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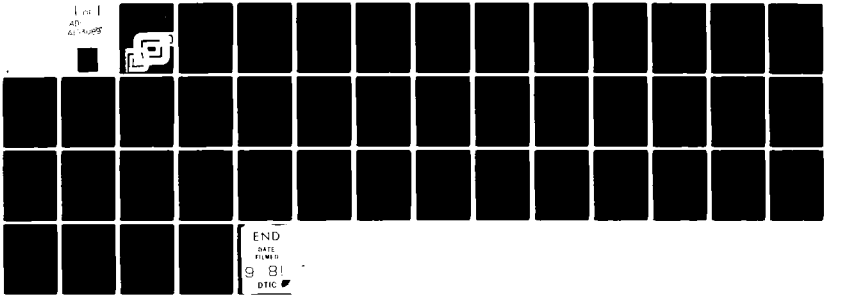

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INTERIM REPORT PR 81-20-330

Research on Management Concepts for Large-Scale Simulations of Naval Warfare

Thomas R. Rhees
Robert N. Kraft
Kenneth P. Kuskey

DECISIONS and DESIGNS, INC.

Prepared for
Office of Naval Research
Arlington, Virginia 22217

INTERIM REPORT PR 81-20-330

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by

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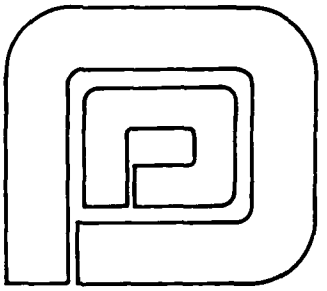

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New computer simulation technology makes possible widespread and effective use of naval warfare simulations. These are very useful and economical as a way to enhance naval warfare training and to develop and evaluate tactics.

This report addresses some possible ways for the Navy to manage development and acquisition of large-scale naval warfare simulations. Roles and responsibilities need to be clarified. Present management systems work adequately for acquisition of computer hardware management information systems and training devices, but

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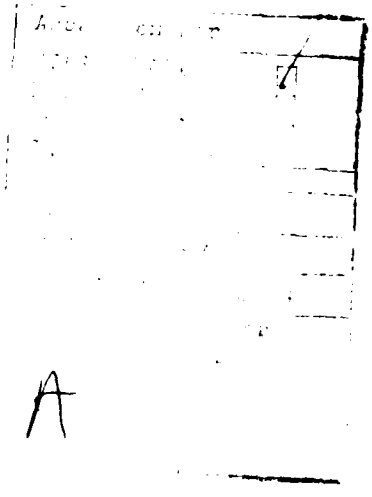
they have not been systematically applied to war games.

The work that has been done has identified a range of management options, from the Planning, Programming and Budgeting System to field activity directives, that can be brought to bear on managing warfare simulations. The options were developed from an examination of what is to be managed, who should do it, and how it is to be done. To evaluate the options, eight principal criteria were derived for assessing their benefit to Navy program management. Also, an outline management plan has been developed.

The next step is to apply the evaluation criteria to assess the management options, using a group of knowledgeable managers and specialists. This work will be the basis for a management plan which can be recommended for implementation.



SUMMARY

New computer simulation technology makes possible widespread and effective use of naval warfare simulations. These are very useful and economical as a way to enhance naval warfare training, and to develop and evaluate tactics.

This report addresses some possible ways for the Navy to manage development and acquisition of large-scale naval warfare simulations. Roles and responsibilities need to be clarified. Present management systems work adequately for acquisition of computer hardware, management information systems and training devices, but have not been systematically applied to war games.

The work that has been done has identified a range of management options, from the Planning, Programming and Budgeting System to field activity directives, that can be brought to bear on managing warfare simulations. The options were developed from an examination of what is to be managed, who should do it, and how it is to be done. To evaluate the options, eight principal criteria were derived for assessing their benefit to Navy program management. Also, an outline management plan has been developed.

The next step is to apply the evaluation criteria to assess the management options, using a group of knowledgeable managers and specialists. This work will be the basis for a management plan which can be recommended for implementation.

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RESEARCH ON MANAGEMENT CONCEPTS FOR LARGE-SCALE SIMULATIONS OF NAVAL WARFARE

1.0 BACKGROUND

Current technology in the field of computer-aided simulation affords the Navy the opportunity to use gaming and simulation to achieve high levels of readiness and tactical capability in naval warfare. The ability to simulate an engagement dynamically, particularly one involving friendly and opposing forces, has great benefit in several naval warfare applications. Gaming and simulation is a very economical way to accomplish a significant amount of tactical training without the necessity for underway exercises. Also, it is an economical and time-saving tool for planning/assessing fleet exercises and for developing or evaluating tactics.

The Navy has long recognized the benefits of simulation in naval warfare; however, only recently have advances in computer simulation provided highly attractive capabilities at greatly reduced total cost with the promise of wider availability. Large-scale simulations of naval warfare can be expected to become much more in demand. Requirements are being actively developed which must be programmed and funded.

The Department of the Navy must respond to the opportunity and demand. In the recent reorganization of the Office of the Chief of Naval Operations (CNO), the Director, Naval Warfare (OP-095), was given responsibilities for "assessment, integration and coordination of tactical warfare programs at the battle and amphibious force level for general tactical development and training, and for special management of selected programs."

He acts as program and resource sponsor for battle and amphibious group tactical training and for all Navy tactical development and evaluation. He coordinates the development of Navy general purpose forces war games for tactical analysis and training. The Director, Tactical Readiness Division (OP-953), is now responsible for coordinating tactical training at the battle group and amphibious group levels and acts as resource sponsor. He is the resource sponsor for interactive gaming capabilities which support this tactical training; he coordinates the development of Navy general purpose force war games for tactical analysis and training and acts as point of contact in OPNAV for all tactical wargaming.

One action taken by the Director, Tactical Readiness Division, has been to develop a plan for ensuring that his responsibilities for large-scale simulations of naval warfare associated with tactical training at the battle group and amphibious level are carried out effectively. This report discusses several tasks undertaken in the early stages of the development of such a management plan.

2.0 DEVELOPMENT APPROACH

The research program for developing a management plan began with a review of existing Department of Defense (DoD) and Department of the Navy directives and instructions to determine how automated systems acquisition and support programs are managed. At the same time, work was undertaken to identify and classify the various kinds of games and simulations, to select candidates for inclusion or exclusion in the plan, and to identify potential management organizations and the functions they might perform. Also, a list of definitions was assembled to provide a uniform understanding of the terminology used in the gaming and simulation area. This work was accomplished by Decisions and Designs, Inc. (DDI) in conjunction with Navy representatives.

It was realized in the beginning that computers are widely used throughout the Navy; that interfaces are bound to exist; that management concepts, processes, and procedures used in one area may have applicability in the gaming and simulation area of concern; and that the corporate knowledge of the foregoing matters which exists in a representative group of Navy specialists is the best source of information to assist in developing a plan for OP-095. Assistance in the initial development steps was provided by representatives of OP-094, OP-095, OP-96, the Chief of Naval Material, the Chief of Naval Research, the Naval Data Automation Command, Naval Education and Training Command, and Naval Training Equipment Center. An annotated bibliography (Appendix A hereto), an interim categorization of systems/models, a set of definitions (Appendix B), possible options for a management strategy, and an outline management plan were the work products.

The next step in the development process involves the interaction of selected, representative Navy specialists with DDI decision analysts using decision-analytic methods to review the available work products and to refine and then assess the suitability of management alternatives. It is planned to accomplish this in an intensive two-to-three-day working session at DDI. The final step is to consider the tentative plan for managing large-scale simulations of naval warfare and selected tactical simulations, if appropriate, in a second, shorter, session. In this session, DDI will assist higher level Navy officials in developing a final proposed plan, one which can be recommended for implementation.

3.0 INTERIM RESULTS

3.1 Review of Current Documentation

Searches were performed on the National Technical Information System (NTIS) on-line data base for relevant citations, using the following criteria words: war games/gaming, computerized, users manual, or users guide. Sixty-three citations were developed and received. Subsequently, NTIS was searched further, for DoD Studies Analysis and Gaming Agency (SAGA) titles. As a result, a copy of the 1980 edition of SAGA's Catalog of Wargaming and Military Simulation Models was located and examined. The catalog contained some salient characteristics of the Navy's wargaming and simulations; however, the listing appears to be far from complete.

The current DoD and current Navy Directives System Quarterly Indexes were searched for relevant directives and instructions, and copies were obtained of those covering policy, procedures, and the mission and functions of organizations with likely activity in the computer and simulation areas. The content of these directives was reviewed, and an annotated bibliography (Appendix A hereto) was produced. The review showed that there exists some overlap in responsibilities assigned OP-095 and OP-96. The review also showed that adequate management structures are in effect for ADP-supported Management Information Systems (MIS) and Automated Information Systems (AIS), for weapon system embedded computers and for weapon system procedure-type trainers. Except for two directives, one covering the war gaming capabilities at the Naval War College and the OPNAV Organization Manual, the review showed a void existing in coverage of large-scale simulation of naval warfare.

3.2 Classification of Systems

The field of simulation is broad and includes several types of models which can be implemented mechanically, or they can be computerized or computer-assisted. Simulations can also be classified by their purpose or purposes. They also appear to interface with other automated systems, accounting systems on one hand and weapon systems on the other. A preliminary classification structure with examples is shown in Figure 3-1.

There are two readily apparent reasons for classifying: first, to delimit those items to be covered in the management plan under development; and second, to match properly the degree to which the models/facilities are managed with such things as their importance, cost, size, use, computer source, or other possible criteria.

With respect to what systems should be covered in the management plan, computerized MIS and AIS are clearly neither war games nor simulations and are not within the OP-095 area of management responsibility. However, MIS and AIS acquisition and support matters are handled in accordance with well-defined DoD and Navy rules which must be observed in the event that off-the-shelf commercial computers are used. The same rules may apply to some war gaming and simulation situations. The embedded computer capabilities in weapon systems are also outside the OP-095 area of responsibility and are handled in accordance with yet another set of well-defined DoD and Navy rules. Here again, awareness of the policies, roles/responsibilities, and processes which are used is necessary in the development of a plan for OP-095. Probably the strongest similarities exist with war games and the training equipment area. Management is well organized for this latter category of systems.

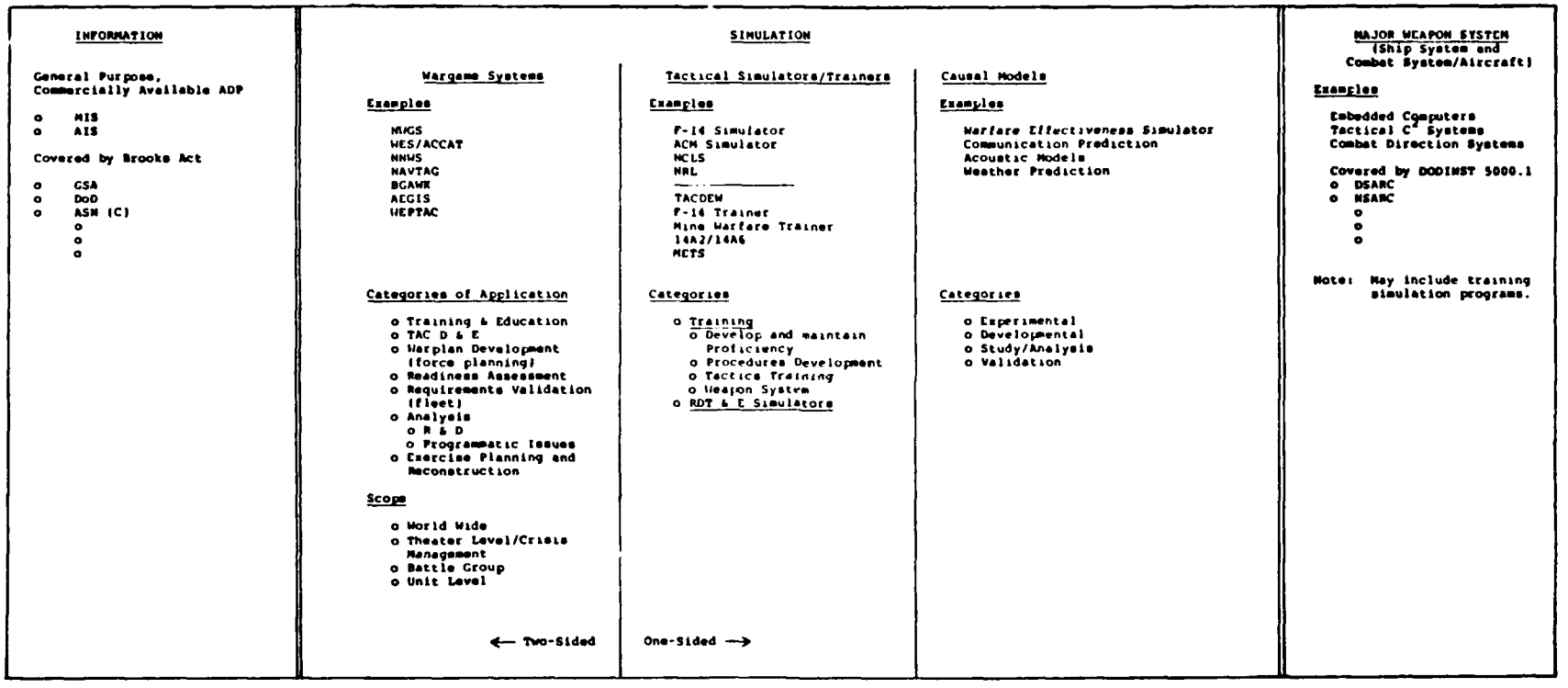

Figure 3-1

AUTOMATED SYSTEMS CLASSIFICATION

The system classifications discussed in the foregoing paragraph not only narrow the scope and coverage issues, but also they illustrate some precedents for management.

3.3 Management Strategy Options

The management strategy can be considered in three general areas: (1) elements to be managed; (2) roles and responsibilities to be assigned; and (3) management processes to be used. Several options were tentatively identified for each of these areas. A selection from among the following options in each area would define the management strategy.

3.3.1 Elements to be managed -

- Option 1 - Status quo; i.e., Navy general purpose forces war games for tactical analysis and training at the battle group and amphibious group levels.

- Option 2 - Option 1, plus interactive gaming capabilities used primarily for tactical development and evaluation.

- Option 3 - Option 2, plus all Navy tactical wargaming capabilities for analysis and training down to the individual platform level.

3.3.2 Roles and responsibilities to be assigned -

- Option 1 - Status quo; i.e., no change in existing roles and responsibilities throughout the Department of the Navy.

- o Option 2 - Clarify roles and responsibilities in OPNAV.

- o Option 3 - Option 2, plus clarify the roles and responsibilities of the Chief of Naval Material, the Chief of Naval Education and Training, and, on a selective basis, their subordinate Systems Commands and/or Centers and Activities.

- o Option 4 - Option 3, plus establish a new Center or Activity with a selected role and responsibilities.

- o Option 5 - In conjunction with any of the foregoing options, establish a joint Fleet/Navy Department board or committee to foster wargaming, expedite capabilities, and advise the CNO.

3.3.3 Management processes to be used -

- o Option 1 - Status quo; i.e., continue to use the current methodology, requirements, procedures, and interactions of the DoD PPBS and related Navy Programming system, and current acquisition and support systems. Acquisition and support would be handled in accordance with either weapon system rules or commercial computer rules, as appropriate.

- o Option 2 - Use the current PPBS and related Navy programming system with the full DoD weapon system acquisition and support system.

- o Option 3 - Use the current PPBS and related Navy programming system with elements of the DoD weapon system acquisition and support system tailored to fit the program; e.g., major programs would use the full process, and lesser programs would use streamlined processes, based upon specific, well-defined program thresholds. A waiver of the commercial computer rules is required in programs involving commercial computer procurement.

- o Option 4 - Option 3, plus use commercial rules when commercial computer procurement is involved.

3.4 Criteria for Management Strategy

The basic criterion for selection of the management strategy is benefit to the Navy. Subcriteria of benefit should include but are not limited to the following:

- o promotes the highest quality tactical training and tactical development and evaluation;

- o affords high visibility to requirements and program objectives;

- o encourages technical modernization and operational realism;

- o ensures intensive management and control;

- o permits timely processing of routine program actions;

- provides means for quick reaction capability;
- assures life-cycle cost realism; and
- establishes necessary interfaces for program compatibility and integration.

3.5 Management Plan Outline

A preliminary outline of a plan for managing war games and interactive gaming capabilties in the Department of the Navy is shown in Figure 3-2. This outline is intended as a guide, showing the basic matters which should be covered in a high-level management plan. When the discussions between Navy specialists and management representatives have been completed and the management strategy is developed, then it should be possible to fill out this structure using the building blocks derived in the development process.

MANAGEMENT PLAN

Objectives of Plan
- Policies and Procedures
- Roles and Responsibilities
- Goals
- Action

Background and Situation

Applicability
- Organizational
- Functional
- Material

Definitions

Policies and Procedures
- Programming and Budgeting
- Acquisition and Support

Responsibilities

Implementing Actions

Implementation Schedule

References

Draft Directives

Figure 3-2
MANAGEMENT PLAN OUTLINE

4.0 CONCLUSIONS

The review of DoD and Navy directives has shown the need for formal documentation of management matters for large-scale simulations of naval warfare. Also, the review has confirmed the existence of viable concepts, policies, and processes. There is a need to clarify the roles and responsibilities in OPNAV and to express the responsibilities of technical, support, and operating commands and field activities that should participate in the management of this area.

Sufficient groundwork has been performed to permit an organized attack on the problem of developing a management plan. It is concluded that the next quantum jump in developmental progress requires broader participation in addressing the many facets of this complex problem.

5.0 RECOMMENDATION

It is recommended that the working sessions in which Navy specialists and managers in fields associated with computer-aided system acquisition, support, and use interact with DDI analysts and proceed as planned, at an early date.

APPENDIX A

BIBLIOGRAPHY OF DIRECTIVES

BIBLIOGRAPHY OF DIRECTIVES
(Annotated for Wargaming and Simulation Interest)

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

DODD 4105.55 19 May 1972 CH-1 13 Mar 1973 (3 changes pub.)
ASD(C)
Selection and acquisition of Automatic Data Processing Resources

Covers general purpose, commercially available ADP components and the equipment systems created from them.

Excludes computer equipment which is integral to a combat weapon system; i.e., essential in real time to combat performance.

Contains policies for acquisition planning, development of specifications, source selection, and procurement.

DODD 5000.1 13 Jul 1971
DDR&E
Acquisition of Major Defense Systems

Covers major programs--RDT&E cost > $50M or Production > $200M. Management principles are applicable to all programs.

Requires management by a single individual (program manager) with sufficient authority to accomplish recognized program objectives. Establishes responsibilities of DoD components and OSD. Establishes policies for program initiation, full-scale development, and production/deployment. Also establishes policies for system requirements, cost parameters, logistic support, schedules and funding, technical uncertainty, test and evaluation, contracting, source selection criteria, and management information/program control requirements.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

DODD 5000.29 26 Apr 1976 w/CH-1
ASD(I&L)
Management of Computer Resources in Major Defense Systems

Covers computer resources of major defense systems.

Excludes general purpose, commercially available automatic data processing assets; however, the terms, tools, and techniques used in the general purpose area will be used when feasible.

Establishes policies for life-cycle management of computers used in Defense systems to ensure adequate planning from concept to operations. Fits computers into the normal Defense system acquisition process. Established a Management Steering Committee for Embedded Computer Resources.

DODI 5000.31 24 Nov 1976
ASD(I&L)/DDR&E/DTACCS/ASD(C)
Interim List of DoD Approved High Order Programming Languages (HOL)

Covers computer software in programs of defense systems acquisition.

Excludes commercially available software for general purpose, commercial ADP equipment and certain user-oriented languages (ATE, simulation, etc.).

Establishes policies designed to reduce proliferation and to ensure management of HOL throughout period of use in defense systems. Lists currently approved HOL (CMS-2, SPL-1, TACPOL, JOVIAL, COBOL, FORTRAN).

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

DODD 5100.40 19 Aug 1975
ASD(C)
Responsibility for the Administration of the DoD Automatic Data Processing Program

Covers general purpose, commercially available ADP components and the equipment systems created from them.

Excludes computer equipment which is integral to a combat weapon system; i.e., essential in real time to combat performance.

Assigns responsibility for the ADP Program to Asst. Sec. Def. (Comptroller) for overall policy and coordination; assigns responsibility to DDR&E, Asst. Secys. of Def. and Dir. Telecomm. & C^2 Sys. in their functional areas; and assigns responsibility to DoD Component Heads for management of development, procurement, operation, and support.

DODD 7920.1 17 Oct 1978
ASD(C), ASD(MRA&L), ASD(C^3I)
Life-Cycle Management of Automated Information Systems (AIS)

Covers AIS, defined as a collection of functional user and ADP personnel, procedures, and equipment (including ADPE) which is designed, built, operated, and maintained to collect, record, process, store, retrieve, and display information. A major AIS--one which costs > $100M through installation at all sites, or costs > $25M in any one year, or is designated by OSD--is reviewed and approved at OSD level; others as designed by DoD Component Head.

Establishes life-cycle phases: mission analysis/project initiation; concept development; definition/design; system development; and deployment/operation. Describes MENS.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

DODI 7920.2 20 Oct 1978
ASD(C), ASD(MRA&L), ASD(C^3I)
Major Automated Information Systems Approval Process

Covers major AIS which are above the thresholds defined in DODD 7920.1 (>$100M for all sites or >$25M any year) but below the thresholds in DODD 5000.1 (R&D >$50M or Production >$200M).

Establishes a System Decision Paper (SDP) process, describes the SDP, and defines AIS milestones and tasks. Requires OSD review and approval of "less than major systems" under the 5000.1 criteria.

DODD 7950.1 29 Sep 1980
ASD(C)
Automated Data Processing Resources Management

Covers general purpose, commercially available components/systems (DODD 5100.40).

Excludes computer equipment in combat weapon systems.

Establishes policies for the DoD ADP Resources Management Systems (ARMS). Establishes guidelines for when ADPE may be considered obsolescent. Establishes responsibilities for ASD(C), USDR&E, Director Def. Logistics Agency, Dir. Natl. Security Agency, and DoD Component Heads. Establishes policies for sharing and reutilization of ADP resources.

SECNAVINST 5000.1 13 Mar 1972
SO-1
System Acquisition in the Department of the Navy

Covers all DON system acquisitions.

CNO/CMC responsible for identifying operational needs, determining characteristics, and defining requirements to meet their needs.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

SECNAVINST 5230.6
NAVDAC-10
Automatic data processing approval authority and acquisition/ development thresholds; delegation of

Covers automated information systems (AIS) and general purpose ADPE.

Establishes policies and procedures for acquisition, services, and development. Specifies approval authorities and establishes approval thresholds (Level 1 - ASN(FM); 2 - COMNAVDAC, for CNO/ CMC/DIRDONADPM; 3 and 4 - etc.).

SECNAVINST 5200.32 11 Jun 1979
OP-942E
Management of Embedded Computer Resources in Department of Navy

Covers weapons, communications, command and control, and intelligence systems with embedded computers.

Established more intensive centralized management during acquisition and operation. Implements DODD 5000.29 and DODI 5000.31.

SECNAVINST 5231.1A 20 Nov 1979
NAVDAC-10
Life-cycle management of automated information systems within the Department of the Navy

Covers automated information systems (AIS) and general purpose, commercial ADPE.

Establishes life-cycle management process, organizational responsibilities and actions to implement them, and lists DON functional sponsors.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

SECNAVINST 5236.1B 15 Oct 1980
NAVDAC-10
Contracting for automatic data processing (ADP) resources

Covers automated information systems (AIS), general purpose commercial ADPE and computational services.

Assigns responsibility and establishes policies supplementing the Def. Acq. Reqs. (DAR), Navy Contracting Directives (NCD), Fed. Procurement Reqs (FPR), and Fed. Property Mgmt. Reqs. (FPMR).

SECNAVINST 5236.2A 7 Jul 1980
NAVDAC-10
Automatic data processing services contracts

Covers all services required in support of an ADP or ADP-related requirement and obtained on a contractual basis.

Establishes DON policies: reliance on commercial services, exempts contracts $<$\$100K from review and approval procedures of SECNAVINST 5230.6. Establishes procedures for contracting of services under the $<$\$100K exemption.

OPNAVINST 1541.2E 18 June 1979
OP-604
Use of War Gaming Facilities at the Naval War College

Covers procedures to be used in requesting support and attendance at scheduled war game exercises for the fleet.

Comment: Have copy of OPNAVINST 1541.2D only.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

OPNAVINST 3000.7C 1 Apr 1974
OP-96
Navy War Games Program

Covers war gaming projects officially sponsored, controlled, or coordinated by the Chief of Naval Operations.

CNO, through Director, Systems Analysis Division, will supervise and coordinate all Navy-sponsored war gaming activities except those at Naval War College. In administering the program OP-96 will: (1) direct Strategic Analysis Support Group and technical support groups at APL/JHV and NWL Dahlgren; (2) provide for development, review, and continuous refinement of naval combat operations war gaming models; (3) establish and maintain library of operational data and performance estimates for use in gaming SIOP and RISOP problems;* (4) control the assignment of problems to appropriate war gaming facilities; (5) provide results of specific problem games to originating/interested activities; (6) distribute game reports and periodic summaries; and (7) provide computer war game support to Director, Navy Program Planning. The President, Naval War College shall coordinate use of NEWS and WARS. Problems shall be submitted to OP-96 or to Naval War College as appropriate. The Operations Evaluation Group shall assist in collection of input data and review of war game models as requested by Director, Systems Analysis Division (OP-96).

Comment: *Conflicts with OP-96 mission statement (see OPNAVINST 5430.48A).

OPNAVINST 5430.48A CH-5 11 Nov 1980
OP-09
Office of the Chief of Naval Operations (OPNAV) Organization Manual

Promulgates the Director, Naval Warfare (OP-095) charter and organization structure, and required changes in OPNAV.

OP-095 Mission: To exercise centralized coordination of planning and requirements for fleet readiness, modernization, and force

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

OPNAVINST 5430.48A (Continued)

levels associated with the conduct of tactical warfare by general purpose naval forces. Included are responsibilities for assessment, integration, and coordination of tactical warfare programs at the battle and amphibious force level for general tactical development and training, and for special management of selected programs.

OP-095 Functions: "...Acts as central point of contact for tactical development, training, and demonstration...

Acts as program and resource sponsor for battle and amphibious group tactical training, and for all Navy tactical development and evaluation, and tactical documentation.

Coordinates tactical training programs at the battle group and amphibious group level.

Coordinates resource allocations for tactical development and evaluation.

Coordinates the development of Navy general purposes forces war games for tactical analysis and training..."

OP-953 Tactical Readiness Division: Coordinates tactical training at battle group and amphibious group levels:

Acts as resource sponsor for above tactical training including interactive gaming capabilities in support of such training.

Acts as point of contact in OPNAV for all tactical wargaming.

Coordinates the development of Navy general purpose force war games for tactical analysis and training.

Coordinates standardization of all data collection equipment and methods, and methods of analysis so that diverse exercises and operations can be compared and performance trends established.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

OPNAVINST 5430.48A (Continued)

OP-96 Mission: To evaluate program alternatives; provide analytical and technical support for general purpose forces war gaming (except politico-military/SIOP/RISOP); manage the CNO studies and analysis program, coordinate with other study efforts and evaluate study results; implement studies through CNA; provide cost analysis capability; and support CNO extended planning objectives.

OP-96 Functions: Coordinates with activities having cognizance over development of tactics, doctrine and procedures; maintains cognizance over development of computer war game models to prevent unnecessary duplication and make efficient use of resources (OP-961/962).

Develop and maintain current capability estimates and unit effectiveness against current threats; and promulgates these estimates for use as inputs in war gaming, studies, and analyses (OP-961/962).

Maintains liaison for mutual assistance in technical and scientific fields and in exchange of factual data for use in war gaming, studies, and analysis (OP-961/966).

Prepares annual budget estimates for CNA study program projects, the CNO Operational, Strategic and Tactical Effectiveness Analyses Project and the CNO Program Analysis and Evaluation Project (OP-966).

NAVMATINST 5450.27B 27 May 1980
MAT-08L1
CNM-Commanded Research and Development Centers; missions and functions of

Promulgates the missions and functions of eight CNM-commanded R&D Centers (DWTNSRDC, NADC, NCSC, NOSC, NPRDC, NSWC, NUSC, and NWC). Also includes for information the missions and functions of NRL, NORDA, and CEL.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

NAVMATINST 5450.27B (Continued)

Roles of all R&D Centers involve all phases of the acquisition and maintenance process from concept formulation to in-service Fleet support. To accomplish their missions and functions, R&D Centers will carry out programs of warfare analysis comprising intelligence, operations research, systems analysis, participation in fleet exercises and operations, and the evaluation of Fleet exercise results and operational reports, to provide an understanding of the operational and support problems and opportunities which face the Fleet and FMF.

Systems Commanders, Project Managers, and other sponsors within the NMC will assign work to Centers, designate a lead activity early in the early formative stages, assign responsibilities to the lead activity, and provide five-year planning by product area and funding category.

The ADCNM(LM) is assigned to carry out CNM responsibilities in R&D Center management.

CNM Product Areas are listed and defined and are identified for each Center in their mission and functions statement.

Missions and Functions:

DWTNSRDC - Principal Center for Naval vehicles and logistics.

NADC - Principal Center for naval aircraft systems less aircraft-launched weapon systems.

NCSC - Principal Center for mine, torpedo, and sonar countermeasures, diving and salvage, coastal and inshore defense, swimmer operations, and amphibious operations.

NOSC - Principal Center for command control, communications, ocean surveillance, surface and air launched undersea weapon systems, submarine arctic warfare and supporting technologies. Product line includes "operational training of Naval Facility Personnel."

Activity, Directive Type and Number Date of Issue
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NAVMATINST 5450.27B (Continued)

NPRDC - Principal Center for human resources RDT&E in the areas of manpower, personnel, education, and training. Product line includes "Tactical Training" and "Team and Unit Training."

NSWC - Principal Center for surface ship weapons systems, ordnance mines, and strategic systems support.

NUSC - Principal Center for submarine warfare and submarine weapon systems.

NWC - Principal Center for air warfare systems (except anti-submarine warfare systems) and missile weapon systems. Product line includes major range development and operation for "Encounter Simulation Facility."

Comment: All R&D Center functions include "System concept synthesis and analysis." Computer modeling of systems is extensively used. NADC organization has a Systems Simulation Division. NWC organization has a Simulation Services Branch. Their work can lead to capabilities in gaming; for example, NWC's Weapons and Tactics Analysis Center (WEPTAC), a computer-based facility which can evaluate weapon systems and tactics as they are used in realistic interactive encounters between opposing forces (from one-to-one encounters to force-level campaigns).

NAVMATINST 5450.28/CNTINST 5450.8 14 Dec 1972
MAT-0411/Code 301
Additional duty functions of the C.O. NAVTRAEQUIPCEN

Responsibilities Include:

Acting as "other support activity" for weapon system-related training devices when assigned by CNM.

Acting as Principal Development Activity for general purpose (non-weapon system-related) training devices when assigned by CNM.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

NAVMATINST 5450.28/CNTINST 5450.8 (Continued)

Procurement of training devices for CNM, SYSCOMs, and PMs.

Inventory management and logistic support of Cognizance Symbol "20" material as assigned.

NAVSEAINST 5450.41A 29 August 1978
MAT-06L4
Fleet Combat Direction Systems Support Activity, Dam Neck and San Diego; mission and functions of

Mission of FCDSSAs is to plan, design, construct, test, and deliver Combat Direction System (CDS) computer programs for the Operating Forces, including training programs, as assigned; to correct, update, modify, enhance, and distribute evolving operational programs; to provide ancillary support of computer program development and maintenance; and to provide technical assistance and computer programs to the Shore Establishment, as directed.

Functions (Development and Maintenance):

Provide computer programs and documentation for CDS, including simulation programs for on-board training in ships and aircraft of classes/types, as directed by COMNAVSEA.

Provide computer programs and documentation for Tactical Command and Control Systems, including simulation programs for on-board training, as directed by COMNAVSEA.

Functions (Support):

Product Fnvironment Simulation Programs for Fleet Training Centers, including multi-unit operational simulation programs for team and flag training, as directed by COMNAVSEA.

Provide technical assistance to the Operating Forces for delivered programs.

Activity, Directive Type and Number Date of Issue
Originating Office
Title of Directive

Description

NAVSEAINST 5450.41A (Continued)

Function (Research and Development): Conduct data system application research and development and provide technical assistance for projects sponsored and forwarded by other Navy commands, as directed by COMNAVSEA.

CNETINST 5450.31
Naval Training Equipment Center, Orlando; Missions and Functions

Copy not available for review.

CNETINST 7000.2A 22 Jun 1979
Code N-341
Procedures and responsibilities for the development of the Program Objective Memorandum (POM) documentation for the CNET Training Device Program

Provides information and guidance and assigns responsibility for POM submission. Notes that scope of training devices program is growing as a result of simulation technology improvement, energy limitations, and other factors.

Covers procurement, support, and update of training devices in the RDT&E, OPN, and O&MN appropriations.

Describes the role of the Submarine Trainer Working Group (STWG) and Surface Warfare Trainer Group (SWTG) and assist role of Fleet Project Teams (FPT).

Comment: A well-structured management process for developing requirements and POM documentation for training devices.

Activity, Directive Type and Number — Date of Issue
Originating Office
Title of Directive

Description

CNETINST 7100.2D 15 Aug 1979
Code N-301
Procedures for documenting Increments, Decrements, and Zero Base Displays required to support training and education programming requirements

Provides guidance in preparing increments (new or expanded requirements), decrements (resource decrements) and ZBDs.

Describes the PPBS/POM process and CNET participation in Navy POM process through submittal of increments, decrements, and ZBDs to OPNAV resource sponsors. Detailed guidance for these submissions is contained in CNET P1500/3, Manual for Preparation of Resource Requirement Requests (RRRs) and Zero Base Displays.

Covers funds, billets, MCON when appropriate, and commercial/industrial contracts, with appropriation guidelines.

Describes the roles of Functional Commanders and CNET Staff Divisions.

Comment: A well-structured management process.

CNETINST 7043.2B 18 Sep 1980
Code N-61
Other Procurement, Navy (OPN) budget procedures

Provides information and guidance in financial management of the OPN appropriation, Budget Activity 7; Personnel and Command Support Equipment (CNET portion). Applies to justification, budgeting, and funding of OPN equipment within NAVEDTRACOM.

Covers training equipment with unit cost of $3,000 or more. Instructions cover 12 categories, including (1) items costing $900,000 or more, (2) ADPE costing less than $900,000 (programmable calculators mentioned), (3) initial spares for

Activity, Directive Type and Number — Date of Issue
Originating Office
Title of Directive

Description

CNETINST 7043.2B (Continued)

Cog 2"0" training devices (NTEC), and (4) Cog 2"0" training device modifications (NTEC). Excludes requests for procurement of Cog 2"0" training devices, which are handled by NTEC in accordance with NAVTRADEV P-530-2.

Comment: A well-structured management process, but complicated by applicability of a number of directives appropriate to different types of equipment.

NAVTRAEQUIPCENNOTE 5215 6 Jan 1981
N-01
Numerical index of effective NAVTRAEQUIPCEN directives

Provides an index of directives in effect 31 Dec 1980.

Comment: Lists over 30 directives with some applicability to the management of training equipment programs. Covers the field.

APPENDIX B

GLOSSARY

GLOSSARY

Algorithm: A defined process or set of rules that leads and assures development of a desired output from a given input. A sequence of formulas and/or algebraic/logical steps to calculate or determine a given task; processing rules. [2]

Canonical Model: A model which describes an entire physical process--typically employing many variables--in which the model's output derives meaning from subsequent referral to a random process. For instance, the canonical model may provide an index of damage for an air strike. This index will later be used with a random process to select a particular level of damage for the air strike.

Command Post Exercise: An exercise involving the commander, his staff, and communications within and between headquarters. [1]

Computer Firmware: The logical code of computer equipment which interprets the control functions of that equipment. [5000.29]

Computer Program: A series of instructions or statements in a form acceptable to computer equipment, designed to cause the execution of an operation or series of operations. Computer programs include such items as operating systems, assemblers, compilers, interpreters, data management systems, utility programs, and maintenance/diagnostic programs. They also include application programs such as payroll, inventory control, operational flight, strategic, tactical, automatic test, crew simulator, and engineering analysis programs. Computer programs may be either machine dependent or machine independent, and may be general purpose in nature or be designed to satisfy the requirements of a specialized process of a particular user. [5000.29]

Computer Resources: The totality of computer equipment, computer programs, computer data, associated documentation, personnel, and supplies. [5000.29]

Computer Software: A combination of associated computer programs and computer data required to enable the computer equipment to perform computational or control functions. [5000.29]

Deterministic Model: A model wherein the same sequence of inputs always produces the same sequence of outputs, given that the model is re-initialized at the start of each input sequence. If the same sequence of outputs is not necessarily always produced, then we say the model is non-deterministic or probabilistic. A computer model is always deterministic; however, a computer model is "pseudo probabilistic" if it incorporates a pseudo-random number generator to help produce its outputs from its inputs, giving the effect of a probabilistic model.

Embedded Computer: A computer which is integral to a combat weapon system. [As defined by DoD Directive 5000.1.] Computer equipment is integral to a weapon system when it is dedicated and essential to the performance of the mission of the weapon system in combat; e.g., automatic combat command, control, and communications processing for specific combat weapons. Specifically, a computer is embedded when:

1) it is physically incorporated into the weapon; or

2) it is integral to the weapon system from a design, procurement, and operations viewpoint; or

3) separate selection, acquisition, and/or management of the computer equipment would not be feasible. [5100.40]

Exercise: A military maneuver or simulated wartime operation involving planning, preparation, and execution. It is carried out for the purpose of training and evaluation. It may be a combined, unified, joint, or single service exercise, depending on participating organizations. [1]

Field Exercise: An exercise conducted in the field under simulated war conditions in which troops and armament of one side are actually present, while those of the other side may be imaginary or in outline. [1]

Hardware: The electric, electronic, and mechanical equipment used for processing data, consisting of cabinets, racks, tubes, transistors, wires, motors, and such. [2]

Heuristic Model: A conditional type of model, often representing a human function, which reaches its solutions not through one particular algorithm but through a trial-and-error procedure that is not guaranteed to reach the best solution.

Interaction: The engagement or meeting of opposing forces in war games. At a minimum, this implies detection.

Manual Wargame: A wargame wherein forces are represented by models, pins, or symbols and are displayed on a chart or map. [3]

Model: A tangible representation of a system wherein the components and relationships between components of the representation bear a close resemblance or relationship to those of the system being modeled.

Modularity: Grouping a collection of algorithms by category, e.g., ASW algorithms.

One-on-One: An encounter between two single units of opposing forces. [3]

Packaged Programs: Those common programs written for various major applications in a manner such that a user's specific problems of data or organization will not make the package less useful. [2]

Platform: The basic simulation input. Each platform (e.g., ship, aircraft, tank, etc.) is defined in terms of a standard group of capabilities and characteristics, such as height, maximum speed, radar cross section, weapon systems, etc. [3]

Player: A person acting as a real-world commander or member of a staff during the conduct of a wargame. [3]

Scenario: The description of a conflict situation, the events leading up to it, and a list of available forces. [3]

Sensors: Electronic hardware aboard ships or shore installations in the electronic or sound emitting family (radars, sonars). [3]

Simulation Model: A model used to represent the operation of a dynamic system (e.g., a military battle) in terms of a state history of the modeled system. That is, a simulation model is a set of models, algorithms, and/or heuristic procedures that (1) bear a one-to-one relationship to the elements and relationships of a dynamic system, and (2) are used to represent the state history of the system.

Simulation Program or Computer Simulation Model: A simulation model in the form of a set of instructions to a computer which allows the computer to generate a state history of a modeled system.

Simulator: A computerized stimulation device that incorporates a reactive simulation model for the purposes of training or evaluating personnel with the simulated events of a given system.

State History: At any given moment in time, the components of a system are in a given state, and a description of all the components is termed a state description. A state history, then, is a succession of state descriptions at sampled points in time. It should be noted that a user may choose to sample only two points in time: the beginning and the end.

System: An interrelated assemblage of components and relationships among components (e.g., submarine warfare).

Table-Driven Model: A deterministic model--typically employing relatively few variables--in which an algorithm deterministically generates the output; single-number look-up.

Time Step: A means of compressing game time. Forces must be repositioned when time step is used. [3]

Trainer: A computerized simulation device that incorporates a nonreactive simulation model for the purposes of studying or training the responses of persons to the simulated events of a given system.

Transportability: The ability to pick up a module and move it; a function of computer language and of the control structure of the simulation.

Two Sided Game: Players control the opposing forces, and the interactions are monitored and/or evaluated by umpires. [3]

Umpire: A member of the control group who monitors player actions, evaluates interactions, and provides intelligence to the players. [3]

Wargame: A simulation, by whatever means, of a military operation involving two or more opposing forces, using rules, data, and procedures designed to depict an actual or assumed real-life situation. [1]

Wargame Analysis: The employment of a wargame as a mechanism for analyzing alternative strategies, doctrines, force structures, or systems of war.

Wargame Evaluation: The employment of a wargame to evaluate the command abilities of the game players.

Wargame System: A computerized, two-sided, free-play, interactive wargame, containing information about the following:

- operating characteristics of the weapons and sensors: hardware characteristics, employment capabilities, limitations, tactical procedures, serviceability, maintenance rates, etc.
- detection assessment: determination of the mutual effects of either side's sensors.
- engagement assessment: calculations concerning the interchange of weapons.
- specification of the locale or context
- force movement: updated information concerning the locations of all participating force units, weapons, and/or sensors.
- umpiring system: a control system which decides on all cases where the data and rules are inadequate for the situation.
- termination rules
- (The system should also provide the necessary graphics displays and messages, and a history of each game's activities.)

Note that the above sets of information should be standardized from wargame to wargame.

Wargame Training: The employment of a wargame to train the game players for war.

Weapon System: An instrument of combat, either offensive or defensive, used to destroy, injure, or threaten the enemy, consisting of the total entity that is an instrument of combat (e.g., Hawk missile, F-14 aircraft, M1 Tank, etc.); may incorporate within itself a complex assembly of functional parts. [DoD 5100.40]

REFERENCED GLOSSARIES

(1) Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, Washington, D.C.: JCS, 1974.

(2) Sipple, Charles J. Computer Dictionary and Handbook, Indianapolis: Howard W. Sams and Co., Inc., 1980.

(3) United States Naval War College, Detailed Statement of Requirements for a War Gaming Support System, 1975.