

Audit



Report

OFFICE OF THE INSPECTOR GENERAL

**ACQUISITION AND UTILIZATION OF MODELING AND
SIMULATION ASSETS AT CONTRACTOR FACILITIES**

Report No. 93-107

June 11, 1993

Department of Defense

The following acronyms are used in this report.

| | |
|------------|--|
| B&P..... | Bid and Proposal |
| DFARS..... | Defense Federal Acquisition Regulations Supplement |
| FAR..... | Federal Acquisition Regulations |
| GAO..... | General Accounting Office |
| IR&D..... | Independent Research and Development |



INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202

June 11, 1993

Report No. 93-107

MEMORANDUM FOR UNDER SECRETARY OF DEFENSE FOR ACQUISITION
AND TECHNOLOGY
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL
MANAGEMENT)
ASSISTANT SECRETARY OF THE AIR FORCE
(FINANCIAL MANAGEMENT AND COMPTROLLER)
INSPECTOR GENERAL, DEPARTMENT OF THE ARMY

SUBJECT: Audit Report on the Acquisition and Utilization of
Modeling and Simulation Assets at Contractor
Facilities (Project No. 3AB-0009)

Introduction

We are providing this final report for your information and use. Expanding technological capability has enabled the application of computer-assisted analysis to more diverse fields of study in an increasingly sophisticated manner. This capability has resulted in a significant increase in the number and frequency of use of modeling and simulation. The primary objective of this audit was to determine whether DoD is funding redundant modeling and simulation projects for Defense contractors.

A "model" is a physical, mathematical, or other logical representation of a system, entity, phenomenon, or process. A "simulation" is a method for implementing a model over time, as well as a technique for testing, analyzing, or training in which real world and conceptual systems are reproduced by a model. "Simulation" is also defined as a model of a "real world" situation. The terms "model" and "simulation" are often used interchangeably. Design of a model starts with assumptions representing this "real world" situation as a mathematical model (equations), list of events, or a combination of equations and events.

Defense contractors use models and simulations to mathematically represent and test alternatives and concepts when designing a weapon system. Models and simulations are used for analytical purposes to dynamically represent a conceptual weapon system during research, development, and test and evaluation of weapon programs undertaken for DoD. This audit focused on Defense industry investments in modeling and simulation. These efforts are funded primarily by DoD through IR&D or general and administrative overhead items of expense on negotiated contracts.

The audit is a continuation of a requested audit. In October 1990, the Deputy Director, DoD Office of Acquisition Policy and Program Integration, requested that the Inspector General, DoD, study possible duplication and proliferation of modeling and simulation efforts in DoD. In response, we performed the "Audit of Duplication/Proliferation of Weapon Systems Modeling and Simulation Efforts within DoD," Report No. 93-060, March 1, 1993. The scope of this audit was limited to DoD-owned models and simulations and disclosed three issues requiring further management attention. DoD management concurred with the findings and recommendations and has initiated corrective action.

- o Model and simulation projects are being procured and developed within the DoD without adequate coordination and control resulting in costly duplication.

- o The vast majority of models and simulations currently used in DoD have not been verified, validated, or accredited. Weapon system requirement decisions, development decisions, engineering designs, operations, and test and evaluation results may be based on computer-generated data that is inaccurate or misleading.

- o The majority of models and simulations used in DoD lack adequate configuration management and documentation necessary to ensure ready access by authorized Defense personnel.

Objectives

This economy and efficiency audit was conducted in accordance with auditing standards issued by the Comptroller General of the United States as implemented by the Inspector General, DoD, and accordingly included such tests of internal controls as were deemed necessary. Our primary objective was to determine whether DoD is funding redundant modeling and simulation projects for Government contractors. Accordingly, our audit was to determine whether redundancy exists between models and simulations owned by DoD and those funded by DoD for Government contractors.

Scope of Audit

This audit was made from October 1992 through March 1993. We reviewed a judgmental sample of 20 contractor models and simulations. Each sample model was analyzed for possible redundancy and evidence of verification, validation, and accreditation. We also analyzed each sample model for adequacy of system documentation and configuration management plans and controls. The Quantitative Methods

Division of the IG, DoD, assisted in the analysis of sample models. Specific contractor locations visited are listed in Enclosure 1.

Internal Controls

We evaluated the effectiveness of internal controls established to prevent redundant or unnecessary investment in models and simulations at Government contractor facilities. The audit identified material internal control weaknesses as defined by Public Law 97-255, Office of Management and Budget Circular A-123, and DoD Directive 5010.38. However, the National Defense Authorization Acts for Fiscal Years 1991 and 1992 and for Fiscal Years 1992 and 1993 (Defense Authorization Acts) essentially negate the DoD's authority to exercise reasonable control over contractors' Independent Research and Development (IR&D) and Bid and Proposal (B&P) expenditures, the source of funding for most contractor-developed models and simulations. Hopefully, Government controls will be replaced by contractor controls. Because DoD has limited ability to address the problems we identified, we have terminated the project and are issuing this report of our observations without recommendations.

Prior Audit Coverage

In addition to the Inspector General, DoD, "Audit of Duplication/Proliferation of Weapon Systems Modeling and Simulation Efforts within DoD," Report No. 93-060, discussed previously, a recently issued General Accounting Office audit report addressed Independent Research and Development and Bid and Proposal expenditures.

General Accounting Office Report (GAO) No. GAO/NSIAD-B-207974 (OSD Case No. 9138), "Government Contracting: Proposed Regulation Would Limit DoD's Ability to Review IR&D/B&P Program," September 1992. The GAO reported that removing IR&D/B&P ceilings would increase costs to the Government between \$100 million and \$1 billion per year. GAO also reported that DoD administrative costs are not likely to be significantly reduced as intended by the proposed legislation. The GAO recommended that the Defense Contract Audit Agency continue preparing an annual financial report on IR&D/B&P expenditures.

Background

Over the years, contractors have developed computer models on an "ad hoc" basis to analyze specific contract-related problems, issues, and questions. This practice has resulted in contractor-owned models written in a multitude

of computer codes, with different designs and language implementation. When these models are compared with internal DoD-owned models, they are frequently oriented toward accomplishing similar, if not identical, types of analyses.

This audit focused on models and simulations developed wholly or in part with DoD funding at Defense contractors.

Audit Results

The same three issues identified in our Audit Report No. 93-060, "Duplication/Proliferation of Weapon Systems' Modeling and Simulation Efforts Within DoD," were identified as problems at Government contractor locations.

Redundant Models. Specifically, models and simulations developed by Government contractors were redundant to existing models and simulations within the DoD. We reviewed 20 contractor models and found 3 (15 percent) that were redundant to models and simulations already existing in DoD and available for use by the Defense contractors. DoD provided the funding for development by the contractors of these redundant models and simulations either through IR&D or general and administrative expense applied as overhead items to DoD contracts.

When doing our "Audit of Duplication/Proliferation of Weapon Systems Modeling and Simulation Efforts within DoD," Report No. 93-060, we compiled a list of models and simulations available to the Defense community from 30 individual compendiums and catalogues. Eliminating duplications on lists obtained from different sources, we identified more than 1,900 models and simulations available for direct or indirect support of weapon system development. The most comprehensive list of models that we identified was the "Catalog of Wargaming and Military Simulation Models," 12th Edition, published by the Joint Staff, Force Structure, Resource and Assessment Directorate (J-8). This list contains 522 distinct models and simulations.

During this audit, we continued to collect lists of models or simulations used by each contractor visited. A total of 171 distinct models were identified. Only 57 of these models (33 percent) had been previously identified in our existing compilation assembled from the numerous compendiums and catalogs referenced above. We believe this lack of visibility contributes to unnecessary proliferation of models and simulations because potential users have no reliable way to determine what models and simulations already exist that might satisfy their immediate requirement.

Verification, Validation, and Accreditation. The majority of models and simulations currently used by the contractors we reviewed had not been formally verified, validated, or accredited. Only 4 of the 20 (20 percent) contractor models evaluated during our audit had completed a formal verification, validation, and accreditation process. An incomplete or informal verification, validation, and accreditation had been completed on 10 of the 20 (50 percent) sample models but no attempt at verification, validation, or accreditation had been made on 6 of the 20 (30 percent) contractor models. As a result, DoD may be using the results of contractor-prepared models and simulations, where the reliability of the analyses has not been demonstrated, to help define weapon system requirements and conduct developmental tests and evaluations.

Configuration Management and Documentation. Adequate configuration management and documentation was lacking for models and simulations developed by Government contractors we reviewed. Of 20 applications reviewed, only one model (5 percent) had adequate configuration management control procedures in place. Ten of the models reviewed (50 percent) had some formal or informal configuration management, but 9 models reviewed had no essential elements in place for effective configuration management.

We also reviewed all available documentation for each model and simulation in our sample. We had previously determined that, as a minimum, the documentation should comprise a User's Manual, Analyst's Manual(s), and Programmer's Manual(s). Accordingly, of the 20 models and simulations surveyed, only 7 models (35 percent) had adequate documentation. For the remaining 13 models, the documentation was either inadequate or did not exist.

Overall, our findings indicate a substantial lack of effective management control over the development and use of models and simulations by the Government contractor community. The Defense Authorization Acts essentially preclude the Secretary of Defense and the Military Departments from exercising the authority to implement management and internal controls over the amount and use of IR&D and B&P expenditures by Defense contractors. The DoD will have to rely greatly on contractors' business sense and responsibility.

Independent Research and Development and Bid and Proposal Costs

Contractor IR&D is a technical effort that is not sponsored by, or required in performance of, a contract or grant and which consists of projects within three areas:

- o Basic and applied research,
- o Development, and
- o Systems and other concept formulation studies.

B&P costs are the expenses incurred in preparing, submitting, and supporting bids and proposals on potential Government and non-Government contracts. Such IR&D and B&P costs are allowed on covered contracts to the extent that the costs are allocable, reasonable, and not otherwise unallowable by law or the Federal Acquisition Regulations (FAR).

Before 1990, Section 203 of Public Law 91-441 and FAR 31.205-18(c) required any company receiving IR&D and B&P payments in excess of \$5.4 million from DoD in a fiscal year to negotiate an advance agreement with the Government. The purpose of this advance agreement was to establish a ceiling for allowability of IR&D and B&P costs for the following fiscal year.

Under United States Code, title 10, the Secretary of Defense was required to prescribe regulations governing the payment of IR&D and B&P expenses incurred by contractors. Accordingly, management and internal controls in place before 1990 generally consisted of Government technical experts performing an on-site technical evaluation of a contractor's IR&D program; the contractor and the Government negotiating a cost ceiling on IR&D and B&P based, in part, on the results of the technical review; and contractors recovering negotiated IR&D and B&P costs in overhead.

The National Defense Authorization Act for Fiscal Years 1991 and 1992 repealed Section 203, Public Law 91-441, and increased the threshold requirement for negotiating an advance agreement with the Government from \$5.4 million to \$7 million. However, a limitation on the amount that may be paid annually for FYs 1993 through 1995 to major contractors was imposed.

The National Defense Authorization Act for Fiscal Years 1992 and 1993 increased the threshold to \$10 million; included the use of a specific formula by which the maximum reimbursable amount may be determined; and changed the allowability ceiling computations for contractor fiscal years beginning after September 30, 1992.

The National Defense Authorization Act for Fiscal Years 1991 and 1992 broadened the definition of the types of research and development projects that a company could consider for recovery under IR&D from those projects that have a potential relationship to military function or

operation to those projects being of "potential interest" to the Department of Defense. These definitions were further broadened for Fiscal Years 1992 and 1993. The new Defense Federal Acquisition Regulations Supplement (DFARS) provisions implementing changes from the Defense Authorization Acts are far less stringent than former requirements.

Specifically, DFARS 231.205-18(c)(2) now provides for seven broad categories of IR&D and B&P projects that are of potential interest to DoD. There are few, if any, IR&D and B&P projects that a Defense contractor would propose that would fail to satisfy at least one of the following categories of projects:

- o Enable superior performance of future United States weapon systems and components;
- o Reduce acquisition costs and life-cycle costs of military systems;
- o Strengthen the U.S. Defense industrial and technology base;
- o Enhance the U.S. industrial competitiveness;
- o Promote the development of technologies identified in the Defense-critical technologies plan that is submitted to Congress annually by the Secretaries of Defense and Energy;
- o Increase the development of technologies useful for both the private commercial sector and the public sector; or
- o Develop efficient and effective technologies for achieving environmental benefits.

In summary, the changes legislated by the Defense Authorization Acts have served to expand the types of research and development projects that a Defense contractor could consider for recovery under IR&D, from those projects having a potential relationship to military function or operation to those projects being of "potential interest" to the Department of Defense. The Defense Authorization Acts have also eliminated the requirement for contractors to submit brochures describing IR&D and B&P projects for evaluation and "grading" by a tri-Service IR&D technical committee and increased the cost threshold requirement for an advance agreement from \$5.4 million to \$10 million. In addition, these changes have modified the allowability ceiling computations for contractor fiscal years beginning

after September 30, 1992, and allowed for the "degree of reasonableness" to prevail in contract negotiations for recovery of IR&D and B&P costs.

The changes legislated by the Defense Authorization Acts have also precluded the Secretary of Defense and Military Departments from having authority to implement management and internal controls over the amount and use of IR&D and B&P expenditures by Defense contractors. Further proliferation of redundant, unvalidated models and simulations could be an unforeseen by-product of the new Government policy.

Conclusions

Because the Secretary of Defense and the Military Departments are not authorized to implement management and internal controls over the amount and use of IR&D and B&P expenditures by contractors and the impact of the recent IR&D and B&P policy changes is not yet assessable, it would be inappropriate to present recommendations for any findings developed as a result of this audit. Pending further evaluation of the situation concerning contractor-owned models and simulations in the future, we believe the best course is for the DoD to put its own house in order by addressing the problems identified in our March 1993 report regarding DoD-owned models and simulations.

Since this report contains no recommendations, written comments were not required and none were received. This report does not claim monetary benefits.

The courtesies extended to the audit staff are appreciated. If you have any questions on this audit, please contact Mr. Raymond A. Spencer at (703) 614-3995 (DSN 224-3995) or Mr. David F. Vincent at (703) 693-0355 (DSN 223-0355).

Activities visited or contacted are listed in Enclosure 1. The planned distribution of this report is listed in Enclosure 2.



Robert J. Lieberman
Assistant Inspector General
for Auditing

Enclosures

ACTIVITIES VISITED OR CONTACTED

Office of the Secretary of Defense

Office of the Under Secretary of Defense for Acquisition and
Technology, Washington, DC
Office of the Director of Defense Research and
Engineering, Washington, DC

Department of the Army

U.S. Army Model and Simulation Management Office,
Arlington, VA
U.S. Army Material Systems Analysis Activity, Aberdeen
Proving Ground, MD

Department of the Navy

Naval Air Systems Command, Arlington, VA

Department of the Air Force

Air Force Studies and Analysis Agency, Washington, DC
1100th Contracting Squadron, Andrews Air Force Base, MD
Wright Laboratory, Wright-Patterson Air Force Base, OH

Defense Agencies

Defense Logistics Agency, Alexandria, VA
Defense Nuclear Agency, Alexandria, VA
Defense Contract Management Area Office - Baltimore,
Towson, MD

Professional Associations

Association of Old Crows, Alexandria, VA

Defense Contractors

Avtec Systems, Inc., Fairfax, VA
BDM Corporation, McLean, VA
CACI, Arlington, VA
Center for Naval Analysis, Alexandria, VA
Hughes Aircraft Company, Los Angeles, CA
McDonnell Douglas Corporation, Huntington Beach, CA
Rockwell International, Inc., El Segundo, CA
Sparta, Inc., Laguna Hills, CA
Summitt Research Corporation, Gaithersburg, MD
The Rand Corporation, Santa Monica, CA
TRW Space & Defense Sector, Redondo Beach, CA
TRW Systems Integration Group, Fairfax, VA
Westinghouse Electric Corporation, Baltimore, MD

REPORT DISTRIBUTION

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition and Technology
Director, Defense Research and Engineering

Department of the Army

Secretary of the Army
Inspector General, Department of the Army

Department of the Navy

Secretary of the Navy
Commandant of the Marine Corps
Assistant Secretary of the Navy (Financial Management)
Office of the Chief of Naval Operations
Naval Air Systems Command

Department of the Air Force

Secretary of the Air Force
Assistant Secretary of the Air Force (Financial Management
and Comptroller)
Headquarters, U.S. Air Force
Air Force Studies and Analysis Agency
Wright Laboratories

Other DoD Activities

Director, Defense Information Systems Agency
Director, Defense Logistics Agency
Director, Defense Nuclear Agency

REPORT DISTRIBUTION
(continued)

Non-Defense Activities

Office of Management and Budget
U.S. General Accounting Office, National Security and
International Affairs Division, Technical Information
Center

Chairman and Ranking Minority Member of the following
Congressional Committees and Subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on
Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Government Operations
House Subcommittee on Legislation and National Security,
Committee on Government Operations

Council of Defense and Space Industries Association

AUDIT TEAM MEMBERS

| | |
|--------------------|---|
| Donald E. Reed | Director, Acquisition Management Directorate |
| Raymond A. Spencer | Program Director |
| David F. Vincent | Project Manager |
| James R. Casey | Team Leader |
| Thomas N. Wright | Team Leader |
| Richard L. Collier | Auditor |
| Calvin L. Melvin | Auditor |
| Francis M. Ponti | Program Director, Quantitative Methods Division |
| Henry D. Barton | Operations Research Analyst, Quantitative Methods Division |
| Dharam V. Jain | Operations Research Analyst, Quantitative Methods Division |