ANNEX A

OTHER SYSTEMS POTENTIALLY ASSOCIATED WITH IMASE, ISGT, AND XM-COMSIM

Electro-Magnetic Propagation Integrated Resource Environment (EMPIRE). The EMPIRE suite of tools shall be a component of the M&S&I toolkits. EMPIRE is a collection of high-fidelity electromagnetic propagation simulations and libraries. Validated EMPIRE tools shall be used to calculate RF propagation and attenuation. EMPIRE is critical to the XM-COMSIM configuration item. It is also important to SIGSIM whenever radar sensing and imaging systems are evaluated in the M&S&I environment.

Signature Reflection/Attenuation/Absorption Toolset (SRAAT). IMASE, ISGT, COMSIM shall include validated tools that accurately calculate reflected, absorbed, or transmitted energy in a given band or frequency. Army Research Laboratory's Electro-Optical Systems Atmospheric Effects Library (EOSAEL) shall be considered a candidate toolset for the SRAAT application.

Signal Simulation Threat Signature Tools and Databases (SIGSIM). The SIGSIM has two inherent missions. The primary mission is to provide an extremely high-fidelity presentation of a signature to support the constructive test and analysis of IEW sensor systems. The second mission is to provide input to the IEW M&S&I initiatives to assist in producing live signatures to drive integrated testing and analysis.

OTC Analytic Simulation and Instrumentation Suite (OASIS). OASIS provides a synthetic *wrap around* environment and integrated tool box that will add fidelity and operational realism to testing environments bolstered by provision of an integrated data collection and analysis capability. OASIS also supports a distributed testing environment through development of the Synthetic Environment Lab (SEL) that will provide an integrated M&S&I and information technology environment as well as serve as a test operations center for test teams. The goal is to provide a robust synthetic operational testing environment.

Simulation, Training, Operations, and Research Model (STORM). The STORM suite was created to provide C4I testing in support of the FBCB2 testing and digital training. It has the capability to combine live and simulated forces into a common battlespace representation. These and other capabilities could be used in the IMASE federation.

Theater Aerospace Command and Control Simulation Facility. The Theater Aerospace Command and Control Simulation Facility (TACCSF) develops and maintains a persistent tactical-level synthetic battlespace for training, testing, experimentation, and mission rehearsal for combat aerospace forces. TACCSF is the hub for Air Combat Command's (ACC) tactical-level synthetic battlespace. TACCSF develops or acquires technologies that permit the effective integration of and scheduling for resources that comprise the synthetic battlespace. These include, but are not limited to, high-fidelity aircraft simulators, realistic threat replications, detailed weapons and weather models, and connectivity to distributed resources. TACCSF

develops and archives realistic scenarios and makes them available to other organizations. TACCSF hosts a cadre of simulator controllers trained in adversary tactics and makes their services available to other organizations. TACCSF links the tactical-level synthetic battlespace to operational- and strategic-level simulations. TACCSF makes its synthetic battlespace available to other commands, services, and nations seeking to improve programs or processes using synthetic means.

Virtual Surveillance and Target Attack Radar System (VSTARS). VSTARS brings virtual SAR imagery to life across the area of operations (AO)–a major step up from all previous Joint STARS simulations. VSTARS uses actual E-8C real-world software providing identical switch actions for operator interface. VSTARS machines are all interconnected using a sub-LAN. VSTARS uses actual radar software model all radar taskings and timeline allocation. Radar model takes terrain, target speed, and location into account while calculating detection. VSTARS implementation includes full TADIL-J implementation using signal PDU. TACCSF's 14-console VSTARS (installed July 2000) provides for full crew operations and is capable of being split into two-Joint STARS configurations. Two of the 14 VSTARS consoles (Advanced Tactical Workstations-ATWS) can be used to emulate GSM/CGS or Joint STARS Workstations (JSWS). Switch actions, voice communications, JTIDS free text, and radar service requests (RSR) input/output closely resemble real-world operations. VSTARS receives targets using a DIS LAN. The system has its own gateway, which reads DIS entity state PDUs and transforms them into targets for the radar processor. VSTARS is capable of interfacing to the real Joint STARS aircraft using a satellite communications (SATCOM) link, and the simulator can hook up to a GSM/CGS using a Ground Data Terminal emulator. VSTARS can run either standalone or in real time with other DIS-compliant simulations and does not depend on any other node for initialization or orbit scripting information. VSTARS Synthetic Aperture Radar Simulation (SARSIM) databases create virtual SAR imagery across the AO, thus providing a realistic SAR simulation capability heretofore not available in any Joint STARS simulation.

STARSHIP. STARSHIP is an exercise or test simulation engine developed by the Electronic Proving Ground (EPG) to aid in conducting live and virtual test of C4I equipment. Operating on a Windows NT platform, it can direct, monitor, and remotely control a variety of sophisticated test instrumentation, continuously providing status information on the equipment. STARSHIP is expansible in size and configuration to accommodate a greater number of instrumentation and users. STARSHIP was developed so that its components can be distributed across separate networked computers, reducing data load and processing demands experienced while testing today's systems. It can easily group test instruments to respond to the needs of a particular test and includes a scenario recorder and player that can log and replay any part of a test in real time or multiples of real time. STARSHIP can communicate over different network types and network protocols. It is designed to interface with other programs using HLA and DIS communication protocols in use by the military for modeling and simulation.

Interoperability Test and Evaluation Capability (InterTEC). InterTEC is a new initiative of the Joint Interoperability Test Command (JITC) and Naval Air Warfare Center (NAWC) to develop improved interoperability testing capabilities for C4ISR systems. It comprises: (a) a joint test federation, which encompass a reconfigurable enterprise of connected facilities from which test resources are drawn to construct and populate a battlespace; (b) a C4ISR distributed

test network, which represents a hardware-in-the-loop distributed interoperability test network to simulate and stimulate C4ISR networks, injecting/retrieving data into/from primary C4ISR networks bringing the information grid to the test; (c) a suite of integrated software applications to support planning, execution, analysis, and reporting of interoperability tests; and (d) a modularized instrumentation suite and mobile platform.

Joint Operational Test and Evaluation (OT&E) Simulation Environment Facility (JOSEF). JOSEF will support multiple JITC C4I testing requirements by simulating a virtual operational environment. It will use HLA standards and RTI interoperable components to emulate communications traffic, stimulate live systems, collect and analyze C4I network traffic, and provide data for calibration and validation of constructive models. It will use validated constructive models to supplement live operational testing data. JOSEF will establish a reusable capability that is critical to providing a realistic environment for OT&E of C4I systems. It will enhance capabilities for evaluating critical operational issues (COI), test measures of performance (MOP), and measures of effectiveness (MOE) not possible with live networks.

Central Technical Support Facility (CTSF). The CTSF is responsible for all ABCS system integration. It provides software and hardware integration for more than twenty DOD programs and touches a large range of cross-functional areas, including but not limited to: battlefield intelligence, situation awareness, communications support, maneuver support, artillery and fire support, forward area air defense, weather, and digital mapping. All of the CTSF efforts support the testing, integration, and configuration of highly complex technology upgrades and advancements, integrating ABCS and supporting systems so that they can operate seamlessly on the battlefield.

Command, Control, and Communications (C3) Driver. The C3 Driver is an ABCS system-of-systems integration, test, and training tool. The C3 Driver program represents a low cost instrumentation and simulation/stimulation suite for use by the developers, testers, and trainers of C3 system communities throughout the Army. It fills a void by providing a consolidated test environment for the ABCS v7.0 systems and will be used to drive intra-Army interoperability certifications. IMASE would provide detailed intelligence battlefield functional area input to aid C3 Driver stimulation of ABCS system centric mission threads, providing a stressful, realistic environment to test system integration and interoperability, thereby enhancing *value-added* evaluation. C3 Driver can stimulate all ABCS systems and FBCB2 as well as communications systems, SYSCON, and IMETS and is expected to portray inputs from other nodes external to IMASE.

(This page intentionally left blank.)

ANNEX B

TACSIM-OT REPRESENTATIONS REQUIRED OF IMASE

Emitter Parameters
Sensor Parameters
Emitter Policies (EMITPOL)
Attrition
Country Codes
Collection Areas of Interests (AOIs)
Signals of Interest (SOIs)
Fixed Site Data
Radio Frequency (RF)
Radio Station Hierarchy (RASH)
Key Objects
National Imagery Interpretation Rating System (NIIRS)
ADARS Scenario Continuity Codes (ASCC)
TACSIM-OT Scenatr.Dat Files, Intelligence Portable ASAS Workstation (PAWS) Advanced Graphics Environment (IPAGE)
TACSIM Router In/Out Processor (TRIOP) Databases
Electronics Intelligence (ELINT) Consolidation Utility (ECU)
Imagery Intelligence (IMINT) Consolidation Utility (ICU)
White Cell Request for Information (RI)
White Cell Free Text Messaging
Interactivity-Attrition (TACVIEW, Information Assurance (IA) Prototype
Battle Damage Assessment (BDA)
Dynamic and Nondynamic Missions
DMMAIN (TACSIM-OT Simulation Control)
TACSIM Utilities Processor (TUP)
Asset Management (AM)/Collection Management (CM)
United States Message Text Formats (USMTF) 93/2000
Intelligence Electronic Warfare Character-Oriented Catalog (IEWCOMCAT) 90
TACSIM Operations at the Collateral Security Level
Time Synchronization

(This page intentionally left blank.)

ANNEX C

TACSIM-OT REPRESENTATIONS REQUIRED OF ISGT

Objects
Elements
Schedule Units
Time Cards
Attrition
BDA
Country Codes
Collection Areas of Interests (AOIs)
Signals of Interest (SOIs)
Fixed Site Data
Radio Frequency (RF)
Radio Station Hierarchy (RASH)
Key Objects
National Imagery Interpretation Rating System (NIIRS)
ADARS Scenario Continuity Codes
TACSIM-OT Scenatr.Dat Files, Intelligence Portable ASAS Workstation (PAWS) Advanced Graphics Environment (IPAGE)
TACSIM Router In/Out Processor (TRIOP) Databases
Various Databases
Visualization

(This page intentionally left blank.)

ANNEX D

IMASE SYSTEM REQUIREMENTS PRESENTMENT

D-1. Capabilities Required. This section specifies the operational performance parameters (capabilities and characteristics) required of the IMASE system. (IOC/FOC)

a. System Performance. The IMASE system-of-systems must provide the following operational, synthetic environment, testing, and TSP support capabilities. TSP is in the context of generating stay behind packages for units equipped. (IOC/FOC)

(1) Friendly and Threat Force Operations Simulation. The primary focus of the IMASE, ISGT, and XM-COMSIM are to replicate the threat forces needed for intelligence specific operational testing. Blue forces (BLUFOR) will be played with the fidelity in the required amount to provide viable support to the SUT primary mission of threat portrayal. External simulations, such as STORM, could also provide BLUFOR portrayal, OneSAF, and JANUS. (IOC/FOC)

(a) Operations. IMASE simulations must reflect the intelligence detectables and entity attributes across of the entire gamut of Army missions, from force protection (stability and support operations (SASO) and stability and support contingencies (SASC)) through high-intensity conflict (HIC). (IOC/FOC)

(b) Combat Functions. IMASE will simulate the tactical level functions and subfunctions. The following paragraphs provide the specific requirements. (IOC/FOC)

1 Maneuver. IMASE and ISGT must portray the various capabilities of threat and friendly joint, combined, and Army maneuver forces (heavy, light, Special Forces, and aviation) on the battlefield. The simulation must portray the forms of maneuver of envelopment, turning movement, infiltration, penetration, and frontal attack. Combat outcomes will consider the relative positional advantages of the forces involved. The simulation must take into account the time and spacing factors associated with large unit movements (division and corps) and the differences between heavy and light units. The simulation must allow all units, to include combat support and combat service support units, to be committed to combat operations in response to threats in a rear area. (IOC/FOC)

2 Fire Support. IMASE and ISGT must portray threat and friendly fire support systems' capabilities and limitations. All designated delivery systems and munitions categories must be simulated. Modeling must be at an entity level of detail to accurately represent their respective capabilities, limitations, vulnerabilities, and employment techniques. It must accurately model the effects of both area and precision, or smart, munitions on targeted units and equipment.

3 IOC, Blue Fire Mission Effects. This modeling must also include the representation of non-lethal systems and/or munitions, such as obscurants and electronic warfare. Target

acquisition systems must also be appropriately modeled, commensurate with the need to represent their capabilities and limitations, vulnerabilities, and employment techniques. (FOC)

4 Air Defense (AD). IMASE and ISGT must simulate the detection, identification, engagement, and attrition of manned and unmanned threat and friendly aircraft and missiles by air defense systems. The system will simulate the acquisition systems' tactics, techniques, and capabilities and vulnerabilities under any environmental condition, to include enemy electronic warfare. All systems' mobility capabilities and limitations must be within operational parameters. (FOC) This AD structure must support the respective intelligence detectables functionality (for example, ELINT). (IOC)

5 Command and Control (C2). IMASE and ISGT must simulate the doctrinal C2 and decision-making processes for automated force units. This C2 structure must support the respective intelligence detectables functionality (for example, COMINT). (IOC)

6 EW. The simulation must portray the effects of EW on threat and friendly communications, radar, and operations. (FOC)

7 Deception. The simulation must allow units to implement deception plans and activities within the capabilities of their equipment and systems. (IOC)

8 Information Operations. The simulation and instrumentation suite must be able to portray the effects of information operations upon the SUT. (FOC)

9 Signal. IMASE and ISGT must realistically portray communications support for both the threat and friendly units. IMASE and ISGT must degrade communications as a function of, at a minimum, extended ranges, equipment malfunctions, weather and space environment, terrain, time of day, and equipment destruction by hostile actions. The simulation must be capable of varying or nullifying the level of communications degradation. (IOC: Weather (WX), distance, space, terrain)

10 The IMASE output will portray automated intelligence sections, for example, brigade analytical control teams (ACTs), division and corps ACE outputs; a full complement of intelligence systems and sensors, for example, CGS, GUARDRAIL Common Sensor-Integrated Processing Facility (GRCS-IPF). (IOC/FOC) (See Block I, capability 3 and Block II, capability 1)

(c) IMASE and ISGT will provide foundational product-generation outputs with appropriate intelligence detectables needed to support other simulations and models. The data extraction will include authentic signatures (communications, noncommunications, TUAV video, EO), IR, CGS MTI, and SAR to stimulate the IEW collection assets, (for example, Tactical Control Station (TCS) for the TUAV and Joint Surveillance and Target Attack Radar System (JSTARS) CGS). Additionally, the following capabilities will also be portrayed: Prophet, Ground Surveillance Radars (GSR), REMBASS, and Brigade Reconnaissance Teams (BRTs). It will also accept collection missions and provide appropriate data output to collection systems simulated or stimulated. Example data include target location data; intelligence reports,

such as size, activity, location, unit, time, and equipment (SALUTE) and situation reports (SITREPs); MTIs, fixed target indicators (FTIs); SAR; secondary imagery; results of tactical interrogations; communications intercept; and simulation of emitter output (for example, RF line of bearing (LOB) data). In the event collection from a higher or lower echelon is not available, IMASE will provide data suitable for a fusion system (such as the ASAS). (IOC HLA)

1 IMASE and ISGT will accurately reflect real-world operational constraints of intelligence operations in a multiechelon, force projection environment (direct, project, and protect the force; gain information dominance; and shape the battlespace). It will replicate preprocessor data as it arrives from ground, air, maritime, echelons above corps (EAC), or allied assets. (Intel Detectables (within actual sensor capabilities)-IOC/data streams (replicate formatted traffic over tactical communications)-FOC)

2 IMASE will provide variable and formatted messages required by the functional requirements of the following systems. (State variables are characteristics of an entity that allow a sensor to collect against that entity and its intelligence detectables, for example, tank T-72, tank T-80, velocity, speed, position, IR signature, visual signature, acoustic signature, magnetic signature, and electromagnetic signature.)

- JSTARS, Target Acquisition Subsystem (messaging).
- CGS (AN/TSQ-179(V)1).
- TUAV includes the TCS that has commonality with UAVs, including HUNTER (BQM-155A), and with other joint tactical UAVs, such as PIONEER and PREDATOR.
- GRCS-IPF.
- System 2 (AN/USD-9E), (FOC).
- System 1 (AN/USD-9C), (FOC).
- System 4 (AN/USD-9B), (IOC).
- System 3 (AN/USD-9D). (FOC).
- Prophet (IOC).
- Ground (IOC.)
- Air (IOC).
- DTSP (IOC).
- Trailblazer (AN/TSQ-114) (IOC).
- Enhanced Trackwolf (ETW) (IOC).
- Rivet Joint, ELINT (IOC).
- Senior Ruby, ELINT (IOC).
- Comfy Levi, COMINT (IOC).
- Rivet Joint, COMINT (IOC).
- Senior Spear, COMINT (IOC).
- Blue Front Line Troop Reporting (BFLTR). Scouts, troops in contact (IOC).
- I-REMBASS (AN/PSQ-7) (FOC).
- DTES (FOC).
- ARL/ACS (FOC).
- CHATS AN/PYQ-3 (V) CHIMS (FOC).

3 The following systems do not require high-fidelity state variables, and, as such, IMASE will provide formatted messages, J-STARS MTI and TUAV video, and secondary imagery dissemination products, as required. (FOC)

- AEPDS (IOC).
- MIES (FOC).
- MITT (FOC).
- ETRAC (FOC).
- ASAS (Bn-Corps) (FOC).

- Others to be identified.

(d) Mobility and Survivability. IMASE and ISGT must portray the capability of all units to modify the battlefield (and supporting infrastructure) with respect to mobility, countermobility, survivability, and sustainment engineering. Units must be able to overcome barriers, obstacles, and mines and be able to maintain and enhance movement through the activities of constructing and repairing combat roads, trails, bridges, forward airfields, and landing zones. This should also facilitate movement on routes by conducting road, air traffic, refugee, and straggler-control operations. Units must be able to emplace and mark barriers, obstacles, and mines; detonate mines and explosives; and deceive the enemy on the location of obstacles. The simulation must account for the survivability measures taken by a force to protect its personnel, equipment, and supplies from enemy and friendly systems and natural occurrences. These measures must include protecting against combat area hazards; employing operations security; conducting deception in support of tactical operations; maintaining counter-reconnaissance, security, and readiness; and evacuating noncombatants. (FOC)

1 NBC. IMASE and ISGT must portray the initial and residual effects of NBC employment. Projected, mobile, and fixed smoke effects and flame weapons will be included. Execution of NBC defensive measures and performance of decontamination actions will be simulated. (IOC)

2 EPW. IMASE must portray realistic events associated with EPW. This includes the simulation of EPW before, during, and after combat operations. Users must be able to manage the handling, interrogation, and evacuation of EPW from the main battle area to the theater EPW collecting points. (FOC)

(e) Reconnaissance, Intelligence, Surveillance, and Target Acquisition (RISTA). IMASE will model unclassified commercial satellites, national systems JTT, and UAV products and operations, including their process for obtaining data and space connectivity. (IOC-UAV, JTT Feed)

(f) Airlift and Sealift.

1 The simulation must model use of airlift for forced entry operations, to include capability to airdrop personnel, equipment, and supplies. (IOC, if data provided by ISGT)

2 The simulation must model use of sealift for forced entry operations, to include capability to conduct amphibious assaults. (IOC, if data provided by ISGT)

3 Special Operations. IMASE AND ISGT will simulate the full range of special operations missions, including maneuver of special operations forces (SOF) on land and water outside of conventional units' area of responsibility. The simulation must portray the capabilities of small units to infiltrate and conduct missions (reconnaissance or destruction) against high value targets. The targets must include both military and civilian infrastructure. (FOC)

a Army Special Forces. The simulation must also account for the ability of special forces personnel to develop and lead units from within the civilian population (unconventional warfare) and to improve the combat effectiveness of other existing forces. The simulation must portray the ability of special forces to move with less likelihood of detection than conventional forces. (FOC)

b Rangers. The simulation must portray the ranger units' ability to operate in all weather and terrain at much higher efficiency than conventional infantry units. It must also portray the ranger units' ability to operate deep inside enemy territory, as well as their ability to direct joint fires. (FOC)

c Special Operations Aviation. The simulation must portray the capability of fixed- and rotary-wing special operations aircraft to infiltrate and extract personnel from denied areas, to include refueling in-flight and longer flying time. (FOC)

d Civil Affairs. The simulation must portray the effect of decisions made regarding the civilian populace in a combat area. This must include, at a minimum, changes in refugee traffic, availability of foreign nation support, incidents of terrorism, and effects of violations of local customs. (FOC)

(2) Synthetic Environment.

(a) Terrain. IMASE and ISGT must provide a level of resolution of terrain to allow tactical considerations of terrain analysis and the dynamic effects of manmade or natural occurrences as considered during intelligence preparation of the battlefield (IPB) and engineer battlefield assessment (EBA). The minimum acceptable tactical considerations include the following: the impact of line of sight (to include acoustic and electromagnetic spectrum considerations of concealment, thermal, optical, and radar visibility, and signal site emplacement) between potential interactions whether they be terrestrial or space sensors or weapon systems, air, ship, space, or ground mounted; the capability of terrain to support the movement of personnel, vehicles and units over time; and the accurate portrayal of the location of natural and manmade obstacles. The outcomes of the simulated events must be sensitive to changes in the weather as it affects terrain. The Wargamer must be able to alter or override simulation-induced changes to the terrain, such as obstacles. (IOC)

(b) Weather. IMASE and ISGT must accurately portray the impact that weather elements have on operations (space, air, and ground), to include explicit consideration of aircraft

minimum ceiling and visibility requirements and environmental effects on communications. As a minimum, the simulation must account for the following weather elements: cloud amount and height, visibility, restrictions to visibility (precipitation, fog, smoke, dust, and sand), precipitation accumulation (both liquid and frozen), surface wind direction and speed (mean, gusts, and gust spread), temperature, absolute humidity, density altitude, pressure altitude, barometric pressure, solar and lunar light data, scintillation and solar flare communications effects. (IOC) The Wargamer must be able to change these parameters during simulation execution. (FOC) The simulation must be capable of using historical climatic conditions for the area of operations from existing databases or current real-world weather existing at the time of the exercise. These weather elements must range from tropical to arctic regions, vary over the geographic area of interest, and change as often as hourly. In addition, wind direction and speed and temperature in a vertical profile up to 70,000 feet must be allowed to impact NBC weapons and air platform performance with changes incorporated at least twice per day. (FOC) The simulation must portray the effects of extremes of temperature, humidity, wind, and precipitation on human and equipment performance when operating in environments such as jungle, arctic, and desert. (IOC)

(c) Fidelity. IMASE and ISGT must be able to portray a level of detail that captures the effects of individual entities on the battle. Entities that operate as cohesive units may be portrayed in aggregated units from team to battalion that represent the normal mode of employment. Individual, low-density entities that operate in a geographically dispersed mode must be portrayed as they are employed. At initial operational capability (IOC), IMASE and ISGT will track individual platform locations in the synthetic environment and maintain consistency of these locations in time and space within simulated units. All modeled systems will use performance data appropriate to the level of classification of the exercise. Movement of all systems must be within the normal operating capabilities of each system and allow for the influences of tactics, techniques, procedures, formations and dispersion, road and surface conditions, off-road maneuverability for different terrain profiles and conditions, and the time required to occupy or vacate a position. (IOC)

1 Battlefield Clutter and Congestion. IMASE and ISGT shall accurately portray the effects of battlefield clutter. Units and separately modeled platforms will conform to the constraints of physical movement through congested areas. Destroyed units, platforms, and other physical structures will continue to occupy space on the battlefield until removed by a unit having that capability. Functionality shall be incorporated to allow for a coordinated passage of units through other friendly units and obstacle zones. (IOC)

2 Multiple Platform Kills. IMASE and ISGT shall allow the continued engagement of targets already destroyed in cases such as where target reengagement is an explicit choice, either by human or simulated decision. Feedback as to target status will be consistent with actual capabilities, for example, visual reconnaissance will provide actual condition and status of the target according to the capabilities of the reconnaissance platform and its sensors. (IOC)

3 Simulated Mistakes and Accidents.

a Simulated Mistakes. IMASE and ISGT must cause simulated mistakes at the option of the Wargamer, who will have control and visibility of simulated mistakes throughout the

scenario build and exercise. The Wargamer will be able to easily adjust the severity and frequency of simulated mistakes during an exercise, to include being able to set the level to zero, in effect turning off the mistakes. (Post FOC)

b Types of Simulated Mistakes. There are two types of mistakes: mistakes in actions taken, which will change simulation ground truth, and mistakes in actions reported, which will not change simulation ground truth. Mistakes in actions taken, include but are not limited to, getting lost, delivering improper quantities of supplies, and/or delivering the wrong supplies. Mistakes in reporting include reports that are accurate but incomplete or reports that are complete but inaccurate. The simulation must be capable of providing correct information if challenged for completeness and/or confirmation. (Post FOC)

4 Night and Reduced Visibility. IMASE and ISGT must portray the effects of night and reduced visibility conditions (to include obscurants) on operations. (IOC)

(d) Automated Forces. Player units supporting the test event must be able to interact with the simulation without the presence of any other units. This will require the simulation to simulate forward, flank and rear units, supported and supporting units, as well as the next higher and lower echelon units, that will normally exist on the battlefield but are not present for the particular test event. The simulation must be able to portray nondynamic (canned) or dynamic scenario and event-dependent intelligence and reports concerning the activities of these units, as well as their requests for information and resources from the training units. (FOC-CORE)

1 IMASE and ISGT must be capable of modeling represented units and activities to stimulate and enable training in peace building, peace enforcement, support to insurgency and counterinsurgency, counter drug, antiterrorism, nation assistance, disaster relief activities, and others. (FOC)

2 IMASE and ISGT must permit control of simulated units by a minimum number of personnel for example, one individual can control the operations up to division. The system must be capable of being changed between testing events to reflect changes in doctrine, organizations, or procedures. IMASE and ISGT must support Simulated Forces (SIMFOR) consisting of up to five separate, distinct factions, or sides, in a single scenario at IOC and an unlimited number of factions at full operational capability (FOC). These factions must be able to create and change alliances (friendly, neutral, and/or hostile) during an exercise. The level of representation (command echelon) for all SIMFOR must be selectable during scenario generation and changeable during scenario initialization and execution.

3 Cognitive Modeling. The system will model the cognitive processes employed by and within automated unit headquarters as part of their decision-making process. Cognitive modeled processes will include the capability to reason on the factors of mission, enemy, terrain, weather, troops, and resources available, and time. Reasoning on mission will include the capability to generate orders in the appropriate format to subordinate automated units and reports to adjacent, higher automated, or live units. Reasoning on enemy will include consideration of probable enemy courses of action. Reasoning on terrain will include considering the factors of observation, cover and concealment, obstacles, key terrain, and avenues of approach. The

system will model development by automated units of courses of action or plans and selection of a course of action for implementation. The system will include course of action analysis and comparison by wargaming friendly courses of action against probable enemy courses of action. The system will simulate inter unit coordination of plans, orders, and actions. The system will model monitoring of execution of plans by subordinate, supporting, and adjacent units, and replanning and issuing of fragmentary orders or new orders. (FOC)

(3) Pretest, During Test, and Posttest Event Support. IMASE and ISGT must provide the following support functions to test events. Additionally, IMASE subsystem foundational pillars must interrelate with each other, for example, ISGT scenario generation and IMASE simulation; ISGT-VTT, product development and XM-COMSIM; XM-COMSIM and product delivery mechanism. (IOC/FOC)

(a) IMASE Scenario Generation Tool (ISGT). The requirement is to allow scenario generation for any operation anywhere in the world in accordance with DPG. The minimum requirement capabilities are for scenario generation for war in Southwest Asia, Korea, the Balkans and Caspian areas, and for operations other than war in these locations as well as Central and South America, and Africa. This includes disaster-relief scenarios in the above locations and in North America. ISGT must have the capability to generate scenarios at the UNCLASSIFIED through SCI levels. The scenario generation system must include the following:

1 Allow users to rapidly build and change scenarios and establish the simulation environment. This involves scenario generation, VTT, player products, and scoring support applications (HPTL, AGM). IMASE and ISGT must link to previously generated libraries of scenarios. ISGT must build scenarios from scratch within 4 to 6 months for a 350 km X 350 km play box containing 150k entities. IMASE and ISGT must tailor existing scenarios in half the time when initially fielded. (IOC/FOC)

a ISGT will allow users to build scenarios from scratch using input from appropriate intelligence databases (for example, NGIC, DIA, and NSA). (IOC/FOC)

b ISGT will have the capability to convert from a real-world intelligence database to a scenario-specific notional database. (IOC/FOC)

c ISGT would allow users to build and modify scenarios from other sources (for example, Vector In Command (VIC), OneSAF, JANUS, DBST). (IOC or FOC)

d ISGT must provide player products resultant of the scenario generation process. This includes operations orders (OPORD), intelligence estimates and annexes, and IPB products. (IOC/FOC)

e ISGT must provide, when required, voice transmissions using VTT to reflect events of the scenario generation. (IOC/FOC)

f ISGT and IMASE must depict military and civilian vehicles (wheeled and tracked). (IOC)

g ISGT and IMASE must depict red and blue aircraft (rotary and slow moving fixed wing). (IOC/FOC)

2 ISGT must create the databases needed to support design and implementation of the communications and noncommunications architecture supporting the test event. XM-COMSIM and ISGT will implement the communications and noncommunications RF injection for the test event. (FOC)

3 ISGT must define SIMFOR structure in the form of missions, tasks, unit relationships, and resources (troops list and equipment characteristics) appropriate to the test requirement and the candidate scenario events, to produce requirements for simulated units. The scenario generation system must automatically set initial conditions to the maximum extent possible, such as input current unit profiles from existing automated sources; for example, in the case of notional DIA, NSA, and Central Intelligence Agency (CIA) databases or in the event these files are not available, 100 percent (or a percentage specified by the Wargamer) of the modified tables of organizational equipment (MTOE). (IOC)

4 ISGT will establish the theater of operations, including the cultural environment, weather, and terrain data. The scenario generation system (ISGT) must be capable of displaying multiple terrain boxes to accommodate multi theater scenarios (Post FOC).

5 Establish the initial intelligence picture from intelligence assets, force lay downs, and SIMFOR task organizations to produce IPB products. (IOC)

6 Identify start of exercise (STARTEX) positions from the above processes and scenario libraries to produce scenario OPORDs for SIMFOR (including higher headquarters and adjacent units) and exercise databases (force files, deployment files, terrain files, BOS parameters).(IOC)

7 Configure the scenario generation-application. The ISGT scenario-generation system must provide automated tools to configure the software, hardware, and networks that comprise the scenario-generation environment. The configuration includes network design, to include both LAN and WAN networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware. (IOC)

8 Load the scenario generator and synchronize databases, scenario times, and other terminals. (IOC)

9 Initialize the scenario generator. (IOC)

(b) Configure the simulation application. IMASE system of systems must provide automated tools to configure the software, hardware, and networks that comprise the simulation

environment. The simulation configuration includes network design, to include both LAN and WAN networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware. (IOC)

1 Load the simulation and synchronize databases, scenario times, other simulations. (IOC)

2 Initialize the simulation. (IOC)

(c) Product Generation. IMASE must have the capabilities to meet the SUT product-generation requirements (for example, JVMF, EDC (IOC), graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS) in a timely manner. (FOC)

1 Messaging. IMASE and ISGT must meet appropriate C4ISR system messaging requirements by standard and message types. Requirement is for the current TACSIM-OT capability (through ASAS-RWS V6). Build flexibility to incorporate new requirements. (IOC)

a Message Standards. IEWCOMCAT 1990, USMTF 2000, USSID-TBD

b Message Types (BFA). (IOC)

Advanced Field Artillery Target Detection System (AFATDS):

- C241 AFU.MFR, Ammunition Fire Unit-Mission Fired Report
- C281 ATI.ATR Artillery Target Intelligence-Artillery Report
- S308 ATI.IEWTC Artillery Target Intelligence-IEW Target Criteria
- D210 FM.CFF Fire Mission-Call For Fire

Maneuver Control System (MCS):

- S201 SPRT.GEOM Support Battlefield Geometry
- F002 GENADMIN General Administration Message (Old Free Text Message)
- S507L RESOURCE Message
- S401 ADABATREP Air Defense Artillery Battle Report

FBCB2:

- K01.1 GENADMIN Free-Text Message
- K04.52 SPOT/SALUTE\
- K05.19 Entity Data Report
- K04.01 SPOT/SALUTE

ASAS:

- S201 SPRT.GEOM Support Battlefield Geometry
- S308 ATI.IEWTC Artillery Target Intelligence-IEW Target Criteria
- S507L RESOURCE Message

- C241 AFU.MFR Ammunition Fire Unit-Mission Fired Report
- C281 ATI.ATR Artillery Target Intelligence-Artillery Report
- C521 WXFCST Weather Forecast
- C523 SVRWXWARN Severe Weather Forecast
- D210 FM.CFF Fire Mission-Call For Fire
- F014 RI Request For Information
- F015 Response For Request For Information (RRI)
- K01.1 GENADMIN Free-Text Message
- K04.52 SPOT/SALUTE
- F002 GENADMIN General Administration Message (Old Free Text Message)
- S308 ATI.IEWTC Artillery Target Intelligence-IEW Target Criteria
- E500 AIREWARN Air Early Warning Message
- D281 ATI.TCRIT Artillery Target Intelligence-Target Criteria Information Report
- D280 ATI.TIR Artillery Target Intelligence-Target Information Request
- D113 COMINTADTSK COMINT Advisory Tasking Message
- C460 COMSPOT Communications Spot Report,
- G130 DISUM Daily Intelligence Summary
- S303 EOBSREP Enemy Observation Report (Old Salute)
- F402 EWDECONFLICT Electronic Warfare Frequency Deconfliction Message
- C100 IIR Imagery Interpretation Report
- C110 INTREP Intelligence Report
- G131 INTSUM Intelligence Summary
- S301 MAER Multiple Assets Effectiveness Report
- S304 MASTR Multiple Assets Status Report
- A423 ORDER Message
- C101 RECCEXREP Reconnaissance Exploitation Report
- S507L RESOURCE Message
- D114 SIEPCM SIGINT/ECM Planning/Coordination Message
- C114 SIREP Sensitive Information Report
- D675 STOP JAM Stop Jamming Message
- C121 TACELINT Tactical Electronic Intelligence
- C111 TACREP Tactical Report
- C110M EDC INTREP External Data Coordination
- X014 MATM Multiple Assets Tasking Report (IEWCOMCAT)
- X031 REXREP RADAR Exploitation Report (EWCOMCAT)
- U300 SPOT (USSID)
- U301 CRITIC (USSID)
- U340 TACELINT Tactical Electronic Intelligence (USSID)
- U369 TACREP/KL Tactical Report (USSID)
- U200 TECHMSG Technical Message (USSID)
- DDO/MCO Overlay (FOC)
- JPEG SCT Digital Picture (FOC)
- M013 JINTREP (Update) Joint Intelligence Report

- NITF SID/MTI Overlay TBD (FOC)
- WXSP Graphics
- SALUTE (VOICE) Voice
- TEMPLATE SALUTES
- IMGRQST IMAGERY Request
- IMGRQMT IMAGERY Requirement

MISC:

- F002 GENADMIN General Administration Message (Old Free Text Message)
- G131 INTSUM Intelligence Summary
- F014 RI Request For Information
- F015 RRI Response For Request For Information
- C523 SVRWXWARN Severe Weather Forecast
- C521 WXFCST Weather Forecast
- C520 WXOBS Weather Observation
- S102 ENACTWPNS Enemy Activity Weapons
- C203 GRAPHREP Graphical Report-Overlay Message
- S305 TIDAT Target Intelligence Data
- X032 WXSITREP Weather Situation Report (IEWCOMCAT)

c USSID 369 Message Scripting (KL/TR). The TACSIM-OT/IMASE TFB, or its upgrade, is required to KLs and TRs.

(d) SUT Performance Scoring. Current capability of TACSIM-OT. (IOC)

1 IMASE SUT Performance Scoring. Minimum requirement is the current capability of TACSIM-OT. (IOC)

2 Concurrently create, retrieve, display, and distribute real-time SUT scoring products as input into TIQS without disrupting the simulation or training exercise. (IOC)

3 Seamlessly link with SUT scoring systems (TIQS, IPAGE, and visualization tool) used in geographically dispersed live and other constructive simulations. Process and merge information collected from different simulation environments (for example, STORM, VSTARS). Linkage may be using T-1 to a data logger or other application. (FOC)

4 Produce data collection forms during the test and posttest event on how the IMASE, ISGT and XM-COMSIM system-of-systems performed during the test event. The current trend is to automate as much of this process as possible. New technologies (palm pads, personal digitized assistance (PDA)) should also be explored and, where appropriate, incorporated. The data collection forms will include, at a minimum, (IOC), the following:

a Communications, including the amount of system downtime attributed to communications and network capacity usage and adequacy (such as, was the network capacity adequate, excessive, or deficient to handle required data flows?). (FOC)

b Databases, including the amount of system downtime attributed to databases and recommended fixes for improved fidelity. (FOC)

c Time synchronization, including latency from the simulation to SUT through C4I interfaces and return. (FOC)

5 Provide an unconstrained view of the battle space and the ground and perceived truth (visualization tool-IPAGE). (FOC)

6 Process information collected from unit C2 equipment, message, and ground truth information to ADARS or other test data recording system.. (IOC)

7 MASE, in concert with ADARS, must support analysis and scoring of the SUT performance to include relevancy, accuracy, completeness, timeliness, and contribution issues. Performance scoring must also answer the causality questions: (IOC)

a Situation Development. Support performance scoring of priority intelligence requirements (PIRs) and information requirements (IR) in both a dynamic and nondynamic simulation environment(s). (IOC)

b Target Development. Support performance scoring of high payoff targets (HPTs) and high value targets (HVTs) in a dynamic and nondynamic simulation environment. (IOC)

c Situational Awareness. Support performance scoring of system relevant common picture (RCP). (IOC)

d Collection Management. Support performance scoring of system collection management, requirements management and asset management capabilities in a dynamic and nondynamic simulation environment. (IOC)

e Asset Status and Asset Tracking. Support scoring of system capabilities. Support includes asset major end items and fully mission capable (FMC), partially mission capable (PMC), and non mission capable (NMC) status. (IOC).

f BDA. Support scoring of system capabilities according to the evolving Army BDA processes. Full specifications TBD. This is a follow-on capability to the current interactivity attrition-prototype. (FOC)

(e) Visualization Tool. Visualization tool support for both scenario generation (ISGT) and White Cell (IMASE-IPAGE), before, during, and after test event scoring. (FOC)

1 IMASE and ISGT support the storage, retrieval, and display of a library of information using text, graphics, and figures to describe tactics, techniques, and procedures. (IOC)

2 IMASE and ISGT standardized products incorporating playback capability that provide a dynamic graphical portrayal of the battle; C4I, audio and video products, including the

capability to build animated segments; access to doctrinal resources; statistical products; and terrain analysis. (FOC)

3 Synchronize the IMASE and ISGT visualization tool with statistics and unit status playback displays and has the following minimum capabilities (FOC):

a Visualization tool (IMASE AND ISGT) speed can be set at real time or at variable rates up to 100 times faster or current warp speed (whichever is quicker) and one half slower than real time. (IOC)

b Visualization tool capability to start, stop, pause, backup, or jump to any point in time. (IOC)

c IMASE should have the capability to display SUT, C4I and simulation times in order to determine if a time sync problem exists. Ideally, SUT and C4I times would come from internal sources (GPS) (FOC)

d ISGT visualization tool simultaneously display both (ISGT) ground truth and white cell (scenario) message truth. (IOC)

e ISGT display forecasted and actual weather and terrain details available. (FOC)

f ISGT will allow the Wargamer and scenario generators to navigate through replays by providing a real-time capability to fast forward, move forward or backward directly from one point in time to another, and move forward or back in specified time increments. (FOC)

(f) Archival Functions. IMASE, ISGT, and XM-COMSIM will automatically archive information into, and access archived information from, appropriate repositories. (IOC)

(g) Test Event Planning. IMASE and ISGT must facilitate and assist test event planning in conjunction with scenario preparation, simulation configuration, product development, delivery, and SUT performance scoring. Test event planning includes the following: (IOC)

1 Identify all M&S resource pretest, test, posttest event requirements (documentation, maintenance, communications, personnel, facilities, time, and equipment) for inclusion into test documentation (for example, OTPs).(FOC)

(h) Technical Control. IMASE, ISGT, and XM-COMSIM will provide a technical control capability for their respective system (such as scenario generation, simulation control). Technical control is responsible for executing required immediate fixes and/or restarts. Technical control monitors distributed hardware, software, and communications to determine if they are running correctly. Technical control is responsible for fault prediction, detection, isolation, correction, and checkpoint management. (IOC)

b. Logistics and Readiness. NA

c. Other System Characteristics. System should operate at the 95 percent readiness level for up to 135-hours of simulation. (IOC/FOC)

(1) The level of representation (platform, company) is a design consideration. IMASE must be able to interface to and interact with simulated units via their C4I, ABCS, and communication equipment. The goal is for the simulation to run without the need for role-players. (IOC)

(2) IMASE and ISGT must be extensible in the future in a standard manner. This extensibility may include eventual interoperability with such simulations as WARSIM, ExCIS, STORM, and CEES. IMASE and ISGT must be fully HLA compliant as defined by the accrediting authority. (IOC)

(3) IMASE and ISGT must support multisided exercises, where the forces involved may form and change alliances during the conduct of the exercise. Each faction, or force set, must have its own doctrine, equipment, and organization and be capable of adopting postures ranging from overt hostility through strict neutrality to overt cooperation towards each of the other scenario force sets. The minimum number of factions is five at IOC, expanding to an unlimited number at FOC.

(4) IMASE must support communications over fielded C4I equipment using valid message formats. All communications must pass through the simulation environment to determine if communication is possible within the synthetic environment. Live-to-simulated unit, simulated-to-live unit, simulated-to-simulated unit, and live-to-live unit communications may be subjected to information attack, jamming, interference, interception, and range considerations as determined by synthetic environment activities. (IOC, FOC)

(5) Security Levels. IMASE must be able to operate in a collateral Secret mode and to accommodate multi security-level requirements for training with classified data in classified scenarios. This includes the capability to transmit classified data over the distributed network or to use classified data as part of the model parameters in a classified database, media storage, purging of classified data from systems, or denial of unauthorized users. Required classification levels include SECRET for the bulk of the system and TS/SCI for intelligence models. Data used by IMASE and ISGT will have security levels ranging from unclassified to TS/SCI. Produced products may be from the Unclassified through SCI classification levels. A DIA-approved method of executing different security levels at the same time shall be provided in IMASE and ISGT. IMASE and ISGT must meet the requirements for a trusted computer system based on DOD) 5200.28.STD, DOD Trusted Computer Evaluation Criteria**.** (IOC)

(6) System Integrity. IMASE and ISGT must incorporate sophisticated protection against unauthorized access to the simulation system and theft, corruption or destruction of software or data. (IOC)

(7) Data Loss Prevention. Each software component of the IMASE and ISGT not backed up by a data logger will have an auto save feature, allowing the recovery of unsaved changes in case of system failure. (IOC)

APPENDIX A

REFERENCES

Department of Defense Directive 5000.1, Defense Acquisition, 23 October 2000.

Department of Defense Directive 5000.2, Operation of the Defense Acquisition System, 23 October 2000.

Department of Defense Directive 5000.2R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System (MAIS) Acquisition Programs, 23 October 2000.

Department of Defense Directive 5000.59, M&S Management, 4 January 1994.

Department of Defense Directive 5000.59M, M&S Glossary, January 1998.

Department of Defense Directive 5000.59P, M&S Master Plan, October 1995.

Department of Defense Directive 5000.61, DOD M&S VV&A, 29 April 1996.

Department of Defense C4ISR Architecture Framework, Version 2.1, October 2000.

Department of Defense Levels of Information Systems Interoperability (LISI), 30 March 1998.

Chairman of the Joint Chiefs of Staff Instruction, CJCSI 3170.01B, Requirements Generation System, 15 April 2001.

Chairman of the Joint Chiefs of Staff Instruction, CJCSI 6212.01B, Interoperability and Supportability of National Security Systems, and Information Technology Systems, 8 May 2000.

Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms, 24 January 2000.

Army Modeling and Simulation Master Plan, October 1997.

Department of the Army Regulation 5-11, Management of Army Models and Simulations, July 1997.

Department of the Army Regulation 71-9, Material Requirements, 30 April 97.

Department of the Army Pamphlet 5-11, Verification, Validation, and Accreditation (VV&A) of M&S, 30 September 1999.

Department of the Army Pamphlet 11-xx, Army Universal Task List (AUTL), no date. (Replaces TRADOC Pamphlet 11-9, Blueprint of the Battlefield, 27 April 1990).

Department of the Army Pamphlet Special Text (ST) 9-11-x, Army Automation Support Procedures, no date.

TRADOC Pamphlet 71-9, Force Development Requirements Determination, 5 November 1999.

TRADOC Guide for Development of Army Operational Requirements Documents (ORD) 13 July 2001.

Army Test and Evaluation Command (ATEC) Handbook 73-21, Modeling and Simulation Support to Test and Evaluation, no date.

ATEC Pamphlet 73-21, System Test and Evaluation Procedures, December 2000.

MITRE Corporation Study on the USAOTC Modeling and Simulation Master Plan, December 2000.

USAOTC Modeling and Simulation Master Plan (Draft), September 2001.

Intelligence Electronic Warfare Test Directorate Study, Orchestrating Simulations, Models, and Operational Systems for Intelligence Superiority (OSMOSIS) Concept of Operations October 2000.

Intelligence Electronic Warfare Test Directorate Study, Orchestrating Simulations, Models, and Operational Systems for Intelligence Superiority (OSMOSIS) IEW Testing Federation Feasibility Study, October 2000.

Test Operating Procedure and Methodology (TOPM) 73-182, Modeling and Simulation Accreditation Process in Support of Operational Testing and Experimentation, May 2001.

IEWTD ORD for IMASE, ISGT, and XM-COMSIM, Version 1.0, 18 May 2001.

WARSIM ORD, Version 3.7, 4 September 1998.

Simulation and Modeling for Acquisition, Requirements, and Training, 15 September 2000.

TEMO Domain Management Plan, March 2000.

STEP Guidelines, 4 December 1997

APPENDIX B

DISTRIBUTION/COORDINATION RECORD

COMMANDER, US Army Test and Evaluation Command, ATTN: CSTE-ITS, 4501 Ford Avenue, Alexandria, VA 22302-1458.

COMMANDER, US Army Operational Test Command, ATTN: CSTE-OTC-MA-S/ CSTE-OTC-TE-E, 91012 Station Avenue, Fort Hood, TX 76544-5068.

DIRECTOR, Threat Systems Management Office ATTN: AMSTI-ITTS-SSC, Redstone Arsenal, AL 35898-7461.

(This page intentionally left blank.)

APPENDIX C

LIST OF ORD SUPPORTING ANALYSIS

C-1. Supporting Analysis.

a. During the summer and fall of 2000, the USAOTC commissioned by MITRE Corporation to conduct an exhaustive study of M&S requirements, capabilities, shortfalls, candidate solution, roadmap and framework investment strategy, and recommendations. The study resulted in a published MITRE technical report, dated December 2000. In this report, IMASE was the candidate solution for the IEW test and evaluation requirements.

b. During the summer of 2000, IEWTD commissioned a study under the Orchestrating Simulations, Models, and Operational Systems for Intelligence Superiority (OSMOSIS) program. Members of WestTech, OAO, and the University of Arizona conducted this study. This report identified IMASE as a candidate solution for IEW test and evaluation requirements.

c. IMASE functional requirements are based on concepts of using a multisensor, sensor-to-shooter, systems-of-systems approach to operational test and evaluation integrating all appropriate ABCS structures and interfaces to prove the *value-added* of the SUT. IMASE will be able to support stand-alone OT&E events or participate through federation in an integrated and/or distributed test or training environment. Additionally, M&S must be capable of connecting to other M&S systems using HLA or some other medium, such as PDU or DIS. The fourth pillar, SUT performance scoring, includes data harvesting, scoring, causality, validity, accuracy, timeliness, and completeness.

d. A study of the feasibility, risks, projected costs, and relevant enabling technologies was performed for IEWTD on the AI MEC project. Electronic Combat Test and Evaluation Company between April and October 2001 conducted this research. This endeavor resulted in the current development effort producing a small, modularized, remotely controlled RF communications simulator with follow-on modules for Infrared signature, MTI radar reflectors, and active image display visual signature. An analysis was performed for the IMASE product delivery requirement. No nonmaterial solutions were identified to provide the function labeled COMSIM. Two materiel solutions were identified and are listed below:

(1) Develop an injection-based simulator that operates like the TRIM system with signal modulation capabilities of the AI MEC.

(2) Procure additional AI MEC emitters and actual foreign systems.

e. The Threat Systems Management Office conducted two proofs of principle tests for the TRIM system. In the first test, TRIM operated in its virtual mode and in the second test, its control tone mode. Both tests proved the viability of the concept and technology.

f. An Analysis of Alternatives for the materiel solutions provided the following results. There would be a significant difference in cost between solutions one and two. Solution one would require building of a single injection simulator to replicate the capabilities of the AI MEC and many threat systems. Since much of this capability exists within the original TRIM and AI MEC under development, risk is low and costs are reduced. Solution two would not require any development to provide the same signals but would require frequency clearances for all emissions and a significantly higher procurement and O&M costs to deliver the same density. Solution one is the recommended solution for correcting this deficiency.

C-2. Summary.

a. The IMASE system-of-systems will consist of computer-based battle simulation models that portray the operational environment. It is needed to support the overall Army acquisition process and the events under the SBA and SMART concept and directives. It will primarily increase the effectiveness and thoroughness of intelligence system operational testing. It will support the acquisition process by simulating the fidelity, consistency, and robustness of actual systems within a synthetic environment. In conjunction with other simulations, IMASE will provide the intelligence portion of the value-added TOC environment using scenarios, which cover a large range of the live, constructive, and virtual environments.

b. IMASE will use the ISGT for scenario generation and the VTT to support the scenario generation and product development pillars. IMASE also expects to use XM-COMSIM with the TRIM PII for RF injection of both communications and noncommunications signals for the product generation and product delivery requirements.

c. IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind Training Support Packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. IMASE may be suited to provide support beyond the RDA domain and into the TEMO and ACR domain. The IMASE program objectives include supporting Total Army and Joint Force events from Battalion through Echelons Above Corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOS. IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE include the ability to interact with other HLA and DIS compliant systems, interact with other constructive simulations, as well as live, instrumented SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants.

APPENDIX D

CAPSTONE REQUIREMENTS DOCUMENT (CRD) -ORD KPP/REQUIREMENTS CROSS WALK/LINKAGE (When CRD Is Applicable)

Not Applicable

(This page intentionally left blank.)

APPENDIX E

BASIS OF ISSUE GUIDANCE

Basis of Issue Plan (BOIP) for IMASE and Associated Components			
	IMASE	**ISGT**	**XM-COMSIM**
Fort Huachuca, Arizona			
• **IEWTD**			
○ **M&S**	**0**	**2**	
○ **Instrumentation**			**8 (TRIM PII)**
Subtotal	**0**	**2**	**8 (TRIM PII)**
Fort Hood, Texas			
• **USAOTC (SEL)**		**1**	**0**
○ **TTD**	**2**	**2**	**0**
Subtotal	**2**	**3**	**0**
Huntsville, Alabama			
• **TSMO**	**0**	**1**	**0**
Subtotal	**0**	**1**	**0**
Total	**2**	**6**	**8 (TRIM PII)**

(This page intentionally left blank.)

APPENDIX F

SYSTEM TRAINING PLAN (STRAP)

F-1. There is no formal STRAP requirement for IMASE. IMASE is an M&S systems-of-systems approach to support IEW BOS system testing and as such, will operate in part or in whole, with other M&S capabilities. Adherence to developmental and interface standards and protocols are paramount to the IMASE program. System operating manuals on each potential component or subsystem associated with a specific IMASE federate configuration will be provided by the respective system developers.

F-2. The IMASE concept was co developed by the USAOTC IEWTD and the USAOTC TTD IMD to satisfy IEW testing requirements.

a. System Description. IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind Training Support Packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. Additionally, IMASE may be suited to provide support beyond the RDA domain and into the TEMO and ACR domain. The IMASE program objectives include supporting Total Army and Joint Force events from Battalion through Echelons Above Corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOS. IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE includes the ability to interact with other HLA and DIS compliant systems, interact with other constructive simulations, as well as live, instrumented SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants.

b. Target Audience. IMASE capabilities may be applied to all aspects of studies and analyses, scenario development, materiel system requirements, doctrine development, training, test and evaluation, readiness assessment, operations planning, strategy development and operations templates – specifying and supporting relationships between IMASE, the Intelligence System Under Test, and other BOS associated with Army and Joint operations.

c. Assumptions. IMASE will support both singular and distributed test environments as well as testing that occur in a variety of field and climatic conditions. The IMASE system-of-systems will use computer-based simulation to support all IEW system testing and thereby minimize total overhead associated with operational testing. By nature of its high-fidelity simulation capability, IMASE will also provide improved training opportunities and more interactive scenario play during TOC involvement during testing events. IMASE interface with ABCS systems will completely exercise the SUT and prove the value-added of the SUT to support the operational

commander's mission. IMASE, and its associated hardware and software peripherals will operate out of climate controlled, fixed facilities and will not need to be moved once established. IMASE IOC capabilities will provide all the capabilities that currently reside in the legacy system.

d. Constraints. Before IMASE development, TACSIM-OT successfully satisfied portions of the IEW testing requirements of selected tests. TACSIM-OT has been an on-going effort at Fort Hood for approximately 20 years and has supported numerous All Source Analysis System (ASAS) operational tests. The modification and enhancement of TACSIM-OT software has become difficult, costly, and time-consuming because of the age and nature of the software. Furthermore, TACSIM-OT is not HLA-compliant nor will it interface with other existing, or planned, simulation systems. IMASE is essentially a major M&S modernization effort incorporating the successes of the TACSIM-OT system with state-of-the-art hardware and that is more efficient than the legacy system. The IMASE system must replicate and enhance all of the functional capabilities in the current TACSIM-OT system. Modeling of the organization; disposition of tactical forces moving across the battle space; attrition; employment of intelligence assets; and generation of realistic, variable, and formatted intelligence messages are only some of the required functions that must be performed. Other major functions (for example, impact of terrain analysis, weather effects, multiple operational security levels, and HLA compliance) not currently in TACSIM-OT will also be added.

F-3. The IMASE Product Developers (PD) will provide any system-specific training documentation and operating manuals for their respective systems as their programs mature. These documents are required prior to both IOC and FOC fielding.

F-4. The PDs associated with IMASE development are:

a. IMASE: USAOTC TTD.

b. ISSS: USAOTC TTD.

c. ISGT: STRICOM, TSMO.

d. XM-COMSIM: STRICOM, TSMO.

F-5. USAOTC IEWTD has overall PM functions and specific expertise for the IMASE and XM-COMSIM development efforts and specific expertise for the ISGT.

APPENDIX G

OPERATIONAL MODE SUMMARY/MISSION PROFILE (OMS/MP)

G-1. Concept of Employment. IMASE is an M&S system-of-systems approach to support IEW BOS system testing. These systems are coming to test with increasingly demanding requirements, associated automated hardware and software sophistication, and complex composition, configuration and interface specifications. This increased scale and complexity requires a corresponding level of sophisticated support. Increased SUT complexity and the requirement to determine TOC value-added have significantly impacted the IEWTD mission to conduct testing of IEW systems (processing and sensor) in a realistic operational environment. The realistic environment for a processing system requires that numerous representative sensor inputs be presented to the TOC. A realistic environment for a sensor system involves over-the-air radio frequency clutter, its doctrinal feed into the TOC, and other sensor inputs feeding the TOC. Modeling of the organization; disposition of tactical forces moving across the battle space; attrition; employment of intelligence assets; and generation of realistic, variable, formatted intelligence messages, including the impact of terrain and weather effects, multiple operational security levels, and HLA compliance provide IMASE with capabilities to allow for realistic and dynamic battlefield depictions and flexibility to support multiple functional area requirements. For a number of reasons, M&S, coupled with appropriate instrumentation, is the process and procedure of choice to support critical phases of the testing mission.

G-2. Mission. IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind Training Support Packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. Additionally, IMASE may be suited to provide support beyond the RDA domain and into the TEMO and ACR domain. The IMASE program objectives include supporting Total Army and Joint Force events from Battalion through Echelons Above Corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOS. IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE include the capability to interact with other HLA and DIS-compliant systems and to interact with other constructive simulations, as well as live, instrumented SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants. The functional requirements are based on concepts of using a multi-sensor, sensor-to-shooter, systems-of-systems approach to operational test and evaluation integrating all appropriate ABCS structures and interfaces to prove the *value-added* of the SUT. IMASE will be able to support stand-alone OT&E events or participate through federation in an integrated and/or distributed test or training environment.

a. IMASE will use the ISGT for scenario generation and the VTT to support the scenario generation and product development pillars. IMASE also expects to use XM-COMSIM with the TRIM PII for RF injection of both communications and non-communications signals for the product generation and product delivery requirements.

(1) The ISGT, the scenario generation portion of IMASE, is initially being developed as a separate project by STRICOM TSMO. ISGT will be used to generate the composition, disposition, movement, and status of enemy forces. IMASE will load this information as a Sequel Server database, will simulate the movement and activity of units in space and time, and will simulate intelligence gathering by selected imagery intelligence, communications intelligence, and electronic intelligence sensors. The intelligence messages will then be routed using a Communications Support Processor (CSP) to selected users (for example, ASAS). ISGT will be incrementally integrated into IMASE during various phases of ISGT development. TESA IMD will exercise configuration control over ISGT.

(2) The ISGT will generate the necessary scenario-related SQL Server databases for initialization of IMASE. The simulation timing and process component will control the activity and movement of scenario forces within the battle space. Simulation interaction applications will allow direct control over starting and stopping the simulation, simulator time (real time versus scenario time), and player unit interaction with simulation and will manage interfaces with other related simulations. The communications intelligence, electronic intelligence, human intelligence, and imagery intelligence messages generated by the simulation, based on sensor tasking and message rates, will be passed to the intelligence production component for storage, quality control, and eventual release as product messages. Workstation operators will script and review radio transmissions stored in the raw transmissions database. Nonsimulation products (such as graphical overlays) and generated intelligence messages will be released to the delivery manager. The delivery component will place the messages in the proper communication format (for example, GENSER and JANAP) and will queue them for release to the CSP.

(3) All RF signals, communications and non-communications, shall also be transitioned from the virtual environment to the real world. The digital representation of a propagated signal can be converted to analogue and can be injected into antenna arrays in a hardware-in-the-loop testing environment. Signal generation modules shall be developed to accept the digital representations of signals and to reproduce them in the RF domain to stimulate RF sensors and SUTs. Those signals that are calculated to be within range of a real RF sensor's/system's detection zone shall be reproduced and injected into its antenna port. DF systems using multiple antennas to detect differences in phase/time of arrival shall receive appropriate signals at each antenna port to represent the virtual location of the transmitter entity. The digital representation of signals shall also be used to drive over-the-air simulators that transmit signals as real RF targets for the SUT. The real signals should be high-priority targets from the simulation that are received through the SUT's antenna while injected virtual signals provide the dense RF environment within which the SUT must operate.

(a) A signal injection based simulator that can provide thousands of simultaneous legacy and modern, communications and non-communications emissions to the SUT, is required. Signals would be injected directly into the SUT antenna port. This injection process will not

interfere with the SUT receiving over-the-air transmissions. Two existing simulator systems each provide a portion of the required capability: the AI MEC, and the TRIM. Integration of these two systems should meet IEW operational test requirements. It is proposed to call this new system TRIM PII.

(b) Two approaches are proposed for the RF product delivery requirement. The first is a signal injection based simulator that can provide thousands of simultaneous legacy and modern, communications and non-communications emissions to the SUT, is required. Signals would be injected directly into the SUT antenna port. This injection process will not interfere with the SUT receiving over-the-air transmissions. The second approach is an over-the-air RF simulator. Two existing simulator systems each provide a portion of the required capability: the AI MEC and the TRIM.

1 AI/EWTS is a suite of truck mounted, open air, communications simulators that transmit scripted threat scenarios as target RF signals for operational testing of Army SIGINT systems. AI/EWTS is being upgraded to increase frequency range, and to add modulation capabilities to include modern digital communications, cell phones, and up to 12 independent channels of Frequency Division Multiplex (FDM) transmissions. Augmenting the AI/EWTS truck based systems is a suite of unmanned mini-AI/EWTS currently under development in a project called the AI/EWTS AI MEC. These pallets are hardware and software compatible with the truck based AI/EWTS and has the additional capability of multiple simultaneous signals and light wave emissions. The OTCC, utilizing a wireless network, communicates with the test assets providing central control, status reporting, and ground truth data collection. AI/EWTS provides a multitude of communications and some non-communications signals necessary for testing IEW sensors.

2 TRIM is a synthetic jammer simulator that injects a validated RF waveform, replicating the appropriate threat jammer, at a realistic power level. The system is comprised of four independently controlled RF jamming modules, a receiver, 486 Micro Processor, Power supply, and GPS Unit with antenna all packaged to allow operation while mounted on SUT tactical vehicles in all operational environments. Propagation effects are simulated by one of three methods, Tone Mode, Virtual Mode, and Script Mode. Control Signal Transmitters (CST) control the injected jamming signal when using Tone Mode. CST(s) placed in the field will radiate a tone of known power. The TRIM unit will measure the power level of the tone at the victim radio location and scale the jamming signal input to the victim radio accordingly. In Virtual Mode, the TRIM will determine jamming signal power by using GPS locations and jammer parameters of a remote virtual jammer and the victim radio and calculating path loss via the propagation model, TIREM. In this mode, the TRIM input originates at a central control in the form of a DIS, PDU message. The DIS PDU is then reformatted at a communications node, consisting of a wireless RF LAN, and transmitted to the TRIM over the RF LAN. In Script Mode, the TRIM will determine jamming signal power by using scripted GPS locations and other parameters of a virtual jammer and GPS location of the victim radio and calculating path loss via TIREM. In this mode, operational realism is of less importance and all jamming data, including start and stop times is preloaded in the TRIM. Use of the communication node would

not be necessary in the scripted mode. TRIM provides the injection methodology and infrastructure along with the virtual jammer capability.

(c) The OTCC consists of three workstations and an RF LAN. It is capable of displaying indications of RF activity based on ground truth instrumentation and the war-gamed scenario. It will accept the DIS PDU messages from the IMASE scenario, translate them into standard commands, and task the TRIM for injection or the AI/EWTS for over-the-air transmission. The OTCC provides real time status of the emitters, SUT, ground truth, and provides the command and control structure for the operational test.

b. Integration and upgrade of XM-COMSIM and TRIM should meet IEW operational test requirements. The XM-COMSIM system will respond to databases created during scenario generation/development that contain multi aspect, high fidelity, validated, threat signature data in appropriate frequencies. Threat data will be available in acoustic infrared and ultra-violet and in appropriate radio frequencies. They are posted in the SIGSIM. At the appropriate scenario time, XM-COMSIM identifies and generates high-fidelity RF signals at the appropriate power levels. Propagation calculations create multi paths and otherwise attenuate the signal to each entity.

G-3. <u>OMS/MP Methodology</u>.

a. IMASE will save significant amounts of time and money in that it will provide the requisite TOC inputs to stimulate the SUT without deployment of large numbers of troops and equipment. IMASE provides greater utility over deployed troops in the field as it can be easily replayed and provide quicker data requirement turnaround for the evaluator. Additionally, IMASE will capture causality data (the why? or why not? questions) required by the evaluator for posttest analysis.

b. The M&S structure needed to support major portions of all IEW testing events (such as Test Schedule and Review Committee and customer) include four foundational categories representing specific M&S capabilities of scenario generation, product development, product delivery (System stimulation), and SUT performance scoring.

(1) The first category, scenario generation, has two primary stages. Stage one underpins the requirement for depiction of large numbers (150K entities) of threat forces at the object level (such as trucks, trailers, and tanks). Each entity must have its representative attribute or intelligence detectives for each intelligence discipline. This depiction includes representative formations and deployments needed by intelligence analysts, along with appropriate schemes of maneuver, during a 96- to 120-hour scenario period. Stage two underpins the orchestration of instrumentation vans (over-the-air) and virtual signal injection to represent the doctrinal emanations from threat systems and occurs once definition one has been completed.

(2) The second pillar, product development, can include voice transmission generation; United States Message Text Format and Joint Variable Message Format; United States Signals Intelligence Directive messages; graphics; and overlays.

(3) The IEWTD product delivery (system Stimulation) is primarily the communications and stimulation portion of M&S. This product delivery can include local area network, wide area network, Mobile Subscriber Equipment, and Combat Net Radio. Additionally, M&S must be capable of connecting to other M&S federations using HLA or some other medium, such as Protocol Data Units or Distributive Interactive Simulation.

(4) The fourth pillar, SUT performance scoring, includes data harvesting, scoring, causality, relevancy, accuracy, timeliness, and completeness.

G-4 Operational Environment.

a. IMASE will support both singular and distributed test environments as well as testing that occurs in a variety of field and climatic conditions. The IMASE system-of-systems will use computer-based simulation to support all IEW system testing and thereby minimize total overhead associated with operational testing. By nature of its high-fidelity simulation capability, IMASE will also provide improved training opportunities and more interactive scenario play during TOC involvement during testing events. IMASE interface with ABCS systems will completely exercise the SUT and prove the value-added of the SUT to support the operational commander's mission. IMASE, and its associated hardware and software peripherals will operate out of climate controlled, fixed facilities and will not need to be moved once established.

b. Projected Operational Test Support.

Projected IMASE Operational Test Support			
Programs	**ACAT/Oversight**	**Test Type**	**Fiscal Year**
JSTARS CGS	IC / Yes	FOTE	02/03
ASAS ACE Block II	II / Yes	IOTE	03
JSTARS CGS	IC / Yes	FOTE/LUTE	03/07
Prophet Ground	III / Yes	IOTE	04
TUAV	II / Yes	LUTE	04
TUAV	II / Yes	IOTE	05/06
ASAS Block III/IV	II / Yes	LUTE	05/07
ACS	III/I / Yes	LUTE/IOTE	05/07
DCGS-A	IC / Yes	?	03/08
ACE – Analysis Control Element **ACS** –Aerial Common Sensor **ASAS** – All Source Analysis System **CGS** – Common Ground Station **DCGS-A** - Distributed Common Ground Station-Army **FOTE** – Follow-On Test and Evaluation **IOTE** – Initial Operational Test & Evaluation **LUTE** – Limited User Test and Evaluation **JSTARS** – Joint Surveillance Target Attack Radar System **TUAV** – Tactical Unmanned Aerial Vehicle			

G-5 OMS/MP Wartime and Peacetime Mission Rates. IMASE capabilities may be applied to all aspects of studies and analyses, scenario development, materiel system requirements, doctrine development, training, test and evaluation, readiness assessment, operations planning, strategy development and operations templates – specifying and supporting relationships between IMASE, the Intelligence System Under Test, and other BOS associated with Army and Joint operations.

a. The following are major tasks that apply to the IMASE Mission Area. The scope and depth of supportive interaction will be driven by specific system requirements, the focus of any event, and sponsoring component objectives. They are representative of tasks that define IMASE support to the Strategic, Operational, and Tactical levels of the battlefield:

(1) IMASE capabilities will directly impact and support development of operational capabilities needed to satisfy Army Tactical Task, **ART 2 – Develop Intelligence (ART 2.1 through ART 2.5, inclusive)** of the AUTL.

(a) Although ART 2 is a common, comprehensive reference point for Intelligence support to the battlefield, it is not an all inclusive, hierarchical listing of Intelligence tasks on or in support of the battlefield.

(b) The AUTL is architecturally linked to the UJTL and decisively links to the other BFA tasks of: Exercise Command and Control, Deploy/Conduct Maneuver, Employ Firepower, Protect the Force, and Perform Logistics and Combat Service Support. It supports field commanders, combat developers, testers, evaluators, analysts, trainers, and planners for analyzing and integrating operations.

(2) National Military Strategic Task, SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing. To evaluate and assess system or material performance appropriate to each phase and milestone of development. This task includes DT&E of alternative concepts and identification of risk. As OT&E, this task is to determine the operational effectiveness and suitability of a system under realistic conditions. Also included in this task is Live Fire Test and Evaluation (LFT&E). (Joint Pubs 2-0, 3-11, 4-0)

(3) Other possible, associated tasks.

(a) National Military Strategic Task, SN 6 – Conduct Mobilization, Specifically SN 6.2 – Alert Forces for Mobilization, Subparagraph SN 6.2.4 – Conduct Preparatory Administrative, Logistics, Medical, and Readiness Activities. To begin activities required at mobilization. These include PTSR, command readiness inspection reports, operational test and evaluations, readiness reports, POM processing, the unit training readiness status, and informal evaluation and observations for determining unit-training shortfalls. In addition, combatant commander evaluations of Joint training are considered, as appropriate. (Joint Pubs 4-0, 4-05)

(b) Theater Strategic Task, ST 7 – Establish Theater Force Requirements and Readiness, Specifically ST 7.1 – Recommend Warfighting and Other Requirements and Test Concepts. To recommend and prioritize the theater's peacetime and wartime needs in light of guidance, threat estimates, technology, projected capabilities, resource constraints, and resulting strategy or employment concepts. This task includes testing and recommending concepts for mobilizing, deploying, employing, and sustaining the force. (Joint Pubs 5-0, 2-0, 3-0, 4-0)

(c) Army Tactical Task, Art 5 – Exercise Command and Control, Specifically Art 5.3 – Direct and Lead Subordinates. To direct subordinate forces so that they understand and contribute effectively and efficiently to the attainment of the commander's concept and intent. This task includes issuing plans and orders, to include intelligence collection plans, essential elements of information, logistics plans, and rules of engagement. Directing includes taking or recommending action to deal with forecasted changes or deviations to accomplish the commander's intent and correcting deviations from the plan or guidance.

b. Annual Mission Rates.

IMASE Expected Annual Mission Rates (hours of operation)					
	System Development [2]	**Pretest** [3]	**Test Execution** [4]	**Posttest** [5]	**Other Domains** [6]
IMASE [1]	800	1520	560	560	400
COMSIM [7]	80	152	240	56	40

[1] All computations are based on using two IMASE systems over a 1920-hour yearly system operating time for a total of 3840 system-hours forecasted for mission support. Requirement development and other functional area support would be evenly distributed across the two systems. ISGT and COMSIM numbers are included on the IMASE line. System use for ISGT and COMSIM can vary apart from the simulator, for example, ISGT used for a scenario build off-line from the simulator or can run in parallel, for example, COMSIM running at same time as the simulator as part of a federate during test execution.

[2] System development encompasses system upgrades and utility development and maintenance.

[3] Calculations based on support to one major scenario development effort per year and tailoring up to six existing scenarios for individual tests.

[4] Based on support to seven test events, each one-week long.

[5] Based on support to seven tests and compiling scoring results within ten days from completion of test.

[6] Other domain support includes (a) stay-behind TSP, (b) Advanced Concept Requirements, (c) contractor in-plant testing.

[7] COMSIM hours are represented separately as instrumentation use (Based on supporting two tests, each of three week durations at five days per week, per year.

(This page intentionally left blank.)

APPENDIX H

SIMULATION SUPPORT PLAN (SSP)

There is no formal SSP requirement for IMASE. As a simulation system, comprised through a system-of-systems approach, IMASE will adhere to DOD and Army-level directives addressing M&S capability development and protocols. Interface and user acceptance testing (UAT) will be performed on each model, simulation, and assistance utility incorporated into the IMASE system. All components will go through strict VV&A processes.

(This page intentionally left blank.)

APPENDIX I

MISSION NEEDS ANALYSIS (MNA)

I-1. Currently, no existing Department of Defense M&S system, system of systems, or M&S federation, nor existing doctrine, training concepts, leader development fundamentals, organizational structure, or other material solution can provide the requisite level of fidelity, consistency, and robustness to satisfy the IEW testing requirements. A robust M&S capability, represented by state-of-the-art hardware and software, is needed to satisfy the numerous emerging IEW testing requirements. IMASE does not negatively impact present or future doctrinal constructs, personnel issues, force development or force projection issues. IMASE will provide simulation capability and support tools to create realistic operational conditions for operational testing and the development of stay-behind Training Support Packages that underpin cradle-to-grave initiatives (for example, SBA) used within the system acquisition process. The program objectives include supporting Total Army and Joint Force events from Battalion through Echelons Above Corps with scenarios from across the operational continuum. It will reduce the resources required to plan, execute, and report on SUT performance during test events executed in a simulation environment. IMASE will support real-time test events in all types of operational environments supporting all IEW BOS. IMASE functional requirements for producing and sustaining a complete simulation environment encompass rapid scenario preparation, generation of supporting products (for example, messages, estimates, reports, overlays), stimulation of the SUT within a supported TOC environment, control of distributed test events, and integrated SUT scoring capability. The requirements for IMASE include the ability to interact with HLA and DIS compliant, interact with other constructive simulations, as well as live, instrumented SUT and test support platforms. Thus, IMASE will provide the constructive simulation shell to surround virtual and live test participants. The functional requirements are based on concepts of using a multi-sensor, sensor-to-shooter, systems-of-systems approach to operational test and evaluation integrating all appropriate ABCS structures and interfaces to prove the *value-added* of the SUT. IMASE will be able to support stand-alone OT&E events or participate through federation in an integrated and/or distributed test or training environment.

I-2. SUT complexity and the requirement to determine TOC *value-added* have significantly impacted the IEWTD mission to conduct testing of IEW systems.

a. The IEW systems that come to test are increasingly more complex in terms of their automation and software composition. This increased scale, sophistication, and complexity requires a corresponding level of sophisticated support.

b. The realistic environment for a processing system requires that numerous representative sensor inputs be presented to the TOC. A realistic environment for a sensor system involves over-the-air radio frequency clutter, its doctrinal feed into the TOC, and other sensor inputs feeding the TOC. For a number of reasons, M&S, coupled with appropriate instrumentation, is the process and procedure of choice to support critical phases of the testing mission.

I-3. M&S will save significant amounts of time and money in that it will provide the requisite TOC inputs to stimulate the SUT without deployment of large numbers of troops and equipment. M&S provides greater utility over deployed troops in the field as it can be easily replayed and provide quicker data requirement turnaround for the evaluator. Model reusability and common use simulations will save stove-piped development costs and provide a catalyst for flexibility allowing tailoring of current capabilities to fill multiple needs. Additionally, M&S will capture causality data (the why? or why not? questions) required by the evaluator for posttest analysis.

I-4. The M&S structure needed to support major portions of all IEW testing events (such as Test Schedule and Review Committee and customer) include four foundational categories representing specific M&S capabilities: scenario generation, product generation, product delivery (system stimulation), and SUT performance scoring.

a. The first category, scenario generation, has two primary stages. Stage 1 underpins the requirement for depiction of large numbers (150K entities) of threat forces at the object level (such as trucks, trailers, and tanks). Each entity must have its representative attribute or intelligence detectives for each intelligence discipline. This depiction includes representative formations and deployments needed by intelligence analysts, along with appropriate schemes of maneuver, during a 96- to 120-hour scenario period. Stage 2 underpins the orchestration of instrumentation vans (over-the-air) and virtual signal injection to represent the doctrinal emanations from threat systems and occurs once definition one has been completed.

b. IEWTD product generation can include voice transmission generation; United States Message Text Format and Joint Variable Message Format; United States Signals Intelligence Directive messages; graphics; and overlays.

c. The IEWTD product delivery (system stimulation) is primarily the communications and stimulation portion of M&S. This product delivery can include local area network, wide area network, Mobile Subscriber Equipment, and Combat Net Radio. Additionally, M&S must be capable of connecting to other M&S federations using HLA or some other medium, such as Protocol Data Units or Distributive Interactive Simulation.

d. The fourth pillar, SUT performance scoring, includes data harvesting, scoring, causality, relevancy, accuracy, timeliness, and completeness.

I-5. Before IMASE development, TACSIM-OT successfully satisfied portions of the IEW testing requirements of selected tests. TACSIM-OT has been an on-going effort at Fort Hood for approximately 20 years and has supported numerous ASAS operational tests. TACSIM-OT, developed in the late 1970s, is hosted on DEC/COMPAQ VAX computer systems using software primarily developed in FORTRAN. TACSIM-OT was never designed to meet the increased SUT sophistication and complexity levels nor the increased emphasis on TOC value-added requirements. TACSIM-OT was developed in FORTRAN using a simulation tool called SALSIM. SALSIM is a batch of FORTRAN subroutines designed to create time-ordered events and linked lists of various events and objects. The modification and enhancement of TACSIM-OT software has become difficult, costly, and time-consuming because of the age and nature of

the SALSIM/FORTRAN software. Furthermore, TACSIM-OT is not HLA-compliant nor will it interface with other existing, or planned, simulation systems.

I-6. IMASE is essentially a major M&S modernization effort incorporating the successes of the TACSIM-OT system with state-of-the-art hardware and that is more efficient than the legacy system. The IMASE system must replicate and enhance all of the functional capabilities in the current TACSIM-OT system. Modeling of the organization; disposition of tactical forces moving across the battle space; attrition; employment of intelligence assets; and generation of realistic, variable, and formatted intelligence messages are only some of the required functions that must be performed. Other major functions (for example, impact of terrain analysis, weather effects, multiple operational security levels, and HLA compliance) not currently in TACSIM-OT will also be added.

(This page intentionally left blank.)

GLOSSARY
PART 1

ACRONYMS AND ABBREVIATIONS

A

A_o	Operational Availability
AAR	After-Action Report
ABCS	Army Battle Command System
ACC	Air Combat Command
ACE	Analysis and Control Element
ACR	Advanced Concepts and Requirements
ACS	Army Common Sensor
ACT	Analytical Control Team
ADA	Air Defense Artillery
ADARS	ASAS Data And Recording System
ADP	Automated Data Processing
AEPDS	Advanced Electronic Processing and Dissemination System
AFATDS	Advanced Field Artillery Tactical Data System
AGCCS	Army Global Command and Control System
AGM	Attack Guidance Matrix
AI MEC	AI/EWTS Multiple Emitter Capability
AI/EWTS	Automate Intelligence Electronic Warfare Test System
AIS	Automate Information Systems
AM/CM	Asset Management/Collection Management
AMSO	Army Modeling and Simulation Office
AO	Area of Operations
AOI	Area of Interest
ARL	Airborne Reconnaissance Low
ARPA	Army Research Project Agency
ART	Code for Army Tactical Tasks in the AUTL
ASAS	All Source Analysis System
ASAS-RWS	ASAS-Remote Work Station
ASCC	ADARS Scenario Continuity Code
ATCCS	Army Tactical Command and Control System
ATEC	Army Test and Evaluation Command
ATM	Asynchronous Transfer Mode
ATWS	Advanced Tactical Workstation
AUTL	Army Universal Task List

AVIM	Aviation Intermediate Maintenance
AWIS	Army WWMCCS Information System

B

BDA	Battle Damage Assessment
BFA	Battlefield Functional Area
BFLTR	Blue Front Line Trip Report
BLUFOR	Blue (Friendly) Forces
BOIP	Basis of Issue Plan
BOS	Battlefield Operating System
BPC	Battle Projection Center
BRT	Brigade Reconnaissance Team

C

C2	Command and Control
C3I	Command, Control, Communications, and Intelligence
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	Command, Control, Communications, and Computers, Intelligence, Surveillance, and Reconnaissance.
CEES	Command, Control, Communications, and Intelligence (C3I) Engineering and Evaluation System
CGS	Common Ground Station
CHATS	CI HUMINT Automation Tool Set
CI	Counterintelligence
CMMS	Conceptual Models of the Mission Space
CNA	Computer Network Attack
CNE	Computer Network Exploitation
COA	Course of Action
COE	Common Operating Environment
COI	Critical Operation Issues
COIC	Critical Operational Issues and Criteria
COMINT	Communications Intelligence
COMSIM	Communications Simulation
CONOPS	Concept of Operations
CONUS	Continental US
CPU	Central Processor Unit
CSS	Combat Service Support
CSSCS	CSS Control System
CSTAR	Combat Synthetic Test and Assessment Range
CTSF	Central Technical Support Facility

D

DA	Department of the Army
DBST	Digital Battle Staff Trainer
DF	Direction Finding
DIA	Defense Intelligence Agency
DII	Defense Information Infrastructure
DII COE	Defense Information Infrastructure Common Operating Environment
DIS	Distributed Interactive Simulation
DMMAIN	DMMAIN, Simulation Control
DMS	Defense Messaging System
DMSO	Defense Modeling and Simulation Office
DOD	Department of Defense
DPG	DPG
DT&E	Developmental Test & Evaluation
DTES	Divisional Tactical Exploitation System
DTSP	Division Tactical Unmanned Aerial Vehicle SIGINT Program
DZ	Drop Zone

E

EAC	Echelons Above Corps
EBA	Engineer Battlefield Assessment
ECU	ELINT Consolidation Utility
EDC	Electronic Database Coordination Message
EEFI	Essential Elements of Friendly Information
EHF	Extremely High Frequency
ELINT	Electronic Intelligence
EMITPOL	Emitter Policy
EMPIRE	Electro-Magnetic Propagation Integrated Resource Environment
ENDEX	End of Exercise
EO	Electro-Optics
EPG	Electronic Proving Ground
EPW	Enemy Prisoners of War
ETRAC	Enhanced Tactical Radar Correlator
EW	Electronic Warfare
ExCIS	Extensible C4I Instrumentation Suite (FSTD M&S replacement for FSATS)

F

FBCB2	Force XXI Battle Command - Brigade and Below
FLIR	Forward-Looking Infra-Red
FOC	Full Operational Capability
FRAGO	Fragmentary Order
FSATS	Fire Support Automated Test System
FSTD	Fire Support Test Directorate
FTI	Fixed Target Indicator

G

GFE	Government Furnished Equipment
GPS	Global Positioning System
GRCS-IPF	GUARDRAIL Common Sensor-Integrated Processing Facility
GSM	Ground Station Module
GSR	Ground Surveillance RADAR
GUI	Graphical User Interface

H

HF	High Frequency
HFE	Human Factors Engineering
HLA	High Level Architecture
HPT	High Payoff Target
HPTL	High Payoff Target List
HUMINT	Human Intelligence
HVT	High Value Target

I

I/O	Input/Output
IA	Information Assurance
IBOS	IEW Battle Operating System
ICS	IMASE Computer Suite
ICU	IMINT Consolidation Utility
IEEE	Institute of Electrical and Electronics Engineers
IER	Information Exchange Requirement
IEW	Intelligence and Electronic Warfare
IEWCOMCAT	IEW Character-Oriented Message Catalog
IEWTD	Intelligence Electronic Warfare Test Directorate
IMASE	Intelligence Modeling And Simulation for Evaluation

IMD	Information Management Division
IMETS	Integrated Meteorological System
IMINT	Imagery Intelligence
InterTEC	Interoperability Test and Evaluation Capability
IO	Information Operations
IOC	Initial Operational Capability
IPAGE	Intelligence Portable ASAS (PAWS) Advanced Graphics Environment
IPB	Intelligence Preparation of the Battlefield
IR	Information Requirements
IR	Infra-Red
I-REMBASS	Improved Remotely Monitored Battlefield Sensor System
ISGT	IMASE Scenario Generation Tool
ISSS	IMASE Simulation and Scoring Subsystem
ISYSCON	Integrated System Control
IT	Information Technology
IW	Information Warfare

J

J-STARS	Joint Surveillance and Target Attack Radar System
JITC	Joint Interoperability Test Command
JOSEF	Joint Operational Test and Evaluation Simulation Environment Facility
JSWS	Joint STARS Workstation
JTA	Joint Technical Architecture
JTT	Joint Tactical Terminal
JTUAV	Joint Tactical Unmanned Aerial Vehicle
JVMF	Joint Variable Message Format

K

None

L

LAN	Local Area Network
LCCS	Life Cycle Contractor Support
LCSS	Life Cycle Software Support
LISI	Level of Information System Interoperability
LOB	Line of Bearing
LOS	Line of Sight
LRU	Lowest Replaceable Unit
LZ	Landing Zone

M

M&S	Modeling and Simulation
MCS	Maneuver Control System
MCS-P	MCS-Phoenix
MEDEVAC	Medical Evacuation
MEDLOG	Medical Logistics
MI	Military Intelligence
MIE	Military Information Environment
MIES	Modernized Imagery Exploitation System
MIS	Management Information System
MITT	Mobile Integrated Tactical Terminal
MOE	Measures of Effectiveness
MOP	Measures of Performance
MOPP	Mission-Oriented Protective Posture
MRC	Major Regional Conflict
MTI	Moving Target Indicator
MTOE	Modified Table of Organization and Equipment
MTP	Mission Training Plan

N

NAI	Named Area of Interest
NAWC	Naval Air Warfare Center
NBC	Nuclear, Biological, and Chemical
NCO	Non Commissioned Officer
NET	New Equipment Training
NGIC	National Ground Intelligence Center
NIIRS	National Imagery Interpretation Rating System
NIMA	National Imagery and Mapping Agency
NSA	National Security Agency
NSC	National Simulation Center

O

O&M	Operation & Maintenance
OCONUS	Outside of Continental US
OneSAF	One Semi-Automated Forces
OOTW	Operations Other Than War
OPFOR	Opposing Forces
OPORD	Operations Order
ORD	Operational Requirements Document

OSD	Office of the Secretary of Defense
OT&E	Operational Test & Evaluation
OTC	Operational Test Command
OTCC	Operational Test Control Center

P

P3I	Pre-Planned Product Improvement
PAWS	Portable ASAS Workstation
PC	Personal Computer
PD	Product Developer
PDU	Protocol Data Units
PM	Program Manager
POL	Petroleum, Oil, and Lubricants
POM	Program Objective Memorandum
POSIX	Portable Operating System Interface
PTSR	Post mobilization Training Support Requirement
PZ	Pickup Zone

Q

None

R

R&M	Reliability and Maintainability
RAM	Reliability, Availability, and Maintainability
RASH	Radio Station Hierarchy
RC	Reserve Component (USAR/ARNG)
RDA	Research, Development & Acquisition
REMBASS	Remotely Monitored Battlefield Sensor System
RF	Radio Frequency
RI	Request for Information
RISTA	Reconnaissance, Intelligence, Surveillance, and Target Acquisition
ROI	Return On Investment
RRI	Response to Request for Information
RSR	Radar Service Request
RTI	Runtime Infrastructure

S

SAB	Special Activities Branch
SALUTE	Size, Activity, Location, Unit, Time, and Equipment
SAR	Synthetic Aperture Radar

SARSIM	Synthetic Aperture Radar Simulation
SASC	Stability and Support Contingencies
SASO	Stability and Support Operations
SATCOM	Satellite Communications
SBA	Simulation Based Acquisition
SCS	Simulation Computer Suite
SEL	Synthetic Environment Lab
SERE	Survival, Evasion, Resistance, and Escape
SE	Support Equipment
SHF	Super High Frequency
SIGINT	Signals Intelligence
SIGSIM	Signal Simulation Threat Signature Tools and Databases
SIMFOR	Simulated Forces
SITREP	Situation Report
SMART	Simulation for Modeling, Acquisition, Requirements and Training
SOF	Special Operations Forces
SOI	Signals of Interest
SRAAT	Signature Reflection/Attenuation/Absorption Toolset
SRC	Standard Requirements Code
SSPS	Single Source Processor-Signals Intelligence (SIGINT)
STACCS	Standard Theater Army Command and Control System
STAMIS	Standard Army Management Information System
STDE	Special Tools and Diagnostic Equipment
STEP	Simulation, Test and Evaluation Process
STORM	Simulation Testing Operations Rehearsal Model
STRICOM	Simulation, Training, Instrumentation Command
SUT	System Under Test

T

TACCSF	Theater Aerospace Command and Control Simulation Facility
TACSIM	Tactical Simulation
TACSIM-OT	Tactical Simulation-Operational Test
TAI	Targeted Area of Interest
TAIS	Tactical Airspace Integration System
TBM	Tactical Ballistic Missile
TCS	Tactical Control Station
TDA	Table of Distribution and Allowances
TEMO	Training, Exercises, and Military Operations
TES	Tactical Exploitation System

TESA	Test and Evaluation Support Agency
TFB	Transmission File Builder
THMIT	Tactical High Mobility Imagery Terminal
TIQS	TACSIM Intelligence Query System
TIREM	Terrain Integrated Rough Earth Model
TMDE	Test, Measurement, and Diagnostic Equipment
TOC	Tactical Operations Center
TOE	Table of Organization and Equipment
TRADOC	Training and Doctrine Command
TRIM	Target Receiver Injection Module
TRIOP	TACSIM Router In/Out Processor
TS/SCI	Top Secret/Sensitive Compartmented Information
TSM	TRADOC Systems Manager
TSMO	Threat Systems Management Office
TSP	Training Support Package
TTP	Tactics, Techniques and Procedures
TUAV	Tactical Unmanned Aerial Vehicle
TUP	TACSIM Utilities Processor

U

UAV	Unmanned Aerial Vehicle
UHF	Ultrahigh Frequency
UJTL	Universal Joint Task List
USAOTC	United States Army Operational Test Command
USMTF	United States Message Text Format
USSID	United States Signals Intelligence Directive (USSID)

V

VHF	Very High Frequency
VIC	Vector-In-Command
VSTARS	Virtual Surveillance and Target Attack Radar System
VTT	Voice Transmission Tool
VV&A	Verification, Validation, and Accreditation

W

WAN	Wide Area Network
WARSIM	Warfighters' Simulation
WFX	Warfighter Exercise
WWMCCS	World-Wide Military Command and Control System

WX	Weather

X

XM-COMSIM	Communications Simulation

Y

None

Z

None

GLOSSARY
PART 2

TERMS AND DEFINITIONS

Abstraction. Abstraction denotes the essential characteristics of an object that distinguish it from all other kinds of objects and Thus provide crisply defined conceptual boundaries, relative to the perspective of the user.

Accessibility. The ease of approaching, entering, or obtaining.

Accreditation. The official certification that a model or simulation is acceptable for use for a specific purpose.

Accreditation Agent. The organization designated by the accreditation sponsor to conduct an accreditation assessment for a M&S application.

Accreditation Authority. An individual occupying a position with the appropriate rank, grade, responsibility and/or authority to accredit a model, simulation, or federation of models and/or simulations for a particular purpose or purposes.

Accreditation Process. The procedure followed that culminates in the accreditation determination.

Accuracy. The degree of exactness of a model or simulation, high accuracy implying low error. Accuracy equates to the quality of a result, and is distinguished from precision, which relates to the quality of the operation by which the result is obtained and can be repeated.

Activity. In modeling and simulation, a task that consumes time and resources and whose performance is necessary for a system to move from one event to the next.

Activity-Based Simulation. A discrete simulation that represents the components of a system as they proceed from activity to activity; for example, a simulation in which a manufactured product moves from station to station in an assembly line.

Activity Models. Models of the processes that make up the functional activity showing inputs, outputs, controls, and mechanisms through which the processes of the functional activity are (or will be) conducted.

Advanced Distributed Simulation (ADS). A set of disparate models or simulations operating in a common synthetic environment in accordance with the DIS standards. The ADS may be composed of three modes of simulation: live, virtual and constructive, which can be seamlessly integrated within a single exercise.

Glossary Part 2 to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

Aggregation. The ability to group entities while preserving the effects of entity behavior and interaction while grouped. See also: disaggregation.

Algorithm. A prescribed set of well defined unambiguous rules or processes for the solution of a problem in a finite number of steps.

Architecture. The structure of components in a program/system, their interrelationships, and the principles and guidelines governing their design and evolution over time.

Association. A type of static relationship between two or more object classes, apart from class-subclass or part-whole relationships.

Asynchronous Transmission. Transmission in which each information character is individually synchronized (usually by the use of start elements and stop elements).

Asynchronous Transfer Mode (ATM). A multiplexing protocol based on a small 53-byte fixed-length cell designed to efficiently transfer information derived from several sources of data over a single carrier at high speeds.

Atmosphere. A kind of mission space entity. The mass of air surrounding the earth and the features embedded within it, including clouds, smoke, and fog.

Attribute. A property or characteristic of one or more entities; for example, COLOR, WEIGHT, SEX. Also, a property inherent in an entity or associated with that entity for database purposes.

Attributive Entity. An entity that has the same primary key as the parent and additional attributes that eliminate the occurrence of repeating groups in the parent.

Authoritative Data Source. A data source whose products have undergone producer data verification, validation and certification activities.

Automated Forces (AFOR). The most automated of the computer-generated forces that require little or no human interaction.

Automated Information System (AIS). A combination of computer hardware and computer software, data, and/or telecommunications that performs functions such as collecting, processing, storing, transmitting, and displaying information. Excluded are computer resources, both hardware and software, that are: physically part of, dedicated to, or essential in real time to the mission performance of weapon systems; used for weapon system specialized training, simulation, diagnostic test and maintenance, or calibration; or used for research and development of weapon systems.

Baseline. A configuration management term that implies that the item is placed under formal control so that it cannot be changed without going through a formal review process.

Battlefield View. A battlefield entity incorporates a direct soldier/machine interface that replicates the soldier/machine interface of the actual battlefield entity.

Battle Space. Refers to both the physical environment in which the simulated warfare will take place and the forces that will conduct the simulated warfare. All elements that support the front line forces (for example, logistics, intelligence) are included in this definition of battle space.

Battlespace Entity. A simulation entity that corresponds to actual equipment, supplies, and personnel that can be seen or sensed on a real battlefield.

Behavior. For a given object, how attribute value changes affect (or are affected by) the object attribute value changes of the same or other objects.

Broadcast. A transmission model in which a single message is sent to all network destinations; i.e., one-to-all. Broadcast is a special case of multicast. Contrast with: multicast; unicast.

Browsing. Opportunity for users to freely examine and peruse through the contents of a database.

C++ (C-Plus-Plus). A high order computer language used extensively in commercial software. C++ is an object-oriented extension to the C language.

Central (Control) Station. A computer connected to a local area network that transmits/receives simulation management protocol data units at the direction of the simulation manager.

Class. A description of a group of objects with similar properties, common behavior, common relationships, and common semantics.

Common Federation Functionality. Agreements on common simulation functionality (services and resources) that are finalized among all participants in the federation during the federation development process. Federation members identified during Federation Design will propose opportunities for common services in areas of assigned responsibilities (also established during Federation Design) during federation development for discussion and negotiation among all federation participants. For instance, agreements on common representations of terrain (data, source, resolution, dynamic versus static), and environment (required types, data sources, resolution, servers), would be negotiated and agreed to, as would any relevant federation-specific algorithms (for example, extrapolation).

Computer Generated Forces (CGF). A generic term used to refer to computer representations of forces in simulations that attempts to model human behavior sufficiently so that the forces will take some actions automatically (without requiring man-in-the-loop interaction). This is also referred to as Semi-automated Forces. DOD programs addressing various levels of computer automation of forces include Command Forces, Intelligent Forces, Modular Semi-Automated Forces, Integrated Tactical Environment Management System, and Close Combat Tactical Trainer Semi-Automated Forces. (DOD Publication)

Computer Hardware. Devices capable of accepting and storing computer data, executing a systematic sequence of operations on computer data, or producing control outputs. Such devices can perform substantial interpretation, computation, communication, control, or other logical functions.

Computer Resources. The totality of computer hardware, firmware, software, personnel, documentation, supplies, services, and support services applied to a given effort.

Computer Simulation. A dynamic representation of a model, often involving some combination of executing code, control/display interface hardware, and interfaces to real world equipment.

Computer Software (or Software). A set of computer programs, procedures, and associated documentation concerned with the operation of a data processing system, for example, compilers, library routines, manuals, and circuit diagrams.

Computer Software Documentation. Technical data or information, including computer listings and printouts, which documents the requirements, design, or details of computer software, explains the capabilities and limitations of the software, or provides operation instructions for using or supporting computer software during the software's operational life.

Computer War Game. A technique by which different concepts, different pieces of hardware, or different military plans can be investigated in a multi-sided confrontation using a computer to generate displays of the battlefield and perform computations of outcomes.

Conceptual Analysis. The step in the federation development and execution process that establishes the conceptual framework for the federation. It feeds the design of the overall federation structure. The conceptual view of the objects and interactions that must be represented in the federation is key to identifying reuse opportunities in established Federation Object Models (FOMs), and high-level representation of the federation scenario refined during Conceptual Analysis also provides the basis for generation of a more detailed scenario instance during Federation Design/Development.

Conceptual Model. A statement of the content and internal representations that are the users and developer's combined concept of the model. It includes logic and algorithms and explicitly recognizes assumptions and limitations.

Condition. The values assumed at a given instant by the variables in a system, model, or simulation.

Configuration. A collection of an item's descriptive and governing characteristics, which can be expressed: a. in functional terms i.e., what performance the item is expected to achieve; and b. in physical terms i.e., what the item should look like and consist of when it is built.

Configuration Management (CM). The application of technical and administrative direction and surveillance to identify and document the functional and physical characteristics of a model or simulation, control changes, and record and report change processing and implementation status.

Consistency. Data that is maintained so that it is free from variation or contradiction.

Constant. A quantity or data item whose value cannot change.

Constrained Simulation. A simulation where time advances is paced to have a specific relationship to wall clock time. These are commonly referred to as real-time or scaled-real time simulations. Here, the terms constrained simulation and (scaled) real-time simulation are used synonymously. Human in- the-loop (for example, training exercises) and hardware-in-the loop (for example, test and evaluation simulations) are examples of constrained simulations.

Constructive Model or Simulation. See: Live, Virtual and Constructive Simulation.

Controllability. In respect to user interface of SAFORs, this is the ability of a user to dynamically change the tactics or behavior of a force during the course of an exercise easily and efficiently. For all exercises, this is the ability to stop and restart an exercise from some interim point in time.

Cooperative Development. A project in which two or more DOD Components share in domain research, technical studies, or technology development that may result in dissimilar M&S applications.

Coordinate. Linear or angular quantities which designate the position that a point occupies in a given reference frame or system. This is also used as a general term to designate the particular kind of reference frame or system, such as Cartesian coordinates or spherical coordinates.

Coordinated Time Advancement. A time advancement mechanism where logical clock advances within each federate only occur after some coordination is performed among the federates participating in the execution, for example, to ensure that the federate never receives an event notice in its past.

Current Time (of a federate). Same as federate time.

Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means.

Data Architecture. The framework for organizing and defining the interrelationships of data in support of an organization's missions, functions, goals, objectives, and strategies. Data architectures provide the basis for the incremental, ordered design and development of databases based on successively more detailed levels of data modeling.

Data Attribute. A characteristic of a unit of data such as length, value, or method of representation.

Data Certification. The determination that data have been verified and validated. Data user certification is the determination by the application sponsor or designated agent that data have been verified and validated as appropriate for the specific M&S usage.

Data Collection. The process of obtaining information that supports a functional activity or information requirement.

Data Exchange Standard. Formally defined protocols for the format and content of data messages used for interchanging data between networked simulation and/or simulator nodes used to create and operate a distributed, time and space coherent synthetic environment. (Army Model and Simulation Master Plan,

Data Integrity. In information processing, the condition in which data is accurate, current, consistent, and complete

Data Logger. A device that accepts Protocol Data Units (PDUs) from the network and stores them for later replay on the network in the same time sequence as the PDUs were originally received. See also: Protocol Data Unit.

Data Model. In a database, the user's logical view of the data in contrast to the physically stored data, or storage structure. A description of the organization of data in a manner that reflects the information structure of an enterprise.

Data Repository. A specialized database containing information about data, such as meaning, relationships to other data, origin, usage, and format, including the information resources needed by an organization.

Data Security. The protection of data from accidental or intentional modification or destruction and from accidental or intentional disclosure to unauthorized personnel.

Data Source. An organization or subject matter expert who, because of either mission or expertise, serves as a data producer.

Data Standardization. The process of documenting, reviewing, and approving unique names, definitions, characteristics and representations of data according to established procedures and conventions.

Data Structure. The logical relationships that exist among units of data and the descriptive features defined for those relationships and data units; an instance or occurrence of a data model.

Data Synchronization. The timing requirements of a data element, or between and/or among data elements.

Data Validation. The documented assessment of data by subject area experts and its comparison to known values. Data user validation is an assessment as appropriate for use in an intended model. Data producer validation is an assessment within stated criteria and assumptions.

Data Verification. Data producer verification is the use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling. Data user verification is the use of techniques and procedures to ensure that data meets user specified constraints defined by data standards and business rules derived from process and data modeling, and that data are transformed and formatted properly.

Data Verification, Validation, and Certification (VV&C). The process of verifying the internal consistency and correctness of data, validating that it represents real world entities appropriate for its intended purpose or an expected range of purposes, and certifying it as having a specified level of quality or as being appropriate for a specified use, type of use, or range of uses. The process has two perspectives: producer and user process.

Database. A collection of interrelated data, often with controlled redundancy, organized according to a schema to serve one or more applications; the data are stored so that different programs can use them without concern for the data structure or organization. A common approach is used to add new data and to modify and retrieve existing data.

Database Management System (DBMS). A system that provides the functionality to support the creation, access, maintenance, and control of databases, and that facilitates the execution of application programs using data from these databases.

Deaggregate. See: disaggregate.

Disaggregate. Activity that decomposes an aggregated entity into multiple entities representing its components.

Disaggregation. The ability to represent the behavior of an aggregated unit in terms of its component entities. If the aggregate representation did not maintain state representations of the individual entities, then the decomposition into the entities can only be notional.

Distributed Interactive Simulation (DIS) Compatible. Two or more simulations and/or simulators are DIS compatible if they are DIS compliant and their models and data that send and interpret Protocol Data Units support the realization of a common operational environment among the systems (coherent in time and space).

Distributed Interactive Simulation (DIS) Protocol Data Unit (PDU). A standard that specifies the format and structure in which data will be organized. The general purpose is to facilitate the electronic transfer of data between agencies with software; specifically, DIS PDUs are designed to enable communications between different types of simulators, simulations, and models.

Dynamic Model. A model of a system in which there is change, such as the occurrence of events over time or the movement of objects through space.

Dynamic Natural Environment. The natural environment is constantly changing because of man-made efforts (battlefield smoke) and natural phenomenon (weather). Incorporating dynamic natural environment into real time simulations provides a more realistic test bed for weapons, equipment, and personnel.

Emitter. A device that is able to discharge detectable electromagnetic or acoustic energy.

Emulate. To represent a system by a model that accepts the same inputs and produces the same outputs as the system represented. For example, to emulate an 8-bit computer with a 32-bit computer.

Emulation. A model that accepts the same inputs and produces the same outputs as a given system.

Emulator. A device, computer program, or system that performs emulation.

Entity. A distinguishable person, place, unit, thing, event, or concept about which information is kept.

Environment. The texture or detail of the natural domain, that is terrain relief, weather, day, night, terrain cultural features (such as cities or farmland), sea states, etc.; and the external objects, conditions, and processes that influence the behavior of a system (such as terrain relief, weather, day/night, terrain cultural features, etc.).

Environmental Effect. The impact that the natural environment or environmental feature has on some component or process in the simulation exercise such as the propagation of energy and image formation, the performance of a weapon system, platform or sensor, or other nonvisualized combat process.

Environmental Model. A numerical model, parametric model, or database designed to produce an accurate and consistent data set for one or more parameters that characterize the state of the natural environment.

Environmental Representation. An authoritative representation of all or a part of the natural or man-made environment, including permanent or semi-permanent man-made features.

Environmental Simulation. A simulation that depicts all or part of the natural or manmade environment of a system; for example, a simulation of the radar equipment and other tracking devices that provide input to an aircraft tracking system.

Event. A change of object attribute value, an interaction between objects, an instantiation of a new object, or a deletion of an existing object that is associated with a particular point on the federation time axis. Each event contains a time stamp indicating when it is said to occur.

Federate. A member of a high-level architecture

Federation. All applications participating in a Federation are called Federates. This may include federation managers, data collectors, real world (*live*) systems (for example, C4ISR systems, instrumented ranges, sensors), simulations, passive viewers and other utilities

Federate Time. Scaled wall clock time or logical time of a federate, whichever is smaller. Federate time is synonymous with the *current time* of the federate. At any instant of an execution different federates will, in general, have different federate times.

Federation. A named set of interacting federates, a common federation object model, and supporting Runtime Infrastructure, that are used as a whole to achieve some specific objective

Federation Element. Term applied to an individual model and/or simulation that is part of a federation of models and simulations.

Federation Object Model (FOM). An identification of the essential classes of objects, object attributes, and object interactions that are supported by a High Level Architecture federation. In addition, optional classes of additional information may also be specified to achieve a more complete description of the federation structure and/or behavior.

Federation Objective. The statement of the problem that is to be addressed by the establishment and execution of a federation. The description of the problem domain implicit in the objectives statement is critical for focusing the domain analysis activities in the conceptual analysis phase. It specifies the top-level goals of the federation, and may specify the operational need or shortfall from which federation developers will derive a scenario for the federation execution. The federation objectives drive this specification, as the scenario development phase must utilize the statement of the objectives to generate a viable context for system evaluations intrinsic to the federation objectives. High-level testing requirements implied in the federation objectives may also drive the identification of well defined *test points* during development of the federation scenario.

Fidelity. The accuracy of the representation when compared to the real world.

Field. A series of contiguous bits treated as an instance of a particular data type that may be part of a higher-level data structure.

Field Instrumentation. An internal or external recording, monitoring, and relaying device employed by live instrumented entities, usually platform, facility, or exercise-unique, and not typically part of the operational system or equipment. These devices provide an independent source of data to assess the performance of operational systems involved in the exercise.

Functional Area. A functional area encompasses the scope (the boundaries) of a set of related functions and data for which an OSD Principal Staff Assistant or the Chairman of the Joint Chiefs of Staff has DOD-wide responsibility, authority, and accountability. A functional area (for example, personnel) is composed of one or more functional activities (for example,

recruiting), each of which consists of one or more functional processes (for example, interviews). Also known as a business area.

Gateway. A device that connects two systems, especially if the systems use different protocols. For example, a gateway is needed to connect two independent local networks, or to connect a local network to a long-haul network

Generic Domain. A domain type where the attribute is constrained only by the data type assigned by the data base management system (DBMS), or implied by the record type in a flat file, whichever is applicable.

Generic Element. A generic element is the part of a data element that establishes a structure and limits the allowable set of values of a data element. A generic element has no functional or application context other than to define a general class of data and ensure consistency in structure and domain

General-Use M&S Applications. Specific representations of the physical environment or environmental effects used by, or common to, many models and simulations; for example, terrain, atmospheric, or hydrographic effects.

Ground Truth. The facts of a situation, without errors introduced by sensors or human perception and judgment.

Hierarchical Model. A model of information in which data are represented as trees of records connected by pointers.

Hierarchy. Hierarchy is a ranking or ordering of abstractions.

High Level Architecture (HLA). Major functional elements, interfaces, and design rules, pertaining as feasible to all DOD simulation applications, and providing a common framework within which specific system architectures can be defined.

Homogeneous Network. A network of DIS objects with fully consistent behaviors and fully correlated databases.

Host or Host Computer. A computer that supports one or more simulation applications. All host computers participating in a simulation exercise are connected by network(s) including wide area networks, local area networks, and RF links

Human Factors. The discipline or science of studying man-machine relationships and interactions. The term covers all biomedical and psychological considerations; it includes, but is not limited to, principles and applications in the areas of human engineering, personnel selection, training, life support, job performance aids, and human performance evaluation.

Human-in-the-Loop (HITL). A model that requires human interaction. See: interactive model.

Implementation. The means by which a synthetic environment, or portions of a synthetic environment, is realized.

Information. Any communication or reception of knowledge such as facts, data, or opinions, including numerical, graphic, or narrative forms, whether oral or maintained in any medium, including computerized databases, paper, microform, or magnetic tape.

Information System (IS). The organized collection, processing, maintenance, transmission, and dissemination of information in accordance with defined procedures, whether automated or manual.

Information Technology (IT). The hardware and software used in connection with government information, regardless of technology involved, whether computers, communications, micro graphics, or others

Information Warfare (IW). Actions taken to achieve information superiority by affecting adversary information, information-based processes, information systems, and computer-based networks, while defending one's own information, information-based processes, information systems, and computer-based networks

Infrastructure. An underlying base or foundation; the basic facilities, equipment, and installations needed for the functioning of a system

Initial State. The values assumed by the state variables of a system, component, or simulation at the beginning of some specified duration of time. Contrast with: final state.

Integrated Product and Process Development (IPPD). An approach to systems acquisition that brings together all of the functional disciplines required to develop, design, test, produce and field a system. This is essentially the same as Concurrent Engineering.

Integrated Product Team (IPT). Integrated Product Teams are a means to achieve concurrent engineering or Integrated Product and Process Development. They are multi-disciplinary teams consisting of representatives from all disciplines involved in the system acquisition process, from requirements development through disposal. Having the participation of all the appropriate disciplines, Integrated Product Teams are often empowered to make decisions to achieve successful development of their particular product.

Interaction. An explicit action taken by an object that can optionally (within the bounds of the Federation Object Model) be directed toward other objects, including geographical areas etc.

Interactive Model. A model that requires human participation.

Interoperability. See: M&S Interoperability

Known Object. An object is known to a federate if the federate is reflecting or updating any attributes of that object.

Latency. The time required for a device to begin physical output of a desired piece of data once processing is complete.

Live Entity. A perceptible object that can appear in the virtual battle space but is unaware and non-responsive (either by intent, lack of capability or circumstance) to the actions of virtual entities. See also: field instrumentation

Live Simulation. One of several categories of simulation. See Live, Virtual, and Constructive Simulation.

Live, Virtual, and Constructive Simulation. A broadly used taxonomy for classifying simulation types. The categorization of simulation into live, virtual, and constructive is problematic, because there is no clear division between these categories. The degree of human participation in the simulation is infinitely variable, as is the degree of equipment realism. This categorization of simulations also suffers by excluding a category for simulated people working real equipment (for example, smart vehicles).

Live Simulation. A simulation involving real people operating real systems.

Virtual Simulation. A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop in a central role by exercising motor control skills (for example, flying an airplane), decision skills (for example, committing fire control resources to action), or communication skills (for example, as members of a C4I team).

Constructive Model or Simulation. Models and simulations that involve simulated people operating simulated systems. Real people stimulate (make inputs) to such simulations, but are not involved in determining the outcomes.

Local Area Network (LAN). A class of data network that provides high data rate interconnection between network nodes in close physical proximity.

Local Time. The mean solar time for the meridian of the observer.

Logical Time. A federate's current point on the logical time axis. If the federate's logical time is T, all time stamp ordered messages with time stamp less than T have been delivered to the federate, and no time stamp ordered messages with time stamp greater than T have been delivered; some, though not necessarily all, time stamp ordered messages with time stamp equal to T may also have been delivered. Logical time does not, in general, bear a direct relationship to wall clock time, and advances in logical time are controlled entirely by the federates and the Runtime Infrastructure. Specifically, the federate requests advances in logical time via the Time Advance Request and Next Event Request Runtime Infrastructure services, and the Runtime Infrastructure notifies the federate when it has advanced logical time explicitly through the Time Advance Grant service, or implicitly by the time stamp of time stamp ordered messages that are delivered to the federate. Logical time (along with scaled wall clock time) is used to determine the current time of the federate (see definition of federate time). Logical time is only relevant to federates using time stamp ordered message delivery and coordinated time advances, and may be

ignored (by requesting a time advance to *infinity* at the beginning of the execution) by other federates

Measure of Effectiveness (MOE). A qualitative or quantitative measure of the performance of a model or simulation or a characteristic that indicates the degree to which it performs the task or meets an operational objective or requirement under specified conditions.

Measure of Performance (MOP). Measure of how the system/individual performs its functions in a given environment (for example, number of targets detected, reaction time, number of targets nominated, susceptibility of deception, task completion time). It is closely related to inherent parameters (physical and structural) but measures attributes of system behavior. See also: measure of effectiveness.

Message. A data unit transmitted between federates containing at most one event. Here, a message typically contains information concerning an event, and is used to notify another federate that the event has occurred. When containing such event information, the message's time stamp is defined as the time stamp of the event to which it corresponds. Here, a *message* corresponds to a single event, however the physical transport media may include several such messages in a single *physical message* that is transmitted through the network.

Message (Event) Delivery. Invocation of the corresponding service (Reflect Attribute Values, Receive Interaction, Instantiate Discovered Object, or Remove Object) by the Runtime Infrastructure to notify a federate of the occurrence of an event.

Mission Space. The environment of entities, actions, and interactions comprising the set of interrelated processes used by individuals and/organizations to accomplish assigned tasks.

Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Modeling. Application of a standard, rigorous, structured methodology to create and validate a physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Modeling and Simulation (M&S). The use of models, including emulators, prototypes, simulators, and stimulators, either statically or over time, to develop data as a basis for making managerial or technical decisions. The terms *modeling* and *simulation* are often used interchangeably.

Modeling and Simulation (M&S) Accreditation. The official certification that a model or simulation is acceptable for use for a specific purpose.

M&S Infrastructure. A M&S infrastructure consists of M&S systems and applications, communications, networks, architectures, standards and protocols, and information resource repositories.

M&S Interoperability. The ability of a model or simulation to provide services to and accept services from other models and simulations, and to use the services so exchanged to enable them to operate effectively together.

Modeling and Simulation Master Plan (MSMP). A DOD plan that establishes short-term (present to 6 years) and long-term (beyond 6 years) DOD goals and objectives for the application of M&S for joint and common use within the DOD. It shall also include an assessment of current M&S capabilities, and a road map that delineates the management, investment, and technical strategies required to achieve DOD M&S objectives.

M&S Working Group (MSWG). The MSWG supports the activities of the Executive Council for Modeling and Simulation and responds to guidance and direction from the USD(A&T). The Director, Defense Modeling and Simulation Office, chairs the MSWG. The membership of the MSWG will normally be 0-6 military officers or GM-15 grade civilians. The MSWG promotes coordination and cooperation of DOD M&S at the working level. Members will represent their organization, serve as the Defense Modeling and Simulation Office point of contact for M&S issues, and prepare their principals for Executive Council for Modeling and Simulation meetings. MSWG membership will mirror the organizational makeup of the Executive Council for Modeling and Simulation; however, other organizations may be added by majority vote of the group, as required.

Modular Semi-Automated Forces (ModSAF). A class of Computer Generated Forces utilizing a modular software structure in which model components have well-defined and documented interfaces allowing run-time reconfiguration of model behavior to develop generalized, and more sophisticated, representations of reactive behaviors and missions.

Multicast. A transmission mode in which a single message is sent to selected multiple (but not necessarily all) network destinations; i.e., one-to-many. Contrast with: broadcast, unicast.

Multi Sensory I/O. The use of more than one sensory mechanism (visual, aural, tactile, etc.) to interact with a computer-generated environment.

Multi-State Objects. Mission space entities that express a changing state (in attribution and visual display) as the simulation progresses (for example, damage to structures, changes in vegetation, damage system representations such as vehicles, tanks, etc).

Network Communication Services. The capability provided to electronically transmit modeling and simulation data between networked computational nodes in a manner that meets requirements for transmission latency, multi-cast addressing and security needed to support the creation and operation of distributed time and space coherent synthetic environments. (Army Model and Simulation Master Plan,

Network Management. The collection of administrative structures, policies, and procedures that collectively provide for the management of the organization and operation of the network as a whole. See: network manager.

Node. A general term denoting either a switching element in a network or a host computer attached to a network.

Non-Dynamic. The natural environment is constantly controlled regardless of man-made efforts (battlefield smoke) and natural phenomenon (weather). Incorporating non-dynamic natural environment into real time simulations presents testing challenges to collect requisite data and still provide a realistic battlefield environment.

Object. A fundamental element of a conceptual representation for a federate that reflects the *real world* at levels of abstraction and resolution appropriate for federate interoperability. For any given value of time, the state of an object is defined as the enumeration of all its attribute values.

Open System. A system in which the components and their composition are specified in a non-proprietary environment, enabling competing organizations to use these standard components to build competitive systems. There are three perspectives on open systems: portability - the degree to which a system component can be used in various environments, interoperability - the ability of individual components to exchange information, and integration - the consistency of the various human-machine interfaces between an individual and all hardware and software in the system.

Operational Environment. A composite of the conditions, circumstances, and influences that affect the employment of military forces and the decisions of the unit commander.

Output Validation. The process of determining the extent to which the output (outcome distributions for the M&S and/or sub-models) represent the significant and salient features of distributions or real world systems, events, and scenarios.

Processes. Processes affect entities. Attrition, communications, and movement are examples of processes. Processes have a level of detail by which they are described.

Process Model. A model of the processes performed by a system; for example, a model that represents the software development process as a sequence of phases. Contrast with: structural model.

Protocol. A set of rules and formats (semantic and syntactic) that define the communication behavior of simulation applications.

Protocol Data Unit (PDU). Distributed Interactive Simulation terminology for a unit of data that is passed on a network between simulation applications.

Protocol Data Unit (PDU) Standards. Formally defined data exchange standards established for each of the several primary classes of functionality that is represented in the DIS synthetic environment; for example, movement, weapons, firing effects, collisions, etc.

Protocol Entity. An object that exchanges information.

Prototype. A preliminary type, form, or instance of a system that serves as a model for later stages or for the final, complete version of the system.

Qualitative Data. A data value that is a non-numeric description of a person, place, thing, event, activity, or concept.

Quality Assurance (QA). The policies, procedures and systematic actions established in an enterprise for providing and maintaining some degree of confidence in data integrity and accuracy throughout the life cycle of the data. The planned systematic activities necessary to ensure that a component, module, or system conforms to established technical requirements.

Queue. In queuing theory, a set of zero or more entities waiting to be serviced by a service facility.

Random. Pertaining to a process or variable whose outcome or value depends on chance or on a process that simulates chance, often with the implication that all possible outcomes or values have an equal probability of occurrence; for example, the outcome of flipping a coin or executing a computer-programmed random number generator

Real-Time. In modeling and simulation, simulated time advances at the same rate as actual time; for example, running the simulation for one second results in the model advancing time by one second. Contrast with: fast time; slow time.

Real-Time Simulation. Same as constrained simulation.

Real World. The set of real or hypothetical causes and effects that simulation technology attempts to replicate. When used in a military context, the term is synonymous with real battlefield to include air, land, and sea combat.

Reliable Service. A communication service in which the received data is guaranteed to be exactly as transmitted.

Research, Development, and Acquisition (RDA). One of the three domains for Army M&S applications. RDA includes all M&S used for design, development, and acquisition of weapons systems and equipment. M&S in the RDA domain are used for scientific inquiry to discover or revise facts and theories of phenomena, followed by transformation of these discoveries into physical representations. RDA also includes test and evaluation (T&E) where M&S are used to augment and possibly reduce the scope of real-world T&E.

Resolution. The degree of detail and precision used in the representation of real world aspects in a model or simulation. See also: granularity.

Runtime Infrastructure (RTI). The general purpose distributed operating system software that provides the common interface services during the runtime of a High Level Architecture federation.

Scalability. The ability of a distributed simulation to maintain time and spatial consistency as the number of entities and accompanying interactions increase.

Scenario Development. A phase of the development of a federation. In this phase, the federation developer(s) formulate a scenario whose execution and subsequent evaluation will lead toward achieving the study objectives set forth by the federation sponsor. The scenario provides an identification of the major entities that must be represented by the federation, a conceptual description of the capabilities, behavior, and relationships (interactions) between these major entities over time, and a specification of relevant environmental conditions (for example, terrain, atmospherics). Initial and termination conditions are also provided. The style of format of the scenario documentation (for example, graphics, tables, text) is entirely at the discretion of the federation developer. However, communities of use may wish to establish scenario documentation standards among themselves to facilitate reuse of scenario components. The output of this phase is a functional-level scenario description, which is provided as input to the Conceptual Analysis phase. Certain key activities during Conceptual Analysis may also drive reiterations of the Scenario Development phase. IEWTD scenario generation, has two primary definitions. Definition one is the depiction of large numbers (150K entities) of threat forces at the object level (such as trucks, trailers, and tanks). Each entity must have its representative attribute or intelligence detectives for each intelligence discipline. This depiction includes representative formations and deployments needed by intelligence analysts, along with appropriate schemes of maneuver, during a 96- to 120-hour scenario period. Definition two occurs once definition one has been completed. It is the development of specific supporting products and orchestration of instrumentation vans (over-the-air) and virtual signal injection to represent the doctrinal emanations from threat systems.

Scheduling an Event. Invocation of a primitive (Update Attribute Values, Send Interaction, Instantiate Object, or Delete Object) by a federate to notify the Runtime Infrastructure of the occurrence of an event. Scheduling an event normally results in the Runtime Infrastructure sending messages to other federates to notify them of the occurrence of the event.

Schema. Descriptive representation of data and/or data requirements that describe conceptual, internal, or external views of information/data needs.

Scope. Used in reference to SAFOR, scope refers to the aspects of combat portrayed by the system. For example, ground combat, combat support, combat service support, air-to-air combat, air-to-ground combat, air-to-ship combat, naval surface combat, naval undersea warfare, and deployment.

Seamless. Perfectly consistent. Transparent.

Semi-Automated Forces (SAFOR). Simulation of friendly, enemy and neutral platforms on the virtual battlefield in which the individual platform simulation are operated by computer simulation of the platform crew and command hierarchy. The term *semiautomated* implies that the automation is controlled and monitored by a human who injects command-level decision making into the automated command process. See also: Computer-Generated Forces.

Session. A portion of an exercise that is contiguous in wall-clock (sidereal) time and that is initialized per an exercise database.

Simulated Time. Time as represented within a simulation.

Simulation. A method for implementing a model over time.

Simulation Application. a. The executing software on a host computer that models all or part of the representation of one or more simulation entities. The simulation application represents or *simulates* real-world phenomena for the purpose of training, analysis, or experimentation. Examples include manned vehicle (virtual) simulators, computer-generated forces(constructive), environment simulators, and computer interfaces between a Distributed Interactive Simulation network and real (live) equipment. The simulation application receives and processes information concerning entities created by peer simulation applications through the exchange of Distributed Interactive Simulation Protocol Data Units. More than one simulation application may simultaneously execute on a host computer; b. the application layer protocol entity that implements standard Distributed Interactive Simulation protocol.

Simulation Clock. A counter used to accumulate simulated time.

Simulation Entity. An element of the synthetic environment that is created and controlled by a simulation application through the exchange of Distributed Interactive Simulation Protocol Data Units (for example, tanks, submarines, carriers, fighter aircraft, missiles, bridges). It is possible that a simulation application will be controlling more than one simulation entity.

Simulation Environment. (a). Consists of the operational environment surrounding the simulation entities including terrain, atmospheric, bathyspheric and cultural information; (b). all the conditions, circumstances, and influences surrounding and affecting simulation entities including those stated in (a).

Simulation Management. A mechanism that provides centralized control of the simulation exercise. Functions of simulation management include: start, restart, maintenance, shutdown of the exercise, and collection and distribution of certain types of data.

Simulation Object Model (SOM). A specification of the intrinsic capabilities that an individual simulation offers to federations. The standard format in which SOMs are expressed provides a means for federation developers to quickly determine the suitability of simulation systems to assume specific roles within a federation.

Simulation Process. The imitative representation of the actions of platform(s), munitions(s), and life form(s) by computer program(s) in accordance with a mathematical model and the generation of associated battlefield entities. May be fully automated or partially automated. In the latter case, the human-in-the-loop injects command-level decisions into the process and is not intended to be a *trainee*.

Simulation Time. a. A simulation's internal representation of time. Simulation time may accumulate faster, slower, or at the same pace as sidereal time; b. The reference time (for example, Universal Coordinated Time) within a simulation exercise, this time is established by the simulation management function before the start of the simulation and is common to all participants in a particular exercise.

Simulator. a. A device, computer program, or system that performs simulation; b. For training, a device which duplicates the essential features of a task situation and provides for direct human operation.

Stability. Constancy of purpose; steadfastness; reliability; dependability.

Standard. A rule, principle, or measurement established by authority, custom, or general consent as a representation or example.

State. (a). The internal status of a simulation entity; for example, fuel level, number of rounds remaining, location of craters, etc. (b). A condition or mode of existence that a system, component, or simulation may be in; for example, the preflight state of an aircraft navigation program or the input state of given channel; c. the values assumed at a given instant by the variables that define the characteristics of a system, component, or simulation.

Stimulation. Stimulation is the use of simulations to provide an external stimulus to a system or subsystem. An example is the use of a simulation representing the radar return from a target to drive (stimulate) the radar of a missile system within a hardware/software-in-the-loop simulation.

Stimulator. (a). A hardware device that injects or radiates signals into the sensor system(s) of operational equipment to imitate the effects of platforms, munitions, and environment that are not physically present; (b). a battlefield entity consisting of hardware and/or software modules that injects signals directly into the sensor systems of an actual battlefield entity to simulate other battlefield entities in the virtual battlefield.

Structural Model. A representation of the physical or logical structure of a system; for example, a representation of a computer network as a set of boxes connected by communication lines. Contrast with: process model.

Structural Validation. The process of determining that the M&S assumptions, algorithms, and architecture provide an accurate representation of the composition of the real world as relevant to the intended use of the M&S.

Symbology. A graphic representation of concepts or physical objects.

Synthetic Battlefield. One type of synthetic environment.

Synthetic Environments (SE). Inter-netted simulations that represent activities at a high level of realism from simulations of theaters of war to factories and manufacturing processes. These environments may be created within a single computer or a vast distributed network connected

by local and wide area networks and augmented by super-realistic special effects and accurate behavioral models. They allow visualization of and immersion into the environment being simulated.

System. A collection of components organized to accomplish a specific function or set of functions.

Technical Data. Scientific or technical information recorded in any form or medium (such as manuals and drawings). Computer programs and related software are not technical data; documentation of computer programs and related software are. Also excluded are financial data or other information related to contract administration.

Technical Infrastructure. The internal framework that must be built to implement an operational service.

Time Management. A collection of mechanisms and services to control the advancement of time within each federate during an execution in a way that is consistent with federation requirements for message ordering and delivery.

Time Variable. A variable whose value represents simulated time or the state of the simulation clock.

Typing. Typing is the enforcement of the class of an object, such that objects of different types may not be interchanged, or may be interchanged only in restricted ways.

Unicast. A transmission mode in which a single message is sent to a single network destination; i.e., one-to-one.

Unit. (a) An aggregation of entities; (b) A basis of measurement

Validity. The quality of maintained data that is found on an adequate system of classification (for example, data model) that is rigorous enough to compel acceptance.

Variable. A quantity or data item whose value can change. See also: dependent variable; independent variable; state variable. Contrast with: constant.

Verification. The process of determining that a model or simulation implementation accurately represents the developer's conceptual description and specification. Verification also evaluates the extent to which the model or simulation has been developed using sound and established software engineering techniques.

Verification and Validation (V&V) Proponent. The agency responsible for ensuring verification and validation is performed on a specific model or simulation.

Virtual. Refers to the essence or effect of something, not the fact.

Virtual Battlespace. The illusion resulting from simulating the actual battle space.

Virtual Network. The interconnection of Distributed Interactive Simulation cells by any communications means that provide the necessary network services to conduct an exercise.

Virtual Prototype. A model or simulation of a system placed in a synthetic environment, and used to investigate and evaluate requirements, concepts, system design, testing, production, and sustainment of the system throughout its life cycle.

Virtual Reality. The effect created by generating an environment that does not exist in the real world. Usually, a stereoscopic display and computer-generated three-dimensional environment giving the immersion effect. The environment is interactive, allowing the participant to look and navigate about the environment, enhancing the immersion effect. Virtual environment and virtual world are synonyms for virtual reality.

Virtual Simulation. See: Live, Virtual, and Constructive Simulation.

Virtual Time. See: simulated time

Virtual World. See: synthetic environment.

Visualization. The formation of an artificial image that cannot be seen otherwise. Typically, abstract data that would normally appear as text and numbers is graphically displayed as an image. The image can be animated to display time varying data.

War Game. A simulation game in which participants seek to achieve a specified military objective given preestablished resources and constraints; for example, a simulation in which participants make battlefield decisions and a computer determines the results of those decisions.

Wide Area Network (WAN). A communications network designed for large geographic areas.

World Coordinate System. The right-handed geocentric Cartesian system. The shape of the world is described by the World Geodetic System 1984 standard. The origin of the world coordinate system is the centroid of the earth. The axes of this system are labeled X, Y, and Z, with: the positive X-axis passing through the Prime Meridian at the Equator; the positive Y-axis passing through 90 degrees East longitude at the Equator; and the positive Z-axis passing through the North Pole.

World Geodetic System 1984 (WGS 84). A geocentric coordinate system which describes a basic frame of reference and geometric figure for the Earth, and which models the Earth from a geometric, geodetic, and gravitational standpoint. The WGS 84 coordinate system origin and axes also serve as the x, y, and z-axes of the WGS 84 ellipsoid, the z-axis being the rotational axis.

(This page intentionally left blank.)

Table A to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

TABLE A
ORD KPP SUMMARY

Interoperability Key Performance Parameter		
	Interoperability KPP	Rationale
IMASE and Associated Subsystems All Blocks	IMASE shall adhere to all standards and protocols of the DOD HLA common technical architecture framework for efficient and effective use of models and simulations to facilitate interoperability and reuse. The technical framework will consist of a common HLA to which all models and simulations must conform, Conceptual Models of the Mission Space (CMMS) to provide a basis for the development of consistent and authoritative simulation representations, and data standards to provide common representation of data across models, simulations, and C4I systems. Furthermore, IMASE developments will adhere to configurable, layered, and reusable software components that will facilitate interoperability of simulations with C4I systems IAW the Defense Information Infrastructure Common Operating Environment (DII COE).	IMASE must interoperate with all types of models and simulations among themselves and with C4I systems to support the needs of operational testing. IMASE must promote flexibility and reuse of models and simulations to support other functional areas.

Key Performance Parameter		**KPP Summary Threshold (T) and Objective (O)**
Scenario Generation	Block I	• Allow scenario generation for war in accordance with DPG. (T) • Generate scenarios at the UNCLASSIFIED through the collateral SECRET level. (T) • Allow scenario generation for war in Southwest Asia (SWA), Korea, the Balkans and Caspian areas, and for OOTW in Central and South America and Africa. This includes disaster-relief scenarios in the above locations and in North America. Scenarios will be generated at the UNCLASSIFIED through SCI levels. (O)

Table A to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

Key Performance Parameter		KPP Summary Threshold (T) and Objective (O)
	Block II	• Allow scenario generation for war in Southwest Asia (SWA), Korea, Balkans, Caspian, OOTW in Central and South America and Africa. (T) • Allow scenario generation for any operation anywhere in the world in accordance with DPG. (O) • Allow users to build and modify scenarios from other sources, for example, OneSAF, JANUS, or Digital Battle Synthetic Trainer (DBST). (O)
	Block III	• Allow scenario generation for any operation anywhere in the world in accordance with DPG. (T) • Allow users to import and modify scenarios from other sources, for example, OneSAF, JANUS, or Digital Battle Synthetic Trainer (DBST). (T) • Allow users to build and export scenarios to other compatible simulation systems. (O).
Product Generation	Block I	• IMASE must have the capability to generate USMTF and USSID textual messages. (T) • IMASE must have the capabilities to meet the SUT product-generation requirements, for example, JVMF, (T) Electronic Database Coordination (EDC) Message. (O)
	Block II	Produce graphics and Defense Messaging System (DMS) products to meet SUT product generation requirements in a timely manner. (T) • Produce graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS to meet SUT product generation requirements in a timely manner. (O) • Provide stay-behind TSP (O) • XM-COMSIM/TRIM PII development of Timer Ordered Master Events Lists (TOEL) and Script (RF, Textual) (T)
	Block III	• Produce graphics, TUAV video (EO/IR), CGS MTI and SAR, DMS to meet SUT product generation requirements in a timely manner. (T) • Provide stay-behind TSP (T) • XM-COMSIM/TRIM PII real-time generation (interactivity) of RF and textual script. (O)

Table A to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

Key Performance Parameter		KPP Summary Threshold (T) and Objective (O)
Product Delivery	Block I	• Configure the Scenario Generation and Simulation Application utilizing the Communications Support Processor (CSP). (T) • Deliver JVMF messages. (T) • Configure the Scenario Generation and Simulation Application. Provide automated tools to configure the software, hardware, and networks that comprise the simulation environment. The simulation configuration includes network design, to include both wide area and local area networks; system parameter selection; location, distribution, and configuration of computers and workstations, whether locally clustered or geographically distributed; and allocation of software to computers based on hardware location and load-balancing across hardware. (O)
	Block II	• Produce capability to execute operational tests in an integrated live and constructive simulation environment. (T) • Provide capability to execute operational tests in an integrated live, virtual, and constructive simulation environment. (O) • XM-COMSIM/TRIM PII hardware system development and delivery of script (RF, textual). (T)
	Block III	• Provide capability to execute operational tests in an integrated live, virtual, and constructive simulation environment. (T) • XM-COMSIM/TRIM PII real-time, fully virtual (no hardware in-the-loop) delivery capability through the HLA/DIS network. (O)
Performance Scoring	Block I	• Current capability of IPAGE, TIQS, and TFB are required. (T) • Minimum requirement is the current capability of TACSIM-OT. (O)
	Block II	• Demonstrate the capability to process and merge information collected from different simulation environments. (T) • Process and merge information collected from different simulation environments, for example, STORM, VSTARS. (O)
	Block III	• Process and merge information collected from different simulation environments, for example, STORM, VSTARS. (T)

(This page intentionally left blank.)

TABLE B
IMASE INFORMATION EXCHANGE REQUIREMENTS (IER) MATRIX

AUTL	Evnt/Action	Info Character	Send Node	Rcv Node	Crit	Format	Tir	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Identify and verify the scenario and SUT fidelity requirements.	Scenario Gen Wargaming	>TRADOC	>IEWTD	YES	>Hard & soft copy scenario info.	W/in monti work :	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Establish scenario development database.	Scenario Gen Wargaming	>National-level databases. >TRADOC >Other scenario generators.	>ISGT >COMSIM >TRIM >VTT	YES	>Red & Blue OB. >TO&E unit & equipment listings. >Data Elm. .>Entity Attributes. >Attrition >Deploys >LOS & RF	W/in monti work :	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Develop and refine the scenario environment to portray the operational simulation.	Product Generation	>ISGT >COMSIM >TRIM >VTT	>IEWTD >IMASE >ISDB >ISSS	YES	>Player Prod. for example, OPORD, Estimates, Overlays. >MEL/ TOEL >PIR Solution Set. >Msg Traffic >RF & text script. >Graphics, for example, UAV Video, CGS MTI/SAR	W/i monti end scen pha	

AUTL	Evnt/Action	Info Character	Send Node	Rcv Node	Crit	Format	Tir	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Ensure realistic scenario & product integration.	Product Delivery (SUT stimulation)	>IMASE >ISGT >COMSIM > TRIM >VTT >CSP	>ISSS >SUT >TOC >ABCS >Network >System Interfaces	YES	All required products IAW scenario depiction and operational situation.	IAW run-ti	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Config scenario gen & sim application using CSP. Use auto tools & utilities to config H/W & Network.	Product Delivery (M&S stimulation)	>IMASE >ISGT >COMSIM > TRIM >VTT >CSP	>Ext Sims >ISSS >SUT >TOC >ABCS >Network >System Interfaces	YES	All required products IAW scenario depiction and Op situation.	IAW run-ti	
SN 7 – Conduct Force Development, Specifically SN 7.2 – Conduct Research and Development, Subparagraph SN 7.2.4 – Conduct Testing.	Ensure SUT performance IAW established standards & requirements. Process and merge data collected from multiple Sim environs.	SUT Scoring	>ISDB	>ISSS	YES	>Validate scoring database. >Causality analysis. >Test report.	W/in 1(of test	

Figure 1 to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

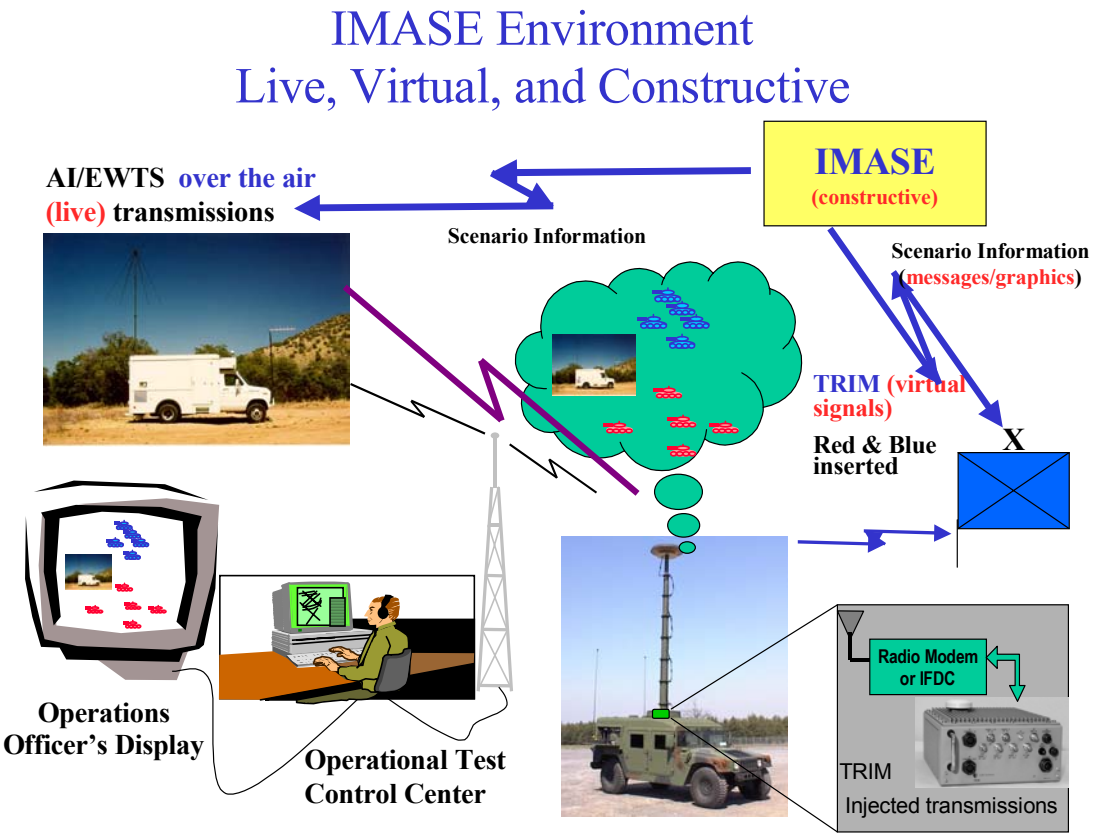

Figure 1. Operational View Diagram (OV-1).

Formatted

Figure 1a to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

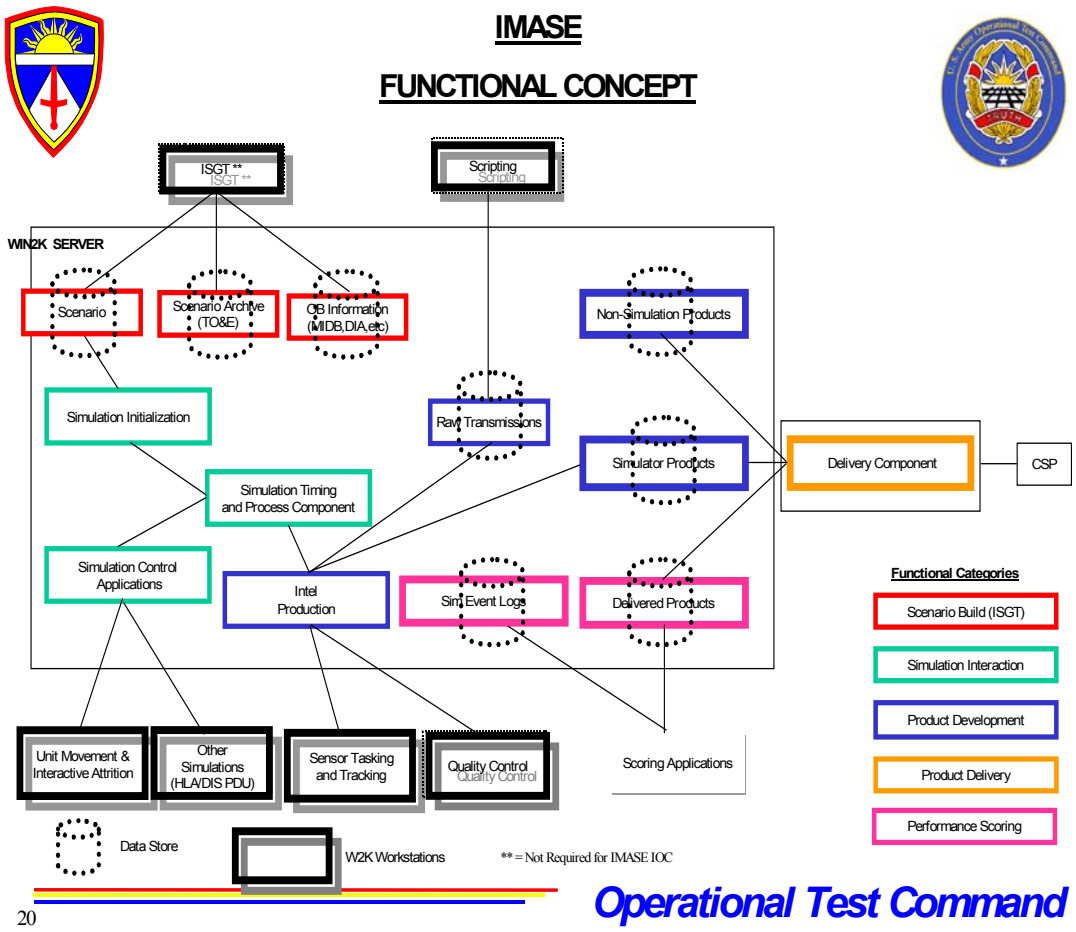

Figure 1a. IMASE Functional Concept Diagram.

Formatted

Figure 2 to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

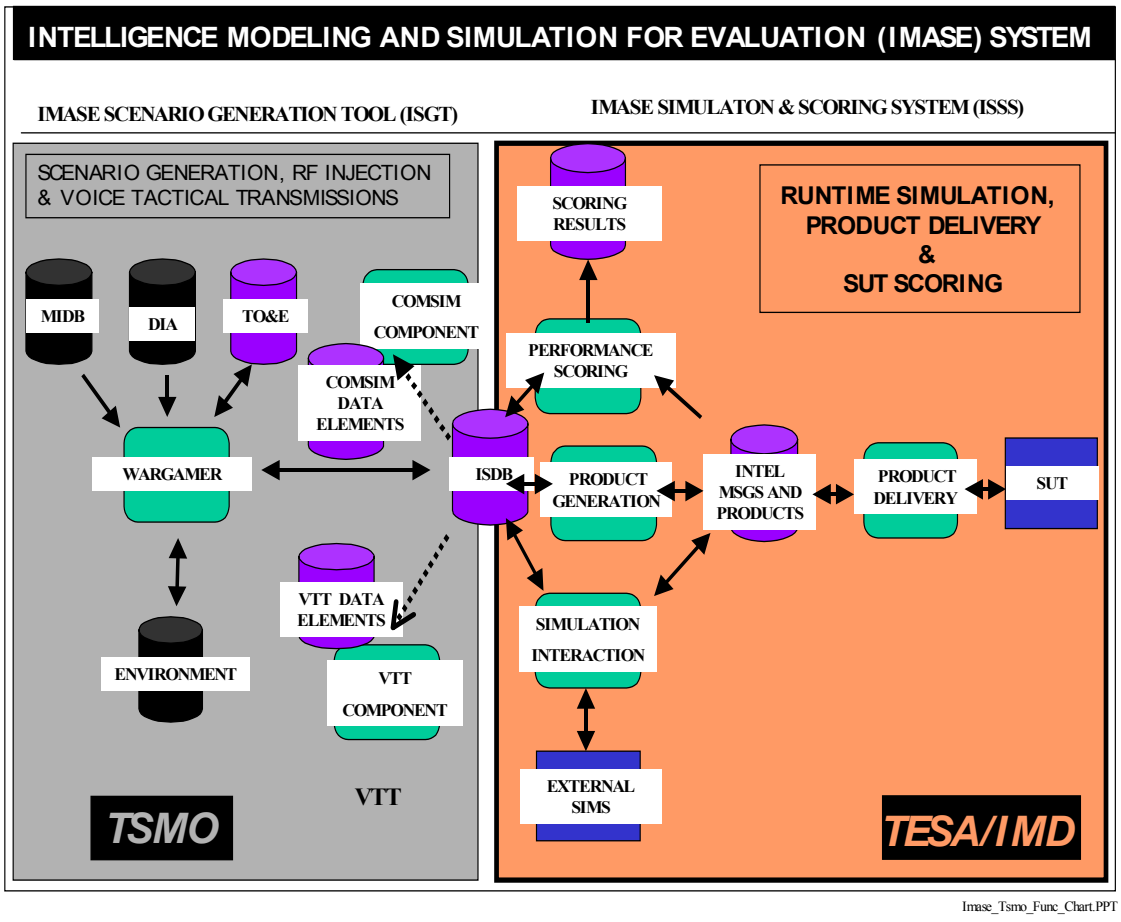

Figure 2. IMASE Systems View Diagram (SV-1).

Formatted

Figure 3 to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

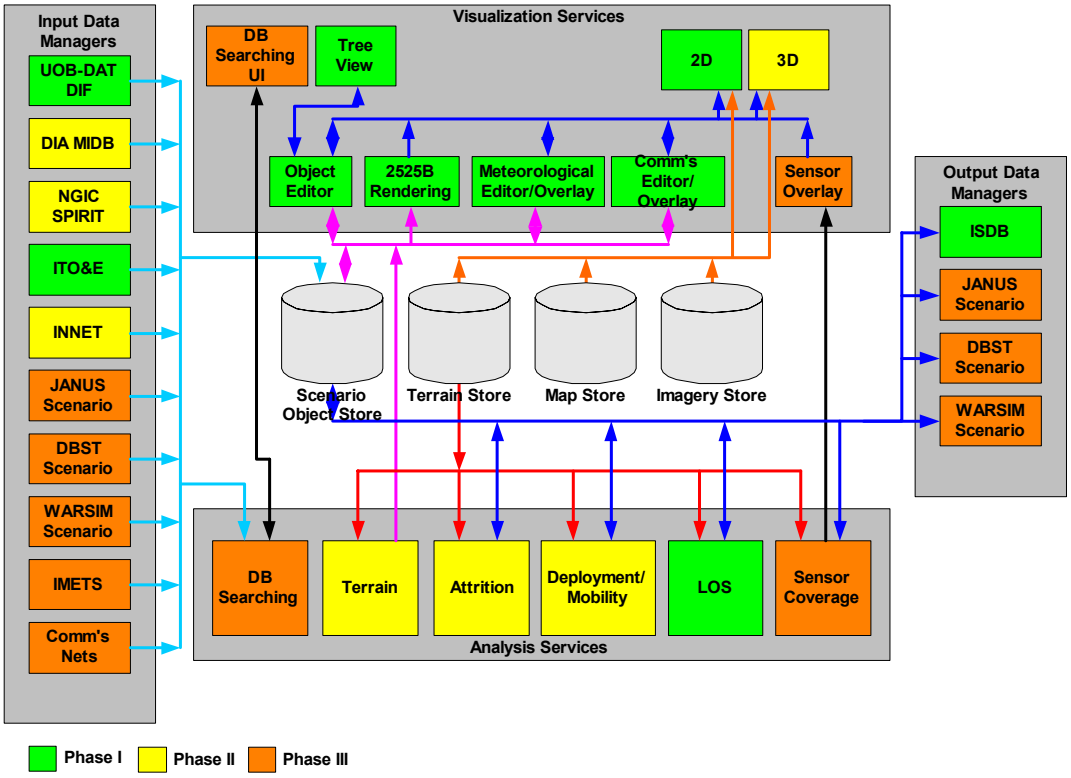

Figure 3. ISGT Systems View Diagram (SV-1).

Formatted

Figure 4 to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

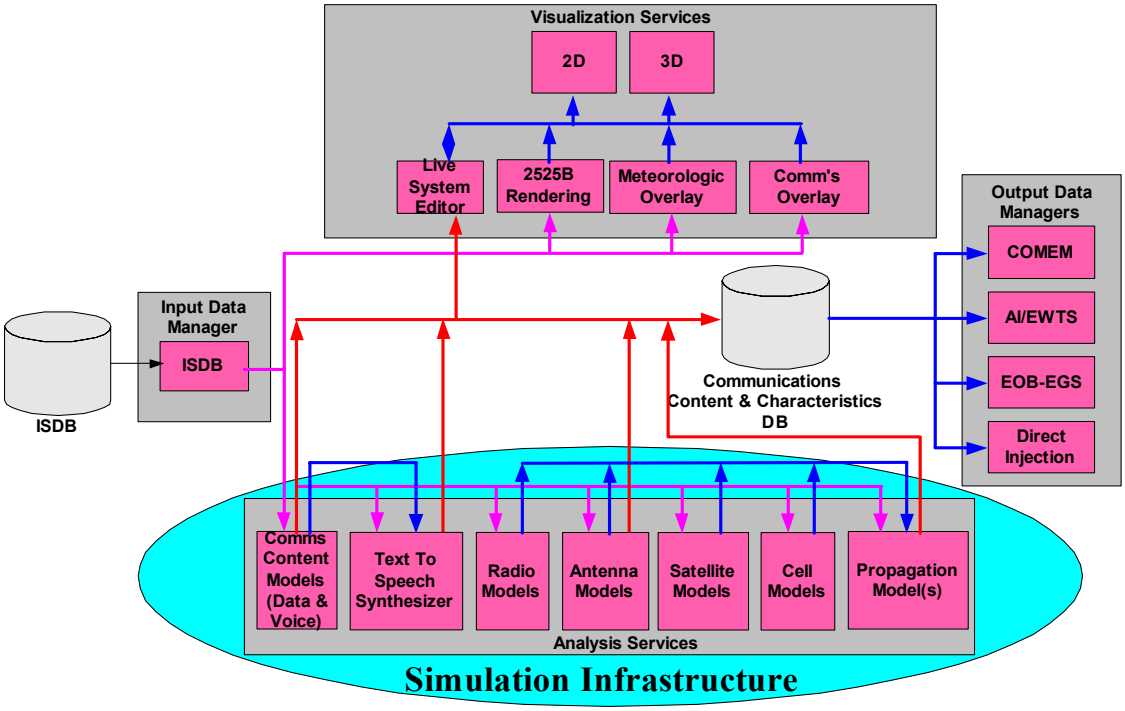

Figure 4. XM-COMSIM Systems View Diagram (SV-1).

Formatted

Figures 5 and 5a to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

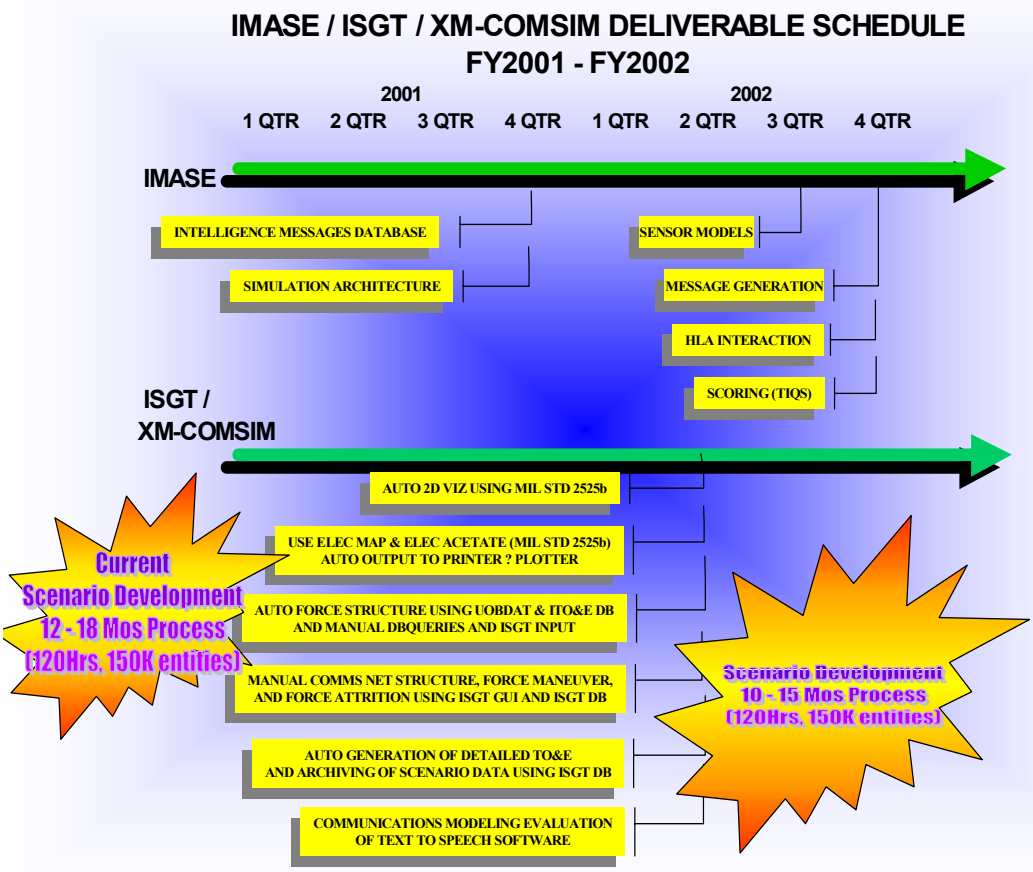

Figure 5. IMASE Deliverable Schedule (FY 2001 – FY 2002).

Figures 5 and 5a to Intelligence Modeling and Simulation (IMASE) Operational Requirements Document (ORD), version 1.1.

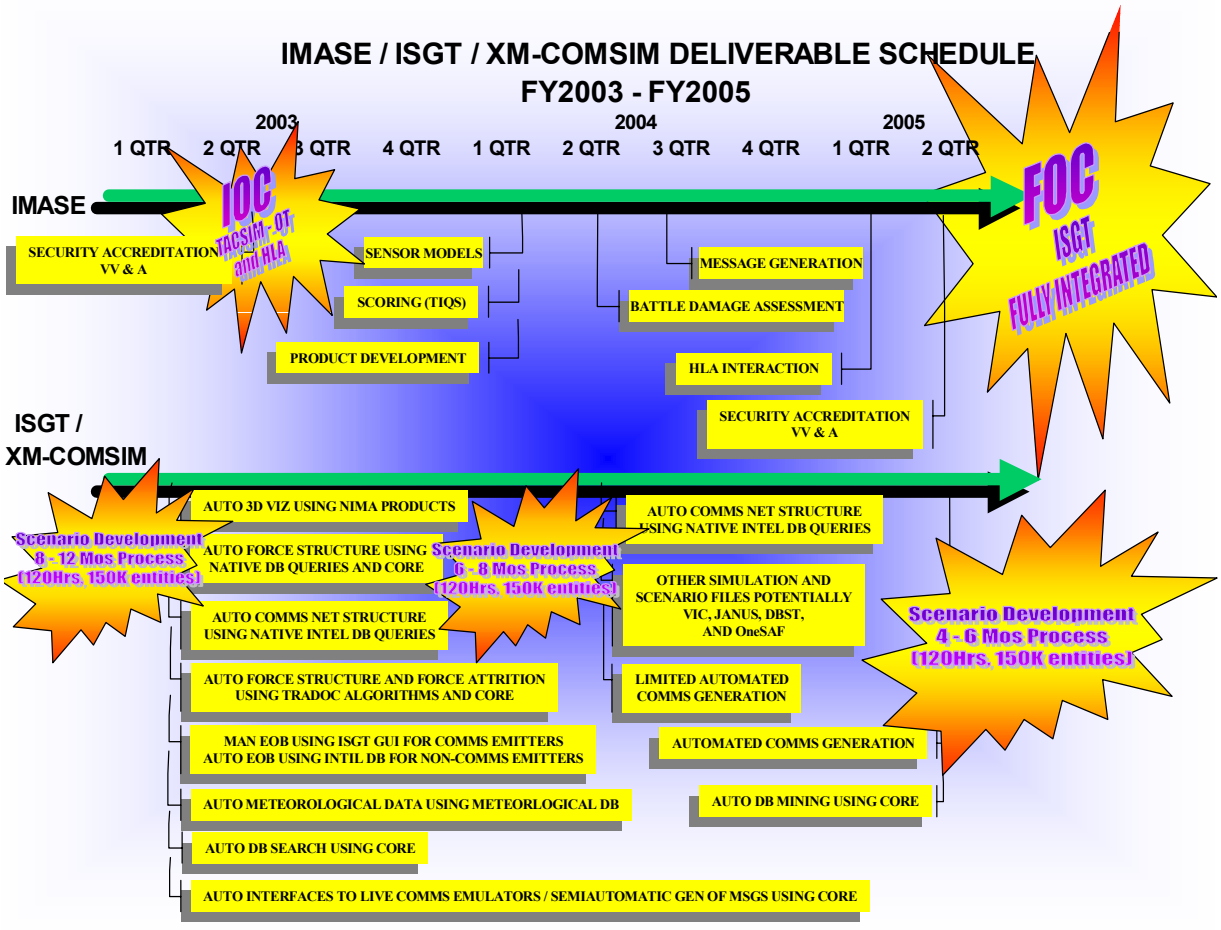

Figure 5a. IMASE Deliverable Schedule (FY 2003 – FY 2005).

(This page intentionally left blank.)