

TECHNICAL REPORT 2004-013

Joint Single Integrated Air Picture
System Engineering Organization (JSSEO)
Common Reference Scenario (CRS)
BETA

February 2004

Joint Single Integrated Air Picture
System Engineering Organization (JSSEO)

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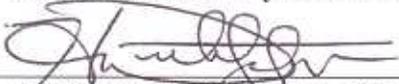
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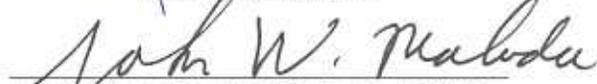
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FOREWORD

List of Contributors

This Technical Report is the result of the collective effort of members of the Joint Single Integrated Air Picture System Engineering Organization (JSSEO) Common Reference Scenario (CRS) Team, who drafted the content of the report through scheduling, planning and personnel interaction between July 2003 and October 2003. The following individuals contributed to the report:

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EXECUTIVE SUMMARY

PROBLEM: Effective systems engineering requires appropriate standardized, operational scenarios that have been approved by the Joint Community. Using these scenarios, analysts can make engineering and investment decisions and objectively evaluating integrated system performance. The Joint Single Integrated Air Picture System Engineering Organization (JSSEO)-developed Integrated Architecture Behavior Model (IABM) is being designed to conduct integrated analysis on a system of systems (SoS). The IABM developers require an unclassified scenario in the same format as the classified operationally credible scenarios to build the interface required to integrate scenarios into the JSSEO developed IABM.

OBJECTIVES: To create a JSSEO-approved, unclassified scenario that utilized the identical structure and file formats of currently developed JSSEO CRS to support system development.

APPROACH: The CRS Team created the JSSEO CRS BETA scenario, an unclassified scenario, to help users and developers integrate their systems to inject scenarios into specific modeling and simulation (M&S) tools. Since it is unclassified, the BETA allows developers to work in unclassified design environments. The data format of the BETA is identical to that of a classified scenario. The BETA uses fictional forces, threat consistencies, aircraft, weapons characteristics, and geography at unclassified levels of fidelity. The simulation data have not been reviewed by the Defense Intelligence Agency (DIA) and do not represent an intelligence estimate of intentions or capabilities. Fictional and/or unclassified weapon system characteristics were used to compute the air routes and missile trajectories.

FINDINGS: With the BETA scenario, users can develop the necessary media to integrate a JSSEO CRS into the IABM and other analysis tools used to support M&S activities such as hardware-in-the-loop (HWIL), operator-in-the-loop (OITL), and live exercises.

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1. Introduction

This technical report (TR) documents the Joint Single Integrated Air Picture System Engineering Organization (JSSEO) Common Reference Scenario (CRS) BETA Version 1.1. Typically classified, a JSSEO CRS is developed by a Joint team in order to provide an operational context in which to conduct analysis, make engineering and investment trades, and allow objective evaluation of integrated system performance. The JSSEO-developed Integrated Architecture Behavior Model (IABM) will be designed to conduct integrated analysis on a system of systems (SoS). The IABM developers require an unclassified scenario that reflects the classified operational scenarios such that an interface can be developed to integrate scenarios into the IABM analysis tool. To meet this need, the JSSEO CRS Team created the CRS BETA. It will also allow other users to familiarize themselves with and integrate the JSSEO-formatted scenarios into other M&S tools.

2. Scenario Overview

2.1 Function

The CRS BETA, an unclassified scenario, was created to help users develop the peripheral necessary to integrate scenarios into the IABM and other analysis tools. Since it is unclassified, the BETA allows developers to work in their normal design environments. The data format of the BETA is nearly identical to that of a classified scenario. The BETA uses fictional forces, geography and models various combat systems at unclassified levels of fidelity.

2.2 Sources

The CRS BETA is a notional scenario containing unclassified notional threat consistencies, aircraft, and weapons characteristics. The simulation data have not been reviewed by the Defense Intelligence Agency (DIA) and do not represent an intelligence estimate of intentions or capabilities. Notional and/or unclassified weapon system characteristics were used to compute the air routes and missile trajectories.

2.3 Setting

The scenario occurs in a notional location. Red and blue forces (graphically depicted in Figures 1 and 2) represent an unclassified representation of currently operating systems. This product is not based on any real or perceived threat. System characteristics are unclassified and based on unclassified sources. Ballistic missile flight characteristics are notional but consistent with the physics of ballistic missile flight. The CRS BETA data files include detailed information about the systems in the scenario. This product, like all JSSEO CRS products, comes as a collection of compact discs (CDs). The CRS BETA consists of 6 CDs, which are UNCLASSIFIED / FOR OFFICIAL USE ONLY. All other JSSEO CRS products are currently SECRET / NOFORN.

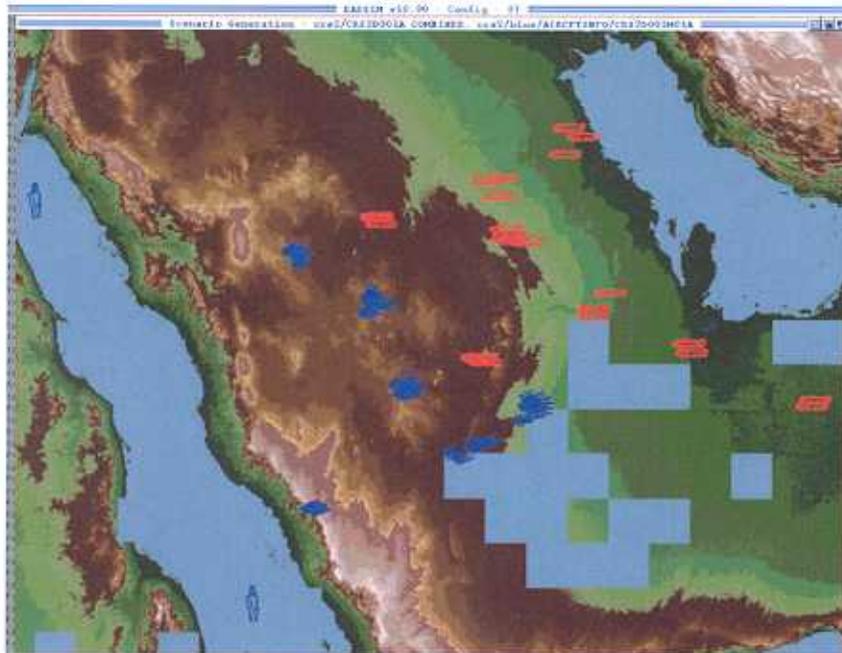


Figure 1 - Red and Blue system locations

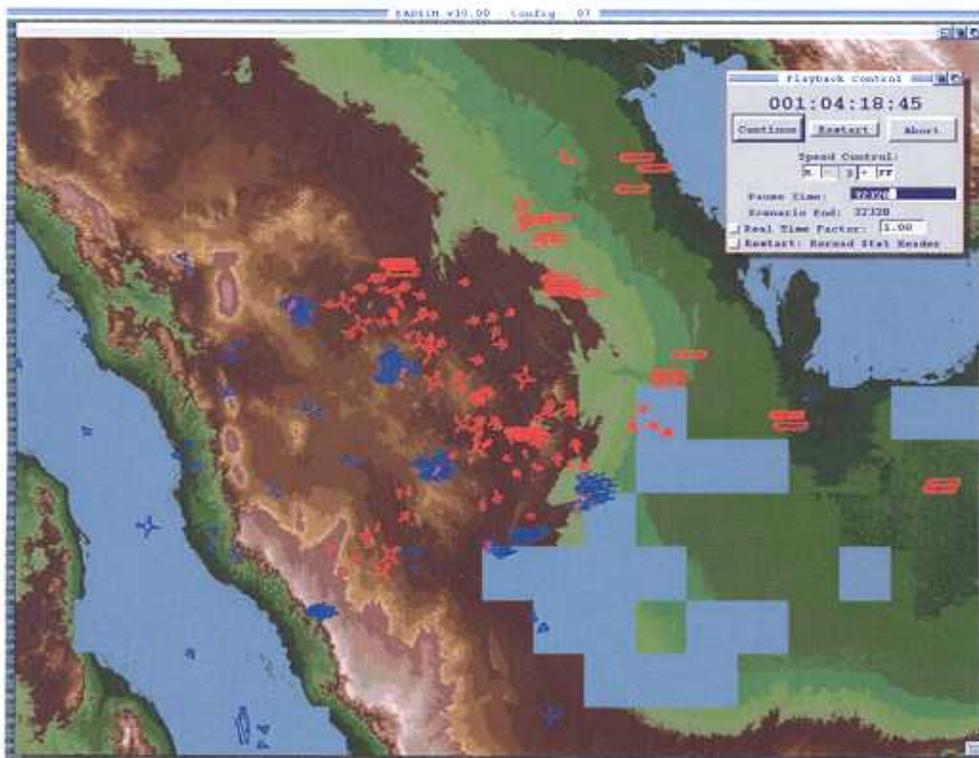


Figure 2 - Scenario Replay

2.4 Geography

The CRS BETA takes place in a relatively flat, low population-density region. It encompasses land, sea, and air assets.

2.5 Periods of Interest

The BETA vignette contains one scenario day with air and missile attacks by one notional country targeting another notional country using theater ballistic missiles (TBMs), piloted aircraft (including helicopters), and cruise missiles (described below).

3. Format

3.1 Technical

As indicated below, the CRS BETA mirrors the data format and structure of the classified scenarios.

- Scenario Documentation: Adobe Acrobat files;
- Detailed scenario description and tables summarizing the simulation data (also provided as percent delimited ASCII text files);
- EADSIM Element and Scenario files (for visualization purposes only);
- ASCII text files that identify each object's position and velocity (acceleration included for theater ballistic missiles (TBMs)) in space. Files are percent-delimited ASCII text files compatible with MS Excel;
- Earth model: WGS Earth Centered Rotational (ECR);
- Oblate: J2 (Air-Breathers) / J4 (Ballistic Missiles) with Digital Terrain Elevation Data (DTED) Level 1;
- Data Rates - 1 Hz (Air-Breathers) / 10 Hz (Ballistic Missiles and Air-Breathers).

3.2 Force Structures

To support simulation and subsequent engineering-level analysis, the scenario documentation included on the product CDs provides detailed tabular information (*.pdf and *.txt) on weapons systems' characteristics. This information includes tables that describe the specifics of each flight simulated in the scenario. Unclassified parameter data for U.S. weapon systems were used for the air breathing threat.

The scenario documentation includes written descriptions of possible Rules of Engagement (ROE), blue and red tactics, force placement and strength, and the objectives of each force.

3.2.1 Air-Breathing Systems

As indicated in Section 3.1, the scenario includes air-breathing systems in two high-resolution formats in the following directories:

- The *J2_1hz directory* contains a set of air systems high resolution files that use the WGS-84 datum, a J2 oblate earth gravity model, and an ECR earth with DTED at 1 Hz;
- The *J2_1hz_10hz directory* contains a set of air systems high-resolution files that use the WGS84 datum, a J2 oblate earth gravity model, and an ECR earth with DTED at speeds of 1 or 10 Hz.

3.2.2 Blue Forces

The scenario threat media consists of the following fictional blue forces:

- Surface-to-air sensor and missile launcher platforms;
- Seven airborne intelligence, surveillance, and reconnaissance (ISR) assets;
- 50 air-to-air fighter aircraft.

3.2.3 Red Forces

The scenario threat media consists of the following fictional red forces:

- 78 Theater Ballistic Missiles (TBMs) - with separating re-entry vehicles (RVs) and debris;
- Ten cruise missiles - modeled after a selection of existing cruise missiles; and
- 227 piloted aircraft (strike, fighter, rotary-wing, and cargo) - modeled after unclassified American systems.

3.2.4 Ballistic Missiles

The ballistic missile behavior is identified below for TBM modeling. This information is also included in the scenario documentation.

- all spent tanks/stages tumble at 2-5 deg/s;
- there are at least 6-12 Separation Related Objects (SROs) deployed per missile. Each one tumbles at 2-5 deg/s;
- the orientation of all RVs, Attitude Control Modules (ACMs) and spent tanks/ stages dampen to the ECR velocity vector between reentry and approximately 60-km altitude (for those objects that go exo-atmospheric).

The ballistic missile portion of the media contain two sets of high resolution files in the following format:

- *crs_baseline* - contains a set of missile high resolution files that use the WGS84 datum, a J4 oblate earth gravity model, and an ECR earth with Digital Terrain Elevation Data (DTED) at 10 Hz;
- *crs_eadsim*- (for EADSIM visualization purposes described in more detail below) contains a set of missile high resolution files that use the WGS84 datum, a spherical earth gravity model, and an ECR, rotating earth with DTED at 1 Hz.

3.3 Communications Protocol

For a typical classified CRS, the Joint Network Design Team (JNDT) creates a Link 16 network design for vignettes and excursions intended for analysis. Since the BETA is intended for integration purposes only, the JNDT did not develop a network design for this scenario.

3.4 EADSIM Visualization

The BETA scenario CDs provide the appropriate scenario, laydown, and element data files to view

the scenario in EADSIM v5.01 or better (v10.0 is recommended). This data is intended for visualization purposes only, not for analysis nor to validate the use of EADSIM as an analysis tool. Though the elements associated with the EADSIM data are representative of the contents of the high-resolution simulation files that define the CRS, the file names do not correlate.

4. Limitations and Assumptions

This scenario does not establish communications networks, command chains, fighter engagement zones, missile engagement zones, areas of responsibility, etc. These depend on tactics and ROE that, in turn, depend on the analysis the users will perform.

A CRS product is only appropriate for a given analysis if it meets three key criteria. First, it must have an operationally credible level of air activity. Second, it must implement reviewed and approved air tactics, policies, and procedures. Third, the activity within the scenario must be sufficiently rigorous to support the analysis objectives. Thus, a scenario that supports one SIAP analysis activity may be totally inappropriate for another analysis activity. It is through the combined activities of the CRS developers and the analysis team that the specifics of an analysis effort are addressed and resolved.

For the purpose of compliance with Theater and Air Missile Defense Capstone Requirements Document (TAMD CRD) SIAP Key Performance Parameters (KPP) analysis, the JSSEO Technical Director must review the application and implementation of this scenario for appropriateness in any analysis activity.

5. Summary

The CRS BETA scenario provides an unclassified tool to help users and developers produce the peripheral necessary to integrate scenarios into the IABM and other analysis tools.

Questions / concerns regarding this or any other CRS product should be directed to Eric Byrd, CRS Manager, at the Joint Single Integrated Air Picture System Engineering Organization (JSSEO) by phone, 703-602-5088 x230, or email, Eric.Byrd@Siap.Pentagon.mil.

6. Bibliography / Source Documents

More detailed, descriptive information is included in the unclassified scenario overview document, *Single Integrated Air Picture (SIAP) Common Reference Scenario (CRS) BETA Scenario Simulation Data Version 1.1, June 4, 2003*, that accompanies the CRS BETA Scenario. The information necessary to develop this BETA Scenario was obtained from a variety of unclassified publications and web sites. They are listed in the bibliography (Appendix C) included with the above document.