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POC: Joint Warfighting
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Operational Requirements Document (ORD)

for

Joint Simulation System (JSIMS)

Version 1.9
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1. General Description of Operational Capability

The Joint Simulation System (JSIMS) will be a core of common and joint representations and services, a run-time hardware and software infrastructure, and interfaces, that is augmented by the representations of Air/Space, Land, and Sea Warfare Functionality. The representations of Air/Space, Land, and Sea Warfare Functionality will be provided via sponsorship by Executive Agents. The primary focus of JSIMS at Initial Operational Capability (IOC) and Full Operational Capability (FOC) will be training. JSIMS will utilize authoritative representations of the environment (natural and man-made), systems, and behaviors to create a capabilities to create synthetic representations and interactions within the synthetic environment for training. The JSIMS infrastructure will interface with users via training systems and operational command, control, communications, computers and intelligence (C4I) systems.

JSIMS will support Unified Combatant Commands, Service, and Joint Task Force (JTF) training in all

phases of military operations (i.e., mobilization, deployment, employment, sustainment, and redeployment activities) and operations other than war (OOTW). JSIMS will be employed by the combatant commands in configurations and modes relevant to the unique requirements of their respective theaters or missions. JSIMS will specifically support the training required by their Joint Mission Essential Task Lists.

JSIMS will provide a capability to simulate the actions and interactions of all entities (e.g., platforms, weapons, sensors, units, C4I systems, etc.) within a designated area of operations as influenced by the environment, system capability, and human and organizational behavior affecting the achievement of missions and objectives for that area of operations.

Though initially focused at the operational level of war for both combat operations and OOTW, JSIMS will be extensible to the strategic level (e.g., activities involving multiple Commander In Chiefs (CINCs) and/or theaters) and to the tactical level (e.g., the prosecution of individual battles or engagements) to support multi-echelon exercises and contingency planning. Therefore, JSIMS will be able to support training (i.e., strategic-national, strategic-theater, operational, and tactical tasks) identified by the Universal Joint Task List published by the Joint Staff (JSM 3500.04).

In addition to planning and training activities, as the underlying JSIMS architecture matures, it will also provide a flexible framework to the Department of Defense (DoD) community at large to support evaluation of doctrine.

JSIMS will provide consistent representations of across the synthetic environment through disciplined use of standard, accredited descriptions for all Joint and Service mission areas (land, sea, air, and space). All military functionality will be represented including combat, combat support, special operations, combat service support (logistics), C4I, inter- and intra-theater transportation. JSIMS will employ consistent representations of the natural, physical environment (i.e., land, ocean, atmosphere, and space) with the level of detail required to meet the user's needs. These representations will be provided by the designated DoD Executive Agents. Similarly, all potential opposing forces (OPFOR), allies, and neutrals will be represented at the user's required level of detail.

JSIMS will operate in a distributed environment interacting with live, virtual, and constructive simulations with the capability to operate a subset of JSIMS in a stand-alone (scaleable, part task) mode. JSIMS will foster interoperability that allows interaction of synthetic environment activities required to emulate joint military operations. JSIMS will enable users to create a cohesive training environment despite extended geographical separation of the participants.

Prior to an exercise, JSIMS will provide the capabilities to perform distributed scenario development and collaborative planning. During an exercise, JSIMS will provide model execution which simulates all forces (joint and coalition). JSIMS will also provide an After Action Review (AAR) function to support rapid turnaround of exercise results.

JSIMS will provide support training by interacting with the training audience through interfaces to actual C4I systems and existing organizational equipment in a manner indistinguishable from real- world operational interaction. JSIMS will reduce the overhead associated with current simulation-supported training, through reductions in role player and controller requirements.

JSIMS will support realistic wartime and OOTW scenarios, allowing commanders and their staffs to be trained in the proper assessment of conditions, allocation and management of resources, and decision making under the pressures of simulated real-time combat and non-combat environments. Training for OOTW operations may involve the US Armed Forces, host nation and other coalition forces, US government agencies, non-government agencies, and international organizations.

OOTW may include, but is not limited to, the following: arms control, combating terrorism, DoD support to counter-drug operations, nation assistance, noncombatant evacuation operations, humanitarian assistance, disaster relief, and others as identified in the National Military Strategy and Joint Publication 3-07.

2. Threat: Not Applicable

3. Shortcomings of Existing Systems

With the existing training simulation systems, a robust, complete electronic representation of the operational environment cannot be created without excessive overhead in personnel, time, and other resources. Examples of shortcomings in the existing systems are:

a. Each of the Services have independent systems that support Service-specific or function-specific needs. While these legacy systems have served their purpose with respect to the individual Service training needs, they presently do not adequately or efficiently interoperate with other Service models to satisfy all the theater commander/JTF training needs.

b. The existing simulation models that replicate functions such as logistics, intelligence, space, and special operations do not interact with sufficient resolution and fidelity with combat models.

c. The combat adjudication process in current models developed by the Joint and Service communities does not replicate a complete operational environment.

d. There is no standard method to incorporate consistent, natural, or physical environmental effects in a simulation effort attempting to integrate two or more models.

e. Existing simulations do not adequately replicate OOTW scenarios. Social, economic, and political factors affecting missions across the full range of military operations are not adequately modeled to support joint training.

f. Existing Service simulations require high manning levels for Service and Joint exercises. Deficiencies in current models require personnel vice automation to represent the actions of higher and lower echelons of friendly forces that are not actually participating in the exercise, as well as, . Personnel must also execute the actions of the enemy. Also, substantial personnel augmentation is required to operate the computer systems and to manually enter plans, instructions and orders to support the training scenario.

g. It is difficult and expensive to make significant enhancements to the existing models and it may no longer be cost-effective to update the models to support evolving Joint and Service training requirements. Proprietary software, limited graphics capabilities, non-modular design, and hard-coded data representations do not integrate easily into an open systems environment.

h. The existing simulation systems do not provide the users the ability to freely interact with each other through the simulation, nor can they leverage other simulation capabilities through electronic connectivity. The major reasons for this are as follows:

(1) CINCs and other simulation users are not adequately linked for complete inter-Service functionality.

(2) Combat simulations are not fully compatible with existing C4I systems

(3) Lack of a common supporting infrastructure has led to the creation of independent simulation development projects which exacerbate our inability to interoperate and ultimately raise costs and degrade performance.

i. Existing simulations do not effectively link the phases of conflict.

In general, existing systems do not allow the simulation to interface with existing C4I systems in a comprehensive fashion. Existing simulations require specialized equipment to display geographic and

situational information. There are also limitations in the design of human interface equipment supporting the C4I systems. Therefore, users are often forced to participate in simulation supported events using unfamiliar equipment and interfaces.

4. Capabilities Required

a. System Performance

JSIMS will provide the ability to execute joint exercise scenarios and the capabilities to train JTF and JTF component staffs, Service staffs, and subordinate units staffs. The system will support the interaction of live, virtual, and constructive simulations and the training systems/simulators necessary to support both Joint and Service training. Adherence to the DoD High Level Architecture (HLA) is required to ensure interoperability across the full spectrum of the joint operations mission space as well as automated connectivity to C4I systems. The HLA will provides a standardized foundation for consistent and reliable data exchange between live, virtual, and constructive simulations. Compliance with the HLA is also necessary to foster maximum reuse of simulation components.

At IOC (FY99), JSIMS must provide a simulation system with a full spectrum of integrated joint warfare functionality and automated C4I interfaces that supports training for of JTF battle staffs. As a minimum threshold, JSIMS must exceed the functionality demonstrated by the FY99 Aggregate Level Simulation Protocol (ALSP) Confederation of models.

At FOC (FY03), JSIMS must include integration of live, virtual, and constructive simulations to support high fidelity applications such as mission rehearsal and interoperability with emerging joint analysis tools.

(1) Functional Overview

JSIMS must provide a coherent time and space representation of the environment (natural and man-made), entities, activities and interactions. This representation must remain consistent for all participants even when operating in a distributed mode at dispersed geographic sites.

In order for JSIMS to support these requirements to create a consistent mission space representation, measurable descriptions of the synthetic environment, its components, and activities must be developed and maintained as the standard for all JSIMS developers and users. Standard descriptions are required for such components and activities as: organizations and their tasks, system and materiel performance, and warfighter/civilian characteristics and behavior. Descriptions are required for all US, allied, opposing and neutral military forces and civilian activities required to be represented in a joint exercise. The JSIMS synthetic environment includes representations of: terrain, oceans, atmosphere, and space; as well as the effect of natural and man-made processes (e.g., changes in vehicle trafficability due to rains or bomb craters in the road).

The goal of the current Conceptual Model of the Mission Space (CMMS) project is to provide an HLA compliant representation of the mission space. Wherever practical, JSIMS designated Executive Agents for Land, Air/Space, Sea, and Environment will expand or modify the CMMS to meet JSIMS requirements. Verification, validation, and certification procedures must be developed and implemented to ensure that accurate and realistic data exists in each of the pieces contributed to JSIMS from the designated Executive Agents.

The JSIMS mission space definition will expand to include the entities and behaviors necessary to support OOTW scenarios. At FOC, this includes the portrayal of national and international agencies, non-aligned forces, and noncombatant groups or factions. Factors

such as the degree of participation in a coalition and switching allegiances must be considered. Future OOTW areas that JSIMS may be capable of simulating include support to insurgency and counterinsurgency, anti-terrorism, peacekeeping, shows of force and other small contingencies, and support to counter drug operations.

JSIMS will also provide common support services such as: user interface tools and utilities, data definitions, storage, distribution capabilities, operating system interface, system management, exercise/scenario generation capability, and application programming interfaces to the common support services. JSIMS will also provide automated interfaces to designated C4I systems and an integrated after action review (AAR) capability.

(2) System Attributes

(a) System Flexibility:

The JSIMS architecture must provide for future development and system enhancements that will evolve as new requirements are generated. It must be developed to allow for the incorporation of technological advances in hardware and software technologies. Where feasible, emerging technologies successfully demonstrated by ARPA's Synthetic Theater of War (STOW) and other Advanced Distributed Simulation (ADS) projects will be leveraged.

JSIMS will be compatible with existing network and interface systems infrastructure to facilitate implementation . However, the system will be robust enough to capitalize on emerging hardware and software interface technologies.

JSIMS must have the ability to add and delete workstations and reconfigure workstation functionality as required by the particular process (i.e., training, planning, or test and evaluation support).

(b) Distributed Capability:

JSIMS will support distributed simulation operations that allow exercise participants to receive, process, and transmit commands and information to geographically dispersed locations.

To support a variety of exercise configurations, JSIMS will provide a modular simulation capability to permit operation as a stand-alone system, or in combination with designated applications. JSIMS will be capable of operating in either a local (single site) or remote/distributed (multiple site) configuration. Pre-exercise training of operators must be supportable in each configuration.

(c) System Performance Monitoring:

JSIMS must provide the capability to monitor system performance, detect degradation, and notify exercise controllers. Exercise controllers require the option to continue system operation in a degraded mode when warranted by exercise requirements. Exercise controllers must be provided an option to either continue system operation in a degraded mode when warranted by exercise requirements or stop the exercise when system performance is degraded to an unacceptable level.

(d) Security:

JSIMS must provide multi-level security capabilities, ranging from Unclassified to Top Secret, simultaneously. Security capabilities will include segregation by categories (NATO, NOFORN, SCI, etc.). JSIMS will require protection from unauthorized access and will require protection from information security (INFOSEC) threats as defined by the designated approval authority at each anticipated deployment site.

The system must meet all security and TEMPEST requirements for interoperability with theater and national command and control C4I systems and must be able to interchange data with these systems in DoD standard formats.

JSIMS must protect classified data through concepts integrated into system hardware and software as part of the architecture for storing, retrieving and passing data between processes. External protective devices may be used but the integration of security safeguards into the hardware and software is preferred.

(e) Training Environment:

Training exercises are developed to provide conditions as close as possible to those of real-world operations. JSIMS supported exercises must provide a training environment that approaches actual operational conditions for the participating battle staff(s). Exercise participants should not be able to distinguish between real and simulated entities. Exercise participants should interact with simulated entities provided by JSIMS using the same C4I systems, processes, and procedures they would normally use. However, necessary safeguards must be present in the system to avoid confusion with real-world events and permit orderly transition from exercise to real- world operations.

(f) Scenario Generation:

A scenario generation capability must be provided to rapidly create and modify scenarios via a graphical user interface capability. The scenario generation capability must include the ability to create, review, and modify data sets that contain data pertinent to the exercise such as: information on the natural, physical environment (land, ocean, atmosphere, and space), friendly unit information, opposing forces information, exercise control information, rules of engagement (ROE), etc. The data sets must be built in an automated, efficient manner from approved certified DoD data sources.

JSIMS must have the ability to modify the training environment by manipulating scenarios, adding or replacing models and simulations, modifying doctrinal representations, changing system parameters, allowing for multiple level resolution and varying levels of fidelity, adding and deleting workstations, reconfiguring workstation functionality, and controlling an exercise (e.g., starting, stopping, etc.).

(g) Interfaces:

JSIMS must interact directly with the training audience through operational C4I systems while communicating in a format that is transparent to the user in terms of distinguishing between real and simulated participants. JSIMS must provide the mechanism to interface with appropriate Joint and Service C4I systems, such as Global Command and Control System (GCCS), Standard Theater Army Command and Control System (STACCS), Joint Maritime Command Information System (JMCIS), Contingency Theater Automated Planning System (CTAPS), Special Operations Forces Planning and Rehearsal System (SOFPARS), and Consolidated Aerial Port system (CAPS).

JSIMS must have the capability to interoperate with live, virtual, and constructive HLA compliant models and simulations developed independently of JSIMS.

(h) Data Support:

JSIMS must use standardized data elements to facilitate interchange of data between JSIMS, external simulations and real C4I systems. Data standardization will be consistent with DoD guidelines and data sets must be from certified DoD data sources.

Tools and utilities must be provided to import and export standard formatted files (e.g., Time Phased Force and Deployment List (TPFDL) and Air Tasking Order (ATO)) in order to create efficient information exchange among simulation databases.

(i) Human-in-the-Loop (HITL):

JSIMS must allow for the HITL, even if the procedure can be executed automatically. JSIMS must provide HITL capability with all simulations executing concurrently, including those above and below the main user level (i.e., echelon of command) of the simulation being played. JSIMS must provide for HITL with computer generated forces (CGF) representing friendly, neutral, and opposing forces. JSIMS will provide the ability to combine and switch between HITL and semi-automated forces during execution.

(j) Simulation of Human Performance Factors:

JSIMS must support adjustment to unit/human effectiveness due to combat experience, level of training, social, religious, morale, weather, nutrition, sleep deprivation, and political influences.

JSIMS must support adjustment to human performance due to conditions contained in the current version of the Universal Joint Task List published by the Joint Staff (JSM 3500.04).

JSIMS must be able to cause simulated entities to "make mistakes" based on factors such as: level of training, misperceptions of the operational situation, fatigue, or reduced combat effectiveness.

(k) Multi-sided Play:

JSIMS must support a variable number of sides including US forces, US allies, enemy forces, enemy allies, and neutral forces. JSIMS must be able to support allegiance changes during execution. Forces must have the capability to change sides during the exercise. JSIMS must also be able to support alliance or coalition realignment.

(l) Scaling Factors:

JSIMS must be able to accommodate exercises where different scales of simulation are interacting with one another. For example, a high-resolution entity-level virtual simulation could be linked to an aggregate level constructive simulation.

(m) Fidelity:

Fidelity refers to the degree of accuracy with which JSIMS must represent actual environmental activities. JSIMS must allow for variable degrees of fidelity. High fidelity simulation is required for realistic interactions at the entity level.

(n) Level of Resolution/Aggregation:

JSIMS must be able to portray variable levels of detail in accordance with training requirements as defined by tasks in the current version of the Universal Joint Task List published by the Joint Staff (JSM 3500.04). It must be able to aggregate tactical entities (e.g., battalion, squadron, battle group) appropriate to the exercise or portray events down to the effects of individual Service entities (e.g., tanks, aircraft, warfighter). The level of detail required will be dictated by the scenario being executed. National and tactical intelligence data must be provided in appropriate detail, format, and method of transmission with realistic timeliness.

JSIMS must generate appropriately detailed results for each level of play. Aggregation of

entities into larger groupings (variable resolution) with scaleable terrain must be available to reduce overhead without a loss of fidelity. Resolution will increase as requirements for training lower unit echelons[JTSS] are incorporated. For higher level training (where only senior staffs are involved), the system will aggregate data as required to present results to the players in a useable format. When training lower levels, the system must simulate the echelon directives in a realistic manner.[JTSS]

(o) Simulation Time:

Simulation time must be controllable within a range from slower than real-time to substantially faster than real-time to support accelerated execution replay, fast forward, and after action review (AAR) functions. The goal is to support simulation execution rates on the order of 1:10 (slow time) up to 100:1 (fast time). Simulation time must include event driven step synchronous, event driven step asynchronous, and time driven step (real and clock) options. This will provide end users with the capability to support a wider variety of mission taskings.

(p) Exercise Control and Players:

Exercise control addresses the simulation control and system control required to ensure the simulation operates to satisfy the training requirements. JSIMS operation must be user friendly so that learning to operate the system is simplified. Ideally, not more than 24 hours of training will be required to train new controllers, role players, and response cell personnel. The number of exercise controllers required will vary according to the human-in-the-loop requirements of the particular exercise, test or training activity. (Significant reduction in the number of support personnel to conduct training and exercises is a primary objective of JSIMS. At IOC, the goal is to reduce the support personnel overhead by at least two thirds of what is required to conduct an ALSP supported JTF level exercise in 1995).

(i) Exercise Controller Privileges:

(a) JSIMS exercise controllers must have the ability to start, freeze, stop, fast forward, restart, shutdown, take a snapshot of all data in the system, record selected events, select the time scale in which to operate, vary game speed, and manage system configuration (i.e., distributed, single site). A restart/replay function must be present for AAR, debrief, and exploration of alternative courses of action.

(b) The exercise controllers must have the ability to modify the status of simulated units, equipment, features, and event outcomes. For example, controllers need the ability to relocate units, resupply units, restore equipment, disable equipment, change the damage status of roads, bridges, airfields, etc.

(ii) Player Privileges:

The player only has the ability to make limited modifications to his side's data consistent with actual operational capabilities. Any additional capabilities will be assigned by the controller on an as needed basis.

(iii) Semi-Automated Controllers:

JSIMS must provide the capability to incrementally automate many of the manpower intensive control functions typical to existing simulations throughout the exercise time frame: planning, scenario generation (intelligent laydown of friendly and opposing forces), execution (knowledge-based order validation), and after action review (data capture for playback of key events).

(q) Ground Truth:

Display information depicting ground truth will be maintained as a separate function for use by exercise controllers as opposed to the perceived or reported truth available to exercise participants. Even when all the opposing sides are simulated, the opposing commanders' actions must be based on a less than perfect perception of the battlefield rather than ground truth. The simulation must have the ability to track and compare a side's perception versus ground truth.

(r) After Action Review (AAR):

JSIMS must provide an AAR capability to assess the performance of participants in a training exercise as well as provide rapid feedback to the exercise sponsor on the attainment of exercise objectives. JSIMS will provide the capability to record user specified events and data, to respond to specific queries regarding the exercise, and to provide information in various formats while the simulation continues to execute. It is important to emphasize that data extraction must be a continuously available process to support real-time updates. As an example, a three person team of AAR analysts must be able to collate a daily status report for presentation to the exercise sponsor in less than two hours. A team of six analysts should be able to present a "hot wash" type briefing to the training audience from previously extracted and archived data within three hours of the training event conclusion.

AAR formats include, but are not limited to, the following: three dimensional graphical displays on a portable screen, printouts and overhead view graphs of data (overlaid on maps when applicable), statistical graphs of data, tabular outputs of data as well as text messages. JSIMS must be able to track special or high interest information, provide automatic detection of events based upon common errors, and to compare recorded ground truth information with the recorded player perspective. The AAR capability must allow the operator to modify existing output formats or build new displays to support debrief and review of data. The AAR capability should allow for playback of the exercise events in real-time and accelerated modes. Two dimensional and three dimensional views of the battlefield are required. A capability to attach to individual units or components during playback would be desired to view the battle from that unit's perspective. The AAR capability must provide the operator with a set of statistical analysis tools.

(s) Report Generation:

JSIMS must include a capability to generate formatted and freeform (text) reports for both players and exercise controllers. This function must provide the user with a wide range of automatic reports that would be expected if actual units were represented in exercise scenarios.[USAF] The report generation capabilities should include: the ability to create and modify user defined reports, the ability to automatically generate reports based upon events or time, and the ability to tailor the report format. The tailoring of the report output formats must support the ability to produce reports in the appropriate formats so that they can be transmitted through real-world message formats.

(3) Analysis Requirements

JSIMS is not an analytical tool. However, it will be interoperable with emerging analysis tools such as the Joint Warfare System (JWARS) in accordance with the DoD-wide Technical Framework for M&S. During joint training exercises, issues such as Course of Action (COA) development and assessment, force on force assessments, and the evaluation of Time Phased Force Deployment Data (TPFDD) for impact on mobilization, and sustainment of forces, all play a key part in the JTF Commander's decision process. Capturing dynamic, operationally valid scenarios to explore these issues can be the basis for realistic analyses. JSIMS scenarios and data must be interchangeable with analysis models to the maximum extent possible to achieve this flexibility.

b. Logistics and Readiness<

(1) Reliability and Availability (R&A)

JSIMS must be capable of operating 24 hours a day with a system availability of at least 95%. Availability is defined, in this instance, as all components of the system being operated at technical control designated speeds, including pausing or shut down of selected components, with the system continuing to process data normally. JSIMS will be required to support training exercises whose duration ranges from 1 to 30 days, 24 hours per day. A significant goal is for the system to be capable of restarting no more than one hour after correction of a full system failure from the point of failure.

(2) Setup/Breakdown

In general, JSIMS hardware will use COTS products wherever feasible. The system components will be plug and play to the maximum extent possible to allow for rapid setup and configuration.

c. Critical System Characteristics

The normal operating environment for JSIMS hardware will be in existing Simulation, Training, and Command and Control Centers. Adherence to industry standards for power consumption, temperature and humidity conditions, and reduction of electromagnetic interference is required. JSIMS components do not have to be capable of operating in hostile nuclear, chemical, or electronic environments.

5. Integrated Logistics Support (ILS)

a. Maintenance Planning

JSIMS must make use of modular design and component technology which supports the integration of new hardware and software modules and substitution of compatible hardware to embrace the pace of technology. Nothing in the maintenance concept will preclude wide use of a cost-effective, expendable hardware spares inventory as ready line replaceable units (LRUs) for low to moderate cost components. Maintenance will be conducted using existing DoD maintenance structures, procedures, and best commercial practices. Costs must be considered in determining repair capabilities but should not override mission requirements.

(1) Hardware Organizational Maintenance

Equipment maintenance at the organization level will be performed by either military, civilian, or contractor maintenance technicians. The contractor's repair level analysis will identify items of equipment, modules, etc. for repair and determine their repair location.

(2) Software Maintenance

(a) Performance Logging and Post-deployment Software Support (PDSS)

A system which supports the functions of modern Computer Aided Software Engineering (CASE) tools, such as, debugging support, error tracking, failure logging, and reliability estimation, will exist to support the correction of errors in the software design and implementation. This capability should support the design, build, test and operational phases of the system implementation.

(b) Maintenance Responsibility

Software maintenance will be conducted by the Service component or federal agent who is the recognized controller of the portion of the software system or module which represents the warfighting subspecialty which fails to function properly. The method of integration and testing of new code at the JSIMS program level will concentrate on integration actions necessary to for the successful operation of the whole system.

(i) Software maintenance concepts will be compatible with existing Service and DoD instructions and will support the use of modern CASE tools for organization of actions, tracking and documentation.

(ii). Strict version control will be required of all offered portions of software systems or modules. Accepted, integrated versions will be formally qualified, by a standardized procedure, for use as a component of JSIMS.

b. Support Equipment

Support equipment for maintenance will be kept to a minimum and the system will be designed to be maintained by standard test equipment and will include fault isolation capabilities to diagnose failures at a level commensurate with the final support concept. The system will be designed to maximize the use of BIT (Built-in Test), BITE (Built-in Test Equipment), and resident and/or loaded diagnostic software to isolate to the line replaceable unit level.

c. Human Systems Integration

(1) Human Computer Interface (HCI)

Modern HCI concepts accommodating novice through expert operators must be used in the architecture of JSIMS to reduce the need for training at the computer operating system level, especially for response cell players and technical controllers. Reduction in the need for training through use of "point and click" and other interfaces, with on-line help screens is a goal of the system. As part of training, the contractor will provide tutorials, on-line references, manuals, and "help screens," to include all system configuration operations and operator maintenance.

(2) Manpower Support

JSIMS should be developed to allow fielding within the current or reduced manpower constraints. An integrated manpower, personnel, and comprehensive training and safety planning team will be formed. This team will be responsible for documenting all manpower requirements, addressing manpower funding, and developing complete Manpower Estimate Reports.

d. Computer Resources

(1) Open System Architecture and Standards

JSIMS will be developed in an open system environment architecture to allow the portability of applications between heterogeneous hardware suites and to facilitate interoperability with Service-level systems and other existing and/or future systems. To facilitate software portability to existing, planned and future hardware suites, all software will be developed in compliance with open system software standards. Existing documented, maintainable, portable, government off-the-shelf(GOTS), or commercial off-the-shelf (COTS) software packages will be used to the maximum extent possible to satisfy identified requirements before dedicating resources to developing major system enhancements or new application components.

JSIMS workstations must be consistent with an open system environment architecture. JSIMS must be hardware platform independent and, where technically feasible, must allow the computers already existing at each command to be used. Lack of specialized hardware at any location should not preclude active participation. The JSIMS design must facilitate the migration to improved workstations as they become available.[NASM, WARSIM ORD]

(2) Software

JSIMS will be designed for portability and reusability in a modern, standards based, supportable programming language using modern programming techniques and CASE tools where appropriate. [TRD, 5.7] Existing DoD and COTS products and NDIs, as appropriate, will be used to the maximum extent possible within the constraints of the life cycle maintenance to reduce manpower and other support resources and permit ready technological upgrades. Quality, non-proprietary software documentation and source code that facilitates software maintenance will be developed and delivered.[WARSIM ORD, TRD 5.7]

Developed software will be modular so that the software can be changed and improved without affecting the design of other modules. The system will be developed with growth in mind. The software will employ error management aids and permit users to obtain on-line guidance by requesting help screens. Following the output of an error message, users should be permitted to request additional information at levels of increasing detail. JSIMS will be designed such that all data (i.e., parameters of the models, rules for expert systems, addresses for network nodes) are not hard-coded into the software. JSIMS will provide the flexibility to change system parameters, rules, network configuration without disruption to an exercise. [WARSIM ORD] JSIMS must include system and software documentation adequate to support PDSS, training, and operation. In addition to hardcopy, the JSIMS documentation must be provided in digital form for on-line access.

(3) Configuration Management

Each Service organization will be responsible for providing inputs relating to unique site requirements to the configuration control board (CCB) for approval and through a Software Support Facility (SSF) for execution.

6. Infrastructure Support And Interoperability

a. Command, Control, Communications, Computers, and Intelligence (C4I)

JSIMS must interface, to the maximum extent possible, with existing C4I equipment that supports the the Unified Combatant Commanders, JTF Commander, Joint Component Commanders and their staffs, as well as other JSIMS users. This includes data, voice, and video for target planning, mission planning, intelligence, and communications activities.

b. Transportation and Basing

Existing Simulation Centers, Training Sites, and Command Centers are planned as primary host sites for JSIMS.

d. Mapping, Charting, and Geodesy Support

JSIMS will use standardized terrain databases to facilitate interoperability with other systems and reduce costs. JSIMS has the goal of using terrain representations of the highest resolution, or most complete detail, which can be supported by the speed of operation of the host computer and remote terminal equipment which best fit the system design architecture. As the M&S Executive Agent for Terrain, the Defense Mapping Agency (DMA) will provide terrain database standards, if available, or will establish new standards.

7. Force Structure

The number of operational systems, subsystems, spares, and training units is TBD.[LHR1]

8. Schedule Considerations

JSIMS IOC is defined as the deployment of a system that provides the initial population of the JSIMS architecture with facilities, services, and tools to provide for JTF and Service training. JSIMS IOC will provide a functional replacement for the ALSP confederation of models. JSIMS FOC will provide the Unified Combatant Commands, Services, and other users a distributed, integrated system capable of supporting the full range of missions and operations, including OOTW.

ANNEX A
References

a. DoD Directive 5000.59, Modeling and Simulation Management
b. DoD Directive 5000.59-Paa, Modeling and Simulation Master Plan
c. Joint Memorandum of Agreement (MOA) on the Joint Simulation System, 30 Jun 94
d. Mission Needs Statement (MNS) for Joint Simulation System, 22 Jul 94
e. DoD 5000.2-M, Defense Acquisition Management Documentation and Reports, 23 Feb 91
f. Draft DMSO Glossary of Modeling and Simulation Terms

ANNEX B
List of Acronyms

AAR	After Action Review
ADS	Advanced Distributed Simulation
ALSP	Aggregate Level Simulation Protocol
ARPA	Advanced Research Project Agency
ATO	Air Tasking Order
AWSIM	Air Warfare Simulation
BIT	Built-in test
BITE	Built-in test equipment
C4I	Command, Control, Communications, Computers, and Intelligence
CAP	Crisis Action Procedures
CAPS	Consolidated Aerial Port System
CASE	Computer Aided Software Engineering
CBS	Corps Battle Simulation
CCB	Configuration Control Board
CGF	Computer Generated Forces
CINC	Commander in Chief
COA	Course of action
CONUS	Continental United States
COTS	Commercial off- the- shelf
CSSTSS	Combined Service Support Training Simulation System
CTAPS	Contingency Theater Automated Planning System
DMA	Defense Mapping Agency
DMSO	Defense Modeling and Simulation Office
DMSP	Defense Meteorological Satellite Program
DoD	Department of Defense
FOC	Full Operational Capability
GCCS	Global Command and Control System
GOTS	Government off-the-shelf
HCI	Human Computer Interface
HITL	Human-in-the-loop
ILS	Integrated Logistics Support

INFOSEC	Information Security
IOC	Initial Operational Capability
JECEWSI	Joint Electronic Combat-Electronic Warfare Simulation
JMCIS	Joint Maritime Command Information System
JMET	Joint Mission Essential Task
JMET	Joint Mission Essential Task List
JPO	Joint Program Office
JSIMS	Joint Simulation System
JTF	Joint Task Force
JWARS	Joint Warfare System
LRU	Line Replaceable Unit
M&S	Modeling and Simulation
MAGTF	Marine Air to Ground Task Force
MTWS	MAGTF Tactical Warfare Simulation
MNS	Mission Needs Statement
MOA	Memorandum of Agreement
NDI	Non-developmental Item
OOTW	Operations Other than War
OPFOR	Opposing Forces
ORD	Operational Requirements Document
OT&E	Operational Test and Evaluation
RESA	Research Evaluation and Systems Analysis Simulation
PDSS	Post Deployment Software Support
ROE	Rules of Engagement
SCI	Sensitive Compartmented Information
SOF	Special Operations Forces
SOFPARS	Special Operations Forces Planning and Rehearsal System
SSF	Software Support Facility
STACCS	Standard Theater Army Command and Control System
STOW	Synthetic Theater of War
T&E	Test and Evaluation
TACSIM	Tactical Simulation Model
TBD	To be determined
TPFDD	Time Phased Force and Deployment Data
TPFDL	Time Phased Force and Deployment List
TRANSCOM	Transportation Command
US	United States
VV&A	Verification, Validation and Accreditation
VV&C	Verification, Validation, and Certification

Annex C
Executive Summary

The mission of the Joint Simulation System (JSIMS) is to provide a readily available, operationally valid synthetic environment for the Commanders in Chiefs (CINCs), their components, other Joint organizations and the Services to: jointly train, educate, develop doctrine and tactics, formulate and assess operational plans, assess warfighting situations, define operational requirements, and provide operational input to the acquisition process. In short, JSIMS will provide not only an improved capability for inter-Service operability but also an enhanced Joint battle staff training capability for the warfighting CINCs.

The Joint Simulation System (JSIMS) will be a core of common and joint representations and services, a run-time hardware and software infrastructure, and interfaces, that is augmented by the representations of Air/Space, Land, and Sea Warfare functionality. The representations of Air/Space, Land, and Sea Warfare functionality will be provided via sponsorship by Executive Agents. In keeping with the premise that the Services/components are best able to define their own capabilities and functionality, the Joint Program Office (JPO) will work in concert with the Services through the Executive Agents to import Service-provided functionality such as land, air, naval and littoral warfare into JSIMS. The JPO will integrate these functionalities for use by Joint battle staffs and by others wishing to inter-operate with one or more of the other Services, e.g., an Army/Air Force exercise.

JSIMS development will be incremental, marked by two key events: Initial Operational Capability (IOC), and Full Operational Capability (FOC).

The JSIMS Operational Requirements Document (ORD) is a programmatic document which details the users' expectations of the functionality of the simulation system. It attempts to characterize the important aspects of the program without precluding the use of emerging technology. After In preparation for Milestone II is achieved review, the Operational Requirements Document will be updated and expanded in accordance with the provisions of reference (e). At that time, more specific performance thresholds will be included based on the results of initial testing and prototyping efforts.

Annex D
Glossary

The following definitions were extracted from reference (b): DoD Directive 5000.59-Paa, DoD Modeling and Simulation Master Plan and reference (f): draft DoD Glossary of M &S Terms. The sources for the definitions in this glossary have not been included. The sources are available in the reference documents.

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

Advanced Distributed Simulation (ADS). A set of disparate models or simulations operating in a common synthetic environment in accordance with the Distributed Interactive Simulation (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. See also: live simulation; virtual simulation; constructive simulation.

Aggregate Level Simulation Protocol (ALSP). A family of simulation interface protocols and supporting infrastructure software that permit the integration of distinct simulations and wargames. Combined, the interface protocols and software enable large-scale, distributed simulations and wargames of different domains to interact at the combat object and event level. The most widely known example of an ALSP confederation is the Joint/Service Training Confederation (CBS, AWSIM, RESA, TACSIM, CSSTSS) which has provided the backbone to many large, distributed, simulation-supported exercises. Other examples of ALSP confederations include confederations of analytical models that have been formed to support US Air Force, US Army, and US TRANSCOM studies. (Aggregate Level Simulation Protocol Technical Specification, July 1992) Note: JECEWSI and MTWS are also now included in the 1995 ALSP Confederation

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

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

Authoritative Representation. Authoritative representations are models, algorithms, and data that have been developed or approved by a source which has accurate technical knowledge of the entity or phenomenon to be modeled and its effects.

Battlespace. Battlespace refers both to the physical environment in which the simulated warfare will take place and the forces that will conduct the simulated warfare. All elements which support the front line forces (e.g., logistics, intelligence) are included in this definition of battlespace.

Combatant Command (s). One of the unified or specified combatant commands established

by the President of the United States. (Combatant Commands currently include: US Atlantic Command (USACOM); US Central Command (USCENTCOM); US European Command (USEUCOM); US Pacific Command (USPACOM); US Southern Command (USSOUTHCOM); US Space Command (USSPACOM); US Special Operations Command (USSOCOM); US Strategic Command (USSTRATCOM); and, US Transportation Command (USTRANSCOM)).

Computer Generated Forces (CGF). A generic term used to refer to computer representations of forces in simulations which attempts to model human behavior sufficiently so that the forces will take some actions automatically (without requiring man-in-the-loop interaction). Also referred to as Semi-automated Forces (SAFOR).

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.

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 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 producer certification is the determination by the data producer that data have been verified and validated against documented standards or criteria.

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. Current standards are ALSP and DIS PDUs.

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

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, & 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.

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.

Environment. The texture or detail of the domain, that is terrain relief, weather, day, night,

terrain cultural features (such as cities or farmland), sea states, etc.); (2) 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 Representation. An authoritative representation of all or a part of the natural or man-made environment.

Extensibility. The ability of a data structure to accommodate additional values or iterations of data over time without impacting its initial design.

Fast Time. (l) Simulated time with the property that a given period of actual time represents more than that period of time in the system being modeled; for example, in a simulation of plant growth, running the simulation for one second may result in the model advancing time by one full day; that is, simulated time advances faster than actual time. (2) The duration of activities within a simulation in which simulated time advances faster than actual time. Contrast with: real time; slow time.

Federation. A system of interacting models and/or simulations, with supporting infrastructure, based on a common understanding of the objects portrayed in the system.

Fidelity. (1) The similarity, both physical and functional, between the simulation and that which it simulates. (2) A measure of the realism of a simulation. (3) The degree to which the representation within a simulation is similar to a real-world object, feature, or condition in a measurable or perceivable manner.

Granularity. Fidelity and level of detail of objects and environment. See also: resolution.

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

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.

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. A body of scientific facts about human characteristics. 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.

Hybrid Simulation. A simulation that combines constructive, live, and/or virtual simulations, typically in a distributed environment. Such simulations combine simulators with actual operational equipment, prototypes of future systems, and realistic representations of operational environments.

Interaction. The explicit action taken by one object toward another object or geographical area.

Joint M&S. Representations of joint and Service forces, capabilities, equipment, materiel, and services used in the joint environment or by two, or more, Military Services.

Legacy Model. A model developed in the past which is still in use that was not implemented using today's standards (e.g., software, communication, DIS, ALSP, etc.). Some legacy models have been modified with interfaces to some of the current standards extending their

usefulness and interoperability with newer, standards based models. Mission Space. Mission space refers to the entities, actions, and interactions that must be represented to produce credible simulations of the specific mission area being addressed. Mission space includes all elements (e.g., logistics, intelligence, manufacturing) which support the simulation and which are required to achieve the desired goals and objectives.

Live, Virtual, and Constructive Simulation. 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 also suffers by excluding a category for simulated people working real equipment (e.g., smart vehicles).

Live Simulation. A simulation involving real people operating real systems.E 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 also suffers by excluding a category for simulated people working real equipment (e.g., smart vehicles). Virtual Simulation. A simulation involving real people operating simulated systems. Virtual simulations inject human-in-the-loop (HITL) in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a C4I team).

Constructive Model or Simulation. Models and simulations that involve simulated people operating simulated systems.

Mission Space. Mission space refers to the entities, actions, and interactions that must be represented to produce credible simulations of the specific mission area being addressed. Mission space includes all elements (e.g., logistics, intelligence, manufacturing) which support the simulation and which are required to achieve the desired goals and objectives.

Model. 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 inter-changeably.

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. An underlying base or foundation; the basic facilities, equipment, and installations needed for the functioning of a system. A M&S infrastructure would consist of M&S systems and applications, communications, networks, architectures, standards and protocols, information resource repositories, etc.

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.

ModSAF. Modular Semi-Automated Forces are a class of CGF 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. ModSAF provides an open architecture that is expected to be the starting point for future extensions of SAFOR capabilities.

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

Object-Based. A software design methodology adhering to only some of the properties of object oriented software; for example, Ada does not support inheritance, a key property of object oriented systems, therefore Ada is often referred to as an object based language. See: object oriented. Object-Oriented. A software design methodology that when applied to DIS results in the battlefield being represented by objects, where objects encapsulate the methods or procedures associated with the object and where objects communicate with other objects by message passing. Examples of battlefield objects are platoons (unit level), tanks (platform level), main guns (component or module level), and gun barrels (part level). One of the main benefits of an object oriented approach is the inherent modularity; e.g., to change a tank model only the tank object must be changed. See also: object based.

Object-Oriented Language. A language which best suits an object-oriented decomposition of software and which provides the capability to implement classes and objects. Directly supports data abstraction and classes, and provides additional support for inheritance as a means of expressing hierarchies of classes.

Object-Oriented Programming. Use of a programming system that results in programs organized as cooperative collections of objects, each of which represents an instance of some class, and whose classes are members of class hierarchies as defined by the inheritance mechanism.

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.

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

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.

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 System. A system that computes its results as quickly as they are needed by a real-world system. Such a system responds quickly enough that there is no perceptible delay to the human observer. In general use, the term is often perverted to mean within the patience and tolerance of a human user.

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. Syn: real battlefield.

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

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

Scenario. (1) Description of an exercise ("initial conditions" in military terms). It is part of the session database which configures the units and platforms and places them in specific locations with specific missions. (2) An initial set of conditions and time line of significant events imposed on trainees or systems to achieve exercise objectives. See: field exercise.

Semi-automated Forces (SAFOR). See Computer Generated Forces

Simulation. A method for implementing a model over time.

Simulation Environment. (1) Consists of the operational environment surrounding the simulation entities including terrain, atmospheric, bathospheric and cultural information. (2) All the conditions, circumstances, and influences surrounding and affecting simulation entities including those stated in (1).

Simulation Fidelity. Refers to the degree of similarity between the training situation and the operational situation that is being simulated.

Simulation Time. (1) a simulation's internal representation of time. Simulation time may accumulate faster, slower, or at the same pace as sidereal time. (2) The reference time (e.g., Universal Coordinated Time) within a simulation exercise, this time is established ahead of time by the simulation management function and is common to all participants in a particular exercise.

Slow Time. The duration of activities within a simulation in which simulated time advances slower than actual time.

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

Stimulate. To provide input to a system in order to observe or evaluate the system's response.

Synthetic Battlefield. One type of synthetic environment.

Synthetic Environments (SE). Internetted 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 complete visualization of and total immersion into the environment being simulated.

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

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

Time Step Models. Dynamic models in which time is advanced by a fixed or independently-determined amount to a new point in time, and the states or status of some or all resources are updated as of that new point in time. Typically these time steps are of constant size, but they need not be.

Unified Combatant Command (UCC). One of the unified combatant commands established by the President of the United States according to Title 10, United States Code. Also referred to as Combatant Commands. (UCCs include: US Atlantic Command (abbreviated as USACOM); US Central Command (abbreviated as USCENTCOM); US European

Command (abbreviated as USEUCOM); US Pacific Command (abbreviated as USPACOM); US Southern Command (abbreviated as USSOUTHCOM); US Space Command (abbreviated as USSPACOM); US Special Operations Command (abbreviated as USSOCOM); US Strategic Command (abbreviated as USSTRATCOM); and, US Transportation Command (abbreviated as USTRANSCOM)).

Validation. The process of determining the extent to which a model or simulation is an accurate representation of the real-world from the perspective of the intended use(s) of the model or simulation.

Verification. The process of determining that 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.

Virtual Modeling and Simulation. A synthetic representation of warfighting environments patterned after the simulated organization and operations of actual military units. Differences in the representation of the simulated battlefield (i.e., whether real-world, computer generated, or interactive players in simulators) are transparent to the participants who interact with their particular representation of the warfighting environment.

Warfare Simulation. A model of warfare or any part of warfare for any purpose (such as analysis or training).

ANNEX E
Coordination

HQDA, Deputy Chief of Staff for Operations and Plans, DAMO-TR
Chief of Naval Operations, Director of Naval Training, N7, DONMSMO
Chief of Staff, US Air Force, AF/XOM
Commandant of the Marine Corps, MCCDC
Commander in Chief, US Atlantic Command, Code J3, J5, J73
Commander in Chief, US Central Command, Code J3, J5
US Commander in Chief, Europe, Code J3, J5
Commander in Chief, US Pacific Command, Code J35, J55
Commander in Chief, US Southern Command, Code J3, J5
Commander in Chief, US Space Command, Code J3, J5
Commander in Chief, US Special Operations Command, Code J3, J5, J5-C
Commander in Chief, US Strategic Command, Code J3, J5
Commander in Chief, US Transportation Command, Code J3, J5
Commander in Chief, US Army, Europe, Code J3, J5
Commander in Chief, Combined Forces Command, Korea, Code J35, J5
Operational Plans and Interoperability Directorate, Joint Staff, J-7
Force Structure, Resources and Assessments Directorate, Joint Staff, J-8
Chairman, GOSG Working Group, Joint Staff
Defense Modeling and Simulation Office
Deputy for C4I Modeling, Simulation and Assessment, Defense Information Systems Agency
JSIMS Joint Program Office, Orlando, FL