:

   a. For each of the characteristics selected for analysis, assign a weighting factor based on the overall importance of the characteristic to the analysis. The weighting factors should add up to 100%.
   b. For each characteristic, establish a rating system. For instance use a number between 1 and 10. A characteristic given a ranking of 10 is highly desirable because it falls within resource constraints while requiring no new addition to Army inventory or stocks. A rating of 1 is very undesirable because this characteristic falls outside the constraints and/or requires a large influx of new resources.

REFERENCES:

1. LSA Task 301, Functional Requirements Identification.
2. Output from Process 303.2.10.2

SELECT ALTERNATIVE SYSTEM/EQUIPMENT ENERGY REQUIREMENTS (PROCESS 303.2.10.4A1)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

	SYSTEMS			
CHARACTERISTICS	ALT. 1	ALT.2	ALT. 3	ALT. 4

CONDUCT ENERGY REQUIREMENT TRADE-OFF ANALYSIS
(PROCESS 303.2.10.4A2)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

Document Trade-Off Results:

PROCESS 303.2.10.4 - CONDUCT TRADE-OFF ANALYSIS

PURPOSE:

Using data from Process 303.2.10.3, determine the energy requirements for use in selecting the system/equipment that best meet the support, performance, logistics, fielding and cost constraints within the mission objectives.

PROCESS 303.2.10.4A1 - Select Alternative Systems/Equipment Energy Requirements

PURPOSE:

To select system/equipment energy requirements characteristics meeting mission requirements and complying with supportability constraints.

PROCEDURES:

1. Develop a matrix using the energy requirements characteristics from Process 303.2.10.3 and the alternative system/equipments under analysis. Let the characteristics form the rows and the system/equipments form the column.

2. In the first column of the matrix, place the resource constraints for each of the identified characteristics.

3. Place quantitative values for the characteristics in the cells for each equipment under analysis.

PROCESS 303.2.10.4A2 - Conduct Energy Requirement Trade-Off Analysis

PURPOSE:

To select potential energy requirements criteria that will meet the performance, support, logistic and fielding requirements of the QMR.

PROCEDURES:

1. Using the model from Process 303.2.10.3 and the matrix developed in Process 303.2.10.4A1, perform the trade-off analysis.

2. If the alternative method provided in Process 303.2.10.3 is used, perform the following:

   a. For each of the system/equipment alternatives, rate the characteristic using the rating system previously developed.
   b. Multiply the characteristic rating by the weighting factor to get a weighted rating of the characteristic.
   c. Add the weighted rating to determine the total weighted score for the alternative system/ equipment.
   d. Divide the total weighted score by the number of characteristics rated to get the average score.
   e. Select the system/equipment with the highest average score.

PROCESS 303.2.10.4A3 - Perform Cost Analysis

PURPOSE:

To identify the system/equipment with the most economical energy requirements.

PROCEDURES:

1. Construct a relationship matrix of the cost for each energy requirement characteristic versus each of the candidate systems/equipment. When possible use a life cycle cost model to determine sustainment costs over the systems useful life.

2. Evaluate each system/equipment to determine which has the most economical energy requirements.

REFERENCE:

1. Worksheets from Process 303.2.10.3.

PROCESS 303.2.10.4A4 - Conduct Sensitivity Analysis

PURPOSE:

To identify those energy characteristics that when varied effect performance, design, supportability, produceability and thus, change the selected system/equipment.

COST ANALYSIS
(PROCESS 303.2.10.4A3)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

Document Cost Analysis Results:

CONDUCT SENSITIVITY ANALYSIS
(PROCESS 303.2.10.4A4)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

Document Sensitivity Analysis Results:

PROCEDURES:

1. Using the trade-off results, select the alternative system/equipments whose results are relatively similar. Use these systems/equipments for the sensitivity analysis.

2. Select one of the following areas to be varied for a specific sensitivity analysis:

   a. Characteristics based on estimates
   b. Characteristics taken from a baseline system
   c. Known cost, schedule or support driven attributes
   d. Characteristics identified as high risk due to technology or resource constraints.

3. Determine the range of values over which the characteristics value should be varied (e.g., minimum value, one-half to one-third the original value, maximum value, double or triple value). Where applicable, change the rating and develop new weighted ratings, total weighted scores, and average scores.

4. Hold all other variables constant, using the mathematical model to determine the effect of varying the characteristic on the system/equipment selected.

5. Determine how the performance, design, reliability, maintainability, supportability and cost are affected over the range of values for the characteristic.

6. Repeat steps 1 thru 4 for all characteristics that were selected for sensitivity analysis.

REFERENCES:

1. Energy Source Trade-Off Analysis results from Process 303.2.10.4A2.
2. Cost analysis results from Process 303.2.10.4A3.

PROCESS 303.2.10.5 - IDENTIFY POL REQUIREMENTS FOR SELECTED SYSTEM/EQUIPMENT

PURPOSE:

To identify POL requirements for the selected system/equipment, and perform a sensitivity analysis of POL cost by varying cost/gallon and system/equipment operating time.

IDENTIFY POL REQUIREMENTS FOR SELECTED SYSTEM/EQUIPMENT
(PROCESS 303.2.10.5)

END ITEM NAME:
NOMENCLATURE:
PART NUMBER:

Type of POL Required:

a.
b.
c.

Personal Required (Quan/MOS):

a.
b.
c.

Storage Facilities Req's:

Transportation Facilities Reqd:

Results of Sensitivity Analysis: (memo)

PROCEDURES:

1. For the selected system/equipment alternative, estimate qualitative/quantitative personnel requirements, developed in Process 303.2.10.2, for the selected energy source.

2. For the selected system/equipment alternative, tabulate qualitative/quantitative POL requirements, developed in Process 303.2.10.2, for the selected energy source.

3. Perform a sensitivity analysis of POL cost for the selected system/equipment alternative by:

   a. Preparing a graph of total POL cost vs cost/gallon.
   b. Preparing a graph of total POL cost vs operating hours.

   NOTE: POL cost do not include storage or transportation costs.

4. Apply the above energy requirements data to LSA Task 402 to assess the impact on existing systems from introduction of the system/equipment.

REFERENCE: Trade-Off Analysis results.

PROCESS 303.2.10.6 - DOCUMENT RESULTS AND RECOMMENDATION

PURPOSE:

To document the trade-off results between the selected system/equipment and energy requirements.

PROCEDURES:

1. Document, in narrative format, the results of the trade-off analysis, showing the selected system/equipment with the optimum energy requirements.

2. Include recommendations and conclusions for any changes in design, schedule, cost, etc. for the system/equipment based on the energy requirements.

3. The report should be as concise and specific as the information available permits. State the rationale for selection of the system/equipment. Summarize the important energy characteristics.

ANNEX D

LSA SUBTASK 303.2.10
VERT APPLICATION METHODOLOGY

VERT APPLICATION METHODOLOGY

BACKGROUND:

Venture Evaluation and Review Technique (VERT) was developed as a network analysis technique to facilitate management decision making. It allows a systematic planning and control of programs and enables managers to find solutions to real life managerial problems.

The terms of the APJ contract require the provision of batch files for each of the VERT networks associated with the various Data Flow Diagrams in the APJ 966 projects.

APJ has been successful in adopting a method for the creation of these networks using the existing EXCELERATOR software package and establishing a naming convention compatible with that used in the Data Flow Diagrams. To do this APJ has made use of the PC model of VERT. A Structured Analysis project was used for this purpose. The prototype VERT network structure was made for one top level and one lower level data flow diagram.

The PC model of VERT has certain limitations built into it. To overcome some of these limitations, certain conventions were used to create the input files. To maintain full generality a set of "dummy" default values were established. The model allows the user to alter the default values of time, cost, and performance to satisfy their specific requirements.

METHODOLOGY:

The basic symbols used to structure the network are:

(i) **SQUARES** - to indicate NODES. These are decision points in the project, or points beyond which the project cannot proceed unless certain criteria are met. There are two type of nodes, one which supports input operations and, the second type which supports output operations.

(ii) **LINES** - to indicate ARCS which are activities that have time, cost, and performance criteria associated with them.

In practice, however, both the arcs and nodes are similar, in that both have time, cost, and performance criteria associated with them. The arcs have a primary and a cumulative set of time, cost, and performance criteria whereas the nodes have only a single cumulative set.

(iii) **NAMING CONVENTIONS** - Efforts have been made to keep the naming convention as compatible as possible to the Data Flow Diagrams. The naming convention used is displayed below.

NODES - All nodes are prefixed with the letter **N**. The individual Nodes are identified by a number and a letter. The number refers to the number of the node within the diagram and the letter refers to the diagram number in the project. In the event that a node has been referenced in an earlier diagram they also carry the number of the node in the earlier diagram as a prefix to the individual node number.

N2.4A

N - All nodes are prefixed with the letter **N**
2 - Gives the number of the node it relates to in a higher level diagram or an earlier data flow diagram within the project. In this case it refers to node **N2** of the top level diagram.
4 - Gives the number of the node it relates to in a higher level diagram or an earlier data flow diagram within the project. In this case it refers to node **N2** of the top level diagram.
A - The nodes in each subsequent explosion are allotted an alphabetical suffix indication the number of the explosion diagram in the particular project. In this case it is the first lower level diagram within the project.

ARCS - All arcs are prefixed with either the letter **C** or **E**. The individual Arcs are identified by two numbers. The first number refers to the number of the arc within the diagram and the second number refers to the number of the diagram within the project. In the event that an arc has been referenced in an earlier diagram they also carry the number of the arc in the earlier diagram as a prefix to the individual arc number. The arcs

which are identified by the letter **E** have direct reference to a process in the corresponding data flow diagram and as such are named the same as the process itself.

C3.3.8.4 **E12.1A2**

C - All arcs are prefixed with the letter C. In some cases, however, arcs carry a prefix of **E**. These particular arcs correspond to a process within the data flow diagram and are thus named the same as the process itself.

3.3- Gives the number of the arc it relates to in a higher level diagram or an earlier data flow diagram within the project. In this case it refers to arc number 3 in lower level diagram #3 within the project.

8.4- Indicates that this particular arc is the #8 arc in the #4 lower level diagram of the project.

BATCH FILES

INPUT FILES - The input file names are given the extension ***.IN**.

OUTPUT FILES - The simulation output files are given the extension ***OU**.

PRINT FILES - The print files have been given the extension ***.PR**.

(This would allow subsequent updates of the input files to be numbered as **IN1...**, **OU1...**, **PR1...** etc.)

DEFAULT SETTINGS:

Control Record:

(i) The output option selected is "0" which provides a detailed listing, and high level of summary information.

(ii) The input record listing option selected is "0" which prints all input records.

(iii) The composite terminal node output option selected is "16" which assumes family mode and intrafamily transfer of histogram data.

(iv) The number of interactions used are "10" in the demonstration model to facilitate operation in the debug mode if required.

(v) The composite node name and the network name are left as blanks.

(vi) In the run identification the name of the corresponding Data Flow Diagram is used as identification for the network description.

Arc Records:

(i) For each of the arcs the following records are provided:
(a) Master Arc Record
(b) Time Distribution Satellite
(c) Cost Distribution Satellite
(d) Performance Distribution Satellite

(ii) The Distribution Satellite Records are created to provide a uniform statistical distribution.

(iii) The default values used for the minimum and maximum in each criteria are:

TIME	10.0	10.0
COST	10.0	100.0
PERFORMANCE	10.0	50.0

Node Records:

(i) Input Logic - The input logic for the nodes are either "**INITIAL**" or "**AND**".

(ii) Output Logic - The output logic has been defaulted to "**AND**" or "**TERMINAL**".

(iii) The output option indicator and the storage option indicator are defaulted to read "0".

(iv) The node description has also been left blank.

(It is again noted that the user can change the default values to desired values as identified by the particular requirement and applications.)

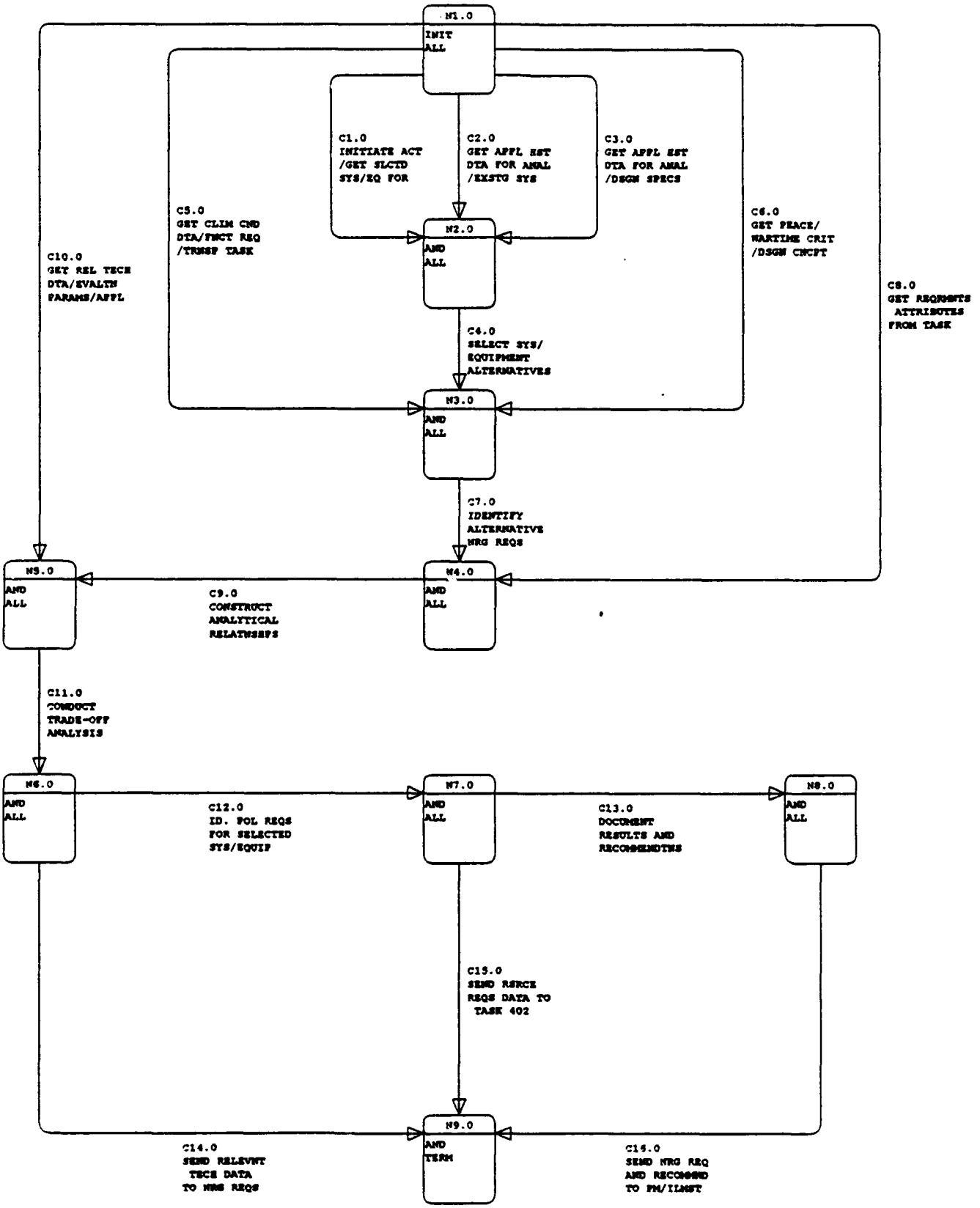
DOCUMENTATION:

With every project report APJ will be providing the following documents relating to the VERT:

(i) A VERt network diagram corresponding to a particular data flow diagram.

(ii) A print out of the VERT network inputs for the particular data flow diagrams.

(iii) A floppy disc containing the sample input, print and the simulation output files for the default VERT network.



303.2.10 VERT OVERVIEW
Created by: jack
Revised by: sid
Date changed: 24-AUG-90

```
1        N E W   N E T W O R K              PAGE  1
                1         2         3         4         5         6         7         8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
  1. 0016  10                ENERGY ALTERNATIVES TRADE-OFF ANALYSIS OVERVIEW
                +         +         +         +         +         +         +         +
  2. C1.0    N1.0    N2.0     1.0 INITIATE ACTION/GET SELECTED SYS/EQUIP FOR ANALYSIS
  3. C1.0    DTIME 1         2      10.0      20.0
  4. C1.0    DCOST 1         2      10.0     100.0
  5. C1.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
  6. C2.0    N1.0    N2.0     1.0 GET APPLCBL HIST DTA AND EXIST SYS/EQUIP FOR ANAL
  7. C2.0    DTIME 1         2      10.0      20.0
  8. C2.0    DCOST 1         2      10.0     100.0
  9. C2.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 10. C3.0    N1.0    N2.0     1.0 GET APPLCBL HIST DATA FOR ANAL/DESIGN SPECS
 11. C3.0    DTIME 1         2      10.0      20.0
 12. C3.0    DCOST 1         2      10.0     100.0
 13. C3.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 14. C4.0    N2.0    N3.0     1.0 SELECT SYSTEM/EQUIPMENT ALTERNATIVES
 15. C4.0    DTIME 1         2      10.0      20.0
 16. C4.0    DCOST 1         2      10.0     100.0
 17. C4.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 18. C5.0    N1.0    N3.0     1.0 GET CLIMTC CNDTNS DATA/FNCTNL REQS/TRNSP TSK FNCTNS
 19. C5.0    DTIME 1         2      10.0      20.0
 20. C5.0    DCOST 1         2      10.0     100.0
 21. C5.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 22. C6.0    N1.0    N3.0     1.0 GET PEACETIME/WARTIME CRITERIA - DESIGN CONCEPTS
 23. C6.0    DTIME 1         2      10.0      20.0
 24. C6.0    DCOST 1         2      10.0     100.0
 25. C6.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 26. C7.0    N3.0    N4.0     1.0 IDENTIFY ALTERNATIVE ENERGY REQUIREMENTS
 27. C7.0    DTIME 1         2      10.0      20.0
 28. C7.0    DCOST 1         2      10.0     100.0
 29. C7.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 30. C8.0    N1.0    N4.0     1.0 GET REQUIREMENTS ATTRIBUTES FROM TASK 301
 31. C8.0    DTIME 1         2      10.0      20.0
 32. C8.0    DCOST 1         2      10.0     100.0
 33. C8.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 34. C9.0    N4.0    N5.0     1.0 CONSTRUCT ANALYTICAL RELATIONSHIPS
 35. C9.0    DTIME 1         2      10.0      20.0
 36. C9.0    DCOST 1         2      10.0     100.0
 37. C9.0    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 38. C10.0   N1.0    N5.0     1.0 GET RLVNT TECH DTA/EVAL PARAMS/APPLCBL MODLS OR EQ
 39. C10.0   DTIME 1         2      10.0      20.0
 40. C10.0   DCOST 1         2      10.0     100.0
 41. C10.0   DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 42. C11.0   N5.0    N6.0     1.0 CONDUCT TRADE-OFF ANALYSIS
 43. C11.0   DTIME 1         2      10.0      20.0
 44. C11.0   DCOST 1         2      10.0     100.0
 45. C11.0   DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
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                1       2       3       4       5       6       7       8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
1        N E W   N E T W O R K                PAGE  2
                1       2       3       4       5       6       7       8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
   46. C12.0   N6.0    N7.0     1.0 IDENTIFY POL REQS FOR SELECTED SYSTEM/EQUIPMENT
   47. C12.0   DTIME 1        2      10.0      20.0
   48. C12.0   DCOST 1        2      10.0     100.0
   49. C12.0   DPERF 1        2      10.0      50.0
                +       +       +       +       +       +       +       +
   50. C13.0   N7.0    N8.0     1.0 DOCUMENT RESULTS AND RECOMMENDATIONS
   51. C13.0   DTIME 1        2      10.0      20.0
   52. C13.0   DCOST 1        2      10.0     100.0
   53. C13.0   DPERF 1        2      10.0      50.0
                +       +       +       +       +       +       +       +
   54. C14.0   N6.0    N9.0     1.0 SEND RELEVANT TECH DATA TO ENERGY REQS DATABASE
   55. C14.0   DTIME 1        2      10.0      20.0
   56. C14.0   DCOST 1        2      10.0     100.0
   57. C14.0   DPERF 1        2      10.0      50.0
                +       +       +       +       +       +       +       +
   58. C15.0   N7.0    N9.0     1.0 SEND RESOURCE REQUIREMENTS DATA TO TASK 402
   59. C15.0   DTIME 1        2      10.0      20.0
   60. C15.0   DCOST 1        2      10.0     100.0
   61. C15.0   DPERF 1        2      10.0      50.0
                +       +       +       +       +       +       +       +
   62. C16.0   N8.0    N9.0     1.0 SEND NRG REQS  AND RECOMMENDATIONS TO PM/ILSMT
   63. C16.0   DTIME 1        2      10.0      20.0
   64. C16.0   DCOST 1        2      10.0     100.0
   65. C16.0   DPERF 1        2      10.0      50.0
                +       +       +       +       +       +       +       +
   66. ENDARC
                +       +       +       +       +       +       +       +
   67. N1.0    1  2 0 0
                +       +       +       +       +       +       +       +
   68. N2.0    2  2 0 0
                +       +       +       +       +       +       +       +
   69. N3.0    2  2 0 0
                +       +       +       +       +       +       +       +
   70. N4.0    2  2 0 0
                +       +       +       +       +       +       +       +
   71. N5.0    2  2 0 0
                +       +       +       +       +       +       +       +
   72. N6.0    2  2 0 0
                +       +       +       +       +       +       +       +
   73. N7.0    2  2 0 0
                +       +       +       +       +       +       +       +
   74. N8.0    2  2 0 0
                +       +       +       +       +       +       +       +
   75. N9.0    2  1 0 0
                +       +       +       +       +       +       +       +
   76. ENDNODE
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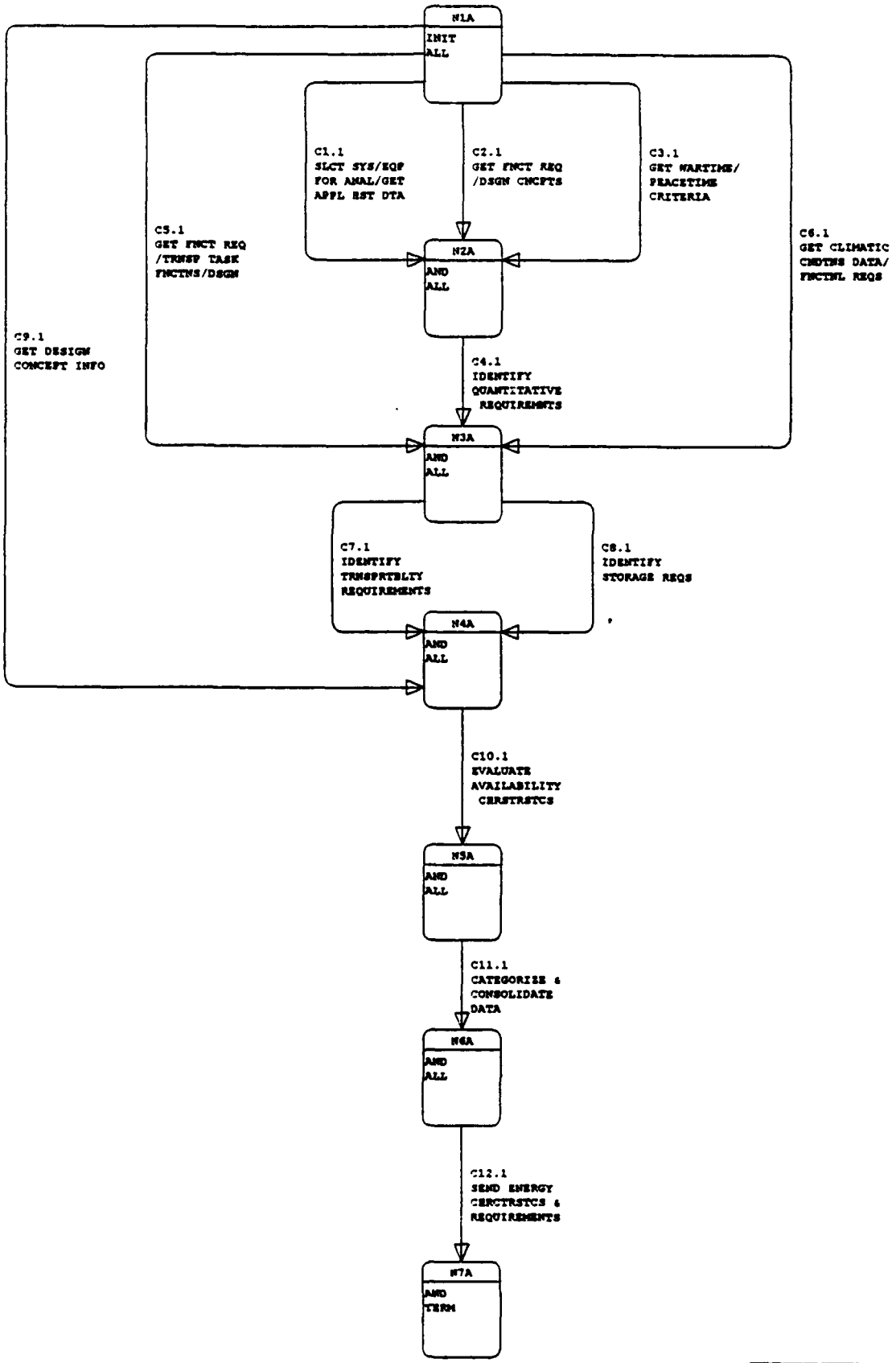

303.2.10.2A VERT ID CHRSTCS/REQS
Created by: jack
Revised by: jack
Date changed: 09-AUG-90

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1        N E W   N E T W O R K              PAGE   1
                1         2         3         4         5         6         7         8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
    1. 0016  10                IDENTIFY ENERGY CHARACTERISTICS AND REQUIREMENTS
                +         +         +         +         +         +         +         +
    2. C1.1    N1A     N2A      1.0 SELECT SYS/EQUIP & GET APPL HIST DATA FOR ANALYSIS
    3. C1.1    DTIME 1         2      10.0      20.0
    4. C1.1    DCOST 1         2      10.0     100.0
    5. C1.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
    6. C2.1    N1A     N2A      1.0 GET FUNCTIONAL REQUIREMENTS/DESIGN CONCEPTS
    7. C2.1    DTIME 1         2      10.0      20.0
    8. C2.1    DCOST 1         2      10.0     100.0
    9. C2.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   10. C3.1    N1A     N2A      1.0 GET WARTIME AND PEACETIME CRITERIA
   11. C3.1    DTIME 1         2      10.0      20.0
   12. C3.1    DCOST 1         2      10.0     100.0
   13. C3.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   14. C4.1    N2A     N3A      1.0 IDENTIFY QUANTITATIVE REQUIREMENTS
   15. C4.1    DTIME 1         2      10.0      20.0
   16. C4.1    DCOST 1         2      10.0     100.0
   17. C4.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   18. C5.1    N1A     N3A      1.0 GET FNCTL REQS/TRANSPRTN TASK FNCTNS/DSGN CNCPT INF
   19. C5.1    DTIME 1         2      10.0      20.0
   20. C5.1    DCOST 1         2      10.0     100.0
   21. C5.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   22. C6.1    N1A     N3A      1.0 GET CLIMATIC CONDITIONS/FUNCTIONAL REQUIREMENTS
   23. C6.1    DTIME 1         2      10.0      20.0
   24. C6.1    DCOST 1         2      10.0     100.0
   25. C6.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   26. C7.1    N3A     N4A      1.0 IDENTIFY TRANSPORTABILITY REQUIREMENTS
   27. C7.1    DTIME 1         2      10.0      20.0
   28. C7.1    DCOST 1         2      10.0     100.0
   29. C7.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   30. C8.1    N3A     N4A      1.0 IDENTIFY STORAGE REQUIREMENTS
   31. C8.1    DTIME 1         2      10.0      20.0
   32. C8.1    DCOST 1         2      10.0     100.0
   33. C8.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   34. C9.1    N1A     N4A      1.0 GET DESIGN CONCEPT INFORMATION
   35. C9.1    DTIME 1         2      10.0      20.0
   36. C9.1    DCOST 1         2      10.0     100.0
   37. C9.1    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   38. C10.1   N4A     N5A      1.0 EVALUATE AVAILABILITY CHARACTERISTICS
   39. C10.1   DTIME 1         2      10.0      20.0
   40. C10.1   DCOST 1         2      10.0     100.0
   41. C10.1   DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
   42. C11.1   N5A     N6A      1.0 CATEGORIZE AND CONSOLIDATE DATA
   43. C11.1   DTIME 1         2      10.0      20.0
   44. C11.1   DCOST 1         2      10.0     100.0
   45. C11.1   DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
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                1         2         3         4         5         6         7         8
        12345678901234567890123456789012345678901234567890123456789012345678901234567890
1         N E W   N E T W O R K                PAGE   2
                1         2         3         4         5         6         7         8
        12345678901234567890123456789012345678901234567890123456789012345678901234567890
    46. C12.1   N6A     N7A      1.0 SEND ENERGY CHARACTERISTICS/REQUIREMENTS>303.2.10.3
    47. C12.1   DTIME 1         2      10.0      20.0
    48. C12.1   DCOST 1         2      10.0     100.0
    49. C12.1   DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
    50. ENDARC
                +         +         +         +         +         +         +         +
    51. N1A     1  2 0 0
                +         +         +         +         +         +         +         +
    52. N2A     2  2 0 0
                +         +         +         +         +         +         +         +
    53. N3A     2  2 0 0
                +         +         +         +         +         +         +         +
    54. N4A     2  2 0 0
                +         +         +         +         +         +         +         +
    55. N5A     2  2 0 0
                +         +         +         +         +         +         +         +
    56. N6A     2  2 0 0
                +         +         +         +         +         +         +         +
    57. N7A     2  1 0 0
                +         +         +         +         +         +         +         +
    58. ENDNODE
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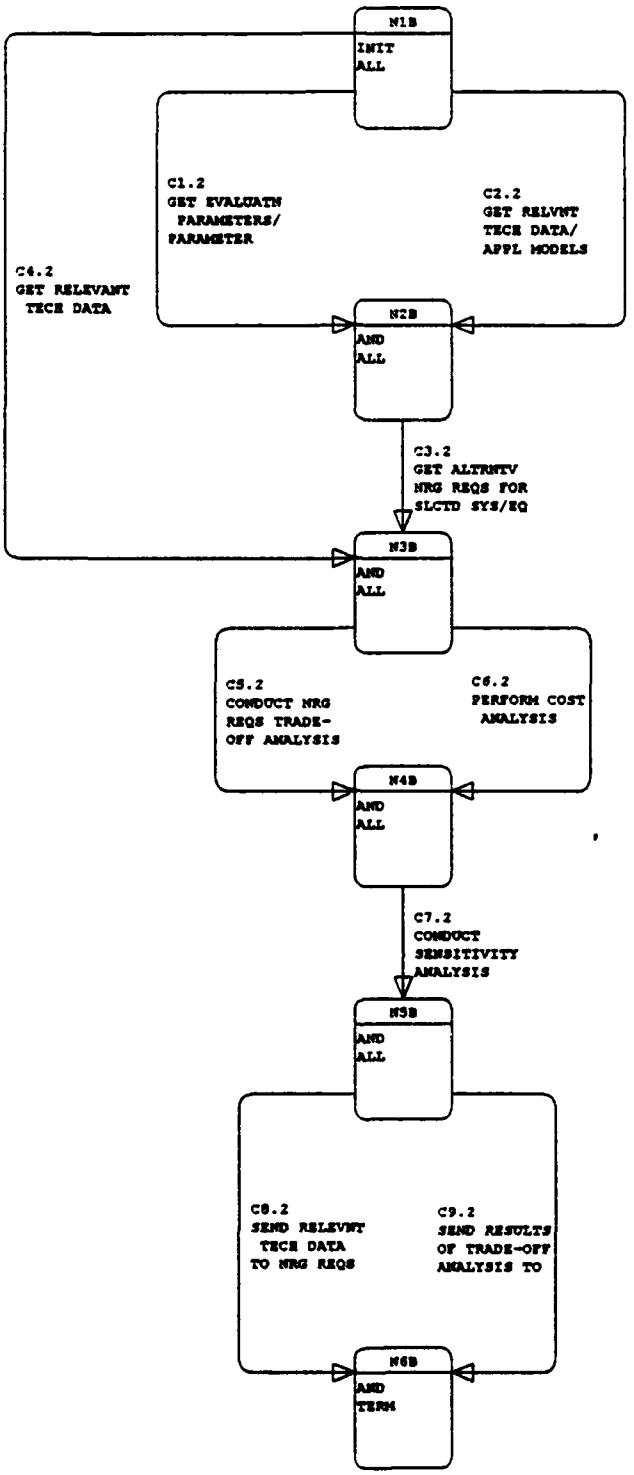

303.2.10.4A VERT TRADE-OFF ANAL
Created by: jack
Revised by: jack
Date changed: 22-AUG-90

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1'      N E W   N E T W O R K              PAGE  1
                1         2         3         4         5         6         7         8
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  1. 0016  10                 CONDUCT ENERGY REQUIREMENTS TRADE-OFF ANALYSIS
                +         +         +         +         +         +         +         +
  2. C1.2    N1B     N2B      1.0 GET EVALUATION PARAMETERS/PARAMETER RELATIONSHIPS
  3. C1.2    DTIME 1         2      10.0      20.0
  4. C1.2    DCOST 1         2      10.0     100.0
  5. C1.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
  6. C2.2    N1B     N2B      1.0 GET RELEVANT TECHNCL DATA/APPLCBLE MODLS OR EQVLNTS
  7. C2.2    DTIME 1         2      10.0      20.0
  8. C2.2    DCOST 1         2      10.0     100.0
  9. C2.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 10. C3.2    N2B     N3B      1.0 GET ALTERNATIVE ENERGY REQS FOR SLCTD SYS/EQUIP
 11. C3.2    DTIME 1         2      10.0      20.0
 12. C3.2    DCOST 1         2      10.0     100.0
 13. C3.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 14. C4.2    N1B     N3B      1.0 GET RELEVANT TECHNICAL DATA
 15. C4.2    DTIME 1         2      10.0      20.0
 16. C4.2    DCOST 1         2      10.0     100.0
 17. C4.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 18. C5.2    N3B     N4B      1.0 CONDUCT ENERGY REUIREMENTS TRADE-OFF ANALYSIS
 19. C5.2    DTIME 1         2      10.0      20.0
 20. C5.2    DCOST 1         2      10.0     100.0
 21. C5.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 22. C6.2    N3B     N4B      1.0 PERFORM COST ANALYSIS
 23. C6.2    DTIME 1         2      10.0      20.0
 24. C6.2    DCOST 1         2      10.0     100.0
 25. C6.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 26. C7.2    N4B     N5B      1.0 CONDUCT SENSITIVITY ANALYSIS
 27. C7.2    DTIME 1         2      10.0      20.0
 28. C7.2    DCOST 1         2      10.0     100.0
 29. C7.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 30. C8.2    N5B     N6B      1.0 SEND RELEVANT TECH DATA TO NRG DATABASE
 31. C8.2    DTIME 1         2      10.0      20.0
 32. C8.2    DCOST 1         2      10.0     100.0
 33. C8.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 34. C9.2    N5B     N6B      1.0 SEND RESULTS OF TRADE-OFF ANALYSIS TO 303.2.10.5
 35. C9.2    DTIME 1         2      10.0      20.0
 36. C9.2    DCOST 1         2      10.0     100.0
 37. C9.2    DPERF 1         2      10.0      50.0
                +         +         +         +         +         +         +         +
 38. ENDARC
                +         +         +         +         +         +         +         +
 39. N1B     1  2 0 0
                +         +         +         +         +         +         +         +
 40. N2B     2  2 0 0
                +         +         +         +         +         +         +         +
 41. N3B     2  2 0 0
                +         +         +         +         +         +         +         +
 42. N4B     2  2 0 0
                +         +         +         +         +         +         +         +
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                1       2       3       4       5       6       7       8
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1        N E W   N E T W O R K             PAGE  2
                1       2       3       4       5       6       7       8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
   43. N5B     2  2 0 0
                +       +       +       +       +       +       +       +
   44. N6B     2  1 0 0
                +       +       +       +       +       +       +       +
   45. ENDNODE
                1       2       3       4       5       6       7       8
       12345678901234567890123456789012345678901234567890123456789012345678901234567890
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ANNEX E

STRUCTURED SYSTEMS ANALYSIS
Fundamentals

NOTE: Our presentation of Structured Analysis Fundamented with the associated figure is reproduced verbatim in each report

ANNEX E
STRUCTURED SYSTEMS ANALYSIS

Fundamentals

Structured Systems Analysis (SSA) has recently become an industry standard for generating Data Flow Diagrams (replacing "logic diagrams" or "flow charts") to aid in coordinating the functions to be performed by a computer program and its associated Inputs/Outputs (I/O). During the SSA, each set of "flow charts" can be checked by the potential user to assure that there is complete agreement on what is to be done by the program, and how it is to be accomplished. It also provides considerable flexibility for updating or changing the program.

Six basic elements (see figure 1) are used in SSA:

1. Process (PRC)
2. Data Flow (DAF)
3. Data Store (DAS)
4. External Entity (EXT)
5. Data Flow Diagram (DFD)
6. Data Dictionary (DCT)

PROCESS (Represented by a Circle):

A function or operation to be performed which can be explained by a set of instructions representing a single task, e.g., "calculate interest on a loan", "prepare a draft report". If the Process description is too complex to describe in a few steps, it may be necessary to develop a lower level description (see below).

DATA FLOW (Lines interconnecting Processes or I/Os):

Each function or Process cannot be a stand-alone in a complex network. To have any meaning in a program, each process must be initiated by a previous action and/or provided information on which to act. Furthermore, a Process must result in an output which is the input to the next logical Process. These inputs, outputs, or initiating actions are identified as Data Flows, and are represented by the Data Flow lines indicating its point of origin and the process to which it provides data.

DATA STORE (Represented by two parallel lines):

Although some Processes generate data used as input to a succeeding Process, there is often a need to "gather or collect" information from files in which it is stored. This information may come from an external source (such as a MIL-STD, Army regulation, historical experience files, etc.), or an internal source or file in which data is temporarily stored for use by succeeding processes. These Data Stores can be visualized as a "file cabinet", in which the data are stored for later retrieval).

EXTERNAL ENTITY (Represented by a Rectangle):

Each program or logical process must have an initiating action, a "point" of disposition of the results, and possible input guidance or instructions. Each of these have authorities, functions, or applications which are independent of the program Process (although required by the program Process). Thus, these activities, agencies, or facilities are considered "External Entities" to the program.

DATA FLOW DIAGRAM:

The general arrangement of the above can be readily seen. First, the circle or Process describes what has to be done; the interconnecting lines represent the Data Flows, together with the specific description of all I/Os. The Data Stores identify the source and/or file designation of a data base, and the External Entities represent those activities remote from the Process, which are the source of guidance or the recipients of the program. This combination of Processes, Data Flows, Data Stores, and External Entities constitutes a "Data Flow Diagram". The unique feature of the Data Flow Diagram (DFD) is that each process can be considered independently, permitting a change to be made in one Process without a major change in the overall program.

DATA DICTIONARY:

The Data Dictionary consists of a complete description of each of the basic elements. For the Process, it contains a step-by-step description of what has to be performed. The description of the Data Flow identifies the nomenclature of the data, a detailed description of its content, and its source. The Data Stores and External Entities are described, including possible location.

The Data Dictionary (a living document) begins with a description of the first Process and is continually built-up as the Data Flow Diagrams are expanded, detailed, and eventually completed.

APPROACH TO PERFORMING STRUCTURED SYSTEM ANALYSIS:

The best approach to Structured Systems Analysis is to assume that the program consists of a series of processes, each of which are to be assigned to an inexperienced analyst. Each analyst is to be walked through the assigned process of the Program, explaining step-by-step functions have to be performed or what actions have to be taken to accomplish the process. The analyst is also informed where the information is coming from (input Data Flow), what is to be generated by each process (output Data Flow), where the data base may to be found (Data Stores), and who to contact for guidance (External Entities).

The best way to initiate a SSA is to set down the point of origin of a program, its final goal(s), and the intermediate functions or actions needed to get from beginning to goal. Each step should be considered as a Process - some may be sequential and others parallel. Then, the steps needed to accomplish the Process should be described. If the description is complex and needs intermediate steps, the Process is then a candidate for an "explosion". That is, the top (or upper) level Process is considered as a "project" and its own Data Flow Diagram is prepared.

When writing the step-by-step procedures in the Process, certain elements of data (or information) must be made available for the procedure. Each element of data is considered as an input Data Flow, which is identified and described. The product (or result) of a Process is an output Data Flow element.

Each Data Flow to the Process must originate from:

1. an earlier Process
2. a Data Store (or file)
3. an External Entity.

These sources are also identified, described and put into the Data Dictionary. As soon as the last portion of the Data Flow Diagram has been described, the SSA is complete.

The structured Analysis phase is followed by Structured Design, then by programming and finally software test and validation. The organization of Structured Analysis and its relationship to Structured System Design is shown on Figure 2.

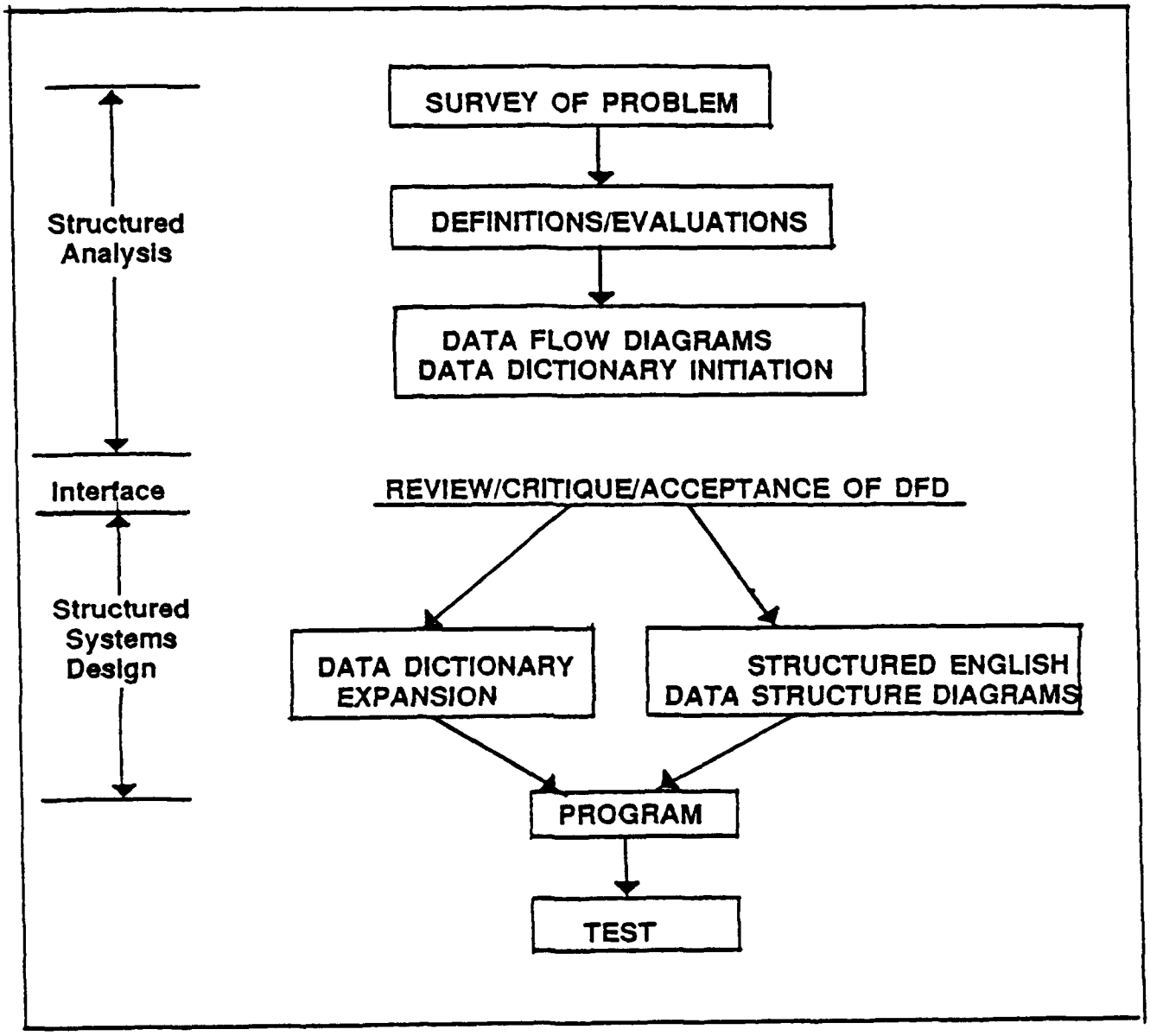

Figure 1. Structured Analysis & Structured Systems Design Organization

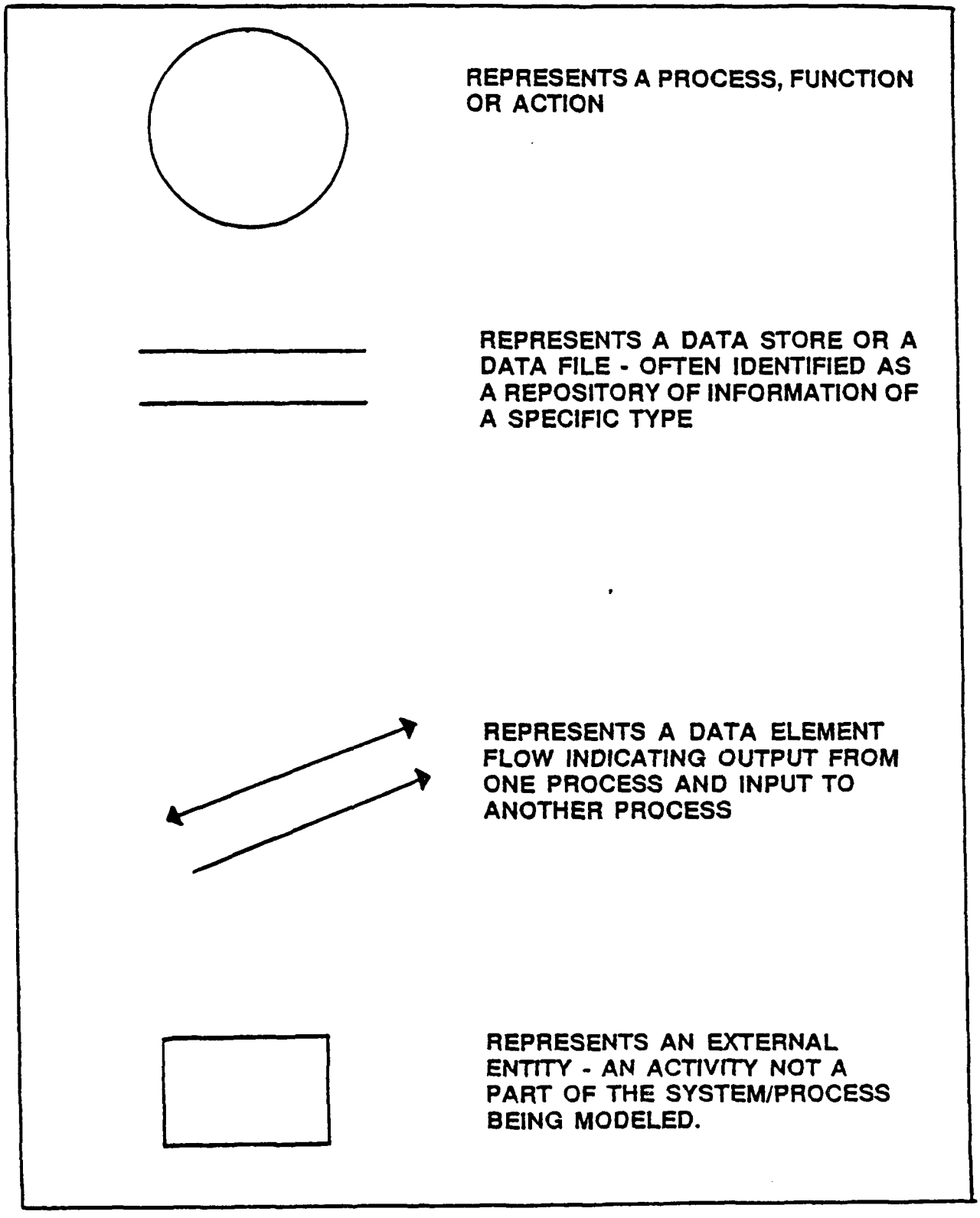

Figure 2. Standard DFD Symbol Definitions