Simulation Based Acquisition (SBA)
Status and International Implications

Prepared by the Department of the Navy Acquisition Reform Office for
The Technical Cooperation Program (TTCP) panel on Systems Engineering for Defence Modernisation
September 2000

1. Introduction

The Simulation Based Acquisition (SBA) concept offers the promise of major quality, productivity and industrial base improvements in defense system acquisition. This paper provides an overview of SBA in the U.S. Department of Defense (DoD) and examines the implications of SBA for coalition defense, international collaborative acquisitions and the defense industrial base.

2. SBA Emergence in the U.S. DoD

Over the last decade, various DoD studies, speeches, documents and presentations identified and promoted the potential benefits of comprehensively applying modeling and simulation (M&S) to the acquisition of defense systems. Enabled by revolutionary advances in information technology (IT), including processing, networks, database management, software and displays, M&S was promoted as offering the ability to define requirements, design, build and operate new weapon systems in the computer before beginning manufacture. Advocates noted that many problems in DoD's traditional acquisition process could be overcome by such an approach.

Developments in industry early in the last decade reinforced this view. Equipment manufacturers such as Chrysler (automobiles) and Boeing (commercial aircraft) were increasingly harnessing IT to enable geographically-dispersed, multi-company teams to efficiently conduct collaborative design and manufacturing, getting better products to market faster and less expensively than ever before. Prominent among industry's IT tools were 3D computer aided design (CAD) modeling systems, product data management (PDM) repositories, enterprise resource planning (ERP) applications, and manufacturing and maintenance simulations. These provided advanced design, planning, analysis and visualization capabilities, better equipping decision makers and better communicating information to all involved parties, including customers and workers.

Arguments for the application of such capabilities to DoD weapon acquisition were persuasive. As understanding of the potential benefits spread, M&S (which includes CAD) became widely regarded as an indispensable tool for meeting DoD's objectives, including its aggressive goals for reducing the time and cost to acquire weapon systems.

Individual acquisition programs began to use such advanced tools and various DoD organizations began to advocate corporate-level action to harness their full benefit. Forums were established to further institutional consideration and adoption of such approaches. Chief among these have been the Acquisition Council, a component of the DoD Executive Council for Modeling and Simulation (EXCIMS), and the SBA Industry Steering Group (SBA ISG), a component of both the National Defense Industrial Association (NDIA) Systems Engineering Committee and the Affordability Task Force of the National Center for Advanced Technologies (NCAT). In December 1997, the Acquisition Council approved a "Simulation Based Acquisition" vision statement for the DoD. The term "SBA" has many detractors, for the concept involves far more than simulation and invites confusion with the Small Business Administration, but it is thus far the most widely accepted name for the pervasive and collaborative application of M&S to enable improved system acquisition and life cycle support.

3. The SBA Road Map

In March 1998, the Acquisition Council established a Joint SBA Task Force to develop a road map for DoD's implementation of SBA. Industry played a limited role, effectively advocating for an expansion in the scope of the road map to address process and culture issues, and participating in the task force's Quality Function Deployment process.

The draft SBA Road Map was released for coordination in December 1998. A voluminous work of almost 400 pages, it proposed a "to be" SBA architecture, discussed cultural issues, attempted to quantify return on investment, and made 24 implementation recommendations. Disputes arose among the DoD Components and with industry over various aspects of the plan, including justifications for the recommended actions, its completeness and coherency, the proposed architecture, industry participation and funding. As a result, the SBA Road Map was never formally approved as a guidance document. In hindsight, it may be said that given the difficulty of the many issues inherent in SBA, the road map simply tried to move DoD farther and faster than was possible within the time available and experience to date.

Still, the SBA Road Map is almost universally regarded as a major step forward. It developed important new concepts and expanded the defense community's understanding of the issues involved. Other SBA depictions, agreeing on vision and goals but differing on

important points such as architecture, exist within both industry and government, but the SBA Road Map thus far remains the most cited and influential document. Many of the road map's terms and concepts have been adopted by individual Services and programs in their own efforts.

4. SBA Definition

Since various SBA views had arisen and the Acquisition Council's original brief SBA statements did not address many issues, a need arose in both government and industry for a clearer definition of what attributes define SBA. Building upon the council's 1997 SBA statements, the SBA Road Map, DoD and industry documents and speeches, several SBA workshops and working level deliberations of government and industry personnel, the SBA ISG and Acquisition Council both approved the following expanded definition of Simulation Based Acquisition in August 2000. Both bodies expect this definition to evolve through implementation experience.

Concise Definition of SBA

An acquisition process in which DoD and Industry are enabled by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs.

SBA Goals

- *Substantially reduce the time, resources, and risk associated with the entire acquisition process*
- *Increase the quality, military worth, and supportability of fielded systems while reducing total ownership costs throughout the total life cycle*
- *Enable Integrated Product and Process Development (IPPD) across the entire acquisition life cycle*

SBA Is

- *A dramatically improved acquisition process enabled by the application of advanced information technology (IT); legislation, policy, budgeting and management changes; and the education and motivation of all participants.*
- *Better informed decisions and reduced risk by more accurate and comprehensive assessments of design, manufacturing, employment and support concepts earlier in the acquisition cycle.*
- *The optimization of system performance versus total ownership cost (TOC) by early and continuing collaborative exploration of the largest possible trade space: across all of a system's life cycle activities, within and among multiple government and commercial organizations, across professions and disciplines, and up through system of systems mission area perspectives.*
- *Faster time to field through increased concurrency, tighter decision cycles, more efficient and effective testing, and a reduction in costly fixes for problems discovered late in the acquisition cycle.*
- *Lower total ownership cost of individual systems via lower personnel and material costs accruing from the above, and from the standards-based reuse of information and software to minimize their cost.*
- *Greater modernization for DoD through this reduction in the cost of individual systems and the more optimal program investments enabled by system of systems mission area assessments.*
- *The provision of enduring collaborative environments, in which government and/or industry experts utilize off-the-shelf (or minimally modified) sets of reusable, interoperable tools and supporting resources (such as information sets) to assess the attributes of an emergent capability, concept, doctrine, tactic, process or situation in the broader context of an expected real-world environment.*
- *The efficient, automated and near-real-time sharing of relevant information among all personnel with a need to know, such that they have accurate and consistent understandings of a system (both physical and behavioral) and its external environments, including their variants, as they evolve. Information about the system is shared via a distributed product description (DPD). Information about its external environments is shared by similar mechanisms. A DPD is characterized by:*
  - *The integration of information in disparate locations into what appears to the user as a single integrated data set;*
  - *Minimal data duplication, such that data is created once, but used many times;*
  - *Data set coherency in terms of semantics, syntax, levels of resolution (granularity), and integrity among interdependent attributes;*
  - *Web-based access and user-friendly search, display, parsing, download and subscription mechanisms, with alert, trigger and threshold functions to enable delivery of only relevant information (to minimize bandwidth and processing costs, and avoid human overload);*
  - *Security/access controls to protect classified, proprietary or private information; and*
  - *Configuration management of multiple versions and their histories, to include analysis results and decision rationales.*
- *The aggressive, comprehensive application and sharing of mature advancements in information technology such as distributed networking, multi-user computer environments, database management systems and particularly advanced modeling and simulation (M&S) tools, including commercial product development automation tools (e.g., CAD, ERP), HLA-based distributed simulation, and interactive virtual reality. The models and simulations will:*

- *Be verified and validated, with documentation of this to facilitate accreditation and reuse;*
- *Communicate system concepts and capabilities;*
- *Manage the details of complex spatial, causal and temporal relationships, helping humans assess key parameters, identify issues, track trends and assess the merits of alternatives;*
- *Allow a system to be designed, built, tested and operated in the computer before critical decisions are locked-in and manufacturing begins;*
- *Allow alternative designs to be carried further into the acquisition process;*
- *Make test an integral aspect of design, make live testing more cost-effective, and allow effective testing where live testing is impractical; and*
- *Collectively satisfy all program needs capable of being addressed via M&S.*

- *Dependent on the capability to interoperate and reuse heterogeneous tools and digital information, and to incrementally insert technology upgrades and replacements for each, made possible by specifying:*
  - *Reference operational and system architectures, adaptable to individual programs;*
  - *A common technical architecture; and*
  - *Open, preferably commercial, data interchange standards.*
- *A non-proprietary environment, allowing the use of proprietary tools and information as appropriate.*
- *An enduring means for understanding, managing and modifying a system throughout its lifetime.*
- *Dependent on competent professionals, including M&S experts, in both government and industry.*

SBA Is Not

- *A replacement for good systems engineering.*
- *Having simulations make the decisions.*
- *Giving all information to everyone and letting everyone see everything you do.*
- *The loss of security and proprietary advantage.*
- *The loss of responsibility, authority and/or accountability.*
- *Just using M&S in an acquisition program.*

The comprehensive and challenging nature of the changes envisioned by SBA is readily apparent in the above statement. It should be noted that SBA is a significant leap beyond the typical extended enterprise, M&S-enabled, product development environments in industry today. Among the key differences are (1) the ability to interchange information among heterogeneous tools, and interoperate those tools, via open standards; (2) simulation of the system's operating environment, including complex system of systems interactions; and (3) M&S use for test, evaluation and certification.

5. Relationship of SBA to IDE and SoS

The panel's three focus areas, Systems of Systems (SoS), Simulation Based Acquisition (SBA) and Integrated Digital Environment (IDE), are closely related. The SoS concept requires the capability to analyze, test and evaluate the combined capabilities of individual (existing, emerging or proposed) systems which must work together to provide a broad mission area capability. SBA aspires to provide a comprehensive, distributed, collaborative and persistent modeling and simulation capability that can, among other things, support such SoS analysis. SBA requires a pervasive and secure information-sharing infrastructure to support the use of its software tools. Providing this sort of real-time digital information exchange environment across an extended enterprise of qualified users is a goal of the IDE initiative. Thus IDE supports SBA, and the two together facilitate the realization of SoS management.

The overlaps and potential synergy among these three initiatives has not always been appreciated. Their logical interdependencies must be recognized. By leveraging the accomplishments of one initiative for the benefit of the others, the advanced acquisition environments they all seek may be achieved faster and more efficiently.

6. Current Status of SBA within DoD

Current DoD policy governing the acquisition of weapons and automated information systems (DoD 5000.2-R change 4 of May 1999) identifies M&S as a key element of a program's acquisition strategy. A revision to the capstone acquisition directive (DoD 5000.1), now in final review, includes SBA under "Policies & Principles," requiring program managers to make effective use of M&S.

The SBA concept is moving forward, but in a more asynchronous and less coordinated way than originally envisioned by the Acquisition Council. Individual military services and programs have embraced the SBA concept to various degrees, albeit sometimes by different names, and significant (but many argue inadequate) resources are being applied to make it happen.

There is general appreciation of the significant technical and cultural challenges inherent in realizing the full SBA vision, particularly those aspects related to broad collaboration and the sharing of information and tools across phases (e.g., using a program's simulations in the operational testing of the system) and programs. Cross-program reuse remains limited, with most occurring only when the same contractor is involved in both programs.

The defense community is searching for an optimal path to bring to fruition the capabilities envisioned by SBA. However, it is not wed to that name nor universally committed to the need for a major SBA initiative to achieve SBA goals.

6.1 Department of the Army

The Assistant Secretary of the Army for Acquisition, Logistics and Technology, ASA(ALT), has established an SBA initiative called Simulation and Modeling for Acquisition Requirements and Training (SMART). It aspires to bring the requirements, training and acquisition communities together to address system development and life-cycle support. The Army is following a "central planning, decentralized execution" strategy, attempting to motivate program managers (PMs) to incorporate SMART into their programs. Four "flagship" programs have been identified: Crusader, Apache, Future Scout Calvary System, and Close Combat Tactical Trainer.

SMART has enjoyed strong advocacy by the Army Chief of Staff and Secretary of the Army. It has recently transitioned to management by the Army Modeling and Simulation Office, where an implementation plan is in preparation. ASA(ALT) has sponsored three well-attended annual conferences and has formed a partnership with the NASA Intelligent Synthesis Environment (ISE) office to sponsor the 2001 conference.

6.2 Department of the Navy

Although the earliest Service proponent for an SBA-like approach to acquisition, the Department of the Navy does not currently have a high-level champion for SBA as a major initiative. There is a solid appreciation at the Secretariat level of the ability of M&S to improve acquisition, particularly with regard to interoperability issues (SoS). Program manager commitment to M&S as a central aspect of their programs is increasing, but far from universal. Navy programs implementing aspects of SBA include the Joint Strike Fighter, LPD-17, DD 21, Virginia Class Submarine, and Advanced Amphibious Assault Vehicle. Many other SBA-related enabling efforts are underway within the research and development (R&D) community and the various system commands.

The Navy Acquisition Reform Office is developing a plan to achieve the goals of SBA, and the many other SBA-related initiatives that it has identified, in a harmonized way. By documenting their enabler superset and performing a gap analysis of what is in hand or in work across government and industry, the Navy intends to establish a work breakdown structure (WBS) to support collaborative, cost-effective realization of SBA. A preliminary version of this WBS framework has been drafted.

6.3 Department of the Air Force

The Air Force Materiel Command (AFMC), assisted by the Secretary of the Air Force Staff, is leading SBA implementation for the USAF. An SBA Tiger Team, formed in 1998 under AFMC leadership, explored SBA Road Map concepts and made recommendations regarding implementation of SBA. This was followed by a January 2000 General Officer SBA conference, which directed the establishment of an SBA Infrastructure Program, to begin in October 2001 under Electronic Systems Center management.

The Air Force has also issued a new directive, Air Force Instruction 16-1002, "Modeling and Simulation Support to Acquisition," that provides a framework for SBA implementation. Its purposes include guiding the direction of M&S in acquisition; guiding USAF M&S investment strategy; ensuring M&S acquisition products are effective, suitable, and reusable; and linking M&S use in acquisition to requirements generation, testing, logistics, training and education. Although never using the term SBA, it adopts many SBA Road Map terms and requires program managers to develop an M&S Support Plan.

6.4 Office of the Secretary of Defense (OSD)

The Service activities are currently taking place independent of any central direction from OSD. The Office of the Undersecretary of Defense for Acquisition, Technology and Logistics [OUSD(AT&L)] has undergone several organizational re-alignments over the past year and a half to streamline its operations. Responsibility for the SBA initiative within OSD transitioned along with the re-alignments. As Director, Test, Systems Engineering and Evaluation (DTSE&E), Dr. Patricia Sanders had been chairman of the Acquisition Council, a catalyst for the emergence of the SBA concept, and its vocal proponent. When DTSE&E was disestablished in 1999, council leadership and SBA responsibility were transferred to the Director, Systems Acquisition, Mr. John Wilson. In early 2000 this office too was abolished, and SBA responsibility transferred to the newly-established office of the Director of Interoperability, Dr. V. Garber, where it now resides. Each move resulted in a re-examination of the Department's strategy in the SBA arena.

Dr. Garber and other acquisition community leaders regard modeling and simulation as essential to the development and verification of interoperable defense systems. Another major motivation for pursuing SBA capabilities is the growing consensus among DoD leaders that the department must manage its acquisition on a mission area (SoS) vice individual weapon system basis. As noted previously, SoS requires the existence of the capabilities collectively envisioned by SBA and IDE.

Under Dr. Garber's leadership, the Acquisition Council is again considering what actions are appropriate and practical at a corporate level to promote the attainment of the capabilities envisioned by SBA. Tasks that the Acquisition Functional Working Group, a working-level body under the council, has thus far identified include:

- Open a dialog with other agencies and nations
- Examine SBA-related activities underway across government and industry in order to assess progress on SBA enablers and identify overlaps and gaps

- Ensure SBA materials are appropriately reflected in the DoD acquisition references
- Expand M&S education and training opportunities
- Draft SBA related issues/recommendations for the incoming administration
- Establish mechanisms for improved partnership with government, industry and academia on SBA

In the test and evaluation (T&E) arena, the promulgation of STEP (Simulation, Test and Evaluation Process) guidelines in 1997 by the DTSE&E and Director of Operational Test and Evaluation (DOT&E), spurred new thinking about the use of M&S. However, T&E organizations have thus far not decided on specific criteria for M&S use (e.g., what is good enough in terms of scope and fidelity), often leaving program managers in a quandary about how to satisfy T&E requirements.

OSD's Ballistic Missile Defense Office (BMDO), which manages, directs, and executes the acquisition program for DoD's missile defense capability, maintains a suite of core models that are used to address all aspects of the missile defense "Family of Systems." These range from campaign and mission level models, like the Extended Air Defense Simulation and the more detailed Extended Air Defense Test Bed; to the distributed hardware-in-the-loop tool used to address interoperability engineering issues, the Theater Missile Defense System Exerciser (TMDSE); the concept of operations development tool, Wargame 2000; and a host of engineering models and simulations.

7. Defense Leadership Imperative

It may be concluded from the foregoing that significant progress is being made but many challenges remain. It remains to be seen whether SBA will gain traction as a major DoD initiative or be merged into one or more other efforts to achieve advanced acquisition environments. In either event, the need for DoD to embrace SBA's key concepts, and put in place the necessary enablers to facilitate its institutional adoption, will remain.

To use a nautical analogy, the DoD has little choice but to move forward if it hopes to maintain steerage. To remain competitive in the marketplace, defense companies, like their commercial counterparts, are harnessing IT to integrate geographically dispersed, multi-company teams for product definition, development, production, marketing and support. This is logical and consistent with historic system engineering trends of opening up the trade space, increasing collaboration and making greater use of M&S.

Thus it is clear that at least some of the capabilities and concepts embraced by SBA will become commonplace. The question is whether the new environment that emerges will meet DoD needs. In this context, the government must consider many questions, including:

- Will information and tools be reusable across programs, so that each program and government oversight office does not have to develop or procure a separate set for each program?
- Will incentives (e.g., financial compensation) be in place to encourage models, simulations, datasets and other tools to be made reusable and be reused across programs and companies?
- Will requirements for the protection of classified and proprietary information, and export restrictions, be optimally accommodated and/or revised?
- Will the information and system representations in M&S authoritatively represent the most relevant entities, attributes and interactions that affect the question at hand, vice being selectively decided by the contractor trying to sell a product?
- Will industry be able to exchange information and interoperate their tools to facilitate teaming, second sourcing, foreign military sale (FMS) offsets and multi-national collaborative acquisitions?
- Will DoD acquisition professionals be equipped to deal with this new marketplace and its issues?
- Will our budgeting and business practices be revised to leverage these new approaches, vice making it impossible to harness their potential or wasting funds by insisting on interacting in traditional ways?

Experience to date and current industry trends indicate that unless the government takes concerted action, the answer to all these questions will be NO.

8. International Implications

The SBA courses chosen by each nation and its industrial base will have a profound effect on international defense cooperation. The impacted areas include coalition defense, collaborative acquisitions, and the industrial base.

8.1 Coalition Defense

When nations conduct coalition (combined) operations, a larger system of systems (SoS) is formed and interoperability between the nations' forces is required. The degree of interoperability needed for effective coalition operations will vary with the nature of the interactions (e.g., media, type, volume, time constraints). The least demanding scenario might be an operation where each nation's forces are geographically segregated and only loose coordination need occur, such as passing advisory information. Most demanding might be an intimate mixing of forces across multiple mission areas, involving tightly coupled offensive and defensive operations such as mixed amphibious assaults, aircraft strikes and the cooperative engagement of airborne threats.

Whatever the expectation, the required interoperability must often be "built in" and verified prior to the assembly of the coalition force. SBA capabilities must enable SoS

analysis of the systems that have to work together. A bi-lateral or multi-national SoS analysis can only occur if the SBA tools can exchange information that is understood by all in a common context and with adequate security.

Many things must be agreed to for this to be possible. For instance, without a common understanding of the entities and interactions in the battlespace, common standards for the semantics and syntax of exchanged information, compatible security mechanisms (e.g., encryption devices and access policy), and the ability to link the systems and/or simulations together as they run, a meaningful SoS analysis cannot be achieved.

8.2 International Collaborative Acquisitions

Conducting international collaborative acquisitions, such as Joint Strike Fighter, requires an even greater degree of interoperability among SBA tools. The reason for this can be understood by considering the granularity of what is being represented in M&S.

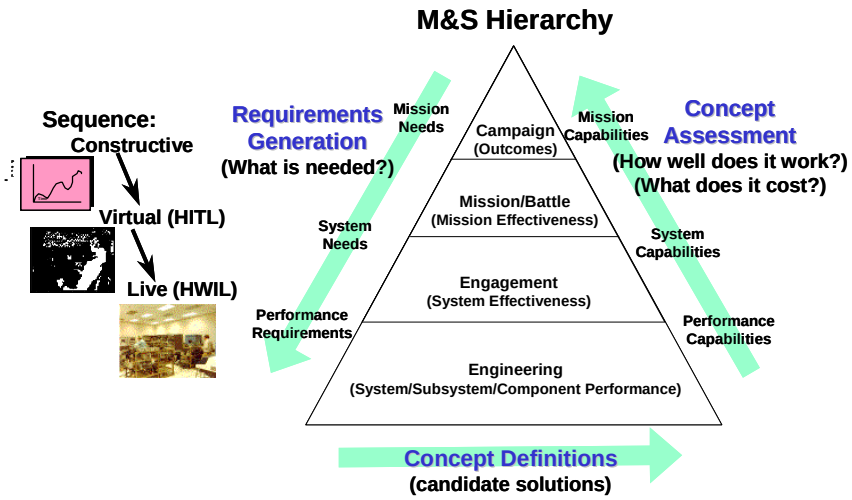

Figure 1. M&S Use in System Design

As shown in the above figure, collaborative design of a new system typically requires exploration of issues at the sub-system level, whereas representations of the interactions of two nations' forces engaged in a coalition defense operation would more commonly be represented at a higher level (e.g., mission level).

The specific depth and breadth of interoperability needed among the components of a new system will vary with the manner in which work is divided among the nations and the complexity of the component interfaces. For example, one nation building a crane to be installed on another nation's ship will likely have less stringent interoperability constraints than each nation building different components of the same gas turbine. The more intimate the interactions, the greater the degree of standardization required among the nations' SBA implementations.

8.3 Industrial Base

If SBA implementation is coordinated among the nations such that all share (within security constraints) a common view into, and ability to interact with, a simulated representation of a system's design, manufacturing and operating environment, then the dynamics of the defense marketplace change dramatically. SBA could thus usher in greater business opportunities for each nation's defense companies by providing them an expanded marketplace in which to sell their skills and products. The converse is also true – each government can enjoy the benefits of having more companies compete for their business. While some may feel threatened by this increased competition, the record is clear that this is good for all nations.

9. Potential Areas of Cooperation

If TTCP nations desire favorable SBA impacts in the three areas discussed above, the critical question is what should be done. The following areas of potential cooperation are offered for consideration:

a) Agreements regarding the sharing of data, models, simulations and analyses

b) Ways to identify such reusable resources

c) A standard technical architecture for simulation runtime interoperability (e.g., the High Level Architecture, HLA)

d) Identification of authoritative sources for information

e) Common conceptual models of each mission space (an SoS issue as well)

f) Common information models for different system types

g) Data interchange standards (an IDE issue as well)

h) Verification, validation and accreditation (VV&A) procedures and documentation

i) Methods and tools to mange collaboration and multi-domain optimization

j) Sharing lessons learned (e.g., successful and failed policies, processes, return on investment, motivation)

k) SBA education (methods and materials)

l) SBA experiments and pilot projects

10. Summary

SBA is a very promising but challenging concept. The manner in which SBA is implemented, or not implemented, within and among nations will have major implications on coalition defense, collaborative acquisitions and the defense industrial base. This is a compelling area for international cooperation.

Bibliography

"Report of the Defense Science Board on Improving Test and Evaluation Effectiveness," OUSD(A&T), December 1989

"Report of the Defense Science Board on Simulation, Readiness and Prototyping," OUSD(A&T), June 1994

T. Parker, "Final Report of the DDR&E Acquisition Task Force on Modeling and Simulation," ODDR&E, 17 June 1994

"Naval Research Advisory Committee Report on Modeling and Simulation," NRAC 94-3, Office of Naval Research, November 1994

DoD 5000.59-P,"Modeling and Simulation Master Plan," October 1995

H. Portmann, "Study on the Application of Modeling and Simulation to the Acquisition of Major Weapon Systems," American Defense Preparedness Association, 27 September 1996

A. Patenaude, "Study on the Effectiveness of Modeling and Simulation in the Weapon System Acquisition Process," SAIC, October 1996.

"Simulation Support Plan Guidelines," Office of the Assistant Secretary of the Army for Research, Development and Acquisition, May 1997.

P. Sanders and P. Coyle, "Simulation, Test and Evaluation Process - STEP Guidelines," OUSD(A&T), 04 December 1997.

J. Gansler, Memorandum on "Modeling and Simulation in Defense Acquisition," OUSD(A&T), 16 March 1998.

N. Karangelen, "The Simulation Based Acquisition Vision – A Brief Tutorial," NDIA Workshop on Simulation Based Acquisition, Orlando, March 1998.

"Simulation Based Acquisition Functional Description Document" (draft), NDIA SBA Industry Steering Group, 23 September 1998.

"Crusader Simulation Support Plan," Crusader Program Office, November 1998

"A Roadmap for Simulation Based Acquisition – Report of the Joint Simulation Based Acquisition Task Force," Acquisition Council Draft for Coordination, 04 December 1998.

ASN(RDA) Memorandum on "DoN Leadership for Simulation Based Acquisition," 04 December 1998

R. Frost and D. Thomen, "Simulation Based Acquisition, the Road Map," 1999 Spring Simulation Interoperability Workshop, March 1999.

R. Lutz and J. Keane, "An Architecture for Simulation Based Acquisition," 1999 Spring Simulation Interoperability Workshop, March 1999.

DOD 5000.2-R, "Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information Systems (MAIS) Acquisition Programs," with Change 4 of May 1999

"SBA Implementation Plan," Acquisition Council draft of 14 June 1999.

R. Lutz and J. Coolahan, "Developmental Concepts for Digital Distributed Product Descriptions," 1999 Fall Simulation Interoperability Workshop, September 1999.

S. Olson, "Simulation Based Acquisition (SBA) – A U.S. Overview and Industry Perspective," Proceedings of the SMi Conference, London, March 2000.

J. Gansler and P. Coyle, Memorandum on "Application of Modeling and Simulation for Department of Defense Acquisition Programs," OSD, 21 March 2000.

"VV&A Recommended Practices Guide, Year 2000 Edition," Defense Modeling and Simulation Office, http://www.msiac.dmso.mil/vva/, May 2000.

"Planning Guidelines for Simulation and Modeling for Acquisition, Requirements and Training" (SMART Guidelines), Army Modeling and Simulation Office, May 2000 (supercedes Army's May 97 "Simulation Support Plan Guidelines")

Air Force Instruction 16-1002, "Modeling and Simulation Support to Acquisition," 01 June 2000.

"Joint Strike Fighter (JSF) Modeling and Simulation Support Plan (MSSP) Version 4.1," JSF Program Office, August 2000.

J. Hollenbach, "Department of the Navy Approach to Simulation Based Acquisition," 2000 Fall Simulation Interoperability Workshop, September 2000.