JOINT SIMULATION SYSTEM (JSIMS)  
AN OVERVIEW

Robert W. Bennington, Lt Col, USAF, PhD  
Wright Laboratory WPAFB OH

ABSTRACT

This paper describes the mission, scope and organization of the Joint Simulation System (JSIMS) Program. The mission of JSIMS is to develop a joint simulation system that will provide readily available, operationally valid synthetic environments for use by the CINC's, their components, other joint organizations and the Services. JSIMS has five major objectives: integrate the range of missions of the Armed Forces within a common M&S framework that includes live, virtual, and constructive M&S capabilities; provide a training environment which will also accommodate space, transportation and intelligence requirements; establish a common simulation support structure which enables harmonious sharing of simulation resources, processes, and results among users; enable simulation users to readily create or access a simulation environment which supports their requirements; and enable joint simulation users to interact freely with elements of their command structure, supporting/supported organizations and other simulation centers or users. While the initial focus of JSIMS is joint planning and training activities, as the system matures, JSIMS will be available to the DoD community at large for the analysis of doctrine, organization, system and material alternatives.

BACKGROUND

Since the early 90's, US forces have been challenged to cope with increasing roles and responsibilities, and reductions in force levels and operating resources, while trying to preserve operational readiness. More and more, Joint and combined commands are being required to deploy rapidly around the world and effectively engage diverse military capabilities against a wide spectrum of conflicts. Modeling and simulation (M&S) is being increasingly employed to counteract the adverse effects of these reductions, and to support military planning, training and operational readiness. While the use of M&S is not new to the Services, its applications within the Services is growing rapidly, causing problems of its own.

Historically, the Service have developed their respective M&S capabilities independently. Even within each Service there has been a lack of commonality and sharing of M&S assets. A 1992 DoD wide M&S survey showed that each Service had literally thousands of models and simulations, and that a significant number of those were duplicative. More important however, was the fact that there is no common modeling and simulation architecture. Different architectures have been developed for the three classes of simulation: live", virtual", and constructive". It is generally recognized that while each class of simulations has unique requirements and applications, there is a need for a more common approach.

One consequence of these "stove-pipe" models and simulations is that they do not allow any significant level of interoperability. Hence, there is little capability to support joint or combined requirements which need multi-Service representations. As a short term solution to support Joint requirements, the Aggregate Level Simulation Protocol (ALSP) was developed. ALSP allows disparate Service models such as the Air Warfare Simulation (AWSIM), Corps Battle Simulations (CBS), and Enhanced Naval War Gaming System (ENWGS) to be "linked" together. However there are several significant problems with ALSP. First, since ALSP was developed after the Service models were already in existence, there are still severe limitations in the degree of interoperability that can be achieved. Secondly, there is also a high overhead associated with ALSP because of the extensive individual software development required where model interaction is desired. Lastly, the ad hoc mix of models fails to completely and realistically portray the full range of

*live - real people operating real systems  
*virtual - real people operating simulated systems  
*constructive - simulated people operating simulated systems

U.S. Government work not protected by U.S. copyright 804
missions and capabilities required to meet Joint training requirements.

In response to these shortfalls in Joint training capabilities and the lack of a common M&S architecture, several independent Service initiated M&S working groups were formed. These various groups were charged to examine and make recommendations on such issues as M&S management, architecture, and joint simulation requirements.

Based on recommendations made by these working groups, a Joint Memorandum of Agreement (MOA) for the Joint Simulation System was signed by the Director, Defense Research and Engineering (DDR&E), Director Joint Staff, and the Services on 30 June 1994. The agreement authorized the establishment of the Joint Simulation System (JSIMS) Program Office.

The MOA basically states that "the long term goal of this agreement is to integrate the range of missions of the Armed Forces within a common framework" via the development of the Joint Simulation System. Thus, the JSIMS Program Office was charged with solving the two major issues mentioned above by providing a capability for realistic joint training and developing a common M&S architecture for all the Services.

**JSIMS PROGRAM DESCRIPTION**

**Mission** The mission of the JSIMS program is to develop a joint simulation system that will provide readily available, operationally valid synthetic environments for use by the CINC's, their components, other joint organizations and the Services to: jointly educate; train; develop doctrine and tactics; formulate and assess operational plans; assess warfighting situations; define operational requirements; and provide operational input to the acquisition process. This system is to have an Initial Operational Capability (IOC) of 1999 for Joint Task Force (JTF) training and a Full Operational Capability (FOC) of 2003 for all Service applications.

**Objectives** The five major objective of the JSIMS program are:

a. Integrate the range of missions of the Armed Forces within a common M&S framework that includes live, virtual, and constructive M&S capabilities, and will eventually be capable of addressing training, testing and analytic needs.

b. Provide a training environment at the operational level of war which will also accommodate requirements at the strategic and tactical levels to include space, transport, and intelligence, and also be capable of training down to the individual unit level.

c. Establish a common simulation support structure which enables harmonious sharing of simulation resources, processes and results among users.

d. Enable simulation users to readily create or access a simulation environment which supports their requirements.

e. Enable joint simulation users to interact freely with the elements of their command structure, supporting/supported organizations and other simulation centers or users.

**Definition and Scope** JSIMS is defined as a simulation system that will support Joint and Service training and analysis through an infrastructure of battlespace representations, simulation management and support services interacting with the users through their operational C4I systems. To better understand the full implications of this definition and the scope of the JSIMS program, one must examine the program from three distinct points of view: Operational, Technological and Life Cycle.

**Operational View** JSIMS will support JTF commanders and their service components in campaign planning and training in all phases of military operations (e.g., mobilization, deployment, conflict, and post-conflict activities) during war and operations other than war. In doing so, JSIMS will provide consistent representations of battlespace activities through disciplined use of common, accredited representations for all Joint and Service mission areas. These mission areas include all air, land, space, and sea areas in which friendly, enemy, and neutral forces are conducting operations. Accurate representations of the various "domains" (environmental, military doctrine, equipment characteristics, human behavior, etc.), and the interaction between domains, within each of the mission areas, will also be developed.
Thus, from the operational point of view, JSIMS will provide a realistic, integrated, synthetic environment capable of representing the full range of military missions, in all areas of operations.

Technological View JSIMS will be an open-system, object-based, distributed synthetic environment populated with live, virtual, and constructive representations of interactive battlespace activities.

To ensure JSIMS will be an open-system, the program office will develop a common M&S simulation architecture via three levels of architectural specification: high-level architecture, system, and implementation specification (Descriptions of these three characterizations can be found in Draft DoD 5000.59-P “DoD M&S Master Plan”).

The description of the JSIMS high-level architecture (HLA) will be compliant with the DoD HLA. The purpose of the JSIMS HLA will be to ensure interoperability and maximum reuse of simulation components. It will also define a common vocabulary and specify a base of standards for use by all JSIMS component systems.

The JSIMS System Architecture will also be compliant with the HLA. In addition, it will also further define JSIMS characteristics, partition JSIMS into components, and describe the relationships among the various components. The purpose of the JSIMS System Architecture will be to provide the level of detail necessary to develop the technical specifications of the architecture.

The JSIMS System Architecture will define the requirements in enough detail to allow a contractor to develop the JSIMS Implementation Specification. The purpose of the Implementation Specification will be to establish the performance, design, test, integration, and acceptance requirements for the JSIMS architecture. It will provide the final level of detail necessary to fully describe the architecture, including such elements as specifications of functional and physical interfaces, and design and construction standards.

To further enhance interoperability, JSIMS will include an object-oriented design. All the software components in the system will be object based. JSIMS will provide a common object format to assure intra-simulation interoperability. This intra-operability will be at least as flexible as the Object Management Group’s (OMG) Object Management Architecture (OMA) Reference Model. JSIMS will also provide for a common system object repository to allow JTF or the Services to perform individual simulations without multiple Service participation.

JSIMS will be a distributed system to maximize the number of participants despite geographical separation, and take advantage of common class libraries, data bases, and object repositories. This distributability will also allow multiple component systems to be run on the same computing platform, and a single system’s components to be distributed among several computing platforms. JSIMS will be compliant with the DIS environment and will ensure consistency with ARPA’s Advanced Distributed System (ADS) environment.

Therefore, from the technology standpoint, JSIMS will maximize interoperability, flexibility and reuse of simulation components (both hardware and software) through a common architecture, object-based, distributed system design.

Life Cycle View JSIMS will be a jointly managed synthetic environment throughout its life cycle. It is not a system that can be built, fielded, and then left alone. It will be a dynamic system which requires: acquisition and development management; VV&A and configuration management; and fielding and life-cycle system support management. Figure 1 illustrates the various JSIMS life cycle responsibilities. As shown, JSIMS is solely responsible for some areas, the Services for other areas, and joint responsibility in yet other areas.

JSIMS will manage the Core areas and functionality for CINCs, JTF, Allies, Host Nations, etc. The JSIMS Core consists of two distinct areas: Management and Support Services and Common Applications. In the Management and Support areas, JSIMS will take care of such services as network; data management, graphics, security, operating systems, documentation, distributed computing and user interfaces. Under the Common Applications area, JSIMS will manage the physical environment (meteorology, topology, etc.); common battlespace functionality (attrition, detection, movement, tactical communication, etc.); after action reviews (event tracking/reporting); scenario preparation, and time/event management.
JSIMS will also manage the application and functionality areas for the various joint forces, both foreign and domestic. These areas include such functions and applications as JTF organization, foreign nation organization, facilities and communications, doctrine, command and control processes, intelligence processes, logistic processes, interfaces with operational C4I systems, and human performance.

The respective Services will manage their own Service-unique functionality and applications. This will include such items as doctrine and process, organization, system and materiel, interfaces with Service-unique C4I systems, and human performance. In addition each Service will be responsible for complying with the DoD HLA standards and protocols.

The inter-Service applications and functionality area will be "jointly" managed. This area include those functions and applications that are common to two or more of the Services. Examples of such overlapping areas include close air support, electronic counter measures, special operations, and suppression of enemy air defenses. When simulation expertise of a specific area resides within a Service, that Service will be the lead organization. For those areas without Service expertise, JSIMS will be the lead organization.

Thus, from the Life-cycle point of view, JSIMS will be a simulation system with a simulation management and support services infrastructure that is jointly managed.

**JSIMS ROAD MAP**

The overarching theme of the JSIMS program is the evolutionary development of the system. JSIMS will advance from its notional concept to a fully operational system via a series of progressive stages. During these stages, the operational capabilities and features of the system will be incrementally...
implemented via "product releases" to the end users. A total of five releases are planned: pre-IOC, IOC, pre-FOC, and FOC.

These product releases will show the incremental advances in the JSIMS architecture and Joint Battlespace Definition. A JSIMS testbed will also be developed to provide a mechanism for testing, validating, and assessing simulation capabilities.

The pre-IOC release is scheduled for mid 1996. The system, at that point in time, will be a coded version of the systems architecture document and several selected JSIMS operational concepts and system components. This release will also serve as the 1996 demonstration specified in the MOA. A single, user site will be selected to host the demonstration.

The IOC release will follow in 1999 and be designated as JSIMS release 1.0. It will contain the architecture, tools, and models necessary for JTF training. It will also contain a single, common world view for all concurrent users. That is, each user will operate within a consistent virtual mission space. All battlespace functions (logistics, Intel, etc.) will be able to exchange and share data.

Following IOC, there are two additional product releases planned. Each will have a 12 to 18 month development and test cycle. The purpose of these releases will be to rectify any problems discovered after IOC.

In 2003, the FOC version, or JSIMS 2.0 will be released. This will be fully populated with all the Service applications and functions and have live and virtual simulation capabilities. It will also support, to a limited degree, analysis and test and evaluation applications.

To meet these ambitious timelines, the program office is leveraging ongoing Service and ARPA initiatives in M&S technologies. In the area of architectures, the Program Office is looking at ARPA’s ADS and the Army’s WARSIM 2000 programs. ARPA’s Synthetic Theater of War (STOW) program is also being closely followed because of its work in DIS technology. For Joint Battlespace Definition, the Program Office is examining the Army’s National Simulation Center’s Functional Description of the Battlespace (FDB) program.

JSIMS ORGANIZATION

The JSIMS Joint Program Office (JPO) was formed to coordinate and manage the development, fielding, and supporting of the Joint Simulation System. The JPO is located in Orlando Florida and is managed by a Navy 0-6 Program Manager (PM) who reports directly to the USAF Program Executive Officer (PEO) for Combat Support Systems. The PM is assisted by an Army 0-5 Deputy Program Manager and representatives from each of the Services. The JPO is additional supported by government and contractor personnel. The JPO is currently manned by 15 people.

SUMMARY

JSIMS is a complex program that is tackling a number of issues: interoperability, open-systems, joint training, and commonality. Simply put, the purpose of JSIMS is to provide a simulation product and support services that will allow Joint, combined commands and the individual Services to operate more efficiently and effectively. JSIMS will accomplish this through joint simulation operability, re-use, and technological leveraging. The program will evolve from a training tool for JTF commanders to a system that is used by the DoD community at large for the testing and analysis of doctrine, operational requirements, and system and material alternatives.

REFERENCES


2. Joint Memorandum of Agreement for the Joint Simulation System (JSIMS), 30 June 1994

BIBLIOGRAPHY


