

# **Executive Summary**

## **Modeling and Simulation**

### **PURPOSE OF STUDY**

In the current world political and economical environment, the Department of the Navy (DON) will be required to carry out a diversified list of missions with a smaller force and reduced budgets. The DON will have to find more efficient and less costly ways to train troops, refine new weapon system requirements, evaluate solutions, and acquire new or modified systems. Advances in Modeling and Simulation (M&S) capabilities and technologies offer significant opportunities for responding to these challenges.

### **OBSERVATIONS**

Advances in the M&S world have been driven by the explosion in computer technology. Exponential growth in computer memory capacity, graphics display rates, network transmission rates, and computer power per dollar have made large simulations realistic and economically feasible. This report focuses on two emerging simulation technologies. Advanced Distributed Simulations (ADS) are the combinations of live simulations, virtual simulations, and constructive simulations; these combinations usually involve geographically distributed components that are connected through communication networks. Simulation Based Design/Manufacturing (SBD/M) combines physical models with the common design database from computer-aided design, engineering, and manufacturing, and then adds the visualization of virtual prototypes.

While the DON has developed and used high quality physics-based models for many years, it is not a significant player in ADS. The Department of the Army has been the lead player in the ADS arena. The DON, in a partnership with the Advanced Research Projects Agency (ARPA), has only begun to participate in SBD/M activities through some of the ARPA programs; the leaders in SBD/M activities are in the commercial aircraft and automobile industries.

### **RECOMMENDATIONS**

#### **(1) Embrace Distributed Simulation Based Acquisition**

The panel believes that the tools embedded in ADS and SBD/M provide a capability that can revolutionize the acquisition process. A new Distributed Simulation Based Acquisition (DSBA) process promotes end-to-end verification of requirements matched to design, manufacturing, and supportability, and it facilitates cost and performance trades for the complete life cycle, from pre-concept feasibility studies through development and training. The distribution of the common data base, and interactions with live and virtual simulations, is as valuable to training as it is to confirming operational requirements. DSBA also provides a mechanism to continually support user (operator/tester) involvement in needs, evaluation and training, and facilitates integrated

product and process definition throughout the life cycle. If properly implemented we should be able to "try before buy," using distributed interactive simulation to solve many of the problems that usually are first evidenced only after a hardware construct. Embracing DSBA requires an Executive Agent to provide leadership for all DON modeling and simulation programs.

## **(2) Technical Recommendations**

The DON should leverage the investment ARPA and other services have made in ADS for air and ground combat, and should take steps to ensure that systems developed for the DON are guaranteed to be interoperable with systems developed for the Army and Air Force. The DON must assume responsibility for DON-specific models. In particular, new models must be built and existing environmental models must be modified or extended, with particular attention to the unique problems emerging from interfaces between the air, the water surface, the subsurface, and the land. The DON should also actively participate in standards groups to ensure that evolving standards meet the Naval requirements.

Billions of dollars have been spent by users of SBD/M-like technology and by suppliers of SBD/M-like technology, producing a huge reservoir of software and expertise. Accordingly, DON investment in this area should be focused on leveraging existing technology, rather than attempting to recreate SBD/M technology inside Naval laboratories.

The Office of Naval Research (ONR) should invest in the development of new model-construction, evaluation, and comparison technology that supports reality-checking, validation, and verification. Techniques need to be available to evaluate the quality of the DON's models and other models connected to DON models.

## **(3) Pilot Programs**

The DON should begin evolving DSBA with existing acquisition projects - the DSBA technology has been demonstrated and thus more demonstration programs are not needed. It was not possible for the Panel to consider all DON programs, and thus it cannot recommend the best candidates for pilot programs. However, we do suggest several good candidates that are part of existing acquisition programs. These include two near-term bounded projects that would provide results within a short period of time - the advanced short take-off vertical landing (ASTOVL) project and the unmanned aerial vehicle (UAV) landing deck design for the LPD-17. Other areas of DON acquisition that would provide good candidates for DSBA are mine countermeasures, sea-based theater ballistic missile defense (TBMD), and ship self defense. Certainly areas of ship and submarine design would also greatly benefit from developments of DSBA.

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## **SUMMARY**

The Panel believes that the DON has an opportunity to revolutionize its acquisition process through Distributed Simulation Based Acquisition. We have provided recommendations that would guide investments in areas unique to the DON and in areas that are not yet mature. First-hand experience with Distributed Simulation Based Acquisition should begin immediately through pilot programs within existing acquisition programs. "Seize this opportunity!"