TECHNICAL REPORT 2002-003

Single Integrated Air Picture (SIAP) Common Reference Scenarios (CRS)

JULY 2002

SINGLE INTEGRATED AIR PICTURE (SIAP)
System Engineering
Task Force (SE TF)

1931 Jefferson Davis Highway
Crystal Mall 3, Suite 1109
Arlington, VA 22203

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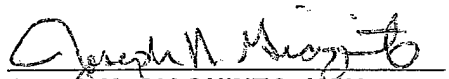

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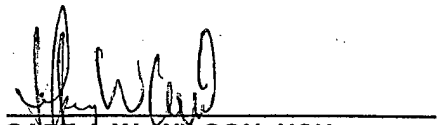

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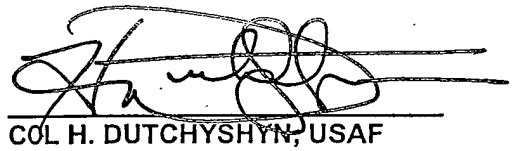

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FOREWORD

List of Contributors

The SIAP Attributes Technical Report is the result of collective efforts of members of the SIAP Common Reference Scenario Working Group, who drafted the content of the report through several face-to-face meetings and e-mail exchanges spanning the period from December 2001 to June 2002. The membership of the Working Group varied over this time period. The following individuals contributed to the report through their participation in meetings of the Working Group:

Eric Byrd, SIAP SE TF (Chair)

Richard Gonzalez, SIAP SE TF
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Andy Dobbs, SMDC (USA)
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The service and agency review process brought some additional input, revision, and commentary to bear on the report, and through this process the contributions of a number of other individuals and organizations are reflected in the final document. In addition to names already noted, contributors to the review process include:

Jon Barto, SIAP SE TF
Larry Gloss, SIAP SE TF Support Team

EXECUTIVE SUMMARY

PROBLEM Effective systems engineering requires appropriate, standardized operational scenarios, approved by the Joint Community, in order to make engineering and investment trades and to allow objective evaluation of integrated system performance. In the case of SIAP, proposed operational scenarios must include the relevant air warfare systems from all services in order to understand current capability and to determine where gaps exist in meeting the desired capability. A jointly developed operational context supports end-to-end military utility analysis linking system level Measure of Performance (MOPs) to force-level Measures of Effectiveness (MOEs).

OBJECTIVES The Joint Community must define campaigns and scenario vignettes for Modeling and Simulation (M&S), Hardware-in-the-Loop (HWIL), Operator-in-the-Loop (OITL), and Live exercises to assist in analyses based on a scenario based design. A common operational context provides assessment consistency across the various analytic venues available to the SIAP SE TF (e.g. M&S, OITL, HWITL...). To ensure credibility within the Joint Community, the operational context of the Common Reference Scenario (CRS) reflects current Defense Planning Guidance and Commander-in-Chief (CINC) concurrence, thus reflecting real world priorities. The CRS allows for greater analytical flexibility for not all Block issues can be assessed with the same systems in the same analytical venue. The CRS Technical Report documents the CRS development procedures for future SIAP Block assessments and defines a standard, digital product.

APPROACH The SIAP SE TF leveraged earlier service and agency work, including the JTAMD Master Plan, the Missile Defense Agency (MDA) Campaign Scenarios, and the Navy's Master Design Reference Mission (MDRM). The SIAP SE chartered a CRS Working Group (WG) composed of representatives of the services and key agencies. These individuals determined criteria and selected the required campaigns. The CRS WG chose appropriate friendly platforms and conops to support selected scenario vignettes. The SIAP SE continuously engaged the JTAMD Process to staff scenario vignettes to ensure accuracy and service concurrence. The CRS WG also defined and documented the CRS development process to support standardization of the SIAP analysis.

FINDINGS The selected scenarios meet the established criteria and are acceptable to services and agencies. The Joint Community continues to refine the CRS development process. The SIAP CRS WG established a mechanism to staff SIAP CRS products through the JTAMD process. Successful staffing of the CRS product ensures successful use of this product for engineering-level analysis by the SIAP SE and military utility analysis by JTAMDO.

CONCLUSIONS The selected CRS serve as a basis for a common operational context for the Joint Community and for integrated air warfare analysis.

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1. INTRODUCTION

The SIAP Integrated Assessment Plan (IAP) discusses the criticality of a common operational context within which to conduct analysis. The SIAP Analysis Team (SAT) implements the IAP across a variety of analytical venues, including Hardware-in-the-Loop (HWIL), Operator-in-the-Loop (OITL), and Modeling and Simulation (M&S) federations. To achieve consistency in integrated air warfare analysis, these venues require a Joint, community-approved, Defense Planning Guidance (DPG)-based operational context. This common operational environment establishes the baseline of system performance from the engineering level to the military utility level. The incremental approach to SIAP analysis, using the Block method, implies that the operational context must evolve to include emerging systems, new requirements, analysis objectives, and critical experiments. Therefore, in addition to the creation of a consistent and credible operational scenario for the Joint Community, the SIAP SE TF is JTAMDO's agent for defining a formal, repeatable process for selection, development, and approval for each iteration of SIAP CRSs. A repeatable process ensures more effective and controllable configuration of the joint operational context.

The following key terms are either used in this report or are generally relevant to the discussion of the SIAP CRS:

> Campaign – A series of related military operations aimed at accomplishing a strategic or operational objective within a given time and space. (JP 1-02, 2001)
>
> Scenario Vignette – A day or portion of a day from an approved campaign containing geographic boundaries, threat forces and activities, friendly forces and activities, and environmental data. It is derived from an approved campaign and provides a common framework for engineering and exercise excursions.
>
> Engineering Excursion – An operational context derived from a scenario vignette and tailored to support analysis in any M&S environment. It includes System Specific Representations (SSRs) and may adjust other scenario vignette characteristics to support analysis requirements.
>
> Exercise Excursion – An operational context derived from a scenario vignette and tailored to support analysis in HWIL, OITL, and Live exercises. It includes SSRs, where applicable, and may adjust other scenario vignette characteristics to support analysis requirements.

SIAP Family of Systems evaluation requires stressing campaigns, scenario vignettes, and engineering/exercise excursions derived from a common foundation of DPG approved scenarios and staffed through the JTAMD Process. The common operational context provides sufficient detail to support integrated air warfare M&S, HWITL exercises, OITL, and Live exercises. This is an important tool for analysis across the full range of analytical venues available to the SIAP SE.

A JTAMDO-approved CRS defines and validates mission capability requirements. It sets the boundary conditions for the SIAP allocated and functional baseline and supports end-to-end analysis for the most cost effective solutions to warfighting deficiencies.

The Block method implementation for SIAP analysis assesses incremental upgrades in system capabilities and the introduction of new systems. Therefore, the SIAP operational context must support evolving analysis requirements. A single scenario vignette is not sufficient to support robust SIAP analysis. The development of a CRS implies the creation of a formal and repeatable process to update the selected scenario vignettes at regular intervals or as required.

The procedure for development and revision of the SIAP CRS requires two critical components. One is a group of subject matter experts to represent the interests of individual service and agency initiatives and programs. The other is the engagement of a process to authoritatively define friendly operational architecture and requirements from the standpoint of joint operations.

This technical report documents the development of derivative scenario vignettes based on three campaigns to assess proposed improvements. This report describes and documents the procedures for scenario vignette selection, development, and approval through the JTAMD process. The details in the technical report provide a stable process for developing SIAP operational models in any venue and with any tool.

The specific product for each CRS is a "digital build" or simulation starting point. The digital build is a translation of the approved scenario vignette into a simulation format. The product includes standardized environmental factors, such as the geodetic model, weather and the threat and friendly systems identified by the CRS WG. System dispositions and limited system activities are scripted into the digital CRS product. Actual system models or representations will be added during assessment efforts to support specific integrated air warfare analysis excursions.

The SIAP SE chartered the CRS WG to develop a practical and credible operational context within which the SIAP SE develops and evaluates Block

improvements. The CRS WG selected the initial DPG-based campaigns and scenario vignettes. The CRS WG developed operationally credible and sound friendly force dispositions (with respect to SIAP Block 0 analysis requirements). The CRS WG operated within the JTAMD process, which piloted a mechanism and paradigm for joint endorsement and an environment for building service and agency consensus.

The CRS WG consists of representatives from each service and the major organizations that are concerned with the applicability of the scenarios and vignettes to SIAP analysis. The members consist of those persons identified in the List Of Contributor contained in the Forward section of this technical report.

This technical report documents the three selected campaigns for integrated air warfare analysis and describes the procedures and processes adopted by the CRS working group for CRS development and joint review. The sections on North East Asia (NEA) III, Arabian Gulf Campaign Scenario (AGCS), and Regional Threat 2 (RT-2), document the selection of each campaign and subsequent scenario vignettes, the year of interest, and the application of each case to SIAP analysis. Technical details and descriptions for each scenario vignette will be as each digital CRS product is completed.

It is the responsibility of each user to insure that the classified information contained within the CRS is protected at the appropriate level. It is also the user's responsibility to ensure that this product and associated data is provided to appropriately cleared individuals with a "need to know". Campaign or scenario vignette elements that require additional security controls will be documented under a separate security cover.

2. LEVERAGING JTAMDO-SIAP SYNERGY

The SIAP SE TF Charter mandates the implementation of a "disciplined system engineering process" to "*achieve a SIAP that satisfies the warfighter needs.*" To reach this goal, the SIAP SE identifies, engineers, and evaluates system improvements and their relative contribution to SIAP performance. Because JTAMDO defines joint warfighting requirements to support military utility, JTAMDO will evaluate SIAP contributions for achieving acceptable levels of military utility to support national interests. Development of a joint operational context serves as the vehicle to carryout the roles and responsibilities of JTAMDO and the SIAP SE TF. The following section addresses the nature of the JTAMDO-SIAP SE TF relationship.

2.1 JTAMDO-SIAP SE ANALYSIS RELATIONSHIP

The fundamental nature of the relationship between JTAMDO and the SIAP SE TF is one of close collaboration. The SIAP SE TF will lead systems engineering analysis; JTAMDO is responsible for military utility analysis. A depiction of the relationship is captured in Figure 1.

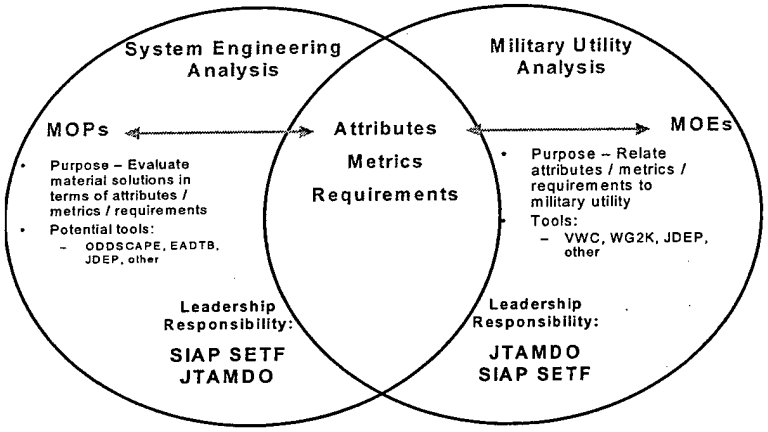

Figure 1. JTAMDO-SIAP SE Analysis Relationship

The area of immediate priority is the intersection of the overlapping areas of responsibility. In order to be effective and meaningful, SIAP SE TF system engineering analysis must support JTAMDO's military utility analysis objectives. The CRS bridges this critical intersection of responsibilities.

For the purposes of this technical report, consider the SIAP CRS to be a joint operational context, firmly based on Defense Planning Guidance, with jointly endorsed blue force lay-downs. It forms the basis for engineering-level Measures-of-Performance (MOP) analysis and engagement-level Measures-of-Effectiveness (MOE) analysis.

2.2 ROLES AND RESPONSIBILITIES

The SIAP SE is responsible for leading the system engineering analysis efforts (supported by JTAMDO) for prescribing, predicting and evaluating system performance as measured by MOPs and SIAP attributes (defined in SIAP SE TF technical report DTIC AD#: ADA397221). The MOPs and SIAP attributes reflect the Key Performance Parameters (KPP) and Information Exchange

Requirements (IER) in the Joint Requirements Oversight Council (JROC) validated TAMD and CID CRDs.

JTAMDO leads the analytical efforts (supported by the SIAP SE) for establishing the military utility of system improvement and measuring those requirements in MOEs (defined in SIAP SE TF technical report DTIC AD#: ADA397221). Since, the SIAP CRS represents an operational context for the joint community, the first proof of this is its viability for JTAMDO analysis efforts.

As envisioned, the SIAP SE conducts all engineering level analysis for requirements validation. Tools available to the SIAP SE include, but are not limited to Ballistic Missile Defense Benchmark, Wargame 2000 (WG2K), Joint Distributed Engineering Plant (JDEP), Air Defense Simulation (ADSIM), Extended Air Defense Simulation (EADSIM), and Operational Data Driven Simulation for Correlation Algorithm Performance Evaluation (ODDSCAPE). JTAMDO is a vital partner in these efforts. The SAT ensures that these tools and their outputs can readily support ongoing JTAMDO efforts.

JTAMDO provides resources, plans, schedules, and tools for appropriate military utility analysis. These tools and resources include the Virtual Warfare Center (VWC), the Joint National Integration Command (JNIC) WG2K, JDEP, and Live exercises.

One of the key aspects of the SIAP SE-JTAMDO relationship is the mutual understanding and use of specific analysis elements. These elements include, but are not limited to, the following:

- SIAP Metrics—MOPs, MOEs, Attributes and implementation methodology as documented in SIAP SE TF technical reports DTIC AD#s: ADA397215, ADA397221 and ADA397225.
- SIAP CRS—As documented in this SIAP CRS Technical Report.
- SAT—Conducts attribute level and engineering-level analysis and is an active participant in military utility analysis as defined in the SIAP Integrated Assessment Plan.

JTAMDO and the SIAP SE must define an appropriate configuration management (CM) process to address analysis methodologies, tools, and CRS. The SIAP SE and JTAMDO will generate and maintain linked system engineering/military utility analysis technical reports.

2.3 JTAMDO-SIAP SE CRS DEVELOPMENT PROCESS

The JTAMD Process effectively and efficiently integrates requirements and acquisition activities for Theater Air and Missile Defense (TAMD) efforts. The JTAMD process incorporates a series of working level teams with leadership from JTAMDO, MDA, the Services, USJFCOM, the Office of the Secretary of Defense (OSD), and Joint Staff. The CRS WG worked closely with the Operations, Architecture, and Requirements Working-level Integrated Product Team (OAR WIPT) and the Analysis Coordination Team (ACT) to refine CRS scenario vignettes. The Joint Council of Captains and Colonels (JCoCaC) resolved outstanding issues faced during coordination with the ACT and OAR WIPT and provided the final endorsement for proposed CRS scenario vignettes.

The final SIAP NEA III 2003 scenario vignettes offer an example of CRS development through the JTAMD process. The JTAMD OAR WIPT reviewed the campaign structure, threat order of battle, and threat characteristics. The working level meetings and updates focused on the accuracy and operational consistency of the friendly force lay-downs developed by service representatives to the CRS WG. The ACT recommended adjustments to the lay-downs to the SIAP CRS service representatives while remaining sensitive to SIAP SE analysis goals and objectives. The OAR WIPT received the update to the lay-downs from the ACT and endorsed the SIAP NEA III 2003 scenario vignettes. The SIAP CRS Lead presented the same results to the JCoCaC which endorsed the scenario vignettes.

The CRS WG will engage the JTAMD process to review each CRS campaign, scenario vignette and to review CRS updates. This process offers an ideal forum for ensuring operational credibility, building consensus among services and agencies, and resolving any issues that confront the continuing CRS effort.

3. CRS BASELINE DEVELOPMENT

The approach to develop a credible operational context began with the formation of the SIAP CRS WG. The CRS WG reviewed existing campaigns that provided the level of flexibility and diversity required to support SIAP analysis. This included a review of existing MDA scenarios, scenarios included in the JTAMD Master Plan, the Navy's MDRM, and the US Army's Training and Doctrine Command (TRADOC) campaigns for threat lay-downs. Once the campaigns were chosen, the CRS WG selected scenario vignettes, which stressed participating systems. From the scenario vignettes the CRS WG defined engineering vignettes to support SIAP analysis requirements. All campaigns and scenario vignettes were based on extensive selection criteria agreed upon by the service and agency representatives to the CRS WG (Section 3.2). The criteria for the selected campaigns and scenario vignettes captured the spectrum of

integrated air warfare considerations (i.e., offensive operations, active defense, passive defense, and C4ISR), supported the SIAP Block analysis, and remained compatible with the M&S requirements documented in the SIAP SE IAP.

3.1 CRS WORKING GROUP CHARTER

The SIAP SE chartered the CRS WG to develop and reach reasonable consensus on a practical and credible suite of operational context scenario vignettes within which the SIAP Block improvements are engineered and evaluated. The CRS WG selected campaigns and scenario vignettes that met both the overall criteria and support analysis requirements.

3.2 CAMPAIGN AND VIGNETTE SELECTION

The upper-level concerns and requirements of the CRS WG centered on the ability of the campaign to support IAP requirements, the availability of the campaign, and the level of simulation data that the campaign contained. The CRS WG ensured that the campaign parameters were DPG-compliant and Intelligence Community-supported. The CRS WG selected campaigns for which the Defense Intelligence Agency (DIA) has defined and validated the threat. In the case of campaigns or scenario vignettes in which the threat had not been fully validated for use in a scenario vignette, the CRS WG coordinated through the assigned DIA representative to satisfy this requirement. Additionally, the CRS WG determined that it was critical, for joint community acceptance, to choose service and agency-sponsored campaigns from previous exercises and activities. The CRS WG ensured that the operational context was appropriate for analysis across the spectrum of joint systems and that the SIAP SE leveraged results from earlier studies using similar scenarios. Figure 2 shows the methodology used by the CRS WG to select and develop the CRS.

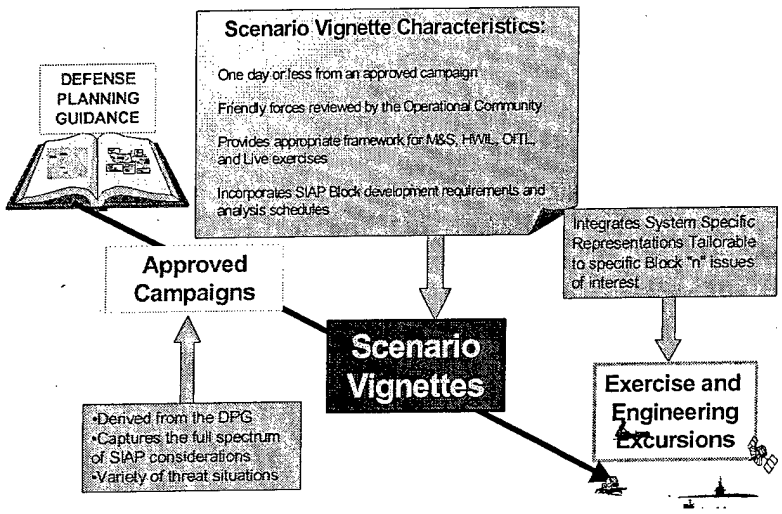

Figure 2. CRS Development Methodology

The CRS WG established the following campaign selection criteria:

1. Derive from the DPG and the associated Multi-Service Force Deployment (MSFD) documents.

2. Capture the full spectrum of analysis considerations in the aggregate (i.e., offensive operations, active defense, passive defense, and C4ISR).

3. Apply across SIAP Block analysis requirements in accordance with the IAP.

4. Provide a sufficient level and mix of friendly forces, geographical constraints, sensor limitations, and threat forces. These campaigns should also provide diversity, complexity, and threat concentrations to stress systems and BMC4I architecture.

Based on the above criteria the CRS WG selected three campaigns for use in the CRS to provide a consistent and quantitative baseline from which to fully assess the impact of SIAP system performance on warfighting from engineering level through the military utility level. The CRS WG selected NEA III 2010, AGCS 2010, and RT-2 2015. The CRS WG used a multiple campaign approach in order to provide sufficient threat system diversity, threat system volume, and unique command and control architectures based on geographical areas of interest. Each campaign supports a robust set of analyses. This provides the diversity of threat environments required for joint integrated air warfare analysis. However, all of the campaigns also share several characteristics that allow the results from each analysis to be correlated and incorporated. Table 1 describes the original campaigns and vignettes chosen for the CRS.

CRS Structure	
CRS Campaigns	**Scenario Vignettes**
NEA III 2003	D-0 (Immature Theater)
	D+47 (Mature Theater)
NEA III 2010	D-0 (Immature Theater)
	D+47 (Mature Theater)
AGCS 2010	D-11 (Immature Theater)
	D+49 (Mature Theater)
RT-2 2015	D-0 (Immature Theater)
	D+69 (Mature Theater)

Table 1. CRS Structure

The CRS WG targeted specific system interactions within a specific geographical area of interest during a time period of minutes to hours. The selections use operationally relevant lay-downs for friendly. The CRS WG extracted the required engineering and exercise vignettes from chosen scenario vignettes.

The following is a list of the scenario vignette selection criteria:

1. Meet specific analytical objectives or support engineering events.

2. Provide specific geographical constraints, variations in sensor coverage and limitations, and threat/friendly systems involved.

3. Traceable to DPG-based campaigns or exercises.

4. Easily integrated into digital M&S, HWIL, OITL, and Live analytical efforts.

5. Gain reasonable consensus from participant services, agencies, and organizations.

6. Joint endorsement through the JTAMD process.

An overview of each scenario vignette as presented in this technical report will be provided as they are developed.

3.3 THREAT DEVELOPMENT

Because all campaigns and scenario vignettes selected for inclusion in the CRS are based on the current DPG, the DIA provides the threat assessments and updates. When any government activity designs scenarios for analysis of systems performance in order to make recommendations, the DIA validates the

representation of threat order of battle, tactics, and technical characteristics. Overall the following campaigns were selected for their respective characteristics:

NEA III 2003

NEA III analysis contributions:

1. A 2010 campaign utilizing blue forces available by 2003.
2. Concentrated command and control geometry.
3. Threats transit several control areas in normal operations.
4. Attack concentrations are higher than in AGCS 2010.
5. Threat system diversity is lower than in AGCS 2010.
6. More activity provides greater opportunities for vignette selection.
7. Opportunities for matching real world flight data.
8. Built by MDA in support of JTAMDO analysis.
9. Used by all of the services in their system analysis.

The NEA III campaign provides a concentrated command and control geometry. It also provides numerous opportunities for threats to transit several control areas. Unlike AGCS 2010, the attacks are more concentrated and the threat is less diverse.

NEA III 2010

NEA III analysis contributions:

1. A 2010 campaign utilizing blue forces available by 2010.
2. Concentrated command and control geometry.
3. Threats transit several control areas in normal operations.
4. Attack concentrations are higher than in AGCS 2010.
5. Threat system diversity is lower than in AGCS 2010.
6. More activity provides greater opportunities for vignette selection.
7. Opportunities for matching real world flight data.
8. Built by MDA in support of JTAMDO analysis.
9. Used by all of the services in their system analysis.

The NEA III campaign provides a concentrated command and control geometry. It also provides numerous opportunities for threats to transit several control areas. Unlike AGCS 2010, the attacks are more concentrated and the threat is less diverse.

AGCS 2010

AGCS 2010 analysis contributions:

1. A 2010 campaign.
2. Unique command and control geometry.
3. Most threats are at the outer edges of the control space where most integrated air warfare concerns occur.
4. Moderate threat system diversity.
5. Developed by MDA to support JTAMD analysis.
6. Used by all of the services in their system analysis.

The AGCS 2010 campaign provides several unique opportunities. Most of the threat activity is at the outer edges of the friendly monitoring capabilities which impacts the integrated air warfare.

RT-2 2015

RT-2 analysis contributions:

1. A 2015 -2017 campaign.
2. More expansive command and control geometry than NEA III 2003/2010.
3. Threats transit a larger and more diverse control structure than NEA III 2003/2010.
4. Highest attack concentrations of the three campaigns.
5. Greatest threat system diversity that includes threat Navy combatants and more aircraft.
6. Contains threat Unmanned Aerial Vehicles (UAV) and helicopters.
7. Provides the greatest analysis flexibility.
8. Modeled by the Special Programs Center (SPC) in support of MDA.

RT-2 2015 provides the same command and control challenges as NEA III 2003/2010. However, it offers higher attack concentrations and more crossings.

3.4 FRIENDLY DEVELOPMENT

The scenario vignette provides the critical link from approved campaigns to engineering excursions used for analysis. The CRS WG developed joint friendly force lay-downs for selected scenario vignettes. The CRS WG referenced real-world planning documents from the responsible theater CINCs, such as OPLANs, Time Phased Force Deployment Lists (TPFDL), and Multi-Service Force Deployment (MSFD) documents. Once the CRS WG achieved consensus on joint friendly lay-downs, it engaged the JTAMD process for endorsement of the scenario.

3.5 CRS PRODUCT DESCRIPTION

The final product for each CRS scenario vignette is a CD-ROM or set of CD-ROMs containing textual documentation and digital simulation files. The digital

product facilitates scenario vignette used in multiple M&S, HWIL, and OITL tools as well as live exercises. Table 2 describes, when available, the baseline information included in the CRS product disks. Each CRS vignette will be described and documented as they are completed.

CRS Product Matrix		
General Description	Hostile	Friendly
Air Systems	• Aircraft • Cruise Missiles • Unmanned Aerial Vehicles • Helicopters • Rockets • Theater Ballistic Missiles	• Aircraft • Cruise Missiles • Unmanned Aerial Vehicles • Helicopters • Rockets
Air System Information	• Radar Cross Section by system type • Quantity by system types • Weapon loadouts by system type and function • Targets for each individual platform • Intelligence based performance parameters by system type • System launch platforms where applicable	• Radar cross section by system type • Quantity by system types, • Weapon loadouts by system type and function • Target types by system type • Generic performance parameters by system type • System launch platforms where applicable • Avionics packages by system and model type
Air System Location Information	Detailed launch, flight, and target locations for each individual platform	• Launch locations by system types and number of each type deployed • Detailed flight locations are provided for the Combat Air Patrol (CAP) stations • Airborne sensor orbits
Air System Simulations	Each individual platforms performance is contained in the simulation	Only CAP and airborne sensor platforms are incorporated in the simulation
Defensive Systems	None	• CAP Aircraft, • Air Defense (Patriot, AAW AEGIS, SHORADS, etc.) • Missile Defense (Patriot, THAAD, LINEBACKER, etc.) • Airborne (Airborne Laser)
Defensive System Information	None	• Defensive system function • Weapon types and number of weapons available • Command and control structure through the joint level • Weapon system performance parameters (firing rate, reload time, etc.) • Generic sensor parameters (range, area coverage, blind spots)
Defensive System Location	None	• Airborne orbital routes • Location of each defensive platform and command node
Defensive System Simulations	None	• CAP orbital routes • Airborne Laser orbital routes
Sensor Systems	None	• Ground Based (Patriot, AEGIS, THAAD, etc.) • Airborne (AWACS, RIVET JOINT, etc.)
Sensor System Information	None	• Sensor alignment • General sensor performance parameters (range, area coverage, blind spots) • Function • Communication structure through the Joint level • Placement in command and control structure through joint level
Sensor System Location	None	Location for each platform, and airborne orbital information
Sensor System Simulations	None	Only airborne orbits are simulated

CRS Product Matrix		
General Description	Hostile	Friendly
Naval Forces	Limited hostile naval resources are defined in the CRS	Surface combatant types (DD, CV, CVN, DDG, etc.), Submarines
Naval Force Information	If present, function and location are provided	• Generic functions • Command and control structure through the Joint level • Locations of each type in the battle group • Command and control structure through the joint level • Locations of each command and control node
Command and Control	None	• Ground facilities • Air facilities • Airborne Command Control Communications (ABCCC)
Command and Control Information	None	• Function in command and control structure • Connectivity • Ground locations • Airborne orbit locations and descriptions • Specific communication systems • Airborne ground control and downlink locations
Tactics	Based on intelligence estimates of regional practices by system type	As defined by the Services and theater CINCs for each system
Timing	Common reference in Greenwich Mean Time (GMT)	Common reference in GMT
Conflict Objectives	Campaign and daily objectives are noted in the scenario	None
Environmental	• Geography • Weather	• Geography • Weather

Table 2. CRS Product Matrix

The textual documentation portion provides information on the scenario vignette events and defines the environment within which the scenario vignette is conducted. The scenario vignette descriptions include information concerning the placement, strength, tactics, goals, and objectives of each of the opposing forces. In support of engineering analysis activities the documentation provides detailed tabular information on each individual weapon system performance. This information includes tables that describe the specifics of each flight included in the scenario vignette, as well as statistical analysis of each weapon systems performance in the scenario. Tabular data is also provided on the weapon system performance parameters for each weapon system in the scenario vignette. All of the tabular information in the document section is generated directly from the simulation data.

Each completed CRS is distributed on one or more CD-ROMs. The CRS CD-ROMs contain the scenario vignettes, Adobe Acrobat-formatted textual descriptions, and American Standards Code for Information Interchange (ASCII), Tab-delimited digital simulation data. Each set of CRS CD-ROMs has the following directory structure:

ACROREAD - The textual data is formatted in Adobe Acrobat. This directory provides Acrobat Readers for the operating systems used by computers. Users

can download these files if they do not already have Acrobat Reader on their system.

DOC - This directory contains the Adobe Acrobat formatted textual data and tables that describe the vignette and it associated activities. The documents in these directories provide detailed information on the scenario vignette, and the air and missile systems that were used in the vignette. These documents also include discussions of the tactics, system performance summaries, system performance parameters, and textual descriptions of the systems flights.

Extended Air Defense Simulator (EADSIM) - This directory provides the ASCII, Tab-delimited, and digital data files that are necessary to generate the vignette activity in EADSIM. These digital files provide the element description data, map data, digital terrain elevation data (DTED), and EADSIM scenario specification data. These files define the environment in EADSIM within which the scenario vignette activity will occur. The red and blue missile and air system simulations for EADSIM are generated using the data contained in the high resolution (HIRES) files and the EADSIM "ttcreate" ASCII C program. The file structures for the data files contained in this directory are detailed in the attached the Threat Modeling and Simulation System (TMSS) Interface Requirement System (IRS) document.

UTIL - This directory contains ASCII C programs that allow the users to modify the structure and format of the HIRES digital data files. These programs are provided for manipulating both the air and missile digital data files. These programs provide the ability to merge the data, split the data, remove objects, add objects, read the HIRES files, write HIRES files, and propagate objects. The attached TMSS IRS contains detailed descriptions of these utility programs.

HIRES - This directory contains the ASCII, Tab delimited, digital HIRES state vector simulation files. This directory contains the digital files for both the air and missile systems, and defines both the red and blue activities at one second intervals.

README - This directory contains both an ASCII and Acrobat version of a textual document that identifies for the user any information that the user should know about the scenario vignette.

VERSION - This directory contains textual documents that provide a history of the changes that were made to the scenario vignette with each revision. The documents in this directory are provided both in ASCII, Tab-delimited, and Adobe Acrobat versions. Additionally, the documents in this directory are updated with each scenario vignette revision.

The SPC generates the simulation using TMSS. TMSS provides a digital representation of all of the maneuvering and non-maneuvering Intercontinental Ballistic Missiles, Medium Range Ballistic Missiles, Short Range Ballistic Missiles, Tactical Ballistic Missiles, Submarine Launched Ballistic Missiles, Space Launch Systems, Artillery Rockets and Multiple Rocket Launcher Systems, aircraft, helicopters, UAV, Ground Launched Cruise Missiles, Air Launched Cruise Missiles (ALCM), Sea Launched Cruise Missiles, Air-to-Surface

Missiles (ASM), and bombs. TMSS is a collection of models that are designed to perform a specific portion of the simulation production process. In addition to the documentation, the products include HIRES state vector simulations, and the EADSIM definition files. The data directory provided with each scenario vignette includes the TMSS IRS, HIRES state vector simulation files, EADSIM definition files, and utility files. The TMSS IRS provides detailed descriptions of the fields in each of the HIRES files, and EADSIM files. The TMSS IRS also provides descriptions of the utilities and their functions.

The HIRES state vector simulation files are in ASCII, Tab-delimited format, and provide one-second increment, three Degree-Of-Freedom (DOF) [position (x, y, z), acceleration (x., y., z.), and orientation (along the velocity vector)] state vectors in an Earth-Centered Inertial (ECI) coordinate system. For these simulations, the earth is modeled as either a sphere or an oblate spheroid. These files include state vector data for both the primary systems and any associated objects that are released by the primary object during its flight. For example, in missile flights the associated objects include cables, bolts, rings, and reentry vehicles. For aircraft, associated objects include fuel tanks and weapons.

The ASCII high-resolution files provide a common data source that support most, if not all, analysis tools currently being used. The HIRES files directly support and interface with the Missile Defense System Exerciser (MDSE), WG2K, and EADSIM. The files indirectly support the Commanders Air Planning System (CAPS) and ADSIM. The files also support the simulations that are used by most system developers.

Each scenario vignette described in this report will contain the appropriate high-resolution files. As the objectives for each Block analysis are defined, the appropriate portions of each scenario vignette are identified and incorporated into the analysis models. These form engineering excursions for the Block analysis and will be maintained and used for future analysis and comparisons.

The EADSIM definition files provide the background files required to run the simulation. These files include the map files, DTED files and object files. The flight files are created from high-resolution files imported using the "ttcreate" utility.

4. SIAP CRS AND THE SIAP ANALYSIS TEAM

4.1 SAT PROCESS

The SAT provides cross-service IADS analytical expertise to support engineering decision-making and event planning, conduct, post-event analysis, and reporting. The CRS WG is a "core" team within the SAT structure that assists in the development of the scenario vignettes and excursions. The SIAP CRS is a tool

to facilitate SAT analysis efforts and a critical common denominator across the set of analytical venues available to the SAT.

4.2 ANALYTICAL VENUE INTEGRATION

The approved CRS campaign and scenario vignette digital data are the direct inputs to the analysis models. The SIAP SE used the Modeling and Simulation Center (MASC) at Hanscom AFB to script NEA III 2003 scenario vignettes in EADSIM. The Special Programs Center (SPC), part of the Joint National Integration Center (JNIC) at Schriever AFB, will script the subsequent scenario vignettes for the CRS WG.

4.3 CRS JDEP TRACK 2 SUPPORT

The CRS support to Joint Distributed Engineering Plant (JDEP) Track 2 HWIL exercise is an example of the process to select vignettes from the CRS for specific exercises or analysis efforts. The JDEP Track 2 excursion was performed utilizing the MDSE based upon a memorandum from JTAMDO. Limitations using MDSE were encountered, therefore the excursion was developed by making the appropriate modifications to the scenario vignettes. Figure 3 illustrates the exercise excursion development for JDEP Track 2 in direct coordination with other participants from the SAT.

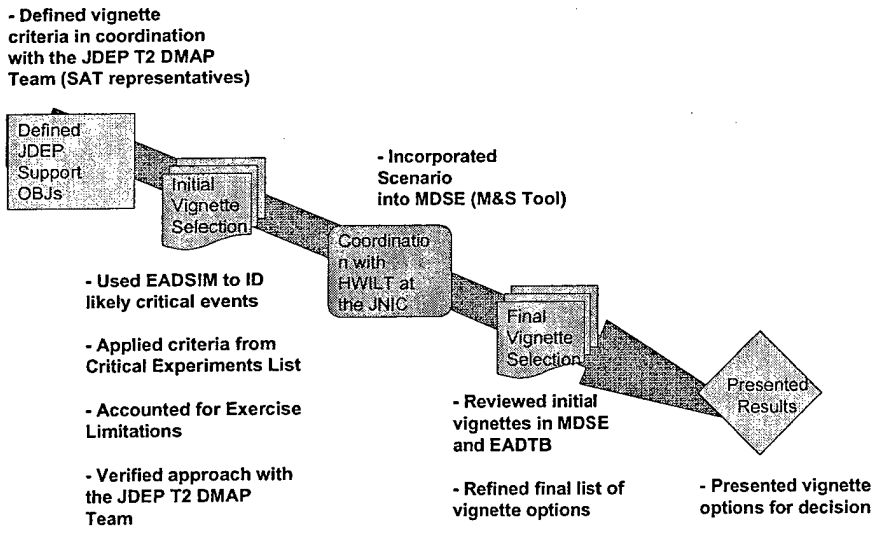

Figure 3. CRS Working Group Support to JDEP Track 2

In support of the JDEP Track 2 exercise, the vignette development team, consisting of the CRS Lead and two "core" members of the CRS WG, defined the support objectives.

Support Objectives:

- Develop and justify recommendations for the exercise excursion from the SIAP NEA III 2003 scenario vignette to support SIAP SE critical experiments

- Document specific events that were most likely to result in desired system interactions, which satisfied criteria for SIAP critical experiments

- Present initial excursion options to the SAT

- Provide support to JDEP Track 2 exercise designers at the Hardware in the Loop (HWILT) section at JNIC

The assumptions for support of JDEP Track 2 follow:

- The operational context for the MDSE used by the HWILT section should not exceed 30 minutes

- The excursion must derive from a NEA III 2003 scenario vignette with mature theater friendly force generation to provide a larger network and more potential friendly systems

- The CRS contribution to the JDEP Track 2 exercise excursion does not include network definition or system/sensor representations

The critical limitation for the JDEP Track 2 excursion was the number of systems available for use in the exercise. The SIAP NEA III 2003 scenario vignettes contained operationally credible locations for far more friendly systems than were available for use in the exercise. For example, out of more than ten Aegis-equipped cruiser or destroyer locations in the CRS, JDEP Track 2 could only represent two.

The approach for selecting an excursion from the SIAP NEA III scenario vignettes began by defining a 20-35 minute time segment within the NEA III 2003 Scenario Vignette for D-0 with a mature friendly force (C+30). That scenario vignette contained a sufficient number of friendly-threat system interactions to satisfy CRS requirements for the critical experiments. Next, the vignette development team identified specific events, which met requirements for each critical experiment. In the course of identifying specific events, the vignette development team documented threat flight data, friendly systems involved, and the event time period.

The CRS Team presented initial results to the SAT including a summary of the proposed CRS exercise excursion, examples of events that met criteria for each critical experiment, and a list of variations from the SIAP NEA III 2003 scenario vignette.

After subsequent testing of the initial exercise excursion in the MDSE system at the JNIC, the CRS Team documented four options to support JDEP Track 2. The four options and the exercise support process were presented to CRS WG on 21 March 2002.

5. CONCLUSIONS

The CRS is required such that a common, consistent and credible operation context is adhered in performing integrated air warfare analysis. It provides a common baseline from which scenario vignettes and excursions are developed to support integrated air warfare analysis tools such as M&S, HWIL, OITL and Live exercises.

The CRS WG continuously refines and improves the CRS product. The CRS Technical Report documents the development process of the CRS as it pertains to the selected campaigns and the completed scenario vignettes.

The CRS consists of multiple campaigns, which provide unique situations and opportunities for IADS analysis efforts. A multiple-campaign CRS has several advantages. Each campaign provides different characteristics, which support SIAP Block development and evaluation. Specifically, this approach provides a wider diversity of analysis situations, geographic diversity, threat diversity, and friendly system diversity. This approach also provides a more comprehensive set of scenario vignettes for application to live exercises, HWIL exercises, OITL exercises, and M&S.

CRS development and the scenario vignette selection process will be used to support each Block analysis as requirements and parameters are defined.

6. REFERENCES

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CJCSI 3170.01B.