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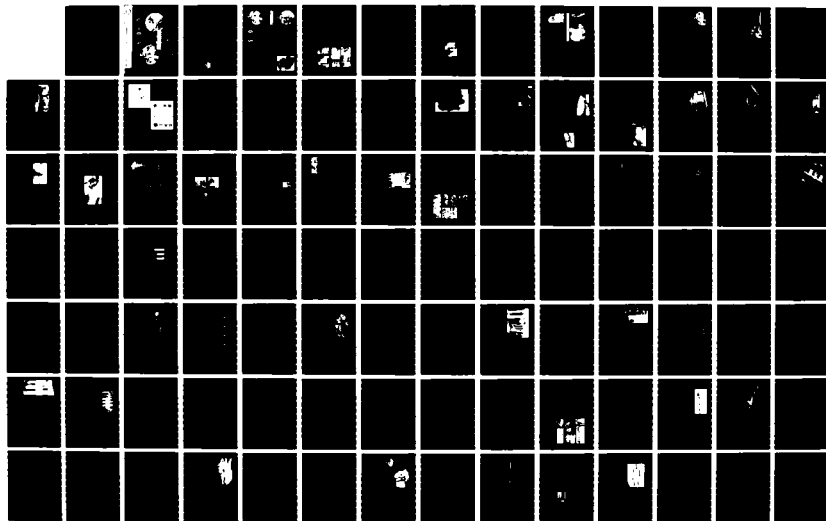
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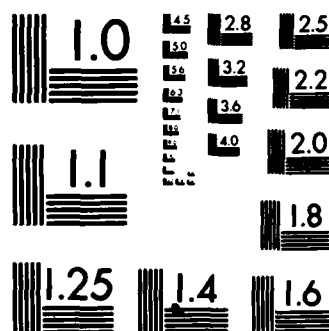
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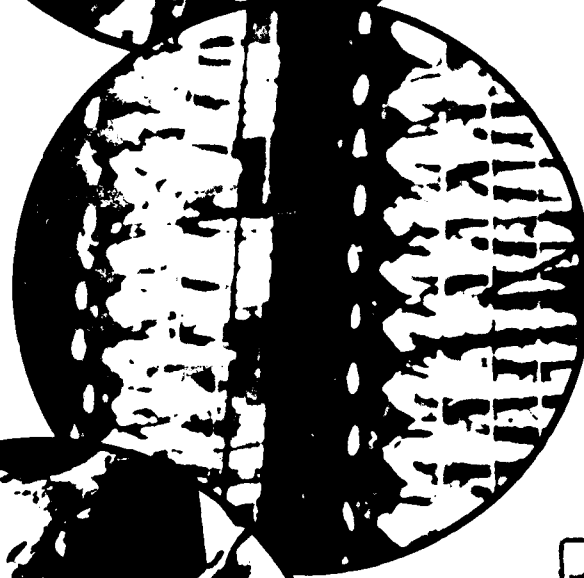
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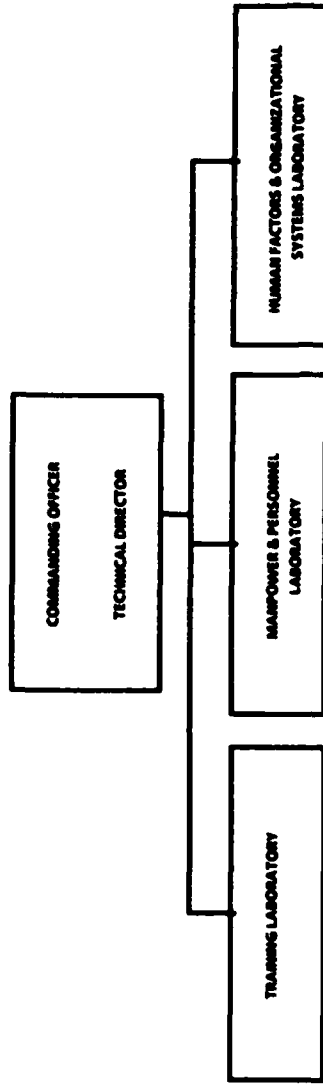
Navy Personnel Research and Development Center



FOREWORD

The Navy Personnel Research and Development Center (NPRDC) is the principal Navy activity for conducting and coordinating human resources research, development, testing, and evaluation in the areas of manpower, personnel, education, training, and human factors. NPRDC fulfills this mission through research efforts in three major program areas.

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In order to fulfill this mission, NPRDC presently is conducting over 100 in-house research and development projects. Brief descriptions of selected efforts within these program areas are contained in this publication. In addition to familiarizing the reader with the Center's work, it is our hope that these project descriptions will lead to an interchange of information between interested readers and project personnel. Please feel free to contact either of us or any member of the staff to discuss our efforts or to obtain additional information.

B. E. Bacon
Captain, U.S. Navy
Commanding Officer

J. W. Tweeddale
Technical Director

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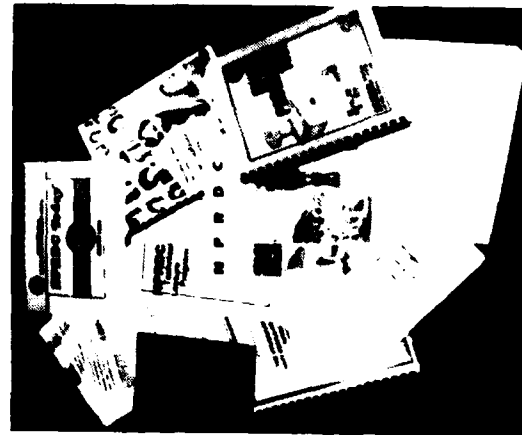
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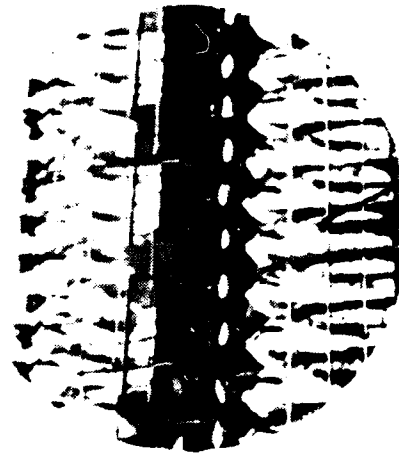
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No attempt is made to describe the NPRDC organization or provide a complete listing of documentation. Other publications designed to inform military and civilian agencies about the Center are available on request.



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31 MANPOWER AND PERSONNEL LABORATORY, and



75 HUMAN FACTORS AND ORGANIZATIONAL SYSTEMS LABORATORY.

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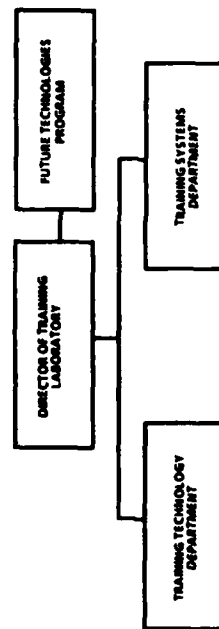
TRAINING LABORATORY

Director: Joseph McLachlan

(619) 225-7105

The training laboratory conducts research, development, test, and evaluation of training technology and applies this technology in schools and in the fleet to ensure the readiness of Navy and Marine Corps personnel.

This laboratory is organized into two departments and a future technologies office.



The training technology department assesses new instructional technologies, and develops and evaluates techniques for course design, instructional delivery, and training management for both individual and team training. It also designs, evaluates, and validates training systems to ensure that they are compatible with operational and personnel subsystems in the Navy. The training systems department adapts existing and emerging training and simulation technologies to shipboard, shore-based, air, Marine Corps, and Navy civilian workforce training requirements. The research of the future technology office focuses on human-computer interaction and the study and development of intelligent systems. Major research and development projects include:



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ENHANCING BASIC SKILLS/ UTILIZATION OF BILINGUAL PERSONNEL

Principal Investigator:

Fredrick Chang

(619) 225-6434

A large portion of the personnel pool from which the Navy draws its recruits is bilingual and does not have English as its primary language. One example of the effect of this is that approximately 20% of the participants in the Navy's Academic Remedial Training (ART) program have learned English as a second language (ESLs). These ESLs are often under utilized by the Navy because they are unable to demonstrate their true potential on selection tests that are highly verbal and written in English. As a result, they are eliminated from consideration for some of the more demanding occupational specialties. In order to ensure that the Navy can meet its personnel requirements, ESL personnel capabilities must be fully utilized. Training research should focus on reversing special

deficits (e.g., language), rather than generalized deficits as seen in the native American recruit receiving training.



The objectives of this project will be pursued through three avenues of research: (1) experimental studies of linguistic abilities of bilingual Navy personnel, (2) naturalistic studies of successful and unsuccessful bilinguals in various environments, and (3) instructional studies aimed at developing, implementing,

and evaluating communication skills instruction for Navy ESL personnel.

Preliminary investigations found that ESL readers differ from native English-speaking (NES) readers in important ways. The major finding was that the ESLs have lower paragraph comprehension abilities than do the marginally literate English-speaking students. ESL readers are worse at both listening and reading paragraph comprehension than NES students with the difference being slightly larger for listening comprehension. Vocabulary knowledge alone did not account for the difference in comprehending the paragraphs used in this research, although vocabulary knowledge in general is important. Additional research suggested that greater gains in ESL reading ability can be had through more training in higher-level paragraph comprehension skills rather than just decoding and vocabulary.

Future thrusts include experimental studies to investigate the linguistic skills and knowledges that contribute to the

comprehension deficit found in ESL students. An understanding of how bilinguals communicate through speech will be important. Questionnaires and observations will be utilized to study language difficulty in Navy environments. Additionally, comparative analyses of different ESL programs will be conducted, including analyses of books, tests, and instructional methods. On the basis of research findings, NPRDC will begin to develop instructional techniques and conduct research studies to assess their effectiveness with populations of bilingual Navy personnel.

P.E. 62763N

522-801-011.02

REPORTS:

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TESTING STRATEGIES FOR OPERATIONAL COMPUTER-BASED TRAINING

Principal Investigator:

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(619) 225-6434

Typical procedures for assessing performance do not measure real-world operationally oriented tasks with sufficient fidelity, validity and reliability. Consequently, student evaluation at its best is somewhat suspect, and decisions based upon this kind of assessment may be erroneous. Many of the customary methods for measuring performance either on the job or in the classroom are typically paper-and-pencil in nature (e.g., true-false, rating scale, multiple-choice formats). A number of deficiencies exist with these traditional testing techniques (e.g., biased items may be generated by different individuals). What is required is a technology for producing testing procedures that will correct these

faults. Very few data are presently available regarding the psychometric properties of testing strategies using computer-based, graphically presented simulations or models.

The objective of this exploratory development is to create and evaluate microcomputer-based graphic models of operationally oriented tasks to determine if their use in testing results in better assessment of student performance than customary measurement methods.

Accomplishments include programming graphic models of Soviet and non-Soviet aircraft silhouettes for a computer-based game to assess recognition performance.

Microcomputers were installed at VF-124, NAS Miramar to

evaluate recognition-game performance, and to construct the data base for semantic network tactical memorization games. The development of alternative testing strategies using paper-and-pencil formats for evaluating the recognition of hostile and friendly aircraft silhouettes and the knowledge of Soviet naval air force threat parameters was completed. These traditional testing techniques will be compared to computer-based testing strategies to establish whether these procedures significantly advance the state-of-the art in performance assessment.

Finally, another computer-based simulation was completed to assess how well individuals can manage the outer air battle in various scenarios involving Soviet aircraft threatening a carrier-based group.

P. E. 62763N
522-801-011.01



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CHEMICAL BIOLOGICAL WARFARE DEFENSE

Principal Investigator:

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The threat of chemical biological warfare faces the Navy. The Chief of Naval Operations (CNO) has ordered the development of an effective Navy chemical biological radiological-defense (CBR-D) capability. The best defense against chemical warfare, is to wear a chemical protective ensemble which could limit the capability of such protected personnel to perform critical combat tasks thus degrading or crippling assigned combat missions.

The objective of this research is to develop procedures to overcome or lessen performance degradation from a CBR-D environment, and examine

the adequacy of the existing training CBR-D course. This effort is being conducted jointly with the Navy Training Systems Center (NTSC). The program is structured so that primary responsibilities for specific lines of research lie with each laboratory. This allows for a joint interchange of ideas and inputs towards the same program goals.

Accomplishments to date include a research program developed jointly by NTSC and NPRDC, an examination of various CBR-D training options, and the identification of training areas required for an optimal course in CBR-D.

Plans for FY86 include synthesizing data obtained in

FY85 in order to make recommendations for the immediate training of the 285,000 Navy personnel in the most efficient and cost effective manner. Exploring the various training interventions or job aids that may help reduce the negative performance effects of wearing the protective ensembles is also planned.

P.E 62763N
522-801-014-03.04



FUTURE TECHNOLOGIES IN TRAINING

Principal Investigator:

James Hollan
(619) 225-6771

The reduced availability of senior technical personnel and the increasing sophistication of naval equipment present major training problems for the Navy. Not only must the Navy meet the challenge of training personnel to understand, operate, and maintain increasingly complex equipment, but it must accomplish this with minimal impact on operational forces. One of the most promising approaches to these problems lies in the application of new computer hardware and software technologies. These technologies and recent advances in the disciplines of artificial intelligence and cognitive science hold great promise of being of major import to future Navy training.

The Secretary of Defense, in endorsing the recommendations of the recent Defense Science

Board Summer Study of Training and Training Technology, has encouraged the use of new computer-based technologies to improve education and training. In order to take maximum training advantage of these technologies, a comprehensive research program to investigate and evaluate the training potentials of these exciting new technologies is required.

An area of application that seems particularly promising at this time is the construction of computer-based training systems for instruction about complex dynamic shipboard equipment. Such systems can provide 10 to 100 times more supervised practice with automated tutorial and explanation facilities and without increasing the need for additional instructional personnel. These systems also have the potential of providing qualitatively different and superior forms of instruction: diagnosis of underlying conceptual

problems, use of models of students developing expertise to modulate the course of instruction, exercises which are impossible or very expensive with actual equipment but which are instructionally important for understanding the operation of the equipment, and eventually many of the advantages of one-on-one tutorial situation.

Although one of the potentially most effective uses of these technologies is to provide students with interactive simulations with automated tutorial and explanation facilities, the construction of such advanced instructional systems currently requires many years of programming experience and familiarity with the new class of personal machines capable of supporting such instructional applications. The objective of this effort is to address the question of how to decrease the amount of programming expertise required to build these types of instructional systems. Specifically this effort will investigate extending the general notion of a graphical editor to include the ability to construct a simulation

model. The very large potential payoff of being able to put powerful new technology in the hands of subject matter experts without requiring that they become programmers and allowing them to directly construct interactive simulation-based training systems is the fundamental idea motivating this research initiative.

A prototype icon editor has been completed. Work is currently focused on the development of a set of underlying computational primitives which will permit the construction of sets of intelligent object-based icons sufficient to support the implementation of instructional interfaces in a number of technical training domains.

P. E. 62763N
522-801-018

CLASSROOM INSTRUCTIONAL TECHNOLOGIES

Principal Investigator:

John Ellis

(619) 225-6434

This project focuses on the processes of instruction in the traditional Navy classroom. The Navy currently teaches over 4000 courses, with the great majority presented in a traditional classroom by a single instructor to a group of students. Recent directives by the Chief of Naval Operations (CNO) and the Chief of Naval Education and Training (CNET) indicate that this training format will continue to play a predominant role in Navy education and training. Given this situation, the quality and effectiveness of Navy classroom instruction is an important concern. Recent evaluations of lecture-type instruction in civilian schools have shown that instructional quality is highly variable, non-standard, and often poor. Similar problems have

been observed in Navy schools.

In addition, recent research on learning in civilian schools has shown that in traditional classroom settings, variables affecting student achievement can be effectively controlled. To date, there have been no systematic attempts to explore the

applicability of controlling these or other potentially useful variables in Navy classroom training. In the face of increasing pressure on the training system to increase its efficiency and effectiveness, the improvement of Navy classroom training is an important issue. This project directly addresses the concern for greater productivity and quality in Navy classroom training expressed by senior Navy personnel.

The objective of this project is to develop recommendations for a system to aid the performance of Navy instructors in the classroom

and for improvement in instructor training.

The planned approach starts with describing Navy classroom and instruction training policies and practices in detail. Then, a detailed synthesis of research will identify those aspects of the instructional process that have the most potential value in Navy classrooms and a process model for the effective classroom will be developed. Finally, this model will be tested for usefulness in actual classroom environments.

This project produced several significant outcomes. First, variables that have an effect on classroom instruction in both civilian and military education and training have been identified. These variables include both those directly related to classroom training (e.g., instructor activities) and those indirectly related (e.g., school-house management processes). These variables are being used to develop a course evaluation system (CES), which, in turn, is being used to assess the current state of Navy classroom training. The results of the CES

assessment will be used to identify areas where potential improvement in training efficiency and effectiveness can be achieved. Then, based on the CES results, specifications for improving Navy classrooms will be developed and tested empirically using either a naturalistic or an experimental methodology or both. This phase of the project will determine (1) if the deficiencies identified by the CES actually affect the quality and efficiency of Navy classroom training, (2) the magnitude of the effects, and (3) whether it is practically and economically feasible to implement the changes indicated in Navy classrooms.

P.E. 62763N

522-801-019



EVALUATING TRAINING MOTIVATION

Principal Investigator:

Barbara McDonald
(619) 225-6434

The military assumes that some of the deficiencies observed in training effectiveness and job performance skills are due to low motivation. In current Navy instruction, training motivation is not encouraged in any systematic way. Further, means for assessing motivational aspects of training environments do not exist largely because of the complexity of motivation and the lack of an overall guiding theory to apply to Navy settings. Nevertheless, some motivational techniques are available for use in training environments. These include carefully timed incentives, team competition, hands on experience and/or computer-based simulations. The question is which techniques will work for different types of training. For example,

technical training differs from tactical training because of varying task elements and skills required on the job. Also, training for high-workload, stressful jobs differs from training for low-workload jobs. Motivational programs should be constructed with these differences in mind. Understanding how various motivational techniques will be appropriate and successful in the wide variety of Navy instructional settings requires a model of motivation in applied settings and a method to assess levels of motivation in training.

The objectives of this project are to develop (1) a model to identify useful motivational techniques for Navy instruction, (2) a method to assess motivation levels for use in a wide variety of Navy training environments, and (3) a plan for incorporating motivation into applied Navy

instruction.

During FY86, literature is being reviewed to identify potentially useful motivational techniques. Data will be collected in selected Navy classrooms to determine the general effects of motivational variables on classroom performance. In addition, Navy programs with existing motivational components will be identified and highlighted. In FY87, a model will be developed to identify important variables, including specification of the setting, student characteristics,

and level/type of training. From this model, an assessment method will be developed to determine levels of motivation in any training environment. In FY88, data will be collected using the assessment method and prescriptions for improvement in motivation will be made. Based on the results of the assessment, implementation strategies will be suggested. This exploratory development task will be incorporated into the Classroom Instructional Technologies project beginning in FY-87.

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522-801-020



INTELLIGENT MAINTENANCE TRAINING SYSTEM

phase, conducting system test and evaluation with the SH-3H bladefold system training course, and initiating plans for a second test of the technology.

P.E. 62763N
522-802

Principal Investigator:
Vernon Malec
(619) 225-6555

This project addresses several severe problems in current Navy technical training. Shortages of skilled personnel place a burden on the training establishment as its instructors are removed to fill critical job needs in the Fleet. The same pressures act on the availability of equipment for hands-on training. Increasing equipment costs tend to limit how much actual equipment can be procured for training purposes and the equipment that is available is typically outdated and does not adequately prepare apprentice technicians to meet fleet job requirements. The use of general purpose simulators that can evaluate student progress, provide individualized coaching, safe practice, and relevant feedback could shorten training

time, as well as provide better qualified technicians to the Fleet.

The objectives of this project are to provide technical and coordinating research support in connection with the acquisition of an intelligent maintenance training system (IMTS). The IMTS will initially be designed to provide exercise selection, sequencing, and tutoring for use with the SH-3 helicopter bladefold and rotor brake maintenance trainer/simulator. NPRDC will also evaluate this technology for other Navy training applications.

The approach planned for this project will be to (1) assist the Office of Naval Research in project planning and preparing coordinating documentation; (2) participate in the contractor source selection process; (3) monitor contractor progress; (4) act as an on-site coordinator; (5) develop,

test, and evaluate program plans and data gathering instruments; (6) conduct the system test and evaluation; and (7) prepare plans for a second application test of the developed technology.

In early FY85, the University of Southern California, Behavioral Technology Laboratory, was awarded a two-year contract to design, develop, and integrate intelligent system technology into existing generalized maintenance trainer/simulator (GMTS) hardware and software systems. This work is being performed in connection with the SH-3 helicopter bladefold and rotor brake maintenance trainer/simulator project, which is currently undergoing system test and evaluation at the Naval Aviation Maintenance Training Group (NAMTRAGRU) Detachment, Naval Air Station, North Island, California. The IMTS design phase was completed in June 1985 and the development phase is now underway.

The FY86 effort will involve completing the development

USMC COLLECTIVE TRAINING STANDARDS

Principal Investigator:
Ray Main
 (619) 225-2561

The U. S. Marine Corps needs systematic methods for developing, applying and updating collective training standards (CTS). Collective training standards guide the development of unit training (i.e. fireteams, platoons, and other unit aggregations), determine unit training direction, provide training feedback, and assess combat readiness. CTSs must permit specific deficiencies in training readiness to be identified and corrected.

The objective of this effort is to provide systematic procedures for developing CTSs. The CTSs will be designed to guide unit training

and aid unit evaluators to assess combat readiness.

An initial analysis of the technical problems in defining, developing, and using CTS was made in FY85. Data were obtained through observation of training, personal interviews, examination of data bases, and evaluation of research findings of other services. Where possible, empirical data on the usefulness of different types of standards was collected. Also accomplished in FY85: (1) A technical report describing the critical components of CTS development, utilization, and validation was written and is in the publication process, (2) a task area (combat service support) was selected for initial CTS development, (3) an outline for developing an

organizational model of unit events was completed, (4) subject matter experts were interviewed to obtain event descriptions, and (5) descriptive flowcharts were developed for three event scenarios.

Plans for FY86 include (1) the preparation of recommendations for CTS characteristics and the integration of CTSs into the overall process of training readiness

development, (2) the development of a task identification procedure to provide criteria for task classification, and (3) the preparation of a list of collective training tasks.
 P.E. 62744N
 522-080-602

REPORTS:

Wetzel-Smith, S. K. & Mitchell, S. R. (in preparation). Collective training standards development: Problem analysis (NPRDC TR). San Diego: Navy Personnel Research and Development Center.



ADVANCED COMPUTER-BASED TRAINING FOR PROPULSION AND PROBLEM SOLVING: STEAMER

Principal Investigators:

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Edwin Hutchins

(619) 225-6771

The STEAMER project is a research effort concerned with evaluating the potential training applications of recent advances emerging from the new disciplines of artificial intelligence (AI) and cognitive science. While the project addresses a host of research issues ranging from how people understand complex dynamic systems of how AI software and hardware advances might be applied to training, it is focused around the construction of a computer-based system to assist in propulsion engineering instruction. The goal of this project is not only to build a training system with automated tutorial and explanation facilities, but also to construct a set of software tools that can assist in the implementation of future advanced training systems. The

development of the STEAMER system and the software tools upon which it is based should provide the experience required to make principled decisions about the application of new AI and cognitive science technologies to Navy training problems.

STEAMER currently consists of a graphical interface (using both color and black and white bit-mapped displays) to the same mathematical model that drives the 19E22 trainer at the Surface Warfare Officer School (SWOS) at Newport. With this graphical interface, the model can be observed and manipulated at different hierarchical levels. The system is designed so that it can be used in a variety of ways. It can, for example, be used by an instructor to provide students with demonstrations of the operation of the plant or of the effects of imposing various casualties. These plant evolutions and changes can

be observed on a color display that depicts normal gages and indicators. Using the system in this way gives the instructor the advantages of being able to rapidly switch between different spaces, to quickly change the condition of the plant, and to repeatedly go through a plant evolution to allow students to observe the effects in different spaces. Of potentially much more importance to training is the ability of the STEAMER system to present dynamic graphical displays. These displays permit students to manipulate and observe representations of the system that resemble the model experts use to understand and reason about the operation of the plant. These potentially more instructionally effective representations derive from the ability to show global views of systems (e.g., lube oil) that are widely dispersed in the actual plant and difficult to see as a total system, to show simplified versions of systems that are easier to understand or provide better models for reasoning about the plant, to be able to look "inside" systems or components and see flows or other internal

characteristics, and to make available indicators that can depict aspects of the operation of a system that are not normally available but can be of tremendous advantage in developing an understanding of a system.

The system is designed so that it can be easily extended and modified through the use of a Graphics Editor. The editor provides a mechanism for a subject matter expert to construct views of the propulsion system and to tie those views to variables in the mathematical model so that the state of the system is dynamically reflected by the view. A user of the editor chooses components (e.g., valves, pipe, etc.) from a menu of available components and positions them by pointing to his choice of locations on the color screen. This makes it possible to rapidly construct a view of the plant that contains the necessary components to allow observation of a subsystem or aspects of different subsystems during the running of the model. The graphical editor allows the system to continue to grow and be modified by users of the system.

The editor is one of the most exciting aspects of the STEAMER training system, since it not only allows the system to be continually updated and improved, but also can serve as an important software tool for the construction of STEAMER-like training systems in other domains.

In order to obtain feedback from potential users on STEAMER-like systems, STEAMER has been evaluated at a number of sites (SWOS, Newport; SWOS, Coronado; Great Lakes: Shipboard Simulation School, New Orleans). The current research effort has two parts. The first is concerned with continuing the development of the intelligent tutorial aspects of STEAMER. This includes the development of an Instruction Editor, the incorporation of videodisk and voice output, and the development of facilities to enable diagrams to explain themselves to students as well as to pose problems and monitor students during their attempts to answer them. The second effort is concerned with the issues of transitioning the system into

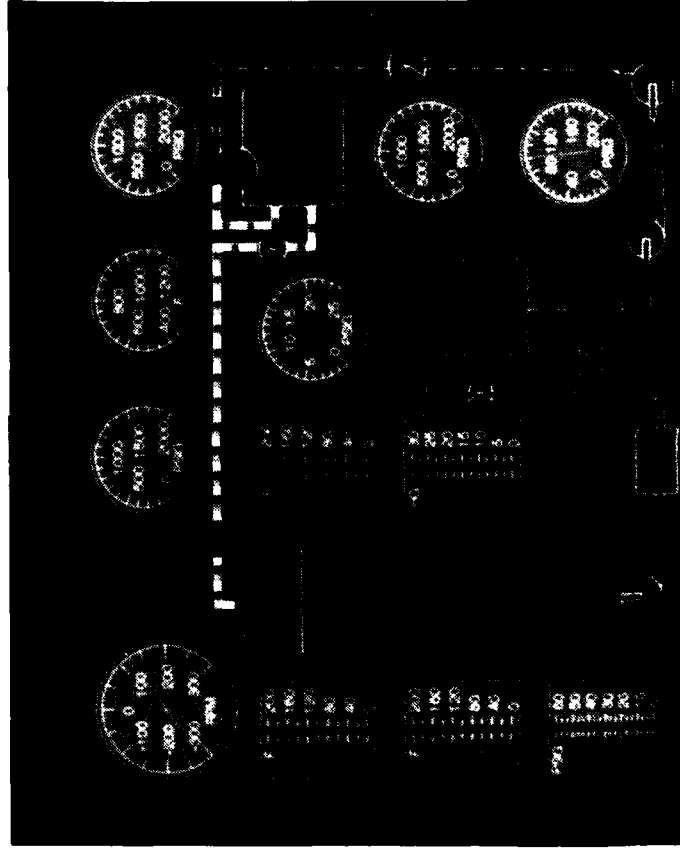
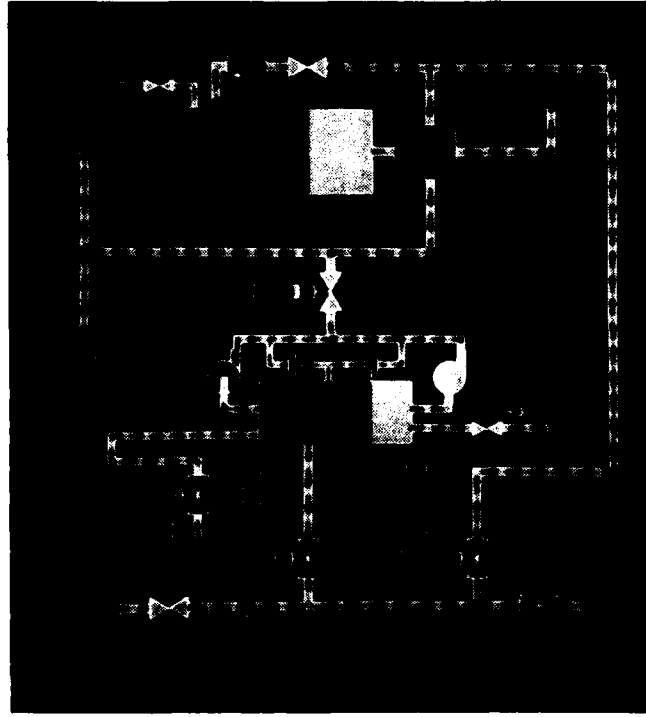
operational use.

P.E. 63720N

Z1772-ET001

REPORTS:

Hollan, J. D., Hutchins, E. L., & Weitzman, L. (1984). Steamer: An interactive inspectable simulation-based training system. AI Magazine, 5 (2), 15-27.



LOW-COST MICROCOMPUTER TRAINING SYSTEMS

Principal Investigators:

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Navy systems are becoming more sophisticated, requiring more time and effort to train personnel, while funds for training are remaining constant or declining. At the same time, rapid advances are being made in computer technology and in developing instructional applications for microcomputers. This project is essential to the development of a coherent investment strategy for microcomputer applications in Navy education and training. By assessing Navy training and education practices and matching them with various forms of microcomputer-based training innovations, maximum advantage can be taken of computer technology in cases where it is cost effective.

The objectives of this project

are to (1) assess Navy training practices and (2) develop, test and evaluate computer-based instructional (CBI) systems for a variety of Navy training applications. The approach for the assessing Navy training requirement has involved both an analysis of course objectives and a survey of course managers. About 30,000 training objectives from a broad sample of Navy training programs were collected to determine the relative frequency with which various types of training practices occur. The most frequently occurring objectives were remembering of facts and practice of procedural steps. Interviews with Navy course managers or instructors in courses with an annual throughput of more than 400 students identified current instructional practices and potential areas for the development of computer managed instructional support and CBI. The results of both of these assessments will be made available during FY86. It isn't

assumed that these are the way things should be taught. They are an assessment of current practices.

Currently, the main thrust of the development, test, and evaluation of CBI systems is a software development contract with the University of Utah. This effort is standardizing CBI programs that have previously been shown to be of practical utility in Navy training under a system called the computer based educational software system (CBESS). This system consists of a set of C-language programs that are relatively portable for a variety of computers and Navy environments. Portability is a significant issue, since the proliferation of many machine specific programs has in the past, caused duplication of effort. CBESS consists of four major elements: (1) the equipment problem solving trainer (EPST) program is a computer- and video-based simulation system designed to reduce reliance on the use of actual equipment trainers in learning to operate and maintain equipment and to troubleshoot malfunctions; (2) the computer-based memorization system

(CBMS) uses a semantic network to represent large bodies of facts to be memorized through data base browsing and gaming; (3) the language skills computer assisted instruction (LSCAI) program provides training in general and technical vocabulary and reading through exercises and gaming; and (4) a general CBI package that allows presentation of screens, asking of questions, and branching based upon student response. All of the CBESS programs have three common components: (1) an author mode for subject matter experts to use to enter new instruction, (2) an instructional delivery mode in which the program interacts with students, and (3) an instructional management mode to record, score, and track student progress.

When the training practices assessment and the core CBESS library are completed in FY86, the effort will turn to tests of the integrated software in Navy courses, software and library enhancement, and development of cost/benefits measures and logistics prescriptions for CBI systems.

P.E. 63720

Z1772-ET002

AUTHORING INSTRUCTIONAL MATERIALS (AIM)

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The Navy has a continuing need to make the production and revision of instructional materials more efficient and effective. The basis of this need is that the Navy teaches over 4000 different courses, which require maintenance and revision. In addition, new equipment and more efficient delivery techniques, like computer-based instruction (CBI), increase development and revision requirements. Currently, the production of one hour of instruction requires from 100 to 1000 manhours of effort by highly experienced personnel, at a cost of from \$5000 to \$50,000. As personnel costs increase and as technological advances necessitate new, increased, and more sophisticated training, the Navy's ability to meet its instructional

material needs will be seriously affected by continuing budget restrictions. Finally, regardless of funding restrictions, there is a shortage of personnel who are experienced enough to develop or revise courses for the Fleet.

The objective of this project is to develop automated systems for the design, development, and production of instructional materials for both conventional and computer-delivered courses. The systems are intended to support military instructional development, by providing computer-based tools that reduce the time, effort, and expertise needed to produce high-quality instructional materials. Attention in this effort will be given to aids for developing printed materials, conventional lecture-based instruction, computer-based or computer-delivered instruction, and videotape or videodisk instruction. The goal is to optimize

the process of instructional development and to standardize its products.

In FY85, authoring requirements were defined and development of hardware specifications for the operational AIM systems was initiated. Demonstration systems were installed in a Navy instructional development activity and programming of authoring tools was started. In FY86, hardware specifications will be completed and software specifications initiated. In the rest of the project, additional authoring and instructional planning tools will be developed, programmed, tested, refined, and evaluated. The project will use econometric tools to model and evaluate various instructional development processes with different levels of automated aids. Finally, the software will be moved to smaller computer systems that can be distributed to individual schools.

P E 63720N

Z1772-ET003

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ENLISTED PERSONNEL INDIVIDUALIZED CAREER SYSTEM (EPICS)

demonstration systems, another R&D product of this effort will be a computer-aided training continuum design system for Navy personnel managers.
P. E. 63720N
Z1772-ET010

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Steadily escalating technological complexity of military hardware systems has increasingly challenged the Navy to develop needed personnel resources that can meet its operational and maintenance requirements at an affordable cost. The common approaches used to improve Navy personnel system effectiveness are independent efforts to change selection, assignment, and training methods. Currently, front-end, shore-based training is the development approach most relied upon. An inherent heavy training investment before the individual achieves adaptation to Navy and shipboard life, skill/knowledge deterioration, and an inattention to petty officer development are among a number of concerns related to the current methods of manning Navy systems.

The EPICS approach is based on the premise that a number of Navy personnel problems are rooted in the inability to integrate career system components, not the effectiveness of any one component. The research objective was to design, develop, implement, and test an integrated career system to fulfill the Navy personnel system requirements while ensuring that potential payoffs from incorporation of job performance aids (JPAs) could be achieved over the long term.

The most significant EPICS accomplishments during FY86 were the ongoing operation of an EPICS personnel pipeline to man the NATO Seasparrow Surface Missile System work centers with apprentice technicians in a period of fire control personnel shortages. Plans to expand this system to the journeyman technician level are being developed. This program involves 31 destroyers, 8 aircraft carriers, and 9 auxiliary ships. Data

collection and analysis of the longitudinal fleet test was completed and a comprehensive final report is in the publication process. This report will cover personnel effectiveness, fleet perceptions of the program, cost effectiveness indices, administrative issues, and recommendations. Two other reports are being prepared one evaluating the acceptance and use of JPAs and the second evaluating the first EPICS shipboard and shore-based training phases. In addition, an implementation handbook was produced.

In testing an alternative personnel development approach to conventional front-end training, the EPICS project represented the first phase of an ongoing R&D program. This program, Enlisted Career Systems Design (ECSYDE), is developing a career system technology base for enlisted occupational groups. Beginning in FY87, the second phase of ECSYDE will model three career system designs spanning a range of Navy occupational areas and will develop, implement, and test the training continuum component of these designs. In addition to these

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TRAINING RESOURCES MANAGEMENT

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Pressure continues to reduce expenditures for classroom training and to provide the fleet with well trained personnel. The purpose of this project is to build ADP-based management aids for:

- (1) allocating and coordinating fleet and school training resources,
- (2) forecasting resource requirements, and
- (3) evaluating training resource policy options.

The approach will be to develop (1) data banks of the effectiveness criteria and cost of various training programs, (2) models for evaluating training effectiveness (i.e., content attained and retained) and student cost, and (3) network models that will balance training effectiveness and cost constraints.

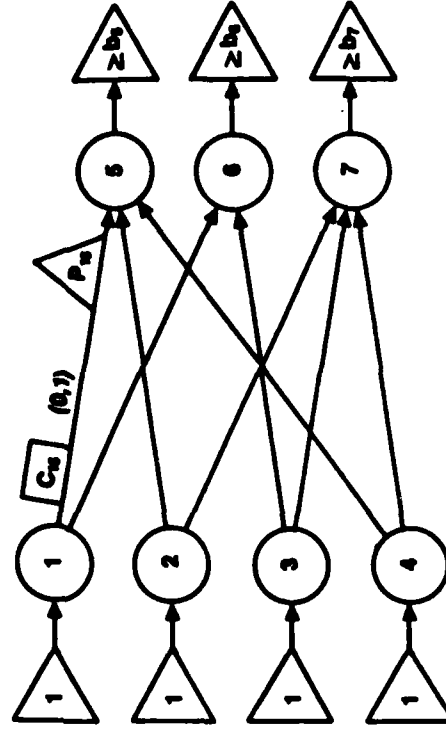
Current cost and performance data sources is being surveyed to

evaluate availability, accessibility, and accuracy. These data are being merged with NPRDC's Survival Tracking File (STF). STF is an automated system that tracks the progress of Navy personnel throughout their careers and permits quick retrieval of key information needed to evaluate new or existing policies and programs in an economical fashion. Given the availability of training performance data, models of training performance will be developed. The models will examine personnel data, training hours, type of training, and other variables related to training performance. A single criteria network model, that maximizes training assignment will be developed. Data generation algorithms for performance and cost will be developed and interfaced with the solution algorithm. A multiple criterion network model, which balances training performance and cost, will be developed in the out-years.

Finally, software will be developed that integrates the data, algorithms, and models into a user friendly management decision aid. It is planned to implement the single criteria network models in the Total Force Training and Education Division (OP-11), at the end of FY87. The transition of the multiple criterion network will likely occur at the end of FY89.

P.E. 63720N

Z1772-ET014



Generalized Network Model.

USMC FIXED WING LOW-ALTITUDE ORIENTATION (MITAC II)

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Analysis of Soviet surface to air missile systems capabilities indicates that low-altitude environments offer increased protection for aircraft. Low-altitude attack profiles take advantage of the inherent weakness of these systems.

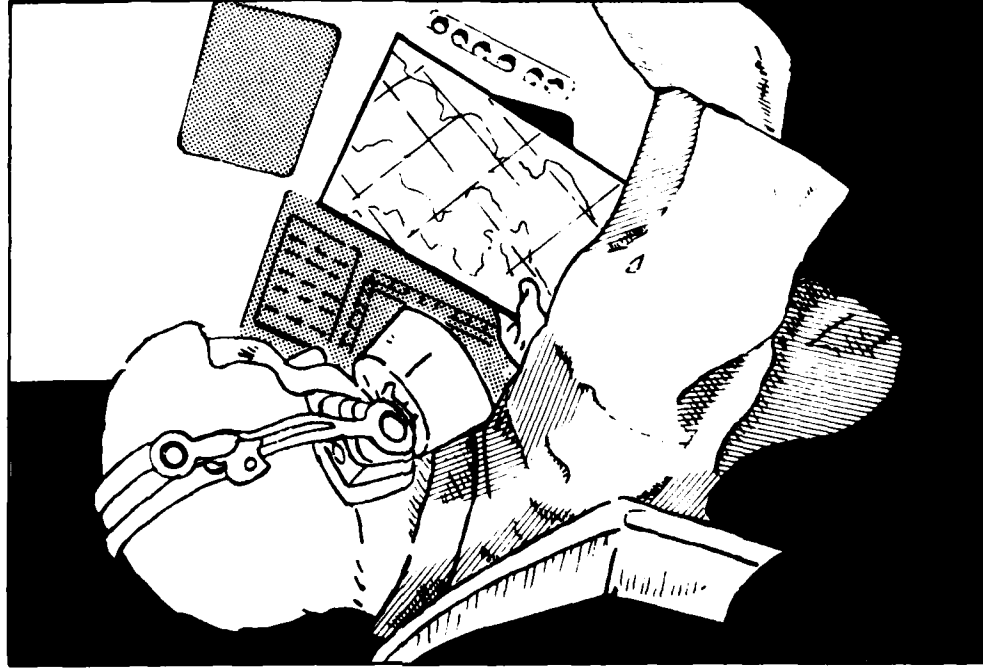
Although future onboard navigation systems will reduce the workload associated with low-altitude navigation and target acquisition, map interpretation skills must be maintained. These skills are essential for preflight mission planning to (1) plan routes to take advantage of terrain masking, (2) choose reliable and recognizable checkpoints, and (3) locate the target within the geographic scene. A Map Interpretation and Terrain Analysis Course (MITAC II) was developed to meet these training objectives.

The two-part

course consists of lecture and simulated low-altitude flight exercises. The lecture material is presented using a dual 35mm slide/sound system. The dynamic exercises use a 70mm film system and were developed from existing DoD low-altitude imagery.

The next objective is to develop a cost effective system to deliver the dynamic exercise portion of the MITAC II program. It is anticipated that in FY87 the 70mm film system (which used an outdated anamorphic lens design) will be replaced with 16mm and that the revised MITAC II training program will be implemented in FY88.

P. E. 63732M
C0074-06.01



USMC LAND NAVIGATION FOR INFANTRYMEN (MITAC III)

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Marine Corps infantry

personnel require map interpretation skills as basic tools for mission performance. Using a map, they must be prepared to navigate quickly and accurately over a variety of terrains. They must use their maps to (1) select routes between points, (2) verify position location, and (3) make tactical decisions based on terrain.

A needs analysis indicated that current training in land navigation focuses primarily on those skills that can be taught through a procedural approach. Examples are skills associated with the reading or plotting of grid coordinates, pacing, compass reading, converting G-M angles, or calculating back azimuths. However, instruction on terrain association was limited in scope and relied on training aids that

presented overly simplified generic terrain and map drawings. Further, there were no procedures to enable infantrymen to systematically determine the relationship between the real world and the map. Therefore, the objective of the land navigation research was to develop training technologies to improve the terrain association skills of enlisted infantrymen.

Three instructional approaches were employed. First, a procedure was developed to enable infantrymen to look at either a real world or mapped landform in terms of its shape, orientation, size, elevation, and slope. The terms "SOSES" was used as a mnemonic to help the infantrymen remember each of the steps needed in the landform assessment process. Second, instruction covering the interpretation of water, vegetation, and man-made features was based on Defense

Mapping Agency map design guidelines. These guidelines explain the conditions for how and when these features are portrayed on maps. Finally, a terrain association strategy was developed to teach position location.

These materials are presented in a Map Interpretation and Terrain Association Course (MITAC III). The program uses a dual 35mm slide, taped narrative system to deliver the interactive training and contains numerous skill building exercises.

The program of instruction has been completed and underwent an evaluation with the First Marine Division. The MITAC students showed significant improvement in their terrain association skills.

P. E. 63732M

C0074-06.02



REQUIREMENTS ASSESSMENT FOR S-3B SENSOR TRAINING

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only dreamed of in the early stages of systems development during World War I.

The Navy depends upon the technical personnel to perform increasingly difficult tasks to support mission requirements. State-of-the-art, computer-based weapon systems installed onboard fast-moving jet aircraft provide extensive defensive and offensive capabilities against a wide range of sophisticated enemy threats. The real value of these systems, however, depends upon how well they can be used by the personnel tasked to operate them. Operators must analyze and interpret the variety of images and digitized displays under combat stress conditions in order to be able to ensure good tactical decisions. The quality of those decisions will make the difference between mission completion and mission failure.

Technology advances in the 20th Century have greatly impacted the ways the Navy does business in all warfare areas. In aviation anti-submarine warfare (ASW), new computer-based weapons systems detect, classify, and attack enemy targets by sophisticated means that were

This project is directed towards providing assistance in developing a training assessment for the sensor crew in the S-3B aircraft.

This aircraft is an update version of the S-3A and includes the S-3 Weapons Systems Improvement Program which introduces new sensors such as the AN/UYS 1 acoustic processor and the AN/APS 137 profile radar. The inclusion of these sensor systems requires modifications in existing acoustic training and entirely new training development for the inverse synthetic aperture radar (ISAR) imagery in the APS-137.

The emphasis of the training requirements analysis will be on the cognitive aspects of analysis, interpretation, and tactical employment of information gained from onboard sensors.

Operator tasks will be analyzed in terms of the complexity of knowledge bases, the amount of inferential reasoning, the size of memorized data bases, the number and criticality of decision points, and the likelihood of error.

The objectives of this effort are to: (1) identify the cognitive skills and knowledge required to fully utilize the various sensor stations onboard the aircraft for individual crew members; (2) use S-3B mission scenarios to identify crew training requirements for transmission and exploitation of gained information between crew members; and (3) develop a training plan that incorporates identified cognitive task training requirements for each crew member.

P. E. 99000N



AUTOMATED MANEUVERING BOARD TRAINING SYSTEM EVALUATION

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The automated maneuvering board training system (AMBTs) was developed in response to the need to improve training in maneuvering board skills at the operations specialist (OS) "A" School. A high percentage of

student setbacks and drops from the OS "A" School occur due to failure by students to understand the concepts and procedures required to track objects using the maneuvering board. Costs of setbacks and drops from the school, as well as the importance of maneuvering board skills aboard ships, called for improved maneuvering board training methods.

AMBTs is an interactive computer program for training maneuvering board skills developed by NPRDC. The program displays, in a dynamic manner, relative and absolute plots; shows lines of motion of both an object and "own" ship; and provides continual course, bearing speed, and range readings as the solution progresses. The program was utilized as an adjunct to the conventional learning of maneuvering board skills. Students were instructed in the conventional manner and were able, under various conditions, to observe the computer program on a large projection screen and/or on a microcomputer at their desks.

The computer program proved very successful in an intensive remedial program for students failing the maneuvering board.

The purpose of the present study is to evaluate the effectiveness of AMBTs in teaching maneuvering board skills at the OS "A" School.

AMBTs was introduced in an experimental study with classes starting at the OS "A" School between December 1984 and September 1985. Students were exposed to AMBTs during initial maneuvering board training. Data collected are currently being analyzed. Results will be used by the Chief of Naval Education and Training in making decisions concerning the use of AMBTs for maneuvering board training.

P.E. 99000N

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BLADEFOLD ELECTRO-MECHANICAL TRAINING SYSTEM (BEMTS)

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This NAVAIRSYSCOM project is an ongoing effort to resolve the shortage of skilled instructors and difficulty in obtaining operational equipment for hands-on training. The high cost of equipment limits its availability for training purposes. In some cases, by the time the equipment is received it is outdated and does not reflect the equipment that is used in the fleet. This prevents the students from obtaining the training required for efficient operation and maintenance.

This project focuses on the testing and evaluation of a bladefold electro-mechanical training system (BEMTS), to determine its effectiveness in developing organizational-level maintenance skills of Navy aviation electrician's mate (AEs) and

aviation structural mechanics (AM) who work on the SH-3H helicopter.

The BEMTS was designed to provide computer-based instruction in concept and procedure learning tasks and to incorporate simulation techniques that allow practice in maintenance and troubleshooting procedures for problems on the bladefold and rotor brake system. The BEMTS consists of a microcomputer, image and adaptive displays fitted with touch-sensitive panels for user input, and a videodisk player, and graphic overlay capabilities. A portable printer is used by the instructor to access student performance data. The adaptive display presents text, problems, and menu choices. The image display presents equipment images and will include an image of the overall system, as well as successively more detailed images of system components and subcomponents. Students interact through

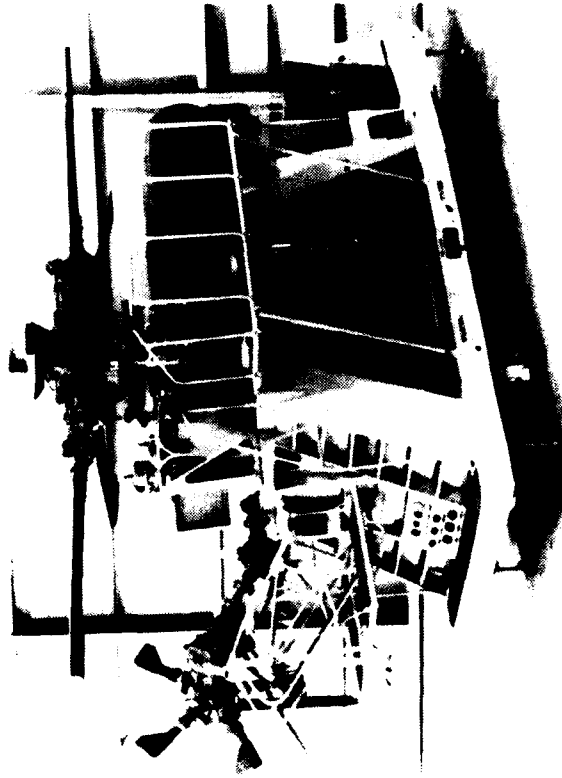
touch panels on the CRT surfaces.

The BEMTS will contain both structured and free-play lessons. The structured lessons will provide instruction on the electrical and hydraulic components in the bladefold and rotor brake systems using a standard interactive tutorial format. The free-play lessons will present maintenance problems dealing with electrical and hydraulic components. The BEMTS will present a problem to the students, allow them to observe and manipulate the simulated equipment until a solution is reached, and then, indicate if the

solution is correct.

The field test evaluation of the BEMTS will be conducted in the AE and AM organizational maintenance courses offered by the Naval Air Maintenance Training Group Detachment at the Naval Air Station, North Island. The trainer will be used to supplement rather than to replace the actual equipment training conducted in the bladefold lab sessions of both courses. The evaluation will provide quantitative measures of the effectiveness of BEMTS when used to train fleet personnel.

P.E. 99000N



JOINT STAFF OFFICER TRAINING SYSTEM (JSOTS)

Principal Investigator:

Raye Newmen

AN 224-5138

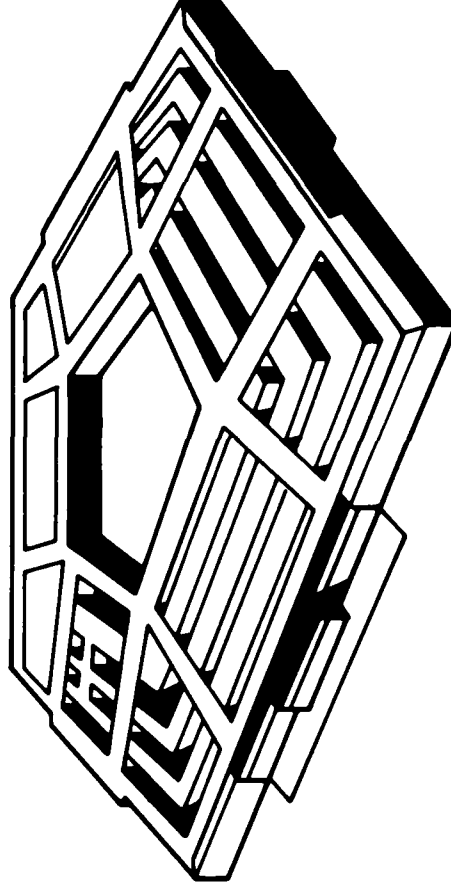
NPRDC is developing a joint staff officer training system for the Organization of the Joint Chiefs of Staff (OJCS). The joint staff officer training system (JSOTS) will provide training to prepare newly assigned OJCS Action Officers (AO) to quickly and competently assume their duties. These duties involve developing Joint Chiefs of Staff (JCS) positions and draft JCS responses within assigned areas of responsibility. The actions are often wide ranging and may concern any aspect of defense planning and operations. They may have considerable economic, political, and diplomatic consequences, and are often extremely sensitive geopolitically.

The typical AO is a mid-career military officer (04-05) who, currently must learn OJCS procedures on the job, sometimes after his or her predecessor had departed. The training system being developed will distill the wisdom of experienced AOs to assist a newly assigned AOs in assimilating the tasks, procedures, and specialized knowledge of their billet. The training package will involve both a core curriculum for all AOs and specialized topics tailored to individual assignments.

One research problem is how to plan a training program that will be accepted by the personnel for whom it is intended, given the conditions stated above. A second problem concerns the development of knowledge analysis methods that will be effective across the substantive areas, procedures, and organizational conditions of the OJCS. A third problem is how to select content that will be neither too specific nor too general to benefit the AO students.

NPRDC is providing all instructional analysis, design, development, test, evaluation, and software support for JSOTS and development. The training will contain a wide variety of delivery options including various forms of computer-assisted instruction, video tape and/or disk, group activities, written manuals, and seminar training.

P. E. 99000N
MR-0014



E-2C OPERATOR SYSTEM TRAINING

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The development and application of computer-based instruction (CBI) technology requires considerable planning. Training activities with requirements for CBI must address requirements analysis, budget justification, acquisition, and implementation to prevent several problems. Computers may be acquired before the instructional use has been determined. Many Navy training activities are buying computers that are not compatible, so common software packages cannot be developed and shared without substantial recoding and duplication of effort. Many current CBI programs must be modified by programmers because they cannot be modified by instructors. This

drives up the life cycle costs, which consist mainly of instructional development and maintenance. Some of these problems can be minimized by providing software that is standardized as much as possible, by carrying out logical instructional development procedures, and by providing a system that can be modified by instructors and educational specialist.

The objective of the current effort is to conduct an Navy demonstration/evaluation CBI project. The vehicle for this demonstration is the APS-125 radar found in the E-2C Hawkeye aircraft. Training will be developed for this radar to demonstrate feasibility, acquire implementation experience, and evaluate authoring software. The APS-125 radar is a complex, computer controlled system that requires extensive training for

proper operation. This project is an attempt to demonstrate the feasibility of using readily available CBI technology to develop appropriate training and simulation materials for a number of facets of radar theory and operation.

Working with subject matter experts (SME) at VAW-110, the Pacific Fleet E-2C readiness squadron, objectives for basic radar theory and operator setup procedures were developed. These objectives were used to define the appropriate testing formats within the constraints of the CBI format. SMEs aided in constructing theory and operation lessons in workbook format, which other instructors and students reviewed.

CBI lessons have been designed and are currently being developed using a commercially available authoring system. A government authoring system (CBESS), will be incorporated when available. This system allows a nonprogrammer to access a number of instructional strategies by developing and entering a data base. A prototype hardware system has been purchased and configured. Testbed implementation of the training system will occur when curriculum components are completed. If COMNAVIAIRPAC and VAW-110 are satisfied with the results of the implementation, further implementations will probably be carried out in VAW-110 as well as in other as yet unidentified commands.

P. E. 99000N

WR 00081



ECM/ECCM TRAINING

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The Fleet Combat Training Centers, Pacific and Atlantic (FCTCP and FCTCL) need electronic countermeasures and electronic counter-countermeasures (ECM/ECCM) training systems in areas for which no adequate alternative training exists. This will require: (1) selecting and configuring state-of-the-art computer equipment for training purposes, (2) identifying and adopting a software support system capable of supporting ECM/ECCM lessons and expanded future requirements, (3) including a high-level authoring system that will allow authoring and revisions by personnel with no special computer skills, (4) evaluating the instructional effectiveness of the training system, (5) developing specifications for packaging (human factors engineering), (6)

developing a deployment plan to remote/shipboard sites for refresher training, and (7) implementing a long-range plan for the training system. This plan must integrate this training system with other microprocessor-based Navy training systems currently being developed or planned to ensure their supportability in future school-house and remote sites.

The major accomplishments to date are as follows. The requirements of the existing ECM and ECCM lessons have been documented by analyzing the existing instruction, documenting the programs, defining software requirements, and choosing the new environment (software, operating system, hardware) based on these requirements. The ECM recognition lesson has been completed and is ready for student use. ECCM lesson components are currently under development. Software has been written in MS-Pascal for use on IBM PC

compatible machines and has been fully documented. Implementation planning is based on delivery of hardware in March of 1986. Maintenance and logistic support planning is underway. The development of the required video interface has been completed, and the software has been transported to the newly identified hardware, language, and operating system.

Plans for the next two years, include the inclusion of an authoring system, the

development of additional ECM/ECCM lessons as required by the schools, the specification of components for a remote/shipboard system, and the specification of the life-cycle support requirements. Direct implementation of the training system is planned in FY86 at FCTCP and FCTCL.

P.E. 99000N

WR-DJ891



This is an example of one of the 12 types of radar jamming that operators must identify and counter.

USMC INDIVIDUAL TRAINING STANDARDS

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The Training Department, HQMC, has the responsibility for developing analysis survey reports (ASR) and individual training standard (ITS) systems. However, the Marine Corps itself lacks the personnel capable of developing the systems for all areas. The ASR system will assist in the validation of current military occupational specialty (MOS) structures. An ITS system will be used to impose training and evaluate individual performance. ITSs must be developed for each category of individual training conducted in Marine Corps units and institutions.

The ASR and ITS systems will contribute to the design, development, implementation, and evaluation of all individual training programs. The ITS system

will be available for instructional institutions and unit commanders as well as for individual Marines so that they will know what is expected of them.

development of the ASR and ITS systems, (3) develop and revise technical guides to support the contractual development of ASR and ITS systems, and (4) prepare, award, and monitor contracts to develop ASR and ITS systems for MOSs designated by HQMC.



The objectives of this project are to (1) develop of ASR and ITS systems in support of the Training Department, HQMC, (2) comment on the Training Department's standard operating procedures (SOP) for the

The systems-approach-to-training (SAT) techniques, as specified in Marine Corps references, will be applied to the development of ASR and ITS systems. Emphasis will be on the elaboration of the analysis phase

of SAT. A technical guide for this process will be developed and verified through the contractual process.
P. E. 99000N
WR-68866

TRAINING SUPPORT FOR USMC DRAGON PIP

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The United States Marine Corps (USMC) has initiated a product improvement program (PIP) for the Dragon Anti-Tank Medium Assault Weapon System.

The program is designed to improve both the operational and systems capabilities of the Dragon. The PIP is being managed by the Naval Surface Weapons Center (NSWC), Dahlgren, Virginia, and will be done under a competitive procurement. NPRDC is helping NSWC procure the training needed to support the improved system.

NPRDC began work on the program in FY85. The initial effort involved a survey and analysis of training for the existing weapon system. Training documents were reviewed and visits were made to the Marine Corps Infantry Training

Schools, the Marine Corps Development and Education Center, Headquarters USMC, and the Dragon program management offices. A number of deficiencies were identified, and possible improvements were discussed with USMC personnel.

Training specifications and requirements have been developed and incorporated into the Dragon PIP prime item specification and the statement of work of the request for proposal to ensure an improved training capability for the Dragon PIP.

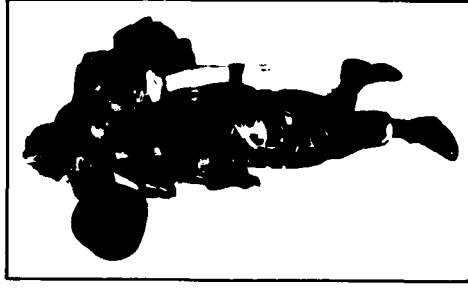
Training requirements have been included for Marine Corps operators and organizational, intermediate, and depot level maintenance personnel. The requirements have been coordinated with the Naval Training Systems Center's program for the Marine Corps precision gunnery training system (PGTS).

The PGTS program represents the next generation of Dragon training devices.

NPRDC will continue in the role of training consultant to NSWC for the duration of the Dragon PIP. Help will be provided in evaluating the contractors' proposals for training and, once a contract has been awarded, in reviewing and evaluating the training products that are being delivered.

P. E. 99000N

WRD0139



MM7 DRAGON WEAPON SYSTEM

DRAGON



TP1B-1

OCCUPATIONAL COMPETENCY TESTING

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Navy shipyards are trying to overcome the lack of measures for testing occupational proficiency. At the present time, there are no written or performance tests to determine if an individual has the skills and knowledge necessary to perform the various jobs required in the shipyard. Because of this, it is difficult to determine if a particular course has been mastered, whether the training was effective, and if the individual needed the information in the first place. In addition, it makes hiring and promotion decisions more difficult.

The objective of this project is to develop and validate tests that will measure occupational proficiency in the skilled trades. If successful, this effort will serve as a prototype from which



additional tests for the shipyard will be developed. The pipefitters trade has been selected as the area to concentrate on initially.

This project started in FY86. The approach will be first to identify competency areas or skills that are essential to the pipefitters trade. This information will be used to develop both written and performance tests, which will be validated by administering them to an appropriate sample of pipefitters. Using the resulting data, pass/fail scores will be determined, and interpretation



procedures will be established. Finally, mechanisms for using the test results in a variety of situations will be developed. This effort is scheduled for completion in FY86.

P. E. 99000N
PO 50003

DEVELOPMENT OF A FEEDBACK AND EVALUATION SYSTEM

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The Defense System

Management College (DSMC) serves the Department of Defense as its center for acquisition management education. The basic mission of the DSMC is to teach people who manage defense systems acquisition programs to employ the most effective management practices. The DSMC offers a number of different courses to military, civil service, and private sector personnel. In its continuing efforts to improve its procedures the DSMC has identified the need for a feedback and evaluation system.

This effort consists of three broad phases. The first phase is aimed at describing the DSMC, its environment, and objectives. This preliminary phase also includes gathering interview and survey information from DSMC personnel

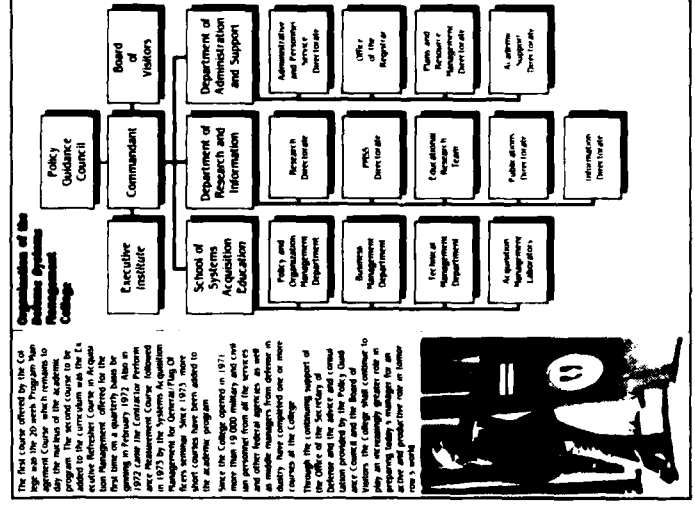
about the potential uses of and perceived need for a feedback system. Based upon this input from faculty and administrators, specific feedback content areas will be determined. In order to move into the design and development phase, the project will build a profile of DSMC's customers and evaluate the feedback systems used at other institutions that are similar to the DSMC. Phase two involves actually designing and developing the feedback and evaluation system. Details of the system, such as time frames, substantive areas, methods for data collection, and recommended statistical analyses will be delineated. The last phase in the project is administer and evaluate the system. Here, one of the goals is to identify specific individuals or departments who will actually do the work of gathering, analyzing and disseminating feedback information. Once feedback information is gathered and

disseminated, its utility will be assessed. In addition, the effectiveness and efficiency of the feedback process will be examined.

This project, which extends into FY 1987, is a joint effort by NPRDC and DSMC personnel. Once the feedback system is institutionalized, the DSMC will assume sole responsibility for administering and maintaining the system.

P.E.99000N

MIPR DSMC 4396



CONTRACTOR PERFORMANCE MEASUREMENT/COMPUTER BASED TRAINING (CPM/CBT)

Principal Investigator:

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The Defense Systems

Management College (DSMC), the primary DoD educational institution for acquisition and logistics training, offers a curriculum responsive to the needs of major DoD program

management offices. DSMC

maintains a research and development department that is dedicated to enhancing the curriculum and advancing the use of educational technology.

This project supports DSMC's exploration of advanced educational technology. DSMC has selected its contractor performance measurement (CPM) course for conversion to a computer based instructional format. The course is currently offered as a resident course at DSMC and as a hard-copy, self-paced correspondence

course. It is one of DSMC's most highly used courses. The course covers the cost/schedule control system criteria required on all major DoD contracts and teaches methods for using contractor reports to identify existing and potential deviations from planned performance.

The objective of this project is to design and develop a computer-based, CPM course that will maximize the use of the computer's instructional capabilities. The course will be designed for delivery on both IBM

and Zenith personal computers to provide maximum access by DSMC's student population. It will provide a high level of student interaction, flexibility for movement within the instructional material, and immediate and tutorial student feedback. Although most of the material will be textual, the course will capitalize on the use of graphics to provide tables, charts, and

supplementary imagery. The instructional software will be designed for initial CPM training but will also provide a valuable reference for on-the-job performance.

The course will be developed in close coordination with subject matter experts from DSMC's faculty. Review cycles will provide input for tailoring revisions to the technical content as well as the display requirements. Most of the developmental work will be completed during FY86, but the final implementation and test will be conducted at DSMC during the first quarter of FY87.

This project will serve as a test-bed for further applications of computer-based instruction to other areas of DSMC's curriculum. Since the new version of the CPM course should be more effective than the current self-paced version, it should enhance the quality of services that DSMC provides to its customers.

P. E. 99000N

MIPR DSMC 4446

Contractor Performance Measurement Course



The 11-week Contractor Performance Measurement Course (CPM/CBT) is a computer-based training course designed to provide a valuable reference for on-the-job performance. The course is designed for initial CPM training but will also provide a valuable reference for on-the-job performance.

A major objective of the course is to provide a valuable reference for on-the-job performance. The course is designed for initial CPM training but will also provide a valuable reference for on-the-job performance.

of 11 weeks for a 11-week course. The course is designed for initial CPM training but will also provide a valuable reference for on-the-job performance.

INTERACTIVE VIDEO TRAINING FOR NAVY SHIPYARDS

Principal Investigator:

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Each of eight Navy shipyards maintains a major training organization with over 7000 students enrolled in just the apprentice training programs. In addition, the shipyards provide certification and recertification training, refresher training, training on new equipment and in technologies, training in the skills required by supervisors and managers, etc. Until fairly recently, each shipyard managed its own training programs with little interaction between shipyards or guidance from the Naval Sea System Command (NAVSEA). In 1982, however, NAVSEA established a shipyard training modernization program designed to encourage the use of instructional system development (ISD) procedures and the sharing of instructional materials. Two

instructional design centers have been established to help the individual yards with ISD and to provide centralized facilities for the development of video training materials. The primary focus of the modernization program is on the major apprentice training programs.

NAVSEA has recently become interested in possible applications of interactive video training in the shipyards. Interactive video is a form of computer-based training in which a microprocessor is used to control access to images and motion sequences stored on a videodisc. Since an extensive application of interactive video would represent a substantial capital investment, NAVSEA decided to start with a pilot study. A limited number of interactive video training devices will be used in two of the shipyards for a year. The instructional materials will be developed jointly by the shipyard

training organizations and the instructional design centers. Data from the pilot study will be used to refine estimates of how extensively interactive video will be used and how much it will cost to develop the instructional materials. Primary emphasis will be in the areas covered by the modernization program.

NPRDC is helping NAVSEA with several elements of the pilot study. Specifications are being developed

for the interactive video training devices that will be used during the pilot study. NPRDC is also helping to procure the training and consultation that the shipyards and design centers will need to develop the instructional materials. Finally, the Center is providing preliminary estimates of the areas in which applications of interactive video training might be most effective.

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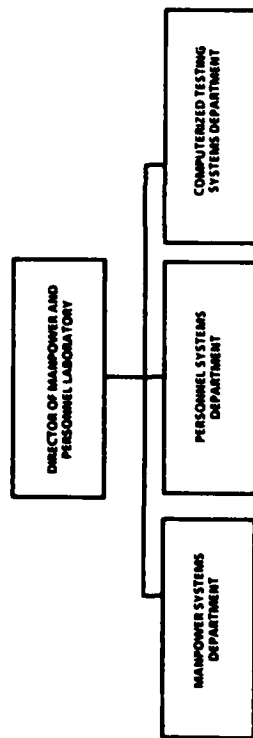
MANPOWER AND PERSONNEL LABORATORY

Director: Martin F. Wiskoff

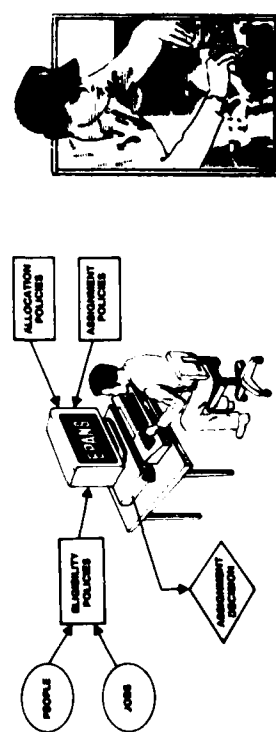
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The manpower and personnel laboratory is concerned with developing technology and procedures that will enable the Navy to obtain and deploy the most effective qualitative and quantitative mix of personnel to meet fleet performance and readiness requirements.

This laboratory is organized into three departments.



The manpower systems department develops techniques and systems for determining manpower requirements, allocating manpower resources, and controlling personnel inventories. It also develops comprehensive manpower planning techniques for rapid, effective response to fluctuations in personnel resources and commitments. The personnel systems department develops methods and procedures to improve recruiting, assessment, selection, classification, satisfaction, and retirement of personnel. The computerized testing systems department develops adaptive assessment systems to replace existing instruments, e.g., the Armed Services Vocational Aptitude Battery (ASVAB), and evaluates new computer-based procedures to improve measurement of Navy personnel. Major research and development projects include:



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MANPOWER SYSTEMS SIMULATOR (IMAGE)

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The success of military

manpower managers is due more to their individual intelligence and energy than the procedures used to prepare them for their jobs. Because of insufficient overlap between succeeding incumbents, many officers arrive at a manpower management position with little or no orientation (much less training) from his or her predecessor. Lacking specific

manpower management experience, many officers require a significant amount of time on the job before they become effective. Consequently, most officers learn personnel force management on the job. Typically, formal instruction is not available or, if available, it concentrates on procedural or administrative aspects of the job. Manpower managers normally have only a

few opportunities to make major force management decisions during their tours of duty. Yet, when such decisions arise, they often have far-reaching readiness and financial impacts. The opportunity to sharpen decision-making and force management skills is desirable, but practicing on the personnel system itself is unacceptable. Like a pilot using a flight simulator, manpower managers need the capability to develop, freshen, and refine their skills without fear of harming the personnel system (or their careers).

During the last year, a prototype of a computerized training simulator for manpower management has been developed. The simulator, known as IMAGE, will enable manpower managers to acquire an understanding of how military personnel systems behave, to grasp the essential techniques for managing these systems, and to see how those systems respond to changes in

policy. Simulations take the form of "management games," which are represented by a series of decision scenarios simulating the management environment of manpower planners. Knowledge acquired in "playing" these games facilitates the operational use of a variety of personnel flow models used in managing the force of military personnel. Managers will gain experience by using IMAGE to test the effects of their hypothetical decisions on the size, shape, and cost of the personnel inventory.

IMAGE encompasses

expository textual material, a graphical representation of the personnel inventory, periodic tests of knowledge acquisition, and an interactive decision-making game supported by a mathematical model of the military personnel system running in the background. Managers initiate their training with a computer-administered test of subject matter knowledge to establish a "before and after" baseline. The student is then directed through different knowledge acquisition sequences based on the results of this test and comprehension of textual

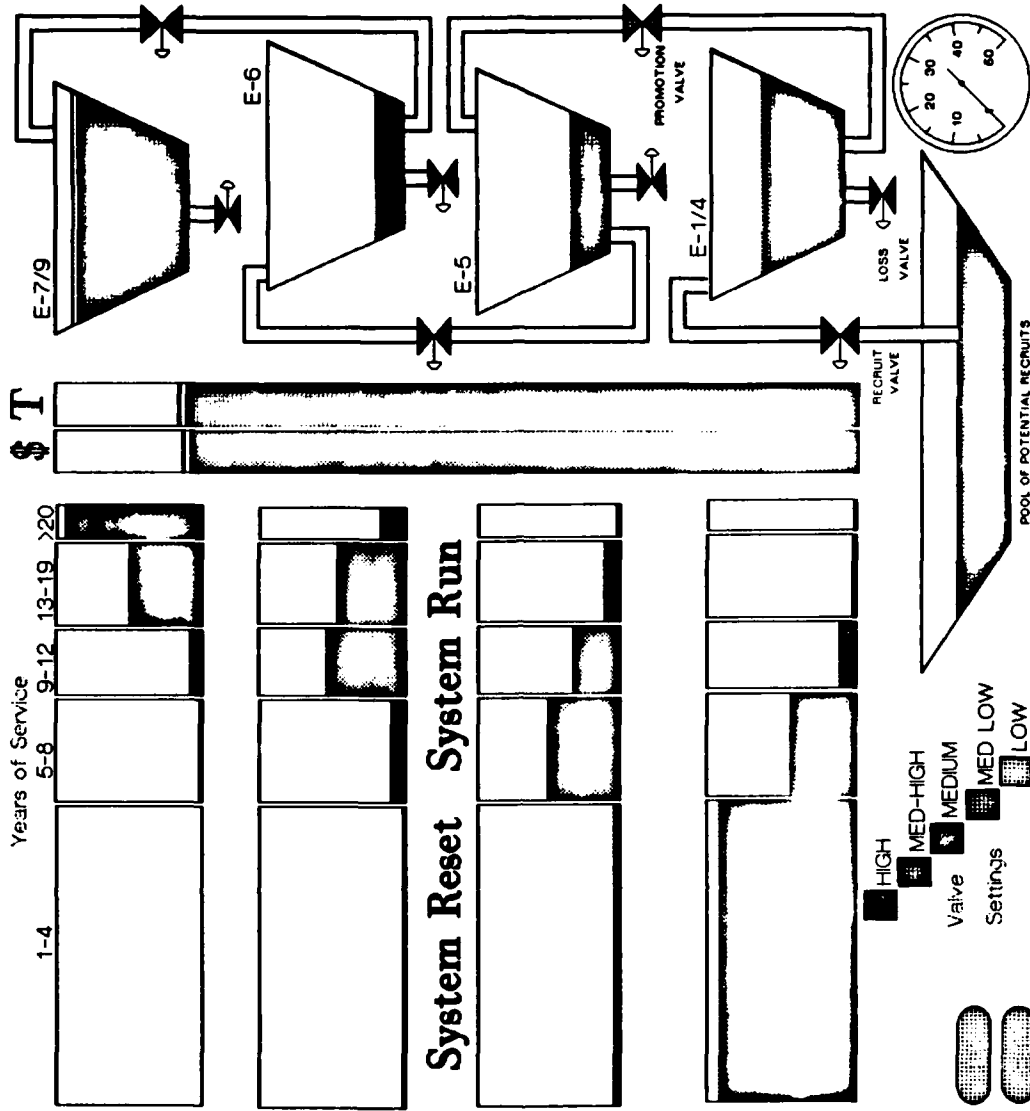
material. A student database is maintained to support analysis and redesign. It is estimated that 8-16 hours on the simulator is equivalent to about 10-12 months of related experience obtained on the job.

The first interactive game embedded in IMAGE involves management of the enlisted personnel inventory, which is represented graphically as a hydraulic system (see figure). Personnel resources are contained in a series of buckets. Each bucket represents a grade or aggregation of grades. A horizontal line on each bucket sets the desired level of personnel strength for that grade. Adjacent buckets are linked by pipes, each with a valve regulating promotion flow from grade to grade. The bottom of each bucket has a valve regulating losses (or its complement, retention) from that grade. By manipulating the valves, the manager exercises a measure of control over the level of personnel in each grade relative to requirements.

A prototype of IMAGE is being prepared for installation in the

Pentagon in FY 86 under the aegis of the Deputy Assistant Secretary of Defense (Manpower). It is anticipated that two more prototypes will be installed in FY87, including an abbreviated version at the Defense Advanced Research Projects Agency (DARPA) Joint Service Demonstration Center in Rosslyn, VA.
P E 99000N
MIPR-13ARI-85-57

Personnel Inventory Management Game - Enlisted



ENLISTED PERSONNEL ALLOCATION AND NOMINATION SYSTEM (EPANS)

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Until now, the Navy personnel assignment system has been basically a manual process. Deficiencies in this process can be attributed to (1) the lack of efficiency in terms of time and cost, (2) the inability to identify all possible assignments and select the best one, and, perhaps most serious, (3) the inability to execute multiple assignment policies properly. Persistent problems due to inventory/billet mis-matches, tight permanent change of station (PCS) budgets, and constraints imposed by existing assignment policies require improved systems to guide the distribution and assignment of personnel.

The objective of this effort is to develop a computer-assisted system for enlisted personnel assignment. This system would improve the effectiveness of

enlisted assignment through the application of large-scale, multiple-criterion optimization models. Measures of success include faster and less labor-intensive personnel actions, better decisions in terms of minimizing the imbalance in personnel assets among the fleets, and the ability to maximize individual location references.

The approach is to (1) develop a prototype automated allocation and nomination system for nonrated personnel (seaman (SN), airman (AN), and fireman (FN) apprentices), (2) test and evaluate the system at the Enlisted Personnel Management Center (EPMAC), (3) progressively expand the system to handle higher skilled (rated) and higher graded (petty officer) personnel, and (4) test and evaluate the expanded system at the Naval Military Personnel Command (NMPC).

Accomplishments to date include the development and implementation of an enlisted

personnel allocation and nomination system (EPANS) for nonrated personnel. EPANS matches people to jobs in accordance with multiple criteria, including fleet balance, PCS cost minimization, and individual geographic location preference. In FY85, EPANS was also developed for the Quartermaster (QM) rating, paygrades E-1 through E-4.

FY86 plans call for developing EPANS for more enlisted ratings and paygrades. EPANS implementation for administrative, deck, and supply ratings will be emphasized.

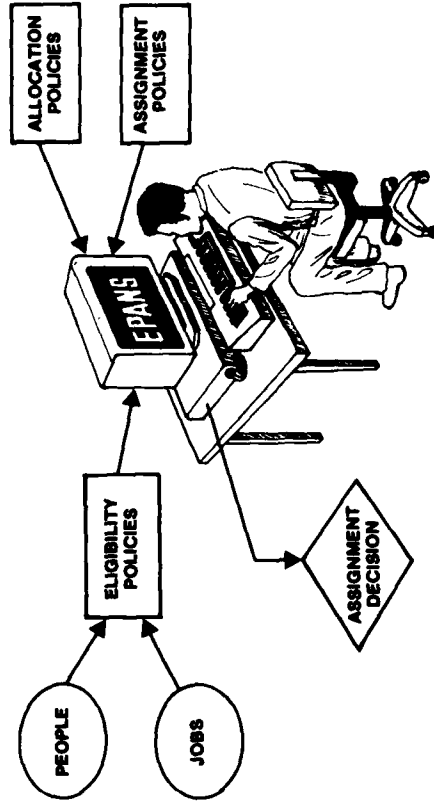
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Z1770-MP006

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MULTIPLE-CRITERION OPTIMIZATION TECHNIQUES FOR PERSONNEL ASSIGNMENT

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Navy personnel assignment is a large, complex operation. Over 500,000 active enlisted personnel are assigned to Navy activities all over the world. These personnel can be found in both sea duty and shore duty jobs and in locations as distant as Antarctica and the Indian Ocean. They are assigned to some 5,000 different activities or units in about 300 distinct occupational specialties and at nine different skill levels. These assignments are made by the "wholesale" allocation of personnel via quotas to major groupings of Navy units distinguished by geographical region, types of duty, etc., followed by the assignment or "detail" of individuals to jobs within those unit groups.

Navy personnel assignment problems hold unique challenges for the integration of multiple

criteria decision making and large scale optimization techniques. Decisions are made at the operational level where aggregate resource allocation plans (fleet readiness, permanent change of station (PCS) budgets, training quotas) must be linked with individual assignments and operational policies and constraints (job priorities, individual preferences). Quantitative policy tradeoffs must be made explicit to assure agreement between Navy assignment "planners" and "operators" on the relative importance of the policy criteria. The objective of this effort is to investigate and develop methodologies to solve complex, large scale, multiple criteria optimization problems associated with Navy personnel assignment.

The approach is to (1) investigate and develop new computational network codes capable of handling a large variety of objectives and constraints for the Navy's assignment problems,

(2) explore structured modeling and aggregation theory for interfacing the links in policy setting at the strategic level and implementation at the operational level, and (3) examine the potential use of artificial intelligence/expert systems technology in assignment systems.

The most significant accomplishment to date is the development of a multiple objective network transshipment model to solve the Navy personnel assignment problem for enlisted personnel who do not require advanced technical training. Another accomplishment is the use of a shortest-path network algorithm to calculate driving distances between duty stations for a PCS costing model.

In FY85, work was begun with academic experts in the fields of aggregation theory, networks with side constraints, structured modeling, and artificial intelligence to advance the technology.

FY86 plans include developing and testing a network model to solve more complicated

assignment problems which consider classroom availability at training facilities. Current research is aimed at developing technology to handle the assignment of enlisted personnel requiring extensive technical training. This technology will also be used with concepts in aggregation-disaggregation theory to develop advanced techniques in global resource allocation and management. Developing techniques for more effective execution of the PCS budget is just one example of an important application.

P E 62763N
521-804-031-03.06
P E 61152N
01-042 00

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PERMANENT CHANGE OF STATION (PCS) MOVES

Principal Investigator:

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Annually, the Navy moves roughly 300,000 of its officers and enlisted personnel. These moves are made to bring new accessions to recruit training and later to their first duty stations, to send personnel to required training courses, to rotate personnel to new assignments, and to relocate crew members when a ship changes home-port. The moves are collectively known as permanent change of station, or PCS, moves.

The Navy spends approximately \$500 million on PCS moves each year. These costs are part of the Navy's \$17 billion Military Personnel, Navy (MPN) budget. In the formulation of the MPN budget for future years, the number of required PCS moves

must be accurately estimated and costed to ensure that adequate funds are available during budget execution to accommodate moves needed to operate and maintain the fleet. The estimated PCS moves must be defended within the Navy, and ultimately, before Congress, as part of the MPN budget justification process. The manual methods currently used to estimate move requirements are sometimes inaccurate and difficult to defend.

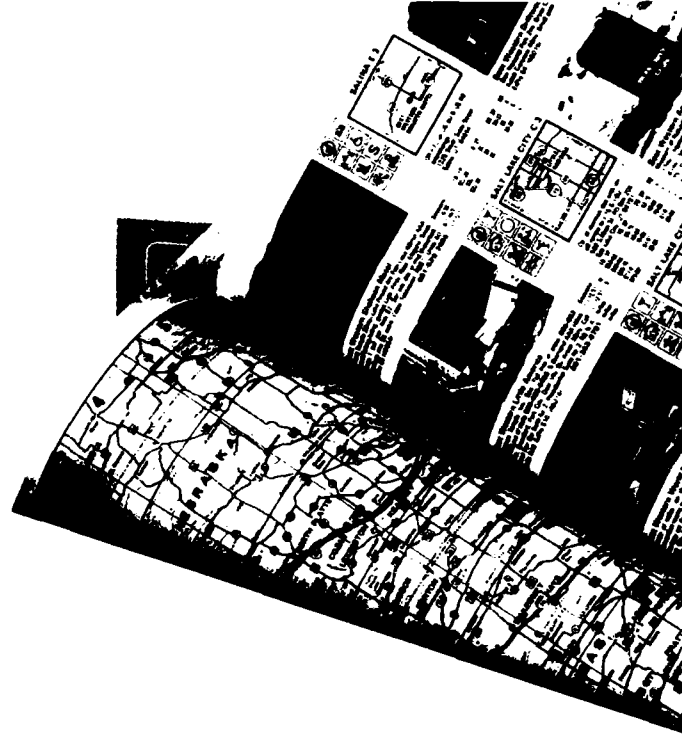
The objective of this project is to develop statistical techniques that can produce accurate and defensible move forecasts for officer and enlisted operational, rotational, and training moves. A review of existing methods used by the Naval Military Personnel Command (NMPC) to forecast moves will be undertaken and machine-readable historical PCS moves data will be collected,

organized, and analyzed. With a move database established, the forecasting problem will be approached from both an aggregate and a disaggregate perspective. That is, an exploratory, bottom-up modeling approach to developing the budget estimate will be investigated, as well as an aggregate level, time series approach for sizing the problem

and verifying the forecast of the detailed model.

In FY86, existing methods used by NMPC to forecast moves will be reviewed, a historical PCS move data-base will be constructed, and methods for forecasting enlisted operational moves will be investigated.

P.E. 99000N
WR-H5085



BUDGET OBLIGATION ANALYSIS AND TRACKING SYSTEM (BOATS)

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Last year, the Navy spent

approximately \$17 billion to pay its military personnel. These payments are made from the Military Personnel Navy (MPN) budget, which is managed by the Naval Military Personnel Command (NMPC-7). Responsibility for managing the MPN budget requires a continuing assessment of how much money the Navy owes its members and the monitoring of these financial obligations with respect to planned monthly spending levels. These management functions are performed separately for over 100 pay and allowance categories (called entitlements), including basic pay and basic allowance for quarters. Most of these pay and allowance categories are composed of numerous subcategories, resulting in hundreds of entitlements

for which obligations must be calculated and tracked during the year.

To determine obligations each month, the Navy's budget analysts rely on entitlement data from the Joint Uniform Military Pay System (JUMPS). The necessary data are extracted from a voluminous report called the Accrued Entitlement Detailed Classification Code Report. This report is also called the IM Report. Data transcribed from the IM are compiled and used to estimate year-to-date obligations. Obligations must be estimated each month because the current month's entitlement amounts reported by JUMPS are incomplete due to lags in the reporting system. Obligations are estimated based on observed patterns of retroactive entitlements which are also reported in the IM. Obligation estimates are compared to planned year-to-date expenditures. This comparison

reveals if the budget is being executed according to plan, or if corrective actions are needed.

The manual extraction, transcription, and manipulation of the data needed to estimate and monitor obligations is very time-consuming. The objective of this effort is to develop a computerized system, called the Budget Obligation Analysis and Tracking System (BOATS), for retrieving past and current JUMPS data, for computing current obligation estimates, and for tracking estimated year-to-date obligations vice planned expenditures.

Efforts to date have produced a database of JUMPS data from July 1981 to the present for 330 entitlements, by paygrade and length of service, where appropriate. Interactive software for retrieving these data in graphic and array formats has been developed. In addition, software to derive monthly obligation estimates for all 330 entitlements and to interactively retrieve and/or override these estimates have been developed. BOATS has simultaneous multiuser capability. It is used interactively

by NMPC-7 budget analysts to retrieve system-generated obligation estimates each month, to evaluate these estimates with respect to current and historical JUMPS data, and to enter their overrides to the system's estimates of obligations.

Efforts in FY86 and beyond will include the expansion of the JUMPS database and database updating system to capture retroactive entitlements for a longer time frame than is captured in the current database. Modifications to the retrieval software will be made to enable user access to the expanded database. A budget monitoring module of BOATS will be designed and developed.

P. E. 99000N

WR-H5130, WR-H5084

MILITARY PERSONNEL COST PROJECTION

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The financial obligations for military pay and allowances are incurred by the Navy throughout the fiscal year, but not all obligations are reported in the month they occur. Part of the total obligation attributable to a specific month is reported, or observed, in up to 35 subsequent months. This phenomenon is called "rollback." Rollback occurs due to delays in transmitting members' entitlement information from field activities to the Navy Finance Center (NFC) in Cleveland, Ohio, where the Military Master Pay Account records are centrally maintained. In addition, the time needed to process and edit this data after receipt by NFC further contributes to rollback. The magnitude of rollback varies from month to month, year to year, and from one budget category to another. The Naval Military

Personnel Command (NMPC-7) has a two-fold need to forecast rollback accurately. First, rollback must be estimated in order to determine how much money to obligate to fund the Navy's year-to-date financial commitments for military pay and allowances. Second, accurate estimates of rollback must be made to determine whether the budget is being executed according to plan or whether appropriate corrective actions are required.

The functions of obligation determination and budget execution monitoring are currently performed manually by NMPC-7 budget analysts, including the task of forecasting monthly rollback for each of approximately 120 budget categories. The objective of this effort is to develop statistical models for forecasting rollback at any desired level of budget category detail, including paygrade and length of service (LOS), where appropriate. Model

development is difficult due to limited historical data and the need to reserve 36 months of data for validation.

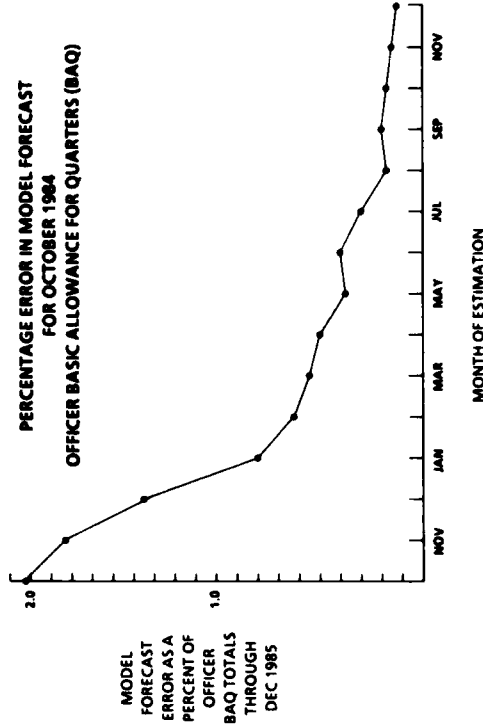
Efforts to date have yielded rollback forecasting models for 120 budget categories, and their component categories, and their paygrade/LOS dimensions. These models are based on rollback patterns observed since FY81. The model's FY84 estimates have been validated against actual rollback totals, as of December 1985. Accuracy to within .15% of actual totals have been observed. As a result, the models have been incorporated into the Navy's Budget Obligation Analysis and Tracking System

(BOATS) as an automated means of estimating year-to-date financial commitments.

Efforts in FY86 and beyond will focus on developing alternative forecasting models for budget categories lacking reliable historical data and on the development of an automated validation system for assessing the performance of different models.
P. E. 63707N
Z1770-MP008

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UTILIZATION OF NAVY ENLISTED SPECIALIZED SKILL TRAINING

Principal Investigator:

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Navy "C" schools provide specialized skill training to Navy officer and enlisted personnel and to members of the Navy Reserve, other services, civilian, and foreign national communities. Many "C" schools award enlisted personnel a Navy Enlisted Classification (NEC) Code. NECs reflect special knowledge and skills when the rating structure is insufficient for manpower management purposes.

Attention has recently focused on increases in "C" school training costs. In turn, this prompted the question how well does the Navy use the members it has trained? The objective of this project is to quantitatively assess NEC utilization.

Analysis of NEC utilization data began in late FY85. Utilization rates were computed from the Enlisted Master Record for a subset of 72 NECs. The utilization rate ranged from as low as 30% to as high as 90% for most of the NECs in the subset. Records for members not using their most recently awarded NEC were analyzed to identify reasons for non-utilization. For example, many NECs in the subset are attached to sea billets only. In this case, a high NEC utilization rate at sea is desirable, low shore utilization is expected. Records for non-utilization personnel were examined to determine the number serving at sea versus the number serving on shore. Figure 1 shows a comparison of sea and shore utilization for 3 NECs.

Changes in NEC utilization rates over time were also identified. The data reflected large increases in utilization for NECs corresponding

to new equipments and decreasing utilization for NECs associated with discontinued equipments.

An analysis of members assigned to NECs in the subset showed that NEC requirements are filled in some cases with personnel who do not hold that NEC. Course data from the Enlisted Master Record were examined to determine the extent to which members without NEC awards were qualified for assignment in a particular NEC.

Planned analysis in FY86 includes examining the relationship between NEC manning levels and NEC utilization, the average time to NEC utilization, and the rate of NEC utilization in the Navy enlisted force.
P. E. 99000N

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DIFFERENCES IN SEA AND SHORE UTILIZATION FOR 3 NECs, END FY84

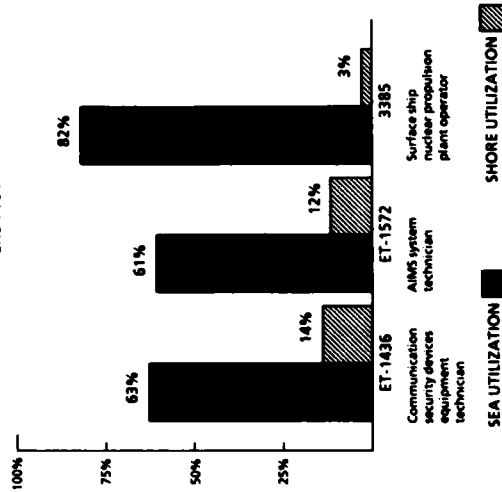


Figure 1.

OFFICER PERSONNEL MANAGEMENT MODELS

Principal Investigator:
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To meet current and future needs for officers, the Navy must forecast losses and devise plans for accession, promotion, and training that will produce the desired personnel structure. To do so requires the development of techniques to improve the accuracy with which force planners predict personnel flows, develop personnel policies designed to meet officer manpower requirements, and track the effects of those decisions on the structure of the force. Without these techniques to guide policy decisions, inventory excesses or shortages may occur or persist.

The objective of this project is to develop a set of computer-based models and databases to assist in the development of a Navy officer force that meets its manpower requirements. Development has focused on the structured accession planning

system for officers (STRAP-O). Operationally, STRAP-O has provided a common "playing field" for promotion and accession planners, retention and compensation managers, strength planners, and community managers concerned with the feasibility of future manpower plans.

A prototype of the STRAP-O system has been operational in OP-13 since 1981. Initial versions were limited to modeling the unrestricted line communities. STRAP-O now has the capability to project personnel structures for the unrestricted line, restricted line, and staff corps communities, as well as for the total officer force.

STRAP-O can also model separately the jet, propeller, and helicopter portions of the aviation community, and the nuclear and non-nuclear portions of both the surface and submarine communities. An end-of-obligation date (EOD) for all unrestricted line officers (URL) has

been developed and validated. This date will be particularly useful in making retention/bonus decisions and accession policies. The design of an Officer Personnel Information System (OPIS) has been completed. The system is composed of modules that enable managers to display a variety of inventory, personnel flow, and retention statistics in both graphical and array formats. Development of a system of data processing procedures to feed the STRAP-O, OPIS, and EOD efforts has been completed.

In FY86, a Medical Community data base will be developed. These data will permit development of a loss forecasting model particular to the medical communities and will provide a historical file of these communities. An EOD for all officers will be determined and

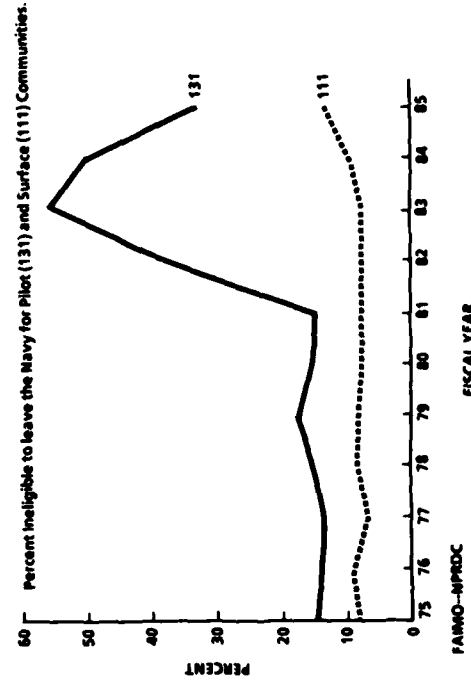
validated. STRAP-O will undergo a thorough verification and validation of its forecasting routines. STRAP-O's loss forecasting parameters will be reestimated to reflect recent unemployment, bonus, and pay raise data. A warrant officers module will be added to STRAP-O. The Force Analysis Simulation Technique Input for Officers (FAIMO) will be updated with FY85 data.

P.E. 63707N
Z 1770-MP004
P.E. 99000N
WR-25113

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PERSONNEL PLANNING DATA DEVELOPMENT

Principal Investigator:
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The accuracy and reliability of enlisted personnel planning models depend on the quality of their underlying databases. Each model requires data in certain formats and employs parameters that must be periodically reestimated. Without effective systems of data support, the models soon lose their design capabilities.

The objectives of this project are to provide data support for the Navy's enlisted personnel planning system and to provide technical support and development for several of the Navy's enlisted personnel forecasting and planning models, including FAST (Force Analysis Simulation Technique), ADIN (Advancement Interface System), and STRAP-E (Structured Accession Planning-Enlisted). To accomplish these objectives, data must be collected from a variety of sources, then

organized and processed, and data inputs generated to fit the operational models.

In FY85, the FAST model was modified to incorporate the four apprentice ratings in greater detail. This addition required numerous changes to existing FAST software, and the creation of more than a dozen new subroutines. Databases were produced for the different versions of FAST, including (1) Active Duty, (2) Training and Administration of Reserves (TAR), and (3) TARless versions. Several software changes were made to accommodate new ratings, such as Fire Controlman (FC), Weapons Technician (WT), and Utilities Constructionman (UC) before their introduction into the fleet.

The ADIN system has been installed for use by the enlisted advancement planner, Chief of Naval Operations (OP-135C). It has now been used operationally during several advancement cycles. The system can be operated by an

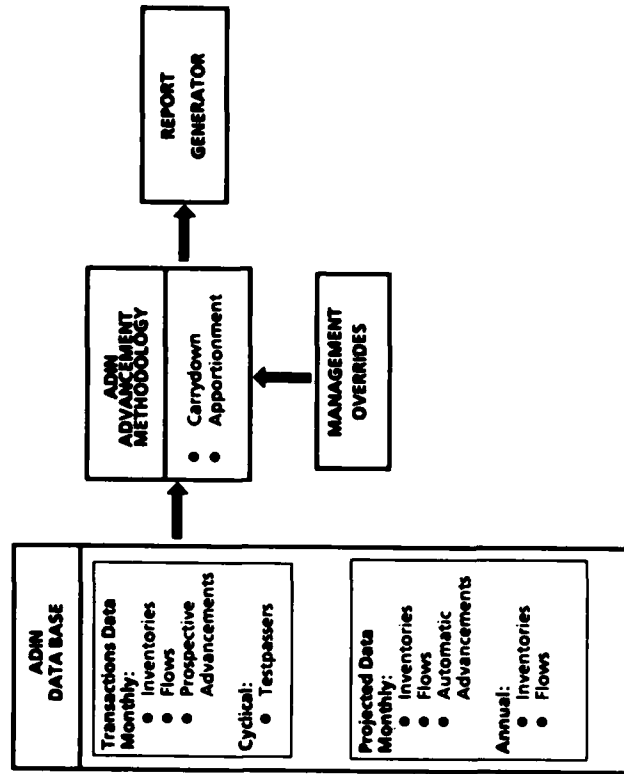
advancement planner with little computational experience.

In FY86, the ADIN system will add a reporting capability that delivers advancement opportunity data to other personnel management organizations. In addition, a number of features to further simplify its use will be developed and the system will be documented.

A new STRAP-E database was delivered, and tutorials and technical support were provided.

P.E. 99000N

WR-25114, WR-25021



The Advancement Interface System (ADIN)

TOTAL FORCE MANPOWER TRADEOFFS

paygrades by functional category and resource sponsor (e.g., air warfare, surface warfare).

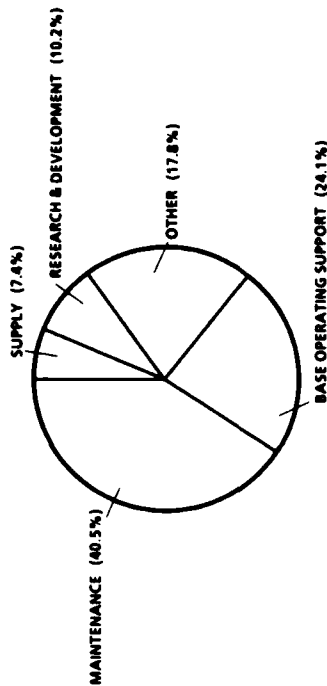
P.E. 63707N

Z1770-MP002

REPORTS:

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DISTRIBUTION OF FY84 NAVY CIVILIAN PROGRAMMED MANPOWER



Principal Investigator:
Michael Shoecraft
(619) 225-2971

Planning for the Navy of the future requires a knowledge of the manpower consequences of future force levels. At present, the Navy lacks quick and relatively accurate methods of assessing the impact of alternative fleet sizes and configurations on the requirement for support manpower. This deficiency is highlighted as the Navy seeks to achieve a force strength of 15 battle groups and 600 ships.

Improved methods are needed to project support manpower requirements through the Extended Planning Annex (EPA), 17 years out, and to verify manpower authorizations projected 2-7 years in the future in the Department of the Navy Five-Year Defense Plan and during

the Program Objectives Memorandum (POM) process. Total force manpower (active military, reserve military, civilian, contractor) needs to be evaluated to achieve a cost-effective support force. The objective is to develop systems to support these manpower planning and allocation functions.

Accomplishments to date include the development of a manpower projection model (MAPRO) for EPA exercises and a series of models designed for use in Defense Planning and Programming exercises.

FY86 plans include the development of techniques to support the manpower, personnel, and training baseline assessment. This will allow comparisons of manpower requirements, billets authorized, and personnel levels for Navy enlisted ratings and

NAVY LABORATORIES STAFFING MODELS

Principal Investigator:
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(619) 225-2971

The Navy's research and development (R&D) centers employ a large quantity of technically trained and expensive manpower. Historically, the R&D centers, under the Director of Navy Laboratories (DNL), have had difficulty in justifying their manpower requirements to higher authority. This is because the nature of R&D is not amenable to traditional work measurement methods, such as engineered time standards, and no methods were available to justify staffing based on workload. A defensible manpower planning system for the R&D centers is needed.

The objective of this effort is to develop manpower estimating models (MEMs) to project total direct-funded scientist, engineer, and technician (SE&T) staffing

levels for eight R&D centers and to provide DNL financial managers with a budget and manpower justification tool.

Significant accomplishments include the development and implementation of a model that projects SE&T staffing levels at the eight DNL R&D centers by product area, given specific funding levels, and in-house/contract mixes. The model can also be used to evaluate the impact of personnel ceiling and in-house dollar expenditure limits.

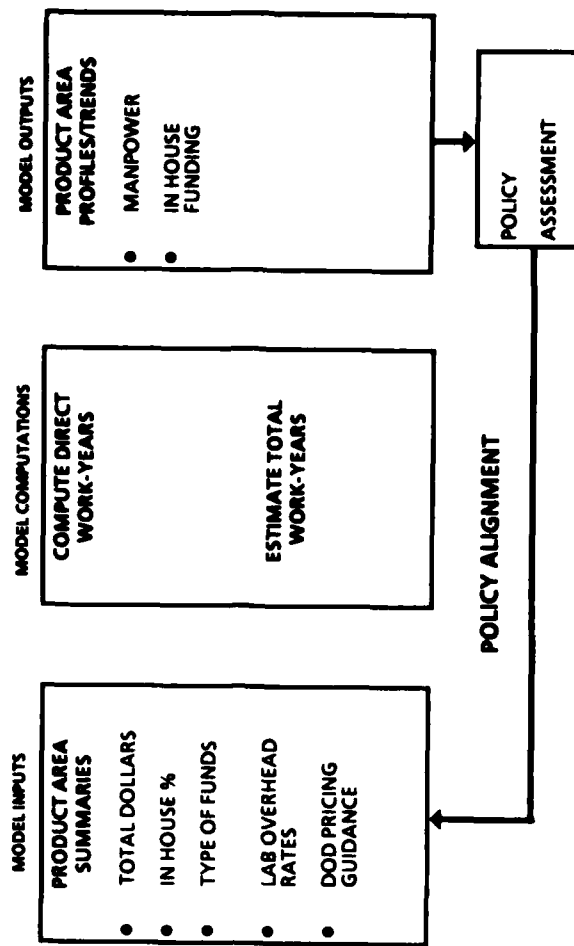
Plans for FY86 include the development of separate MEMs for each of the eight DNL R&D centers. Close working relationships with each R&D center will be established to ensure the MEMs reflect their specific R&D missions.

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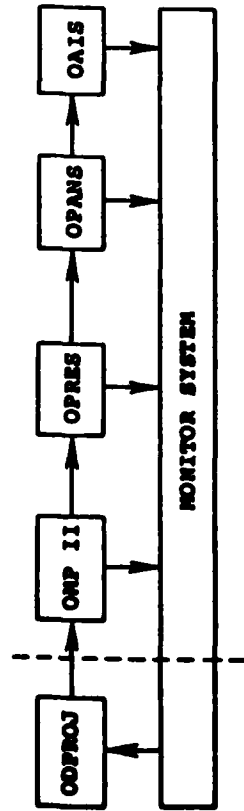
REPORTS:

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MODEL DESIGN



OFFICER DISTRIBUTION MANAGEMENT SYSTEM (ODMS)



Principal Investigator:

LCDR Ken Davis

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conflicts in shore manning

priorities.

The purpose of this project is to

develop an automated Officer

Distribution Management System

(ODMS) to project and allocate the

available personnel inventories to

officer billet requirements by

grade, skill, and claimant. The

major functions of ODMS include

projection, allocation, assignment,

and system monitoring. This

system will allow the Navy to

achieve improved skill utilization, a

better balance of officer

assignments among Navy activities,

and a more accurate assessment of

policy.

A prototype Officer

Distribution Projection (ODPROJ)

system has been developed.

ODPROJ first constructs a current

manning estimate, then projects

next year's available inventory.

Run quarterly using a variable

planning window at projected year

end, ODPROJ outputs onboard

inventory, rotating inventory and

filled billets by grade, skill, activity

composite and Officer Control

Authority (OCA).

A detailed computer system

design for ODPROJ has been

completed. FY86 plans include the

completion of operational

software and implementation on

new Naval Military Personnel

Command (NMPC) hardware. A

conceptual design for MONITOR,

the user interface with all ODMS

subsystems and NMPC's new

Officer Assignment Information

System (OASIS), is also planned.

Prototype allocation software

developed in FY35 has formed the

basis for a new generation Officer

Manning Plan (OMP II). The

prototype is scheduled for

completion in FY86. OMP II will

allocate the rotating inventory by

skill, grade and CNO manning

priority. Output is by activity

composite (i.e., ships, squadrons)

and fair-shared over OCAs and

individual activities (UICs).

Future plans include the Officer

Personnel Requisition System

(OPRES) and the Officer Personnel

Assignment and Nomination

System (OPANS). OPRES will

integrate the OMP II allocation

plan with near-term projections of

available officers and authorized

billets to produce postings of job

vacancies. OPANS is the final

planned subsystem and perhaps

the most challenging. As the

actual selection of an individual to

fill a billet nears, increased human

judgment is required. OPANS will

attempt to maintain a support role

in this vital decision process by

providing planners and assignment

officers with a "nomination" for

assignment.

P.E. 63707N

Z1770-MP020

REPORTS:

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Personnel Research and Development Center.

DEFENSE PERSONNEL ANALYSIS SYSTEM (DPAS)

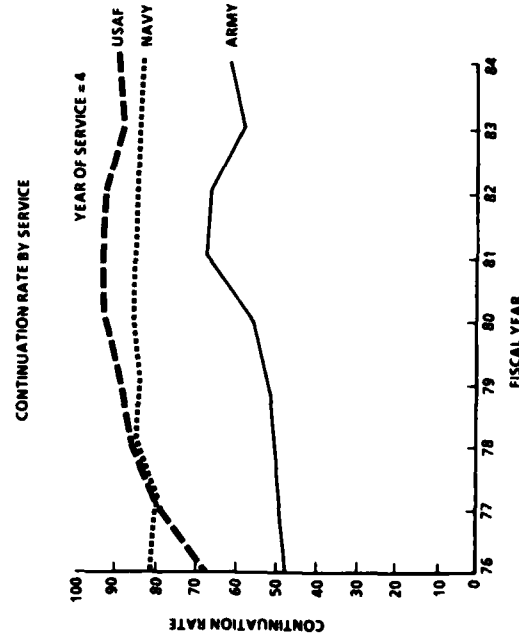
Principal Investigator:
Murray Rowe
(619)225-7388

Major policy and programming decisions in the area of manpower and personnel management are made under severe time constraints and with very limited amounts and kinds of information. This deficiency in decision-making information persists in spite of accelerating advancements in computer technology.

The objective of this project is to develop an information delivery systems (IDS) for the Office of the Assistant Secretary of Defense (OASD) - Manpower, Installations, and Logistics (MI&L) that focuses on management decisions with the appropriate volume, form, and frequency of data.

The approach capitalizes on advances in information technology (e.g., computer generated graphic displays) and interactive software design. A demonstration version of the Defense Personnel Analysis System (DPAS) was completed at the end of FY84 and subsequently installed as OASD. This version contains two subsystems: (1) Enlisted Personnel - Graphics, and (2) Enlisted Personnel - Array. Both subsystems allow the user to retrieve inventory, promotion, loss, and gain data for each of the four military services. Functions within each subsystem permit the user to display data (e.g., inventories by service, skill, grade, and time in service) or to transform the data (e.g., create a loss rate) and then display it.

The initial design of a third subsystem, Objective Force, to accommodate desired or projected forces, was completed in FY85. The design of an Officer Personnel Subsystem was also completed in FY85, with the development beginning in FY86. Other likely subsystem candidates involve accession and retention/bonus data. Also planned is the installation/development of data transfer capability, to permit movement of DPAS data sets to microcomputers for additional processing using packaged software (e.g., LOTUS 1-2-3).
P.E. 99000N
MIPR-DHAM50022, MIPR-60013



MARINE CORPS OFFICER LOSS FORECASTING

Principal Investigator:
Barry Siegel
(619) 225-7388

Marine Corps manpower managers adjust the size and shape (grade and experience mix) of the officer corps by exercising control over promotions and accessions. They have less control over losses, so what they try to do is to forecast losses accurately. Losses play a central role in the operation of military personnel systems. Critical personnel actions, such as promotions and accessions, are initiated by the creation of vacancies. Vacancies are largely the result of losses. Losses in the paygrade hierarchy trigger promotions from lower grades. Vacancies also generate the need for new accessions to replenish or expand the force.

The objectives of this effort are to (1) develop a data base system to permit easy retrieval of historical Marine Corps officer

personnel data, and (2) devise interactive techniques to forecast loss behavior over a seven year planning horizon. These techniques must be able to capture the effect that external factors, such as employment conditions and personnel policies, have on retention decisions.

The Marine Corps Officer Rate Projection (MCORP) has been designed to provide forecasted loss rates for existing officer manpower planning models or permit "what if" exercises under a variety of policy alternatives (e.g., changes in military pay, changes in civilian employment conditions). Through its interactive database, MCORP will have the capability of displaying historical and/or projected rates either numerically or graphically (e.g., bar, line, pie chart).

During FY85, a longitudinal personnel data base was developed. It provides personnel

inventories and loss rates by grade and promotion status, year-of-service, military occupation specialty (MOS), sex, source of commissioning, and other variables. Using data base access techniques, the software will instantaneously retrieve historical and/or projected inventories and rates by all possible combinations of variables.

Both time series and econometric loss forecasting methodologies have been implemented in MCORP. The time series technique is based on historical exponential weighting or Minimum Absolute Deviation (MAD) regression. The econometric approach is based on the "annualized cost-of-living" model, commonly called ACOL, which estimates the changes in loss behavior that are expected to occur in specific skills as a result of changes in compensation policies, including basic pay, retention bonuses, and retirement benefits. Other variables that impact loss behavior, such as civilian employment conditions and the socioeconomic characteristics of the force (e.g., race, education) are also analyzed. Uncertainty in multiple year forecasts is accounted for by a "wear off" function, which provides for the migration over

time of the loss rate forecasts to an historical average. The purpose of the wear off function is to avoid the potential for large forecast errors that may result from projections that are based on recent values that represent historical extremes.

MCORP will be installed at Headquarters, U.S. Marine Corps in FY86 on an IBM PC/AT.

P.E. 63732M

C0073-02.03

MARINE CORPS QUALIFIED MILITARY AVAILABLE (QMA)

Principal Investigator:

Mark Chipman

(619) 225-2971

The supply of young men available for potential recruitment into military service varies greatly in both quality and quantity across the United States. Consequently, the allocation of recruiting and selection resources to states and counties has been a difficult process. This difficulty has included the establishment of recruiting quotas and the allocation of recruiting funds. In order to address these issues, accurate estimation of the number of young men available for recruitment in each county is needed. The objective of this effort is to provide the Marine Corps with county-level estimates of the number of male high-school graduates, 17-21 years old, who are physically and mentally qualified for Marine Corps service.

Forecasts of the number of mentally and physically qualified

male high-school graduates, aged 17-21, for the period 1980-1989, have been developed at both the national and local level using updated and improved population estimates. In order to refine the market potential of the military at the county level, development of indicators that measure the QMA's propensity to enlist was initiated. Finally, a prototype interactive QMA data delivery system was constructed.

In FY86, the feasibility of incorporating economic, demographic, and prior recruiting history data into the "propensity to enlist" measure will be investigated. The feasibility of estimating QMA by ZIP code for large counties will be examined. Refinements to the interactive QMA data delivery system will be undertaken.

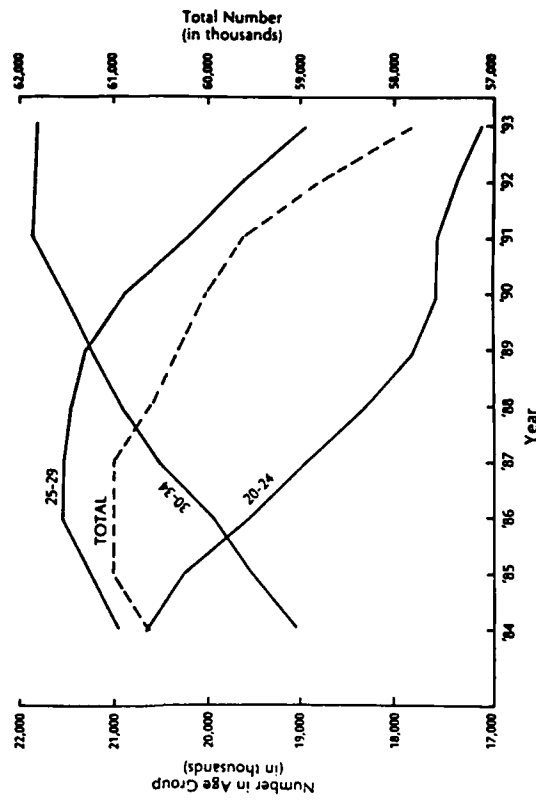
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C0073-01 02

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Projected total number of young adults (dashed lines) and numbers in three age groups (solid lines).

MARINE CORPS OPTIMAL ASSIGNMENT OF ENLISTMENT GUARANTEES

Principal Investigator:
Ben Buclatin
(619) 225-2371

Marine Corps recruiters currently assign recruit applicants to enlistment program guarantees using manual methods. The guidelines employed by recruiters vary from recruiter to recruiter, from case to case, and from month to month. With multiple, and sometimes conflicting, policy goals to be considered, it is very difficult for recruiters to satisfy all policy objectives or make consistent decisions. An automated system is needed to provide recruiters with recommendations which reflect accurate and consistent execution of the policy objectives.

The objective of this project is to develop an automated system which provides recommendations of enlistment program guarantees based on a prioritized set of policies.

In FY85, a prototype system was developed on NPRDC's IBM 4341 computer. The system produces recommended enlistment program guarantees based on a prioritized list of policies. The reports generated by the system show the top ranked program guarantees with a detailed display of the corresponding policy data used in the ranking. The system allows users to manipulate the relative importance of the policy

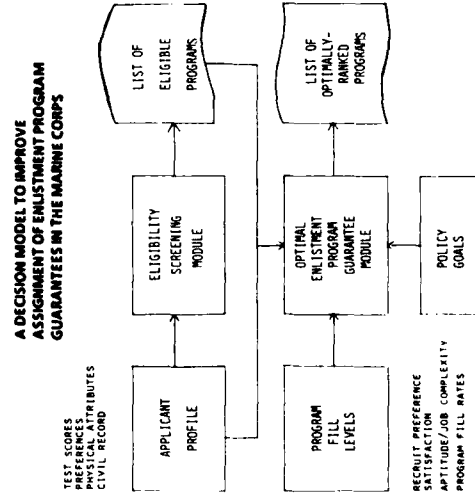
objectives and to view the resulting recommendations.

In FY86, final modifications will be incorporated into the prototype system based on user feedback, and an implementation plan will be developed.
P.E. 63732N
C0073-02.02

REPORTS:

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MARINE CORPS ENLISTED PLANNING SYSTEM

Principal Investigator:
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(619) 225-7388

The objective of this project is to determine the constituent parts, relationships, and operational behavior of the Marine Corps enlisted force management system. This effort will also address the extent to which the current system satisfies the needs of Marine Corps managers. A baseline description of the current system and recommendations for improvement will be prepared. Taken together, both will support a "blueprint" for a new or modified system if that is found necessary.

To determine what comprises the current system and to describe how it works, a "structured analysis" of the system will be conducted. The system will be viewed from a number of different, but interrelated, perspectives. The scope of the

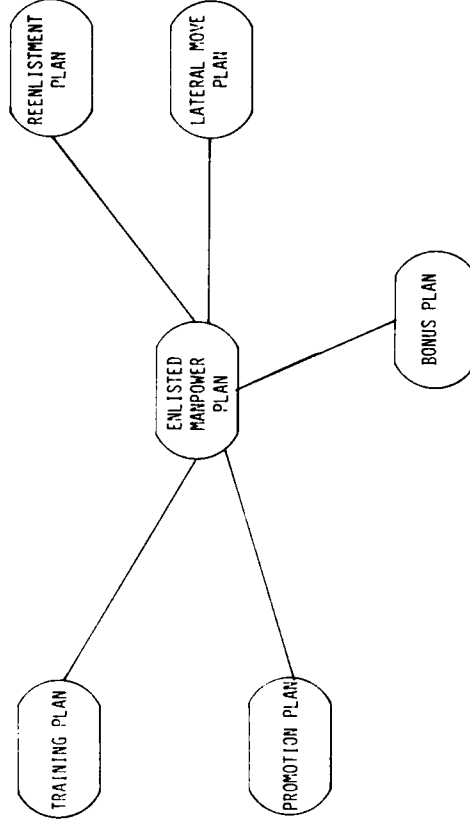
enlisted personnel planning system will be described and the organizational relationships involved in the planning process will be determined. Models and other automated planning tools, as well as the data used in the system, will be explored. The analysis will be conducted primarily through planner/manager interviews. The information will be transformed into a system representation. The approach, structured analysis, is a method for depicting systems in an information flow format supported by narrative process descriptions and a data dictionary.

The initial interviews with Marine Corps analysts, action officers, and other manpower planners have been completed. Documentation on the existing models and data bases used by manpower analysts has been collected and analyzed. An interim report describing progress to date is in preparation.

In FY86, the interim report will be completed. Areas of the manpower planning process that have not been thoroughly examined will be investigated and additional interviews will be conducted as necessary. A final report will be produced outlining the manpower planning system as it currently exists, the extent to which it satisfies the needs of the Marine Corps force managers, and specific areas where improvements or enhancements to the system are needed.

P.E. 63732M
C0073-03 05

COMPONENTS OF THE ENLISTED MANPOWER PLAN



PERSONNEL COHORT RATES

Principal Investigator:

Carol Mullins

(619) 225-7388

The Marine Corps employs several manpower models to evaluate alternative personnel policies and to develop a variety of manpower plans. The quality of personnel data, more than any one factor, determines the value of these models and the policy conclusions that can be drawn from their outputs. The Marine Corps has several fundamental data problems. First, it has no centralized procedures for processing, organizing, and retrieving enlisted personnel data at the managerial level. Second, there is no systematic assessment of data quality. Finally, no capability exists to deliver data to analysts quickly and in easily digestible forms (e.g., graphically).

The objective of this project is to develop a consistent,

centralized enlisted personnel database with software that delivers data to models and analysts in useful forms. The database is expected to be an "events" or longitudinal file. While reducing storage and processing charges, the file will give analysts a cohort tracking capability. The information delivery system will be rapid (5-10 seconds), will be easy to use, and will have easily understood output.

Historical enlisted personnel data, both inventory and flow data, for FY76 through FY84 have been collected. An extensive assessment of the quality of the data was begun in FY85 and is continuing. The quality assessment of the data is a two-step process: first, ensuring that data elements contain only legitimate values, and second, ensuring that the manpower accounting equation (begin FY inventory - losses + gains = end FY inventory)

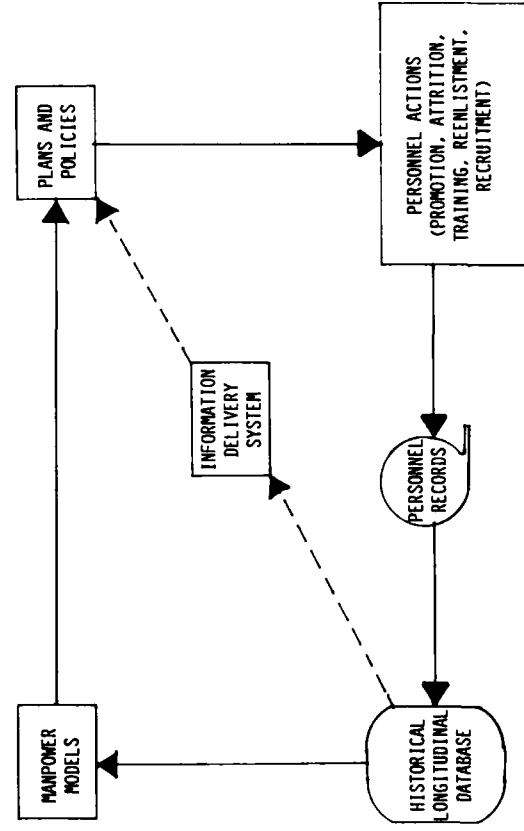
balances. Criteria needed to count personnel flows and inventories have been identified, and attempts have been made to match official historical counts.

During FY86, tasks will include (1) completion of both phases of the quality assessment of the data, (2) developing the computer programs and processing routines necessary to create the longitudinal database, and (3) designing a prototype version of the information delivery system.

The longitudinal database will be an events file, capturing all changes in an individual's status (e.g., advancement, change in military occupational specialty, loss, etc.) during his/her Marine Corps career. The information delivery system will use the events file as its data source and will display a variety of historical enlisted personnel statistics in graphical and array formats.

P.E. 62744N
521-080-301

ROLE OF LONGITUDINAL DATABASE IN THE MANPOWER PLANNING PROCESS



COMPUTERIZED ADAPTIVE TESTING FOR ASVAB (CAT-ASVAB)

Principal Investigator:

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(619) 225-6195

The Armed Services Vocational

Aptitude Battery (ASVAB) is used

by all U.S. military services to determine enlistment eligibility and to classify selected applicants into entry-level training

opportunities. The current version of this aptitude battery involves ten tests and is administered in a paper-and-pencil mode (P&P-ASVAB). Due to this conventional

administration mode, P&P-ASVAB has a number of important shortcomings, including: (1)

lengthy test administration time, (2) a lack of measurement

precision at both the high and low ends of the ability continuum, (3) susceptibility to theft and test compromise, (4) high costs for

printing, distribution, and storage of test materials, and (5) long lead time and high cost of developing replacement forms.

The purpose of this R&D

program is to develop, test, and

evaluate a Computerized Adaptive

Testing version of the battery

(CAT-ASVAB) as a potential

replacement for P&P-ASVAB.

Work is proceeding simultaneously

in two areas: (1) psychometric

research, and (2) delivery system

development.

Work in the psychometric area

includes: development and

calibration of large banks of test

items; evaluation of alternative

procedures for administering,

scoring and terminating adaptive

tests; and demonstration of the

efficiency and measurement

precision of an experimental

version of CAT-ASVAB. Additional

research has begun that compares

CAT-ASVAB with P&P-ASVAB in

terms of measurement utility.

Preliminary results have been

uniformly encouraging. Technical

recommendations for equating

CAT-ASVAB with P&P-ASVAB have

been made by a panel of psychometric experts.

Accomplishments on the

delivery system include

specification of the functional

requirements, evaluation of

alternative generic computer

hardware designs, selection of a

microcomputer system, and the

initiation of software

development.

Contracts have been awarded

to prepare a technical manual

documenting the psychometric

and delivery system characteristics

and the functional specifications

for the CAT-ASVAB Maintenance

and Psychometric (CAMP) facility.

Under the Accelerated CAT-

ASVAB Program (ACAP), FY86

plans include the completion of a

plan for equating CAT-ASVAB with

P&P-ASVAB and preparations for

data collection to accomplish the

equating. Additional evidence will

be collected on the utility of CAT-

ASVAB, including validity and

reliability. Initial design,

development, and testing of the

CAT-ASVAB delivery system will be

completed.

P.E. 62744N

521-080-201

P.E. 64703N

Z1822-MH001

P.E. 99000N

WR-81011, WR-81008, WR-E5086

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Moreno, K. E., Wetzel, C. D., McBride, J. R., & Weiss, D. J. (1984). Relationship between corresponding Armed Services Vocational Aptitude Battery (ASVAB) and Computerized Adaptive Testing (CAT) subtests. Applied Psychological Measurement. Vol. 8, No. 2, 155-163.

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DIMENSIONS OF JOB PERFORMANCE

Principal Investigator:

Leonard Kroeker
(619) 225-2176

The project's objectives are (1)

to identify and describe the criterion dimensions underlying job performance measures, (2) to develop new procedures to improve performance prediction, and (3) to develop methodology using predictor-criterion utility relationships to increase personnel classification effectiveness. The project uses previously developed human abilities taxonomies, such as those of Fleishman, McCormick and Harrow, as well as criterion descriptions of job performance characteristics adapted from previous NPRDC research. It contains the following separate research efforts: (1) Defining "performance" in terms of the behavior manifested by fleet personnel, identifying measures of performance, and describing possible relationships among measures for particular

ratings or group of ratings. (2) developing procedures to facilitate the integration of various measures (e.g., job knowledge tests, job sample tests) within an effective performance prediction system, (3) describing and evaluating personnel record data characteristics of individuals entering each Navy rating under the present selection criteria (e.g., education level and Armed Forces Qualification Test (AFQT) mental ability categories), (4) delineating criterion dimensions based on suitability utility metrics to facilitate developing Classification and Assignment within Pride (CLASP) performance components.

Accomplishments to date include the drafting of a technical report evaluating personnel record data as a source of job performance information.

Plans for FY86 include (1) the preparation of a report on a conceptual framework for

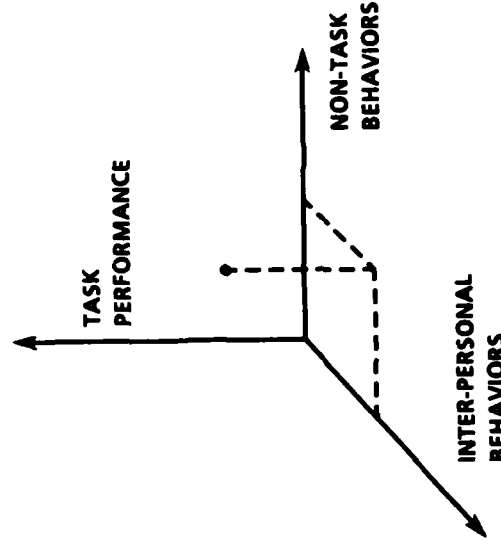
identifying job performance dimensions, (2) the development of a predictor-based taxonomy of Navy enlisted jobs, and (3) the development of a model of the process in which the relationship among predictors and criteria develop/change the early career.

P.E. 62763N

521-804-040-03.01

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PERFORMANCE-BASED PERSONNEL CLASSIFICATION

Principal Investigator:
Gerald Laabs
(619) 225-2181

The effectiveness of the personnel system and, ultimately, performance in the fleet, can be greatly influenced by the personnel classification and assignment process. Although on-the-job performance is generally recognized as an extremely important criterion for validating predictors used in this process, enlistment standards have typically been related to the more easily obtained criterion of end-of-course grades. This project supports a coordinated effort to meet a congressional mandate to link enlistment standards directly to job performance.

The objective of this project is to investigate measurement approaches that might be used to make the Navy's classification and assignment system more performance-based. Various measures of job performance will

be developed with an emphasis on assessing technical proficiency using job-sample, hands-on performance tests, and the more economical measures of job sample simulation and behaviorally anchored rating scales. All three types of measures will be administered to fleet samples to investigate the use of simulations and rating scales as substitutes for the hands-on tests.

The general approach involves the development of methodologies to measure job performance, the establishment of relationships between predictors and the resultant job performance data, and the ultimate incorporation of performance-based components into the Navy's automated classification system.

Accomplishments to date include the final identification and selection of critical tasks for development in the first two of six ratings to be covered. Preliminary identification of critical tasks has

been completed for the four remaining ratings. A field test package consisting of a hands-on job sample test, a paper-and-pencil simulation, and a set of rating scales was completed for Machinist's Mates and fleet data collection has been started. Development of the field-test package for Radiomen also has been started.

In FY86, the fleet data collection for Machinist's Mates

and the field-test package for Radiomen will be completed. Final selection of critical tasks for test development in the Electronic Technician rating will take place and the development of the field-test package will be started. Fleet data collection will be completed for a measurement technology transfer study using an Air Force field-test package with Navy and Marine Corps jet engine mechanics.

P.E. 63707N
Z1770-MP001
P.E. 99000N
M1PR 86-43



COMPUTERIZED TESTING TECHNOLOGIES

Principal Investigator:
John Wolfe
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Current military testing programs employ conventional aptitude measures based on traditional, static paper-and-pencil tasks and traditional test theory. Developments in the field of cognition and human information processing have therefore been difficult to implement in the conventional testing format. The potential of computerized aptitude assessment opens the way for the development of new types of ability measures not feasible with conventional testing. The objective of this project is to (1) develop and apply information processing models and measures of human aptitudes and (2) evaluate their potential for computerized testing.

The approach will involve both model development and measurement. Model development will analyze the

cognitive processes underlying reading and mechanical comprehension with a variety of techniques, ranging from covariance structure analysis to computer simulation of protocol behavior. Computerized testing will be used for measurement of the component cognitive processes. Candidate measures include precise timing of stimulus, accurate recording of response time, and adaption of the individuals' ability level.

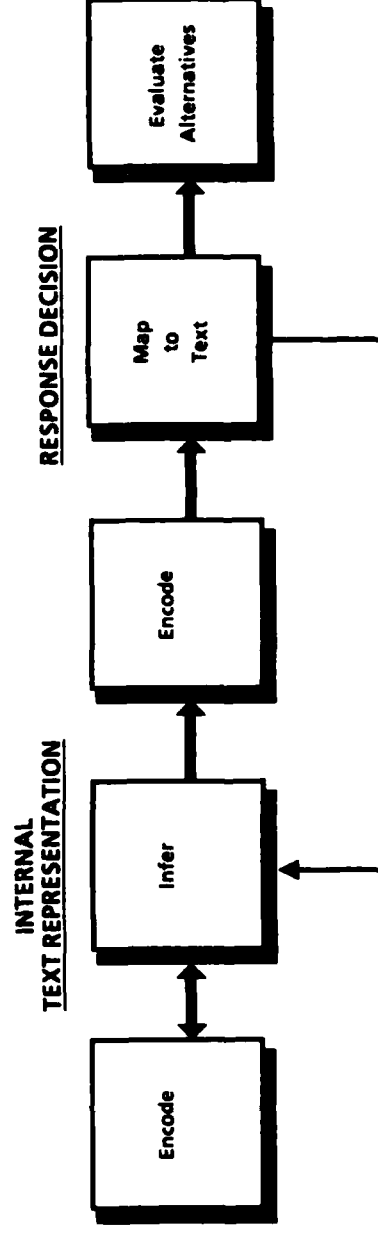
A component analysis of paragraph comprehension has produced several interesting results. The first is a model that predicts the difficulty of paragraph comprehension items much better than standard readability formulas. The second is a finding that experimental computerized adaptive test (CAT) items use difficult text with easy questions. The same method of analysis can be applied to help specify how a pool of items should be constructed. Another accomplishment was the programming of new tests designed to measure spatial abilities and motion

comprehension processes.

NPRDC plans to administer computerized tests developed at the Air Force Human Resources Laboratory and elsewhere using NPRDC's Apple III computers. These tests, along with the newly developed spatial and motion comprehension tests, will be administered to Navy personnel and compared with their training school criteria or their job proficiency. The validity of adding these new tests to the existing paper-and-pencil batteries will be determined.

P.E. 62763N
521-804-040-03 06

AN INFORMATION-PROCESSING MODEL FOR MULTIPLE CHOICE READING COMPREHENSION ITEMS



COGNITIVE SPEED

REPORTS:

Larson, G. E., & Rimland, B. (1985). Cognitive speed and performance in Basic Electricity and Electronics (BE&E) School (NPRDC TR 85-3). San Diego: Navy Personnel Research and Development Center.

Saccuzzo, D. P., Larson, G. E., & Rimland, B. (In preparation). Visual, auditory, and reaction time measures of speed of information processing and individual differences in intelligence (NPRDC TR 86-). San Diego: Navy Personnel Research and Development Center.

battery has been reprogrammed for IBM PC/XT computers. The IBM tests involve several changes that are designed to improve test reliability.

Plans for FY86 include the administration of the IBM PC/XT cognitive speed battery to Navy recruits and civilian university students. Reliability and validity will be assessed. During FY86, several new measures for processing speed will also be evaluated. The new measures are more complex versions of inspection and reaction time. We hope to be able to determine the optimum level of complexity for tests of information processing speed. Also during FY86, we will begin to introduce job performance measures as criteria in order to compare the experimental tests with ASVAB in the context of both training and job settings.

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521-804-042-03.01

Accomplishments to date include the testing of 155 incoming students at the Basic Electricity and Electronics (BE&E) School at Naval Training Center, San Diego. Results indicate that the experimental measures of processing speed improve upon the ability of the Armed Services Vocational Aptitude Battery (ASVAB) to predict the rate at which students reach certain milestones in training. The experimental battery, along with a series of other tests, has been administered to a sample of 96 college students. Results indicate the experimental measures appear to be tapping some aspect of visual-spatial ability distinct from the verbal and numerical aptitude domain assessed by current ASVAB subtests. Further validation will allow us to determine whether operational use of cognitive speed tests will result in selection and classification methods that more fully reflect the diversity of skills required for Navy jobs. The

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The present research was designed to develop and evaluate a battery of tests of information processing speed. Tests of choice reaction time and visual inspection time were programmed on a TRS-80 microcomputer. On the reaction time task, subjects must press a key on the TRS-80 keyboard as quickly as possible in response to lights appearing at various locations on the CRT screen. For inspection time, subjects must discriminate between rapidly presented lines. A typical display might be two horizontal lines of unequal length, with the subject being asked whether the longer line was on the right or left side. The exposure duration for the lines is gradually reduced until the subject's threshold is found. The threshold value is called "inspection time."

MODELS FOR CALIBRATING MULTIPLE-CHOICE ITEMS

Principal Investigator:

J. B. Simpson

(619) 225-6513

An important transition is taking place in the field of personnel testing. Long-established procedures for the development and use of personnel tests are being revised to

incorporate the concepts and methods derived from item response theory (IRT). IRT is principally distinguished from traditional testing theory by mathematical models that can be used to compute the probability that examinees of a given ability will answer a test question in a particular way.

Currently used IRT models classify responses to multiple-choice test questions as either correct or incorrect. These

dichotomous IRT models make no distinction among the different incorrect responses a person might select. Thus, they neglect information about the examinee's level of ability that could be extracted by taking into account which particular incorrect responses have been selected.

In this research project, polychotomous IRT models are being developed that keep the various incorrect responses to a multiple-choice question distinct. When an examinee's test is scored, these models allow one to use the pattern of incorrect responses, as well as correct responses, in estimating the examinee's level of ability.

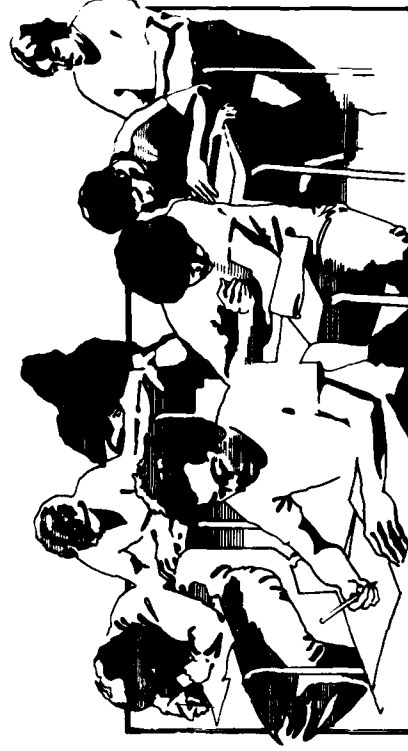
Accomplishments to date include (1) the development and comparative evaluation of five

polychotomous IRT models, (2) the development of a new family of statistical distribution functions, and (3) the development of computer programs to fit the new models to test data.

In FY86, the computer programs will be refined, tested, and evaluated. The new models will be applied to a variety of test data, and computer simulations will be conducted to evaluate the results of employing the new models.

P.E. 61152N

ZR000-01-042-024



COMPUTERIZED EXECUTIVE NETWORKING SURVEY SYSTEM (CENSUS)

Principal Investigator:
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There is a specific need for civilian headquarters to have timely and accurate information on the attitudes of civilians towards personnel policies and practices, especially as they impact on fiscal expenditures. Presently, opinions and attitudes of personnel are surveyed in response to a specific situation or need. This means the data are not timely, they are often costly, and the results may be difficult to interpret because of poor questionnaire design and inadequate sampling methodologies.

Recent developments in computer capabilities and communications are enabling surveys to be designed, developed, administered, and analyzed quickly and accurately. Existing computer technology is sufficiently inexpensive so that most computers can communicate with remote terminals to collect and analyze attitudinal information

and integrate that information with other data bases.

The operational objectives of CENSUS are to develop and test such a computerized survey system to administer questionnaires and collect responses using remote computer terminals. Decision-makers will now be provided with up-to-date, reliable information on the short- and long-range impact of specific policies on the civilian workforce. Second, questionnaire data will be combined with personnel data bases to establish longitudinal data bases that may be analyzed with sophisticated math models and analysis procedures to predict future trends in the workforce

The technological objectives of Censu are to improve survey design in the context of computer technology. Because the technology permits surveys to be administered and analyzed efficiently, measurement issues can be easily addressed--such as response effects that stem from the survey itself, including length

and wording of questions, and individualized and adaptive questions and responses, and effects that stem from the respondents themselves--such as response styles and memory. While these effects have been documented in the literature for traditional paper and pencil surveys, their effects have not been systematically studied in the context of computer technology.

The long-range objective is to develop and test a computerized network linked to a central computer that would meet the operational demands for continuous complex survey designs and analyses while improving survey technology. Surveys will be administered by computer terminals to civilian personnel in activities located in regions where there are high concentrations of civilian employees, with the data linked to a central survey center for analysis.

Accomplishments to date include the conduct of three field pilot tests of the CENSUS system, two in San Diego and one in the Washington, DC area. Survey data were collected on computer terminals linked by commercial phone lines to two IBM PC/AT computers using multi-tasking,

multi-user software specifically designed to enable a number of employees to participate in the survey simultaneously. The outcome from these tests demonstrated the feasibility and user acceptance of using computer technology to administer surveys. By integrating the survey results with personnel data, analyses were conducted that proved useful to civilian policy makers.

Plans for FY86 include developing a nationwide implementation plan for CENSUS and a sampling plan that would enable subpopulations of civilians to be systematically sampled in future surveys. Operational surveys will be conducted and research issues that will be addressed include measurement issues, alternative response formats, the use of survey feedback, and the impact of the technology upon survey responses.

P.E. 63707N

Z1770-MP013

CENUS AUTHORIZING SYSTEM

Principal Investigator:

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The capability exists for developing an automated survey system so that computers can communicate with remote terminals to collect and analyze attitudinal information and integrate that information with other data bases. A current advanced development project, Computerized Executive Networking Survey System (CENSUS), is developing such a system to administer questionnaires and collect responses using remote computer terminals. Decision makers will be provided with up-to-date reliable information on the impact of specific policies on the quality of life for Navy personnel.

Current technology in computerized authoring systems has been developed primarily in the area of computer-based

instruction. While some of these methodologies may be applied to survey development, there are several unique components that need to be developed. What is still needed is a computerized authoring system that would enable managers, untrained in questionnaire design, to produce reliable and useful surveys that could be integrated into a standalone survey system. As the methods of producing questionnaires become more precise and as a computerized data bank of questions and responses is developed, it will become possible to construct an authoring system that can prompt managers to design questionnaires independently and interactively.

The objective of this project is to develop a computerized authoring system that will be integrated into the CENSUS survey system. The authoring system will consist of two main components, a control system and a data base.

The control system will be composed of four basic sub-components: (1) a menu-driven system that will prompt users for questionnaire parameters, such as type of questions and scales to be used, length of questionnaire, etc., (2) an editor facility to create, examine, and modify questions and provide feedback, (3) an error checking system for grammar, questionnaire mistakes, etc., and (4) format specifications, including conversion to a file for computer administration and analysis of the completed survey. The data base will include questionnaire data bases from previous administrations and standardized questionnaires. Topics may include a variety of quality of life issues, e.g., work environment, organization climate, compensation, etc. Organization and retrieval mechanisms of the data base will be determined as the system is developed.

The approach used in developing this authoring system will be the adaptive design approach used in building decision support systems. This approach combines the traditional system development activities, (e.g.,

requirements, analysis, design, development, and implementation) into a single phase, which is iteratively produced. At each iteration, the user, developer, and system interact to improve and add to the system. Evaluation as to the power and performance of the authored system will also be conducted by the user and developer.

This project is a new start. Plans for FY86 include reviewing existing authoring systems to determine if any components may be used in developing an authoring system for survey design. In addition, the first phase of the adaptive design approach will be used to create a usable rudimentary system driver.

P.E. 62763N
521-804-044

SURVEY OF UNACCOMPANIED SERVICE MEMBER LIVING CONDITIONS WORLDWIDE 1986

Principal Investigator:

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Quality of housing and other services are very important components of quality of life in the military service. The quality of life offered by the military service must be able to attract and retain the numbers and types of individuals necessary to maintain strength and readiness. A large segment of the military population is single. The number of single individuals with no dependents approaches 900,000 according to Defense Manpower Data Center (DMDC) information. Housing needs for single service members are different from those of service members living with dependents (spouses and children). Information is needed in order to

aid policy, formulation, commit resources, and evaluate efforts.

Sponsored by the Defense

Housing Management Systems Office (DHMSO) the objective of this project is to provide information from a large sample of single service members worldwide on conditions in which they live (characteristics of housing), satisfaction with various aspects of their residence, problems encountered, housing preferences, responses to policy proposals, suggestions for improvement, and perceived effects of living conditions on job performance and military career intentions. This project will provide a database of service members' attitudes, opinions, preferences, and living conditions that will aid in (1) pinpointing

problem areas (substantive and geographic), (2) estimating the extent of the problems, (3) developing housing policies, and (4) suggesting direction and level of resource allocation.

Accomplishments to date include the development of a draft survey questionnaire based on interviews with members of the four services. The draft questionnaire was pre-tested on-site at several European and CONUS bases.

In June 1986, the questionnaire will be administered by mail to a sample of several thousands of single Navy, Army, Air Force, and Marine Corps members stationed in the United States, United Kingdom, Germany, Italy, Spain, Japan/Okinawa, and Korea. Analysis of the responses will be undertaken in preparation for drafting a report of the survey results in FY87.

P. E. 99000N
WR00H37



**Bishop Bachelor Enlisted Quarters
Naval Submarine Base, San Diego**

OAHU CONSOLIDATED FAMILY HOUSING OFFICE --FAMILY AND CIVILIAN HOUSING OCCUPANT SURVEYS

Principal Investigator:

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The approximately 18,850

military family housing units in Hawaii were consolidated under the management of the

Department of the Army as of 1 October 1983. The Oahu Consolidated Family Housing Office (OCFHO) sets local policy and administratively oversees five area housing offices that serve the 38 individual military family housing sites. In addition, OCFHO is responsible for providing certain services to military personnel living in civilian housing.

OCFHO policy makers and managers need to know the experiences and opinions of service personnel about their housing in order to make informed decisions. Service members' satisfaction levels and desires need to be documented to provide baseline data for future evaluations of the consolidation.

The purpose of the first survey was to obtain detailed information about services provided, problems, and needs of families with respect to their military family housing and support services.

Results of the survey among military family housing occupants showed (1) approximately two-thirds were generally satisfied with their residences, (2) there was approximately equal preference for military and civilian housing, (3) housing assignment was considered fair and housing office personnel knowledgeable and informative, (4) the manner in which service is delivered and the proper and consistent

enforcement of rules were sources of dissatisfaction, (5) playgrounds were considered inadequate, (6) maintenance personnel were considered courteous and the quality of their work generally good, (7) dissatisfaction with maintenance focused on response delays, nonresponse and lack of preventive maintenance, (8) the

self-help program was rated very positively, (9) there was strong desire for additional security devices for the quarters, and (10) there was strong desire for yard fencing, lanai covers and screens, and enclosed outside storage space.

The second survey (of civilian housing residents) addresses the concerns, experiences and needs of military personnel living in the civilian community. In particular, it seeks information on (1) quality, security and costs in civilian housing, (2) satisfaction with civilian housing, (3) usage and satisfaction with housing office services (such as housing referral and TLA), (4) government furniture and appliances, and (5) problems encountered in the civilian sector, including concerns of homeowner.

Information obtained in this survey will be used to help determine future construction needs for military family housing.

Accomplishments to date include: (1) publication of the results of the on-post baseline survey in a technical report and statistical appendix, (2) completion

of five briefings of the results to all Services and to DoD in Washington, (3) development of the first follow-up questionnaire for occupants of on-post housing, and (4) development of the off-post questionnaire based on interviews and pretests in Hawaii.

Plans for FY86 include: (1) administration of the civilian housing residents questionnaire, (2) analysis and write-up of the results, and (3) delivery of briefings on the results as requested. A follow-up survey of military family housing occupants is tentatively scheduled for FY87.

P. E. 99000N
MIPR-85-0045

REPORTS:

Lawson, J. K. & Murphy, D. J. (1986). Attitude survey of military family housing occupants, Hawaii 1985 (NPRDC TR 86-1). San Diego: Navy Personnel Research and Development Center.

FAMILY SUPPORT PROGRAM

Principal Investigator:

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High level Department of Defense personnel, including the Secretary of the Navy, have emphasized the link between family issues, career decisions, and operational readiness. Navy Family Service Centers (FSCs) have been established to address the concerns of Navy personnel and their dependents. These organizations are in the early stages of growth and are experiencing organizational development problems. Because the Navy is so strongly committed to these organizations, it is important that they are operating as effectively and efficiently as possible.

The objectives of this research effort are to: (1) develop pre- and post- measures to assess the impact of FSCs, (2) identify the needs and concerns, as well as awareness of Navy personnel and their

dependents, (3) develop marketing strategies to increase the awareness and aid in the appropriate use of FSCs, (4) evaluate and enhance existing information systems for the Navy Family Support Program and individual FSCs to monitor the needs and concerns of their consumers.

The approach consists of two primary data collection phases. Phase I consists of the collection of command variables associated with FSC functions. These variables include time spent by commands dealing with individual and/or family concerns, retention, unauthorized absences, desertions, letters of indebtedness, nonmedical attrites, and other indices of lost work time. Phase II consists of the identification, development, and evaluation of management procedures that will improve the operational functioning of the FSCs. These procedures include conducting a

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Soriano, F. I., Glasser, L. M., Kerce, E., & Sander, S. (In preparation). Navy support services survey 1985, Volume I: Responses. San Diego: Navy Personnel Research and Development Center.

Hadley, D. S. & Landau, S. B. (1985). A literature review of the marketing of health and human services: Guidelines for Navy Family Service Centers (HFOSL-TN-72-85-14). San Diego: Navy Personnel Research and Development Center.

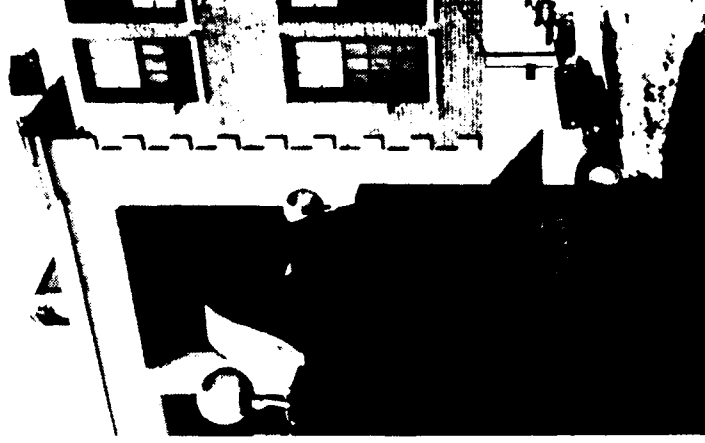
Settle, R. B., & Landau, S. B. (1985). Promotional guide for Navy Family Service Centers (HFOSL-TN-72-86-01). San Diego: Navy Personnel Research and Development Center.

segmented needs assessment, developing promotional and communication strategies, and enhancing existing management information systems.

Data have been collected at selected FSC sites that are associated with FSC functioning. A marketing segmentation needs analysis and the development of a prototype instrument for ongoing collection of essential FSC data is currently underway.

Accomplishments to date include a recently completed survey that involved the participation of 14,152 service members Navy-wide. The purpose of this survey was to assess the needs and concerns as well as awareness of FSCs of Navy personnel and their dependents. A report based on this survey is currently under review. During FY87, an enhancement will be made of the management information systems being used by the Navy Family Support Program and FSCs.

P. E. 63707N
Z1770-MP003



EEO ENHANCEMENT

Principal Investigator:

Patricia Thomas

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In an era of declining numbers of working age adults, Hispanics and women are an under-utilized resource in various Navy civilian occupations. This situation represents a problem, because Federal law requires that the workforce be representative of the nation's diversity and resources spent on processing discrimination complaints should be diverted to other Navy priorities.

The objective of this project is to investigate the cause of under-representation of Hispanics, the problems associated with integrating women into non-traditional jobs, and the reasons for the increase in the filing of discrimination complaints.

The project will be conducted in three phases. The research on Hispanics begins in the first year,

transitioning to Phase II as the problem of integrating women enters Phase I. In this manner, the three issues will cycle through each step in the research design. Phase I consists of problem definition. Through interviews of key EEO personnel and surveys of supervisors' insights into the cause of the problem, efforts to address the problem, and options concerning implementation of the EEO program will be gathered at selected commands. Phase II is the data gathering stage.

Organizational, individual, and social variables that are

hypothesized to contribute to the problem will be investigated.

Phase III consists of experimental interventions. Several promising actions or activities will be instituted on a trial basis and data will be collected to evaluate any changes that occur.

During FY85, people who are charged with implementing EEO in Navy commands were identified,

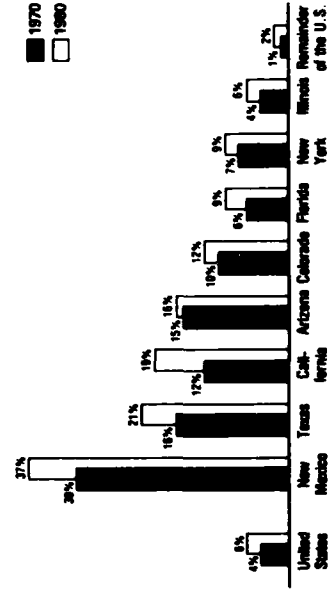
along with descriptions of their EEO responsibilities. A list of Navy activities that are located in areas with a reasonable number of Hispanics in the workforce and that have a population of at least 500 blue-collar workers was developed. Six of these commands were chosen for Phase I and interviews were conducted at three.

During FY86, Phase I of the Hispanic issue will be completed, the hypotheses addressing under-representation will be developed, and Phase II will commence. In addition, Phase I of women in non-traditional jobs will be undertaken.

P.E. 63707N

Z1770-MP012

Percent Spanish of Total Population by Area



MARINE CORPS PERSONNEL VALUES MANAGEMENT INFORMATION SYSTEM

Principal Investigator:

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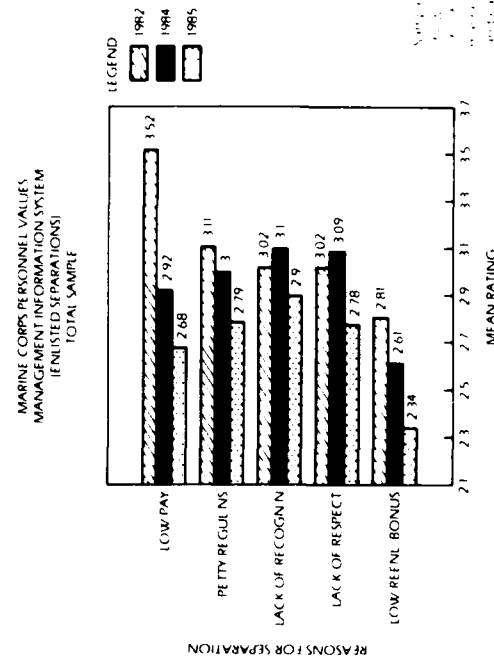
The Marine Corps must monitor the effects of its manpower policy on attrition and retention. Marine Corps decision-makers must be provided with timely and accurate feedback on the effects of manpower policy. This effort will develop an advanced system to accurately assess and report the effects of policy change on attrition and retention. The exit survey system will provide feedback on the reasons officer and enlisted personnel separate from the service.

Accomplishments to date include the development and printing of both officer and enlisted separation forms. Their administration has been made a statement of operating policy. Current material for a comparable reenlistment form has been developed. A microcomputer has been obtained and software developed to analyze the data, and the operating instructions for the system have been developed.

In FY86, the final development and incorporation of the "retention" information will be completed

PF 63732M

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MARINE CORPS DECISION SUPPORT SYSTEM FOR OFFICER ASSIGNMENT

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The task of Marine Corps officer monitors is to simultaneously accommodate the needs of Corps and the desires of the individual officers in the assignment process. Performance of the task requires consideration of the skills and attributes of the officers being assigned and job dimensions of available billets. Because of multiple data elements and the number of alternatives inherent in the assignment process, monitors need support in decision-making. An interactive decision support system, based on reliable data, would assist monitors in implementing USMC policy and enhancing officer assignments.

The objective of this effort is to develop a decision support system (DSS) for officer monitors that

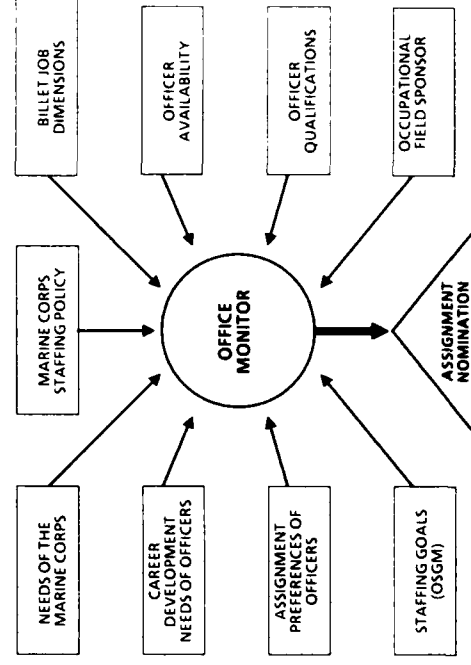
includes pertinent, reliable information about the officers to be assigned and available billets. As an adjunct to the DSS, monitor-oriented training materials and procedures will be systematically reviewed and improved.

The approach involves evaluating data elements currently being used by monitors in assigning officers and capturing decision-making rules. Other factors affecting the assignment process will be evaluated as well. USMC experts will judge the importance of existent and proposed data elements and the levels of information contained in them. Based on these judgments, new data elements will be accessed, relative values attached, and a DSS built. The DSS system will be pilot tested for adaptability, effectiveness, and acceptance.

FY85 accomplishments include extensive interviewing of HQMC Officer Assignment Branch (MMOA) personnel and an analysis of the decision-making process. Existing sources of data elements were evaluated for their relevance and reliability and new data elements proposed for inclusion in the decision process. Documents prepared in accordance with USMC Life Cycle Management for Automated Systems (LCM-AIS) include the project work plan and the Mission Element Needs Statement (MENS).

Plans for FY86 include convening an NPRDC advisory group to propose/review computer hardware and software alternatives for implementing the DSS, preparing the requirements statement (RS), presenting alternatives and associated economic analyses, preparing a functional description of the proposed system, and developing system specifications.

P E 63732N
C0073-02.03



INPUTS TO THE OFFICER ASSIGNMENT DECISION-MAKING PROCESS

USNA MIDSHIPMEN SELECTION

Principal Investigator:
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The cost and difficulties of recruiting, training, and retaining high quality, technically-oriented career officers continue to escalate. The total cost of educating and training each midshipman commissioned by the Naval Academy has grown from an average of \$76,000 in 1975 to current costs exceeding \$100,000. Clearly, it is important to select Naval Academy midshipmen likely to graduate and contribute effectively as naval officers.

Previous research and development efforts provided empirically-based procedures for selecting Naval Academy midshipmen. The objective of this effort is to provide the necessary support to monitor and maintain the effectiveness of those selection procedures now that they have been implemented.

This effort proceeds in two phases. The initial phase covers the updating of the Naval Academy data base. First, selection scores, test data, and demographic information are added to the data base for each incoming class. Second, criterion information (performance measures), such as grades, choice of major, and attrition data are added at the end of each semester for the four current classes. Finally, to permit the evaluation of selection procedures and their effectiveness in predicting the retention of USNA commissioned officers, information is extracted annually from the officer master and attrition tapes and a retention criterion score is computerized for those officers who have had the opportunity to complete their initial years of obligated service and any additionally incurred obligations.

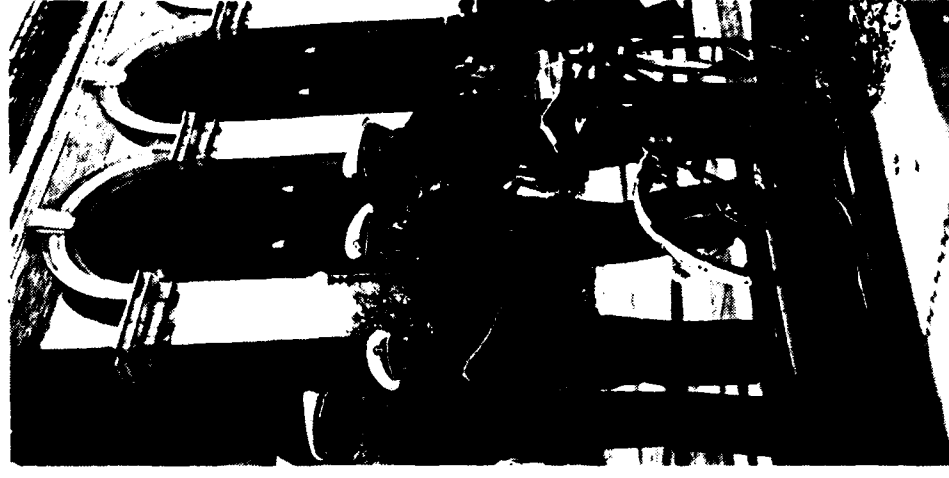
The second phase covers the validation of the current selection

procedures as well as the preparation of the tables, charts, and figures to communicate the results to the USNA selection board.

Accomplishments to date include (1) the updating of the data base for the classes current as of June 1985, (2) the development of optimal equations for the prediction of relevant criteria using validities corrected for restriction in range, (3) the presentation of results to the USNA Dean of Admissions, and (4) the providing of assistance to the Naval Academy in implementing a new selection composite that was approved by both the USNA Superintendent and the Secretary of the Navy.

Plans for FY86 include (1) the drafting of a report to document this year's validation procedures, (2) the redesign of the USNA data base to take advantage of a change in computer mainframes (NOSC UNIVAC to the NPRDC IBM), (3) the continuing update of the current classes in January and June 1986, (4) the validation of the current selection procedures as of

June 1986 and, (5) the addition of fitness report data to permit the assessment of officer quality.
P.E. 99000N
WR-NA0212



INTEGRATING OFFICER SELECTION SYSTEMS

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Substantial resources are invested in recruiting, selecting, and training Navy officer candidates in each of a number of separate programs. Additional resources are invested in developing those candidates who receive officer commissions.

Failure to select initially those candidates most likely to become effective career officers results in considerable waste of individual as well as Navy resources. Due to past limitations in data availability, the officer selection system has focused on identifying those who will do well in training. The emphasis in officer selection must expand to include selection for career performance.

The work in this task is driven by the need to make the officer candidate selection system as

effective and responsive as possible in the face of resource limitations and continual changes in the personal attributes and quantities of available personnel. The problem being addressed may be characterized as the need to develop and refine procedures for improving prediction of an individual's military and occupational tenure and suitability.

An accomplishment of far-reaching consequence has been the development of a longitudinal officer research data base. The data base includes applicant selection data, training performance records from the Naval Academy and NROTC colleges, and officer performance measures throughout the officer's career. The data set for Academy graduates is now complete. Procedures to collect all necessary data for NROTC commissioned officers are being implemented and evaluated.

During FY85, both the NROTC and USNA operational selection composites have been revised in response to the needs of the program. The new selection composites more accurately assess characteristics of applicants, thereby improving the quality of candidates entering these programs. Finally, several experimental measures are under development. These include (1) a fitness report-based measure of officer performance, (2) a biodata questionnaire, the Personal History Questionnaire, to assess career intention and performance potential, and (3) a form to be used by the Academy's Blue and Gold interview teams to assess leadership potential.

In FY86, the NROTC data base will be brought on-line and used to

develop new NROTC selection procedures aimed at reducing training attrition. Work to measure and predict officer performance will also continue. The major emphasis of this work will include identification of multiple measures of performance, development of these measures, and their evaluation.

P.E. 62763N
521-804-041

REPORTS:

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PERSONNEL DISTRIBUTION AND CAREER DEVELOPMENT

Principal Investigator:

John Bruni

(619) 225-6911

The Navy is experiencing shortages in the officers qualified to command major sea and shore activities. The decrement is also becoming critical among more junior career personnel and those who are required to have advanced technical abilities.

The primary objective of this project is to identify the personnel and organizational factors that encourage high-quality commissioned officers not only to make the Navy their career, but also to acquire the skills essential to performing well in senior billets.

A subordinate objective is to modify, develop, and evaluate personnel distribution and career development programs that aid the accomplishment of Navy requirements for quality officer performance.

Interviews and questionnaires

are being used in repeated-measures, multiple-cohort design to examine the Navy careers of 0-1 to 0-5 unrestricted line (URL) personnel. All personnel who participated initially (Time 1) are being followed up four years later (Time 2) to obtain information on developmental change and generational differences in each group. Subsamples have been selected and assessed in interim years to develop operational data on unique factors. Special attention is focused on increasing the effectiveness of formal and informal career advisors in career decision-making, including retention, and also on identifying the critical points in the career when decisions are made.

Based on interview and Time 1 questionnaire data, a recommendation was made and adopted that general unrestricted line officers (GenURLs) reassign the officers from their own community. Previously, surface warfare officers

(SWOs), detailed the GenURL community. A conceptual model was developed and tested regarding the factors influencing GenURL and SWO perceptions of their assignment officers.

The data from the Time 1 phase of this project were analyzed to determine the potential effect of several proposed changes in the surface warfare officer career pattern. Where results indicated that problems needed to be resolved or might arise, adjustments in the proposed career pattern were made. The first officers to be assigned under the revised SWO career pattern reached the fleet in FY85. NPRDC has been asked to develop a prechange database that can be used later to assess the effectiveness of this change.

Plans for FY86 include the distribution of a second wave of career development questionnaires sent to the same individuals completing the first wave of questionnaires (N = 9,000). These questionnaires will produce repeated-measures data. They will also produce data on the current career

management problems of the Navy related to the three officer communities addressed by this research. A questionnaire will also be sent to approximately 5,000 other individuals on theoretical issues prevalent in the research literature. Interviews will be conducted in the three officer communities to supplement questionnaire results and to serve as immediate feedback to Washington on the impact of recent policy initiatives.

P.E. 62763N

521-804-031-03.04

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SHIPYARD TRADES EMPLOYMENT INTERVIEW AND JOB REVIEW PROGRAM

Principal Investigator:

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The Naval Sea Systems

Command (NAVSEA) is

experiencing excessive employee turnover in the blue collar trades. Initial investigations indicate that the cause may be worker dissatisfaction stemming from unmet job expectations, and inadequate person-job matching procedures.

Hiring interviews are loosely structured and of widely varying format. Consequently, they do not elicit the same information from interviewees or interviewers in making wise job decisions. Selection and classification procedures do not include sophisticated applicant preference elicitation, nor do they provide comprehensive occupational information or realistic job previews. In short, current methods are of marginal utility in

the selection and classification process upon which shipyard productivity and quality, as well as worker satisfaction and tenure, depend.

As a result, trade openings are filled with individuals who have perhaps low career maturity and who are operating under unvalidated or even erroneous job expectations. Once on the job, disconfirmed expectations and work under unforeseen conditions lead to dissatisfaction. The consequences of job dissatisfaction are lowered morale, decreased productivity, and shortened tenure.

This project is pursuing dual objectives. First, the improvement of the employment interview process, and second, the design, development, demonstration, and implementation of improved occupational counseling, realistic job preview, and job information procedures.

Improvement in the interview process can be effected by imposing upon it a structure designed to be harmonious with the employment situation of the shipyard. A structured interview protocol will be designed to assess applicant characteristics and deliver occupational information to the prospective employee. Development of the interview protocol will be based upon direct observation of current interviewing procedures, plus consultations with shipyard personnel managers.

A parallel effort will develop prototype instruments and technologies for the provision of adequate occupational information with which the job applicant may make an informed job decision from among alternate openings. It will also develop materials focused on cancellation by the job applicant where job preview indicates probable dissatisfaction. These include (1) a brief Shipyard Trades Orientation film that presents a balanced account of the realities of the shipyard work, together with a review of the benefits of

employment and career possibilities, (2) didactic or counseling, Video Screen Presentations stressing the importance of choosing a job on the basis of both personal and organizational considerations, (3) an on-line Preference Elicitation Instrument that would assess the applicant's desired working conditions in general as well as interest in specific trades, (4) Comprehensive Occupational Information on three selected shipyard jobs presented on computer screen and printed out, and (5) a 3-5 minute Realistic Job Preview audiovisual program for each of the three selected jobs.

All materials and instruments will be demonstrated at the Long Beach shipyard. An initial training program for managers who will be using the interviewing protocol will be developed and conducted, and training materials for future in-house training will be provided.

P.E. 99000N
PO-50003

PLACEMENT SYSTEMS

Principal Investigator:

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Under the present shipyard apprentice assignment system, thousands of individuals apply each year to enter the 50 or so apprenticeship programs at Navy shipyards. These individuals complete an aptitude battery, and those scoring highest within each shipyard's geographic area may continue applying.

These pre-screened individuals must then express job preferences and are interviewed by shipyard representatives to assess their motivation and suitability for different trades. Assignment decisions are made sequentially, starting with the candidate whose combined aptitude test and veteran's preference score is highest. This individual may be offered his or her preferred

apprenticeship, may be offered an alternate apprenticeship, or may be passed over in favor of the next candidate. The assignment procedure then continues, working downward through the list of candidates, until all apprenticeships are filled.

While many appropriate assignments are made with this system, there are also a number of problems. For example, (1) applicants who are part-way down on the aptitude list may be very restricted in their job choices and may not have previously considered or have much knowledge of the jobs which are still available when their time comes to choose, and (2) there is no systematic optimization of assignments for applicants as a group so that ability levels are matched to job requirements, the most critical jobs are filled by people likely to remain at the

shipyards, and preferences are taken into account for people toward the bottom of the list.

The objective of this project is to design and implement procedures to eliminate some of these problems. The new procedures will (1) more systematically provide apprentice applicants with information about themselves and available jobs and job openings, and (2) optimally utilize information about the entire applicant pool rather than about each applicant at a time to generate recommended apprentice placements. An algorithm for use on a micro-computer will be developed for this purpose, with data entry by means of a series of user-friendly data entry screens. The

information entered for each individual may include measures of ability, job preferences, likely tenure at the shipyard, recommendations of trade representatives, and indications of the individual's eligibility for different jobs. Information about each job will include such factors as a quota, an indication of the ability

level required for the job, and an indication of the cost of training and/or filling an opening in that job.

Plans for FY86 include (1) the development of demonstration computer algorithms and procedures for generating the appropriate person-job matchups, (2) the development of components to be entered into the algorithms, including job criticality ratings (e.g., training costs plus turnover), vocational interest scales to predict satisfaction and/or turnover, and aptitude composites to predict apprenticeship grades, and (3) the writing of a report describing the development of the person-job matching procedure.

P.E. 99000N
PO-50003

MILITARY OCCUPATIONAL INFORMATION SYSTEM

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The Office of the Assistant Secretary of Defense (FM&P) has established the policy of encouraging the widest possible dissemination of military career information. The purpose of this effort is to encourage American youth to consider military service as a viable career path when making their occupational decisions. Previously, military career information has been unavailable to civilian educators and counselors, and when it was available, it often proved to be inadequate, inaccurate, and dependent for dissemination on antiquated systems that were, in themselves, a logistical problem.

To foster the effective delivery of military career information, OASD sponsored the CROSSCODE Project, a major joint service effort resulting in the cross referencing

of military jobs with analogous jobs in the civilian occupational structure. Subsequently, this large bank of job information, known as Military Occupational and Training Data (MOTD) was made available to educational institutions nationwide, and has been integrated into a number of civilian career information delivery systems (CIDS).

While these previous efforts have had an positive effect, a considerable amount of educational institutions have no CIDS. Consequently, they are unable to utilize the MOTD information, and their students are deprived of access to this reliable source of military career information. There is a need for a means of disseminating MOTD to these institutions.

Because of the proliferation of stand-alone microcomputers throughout the American society, even small isolated schools may

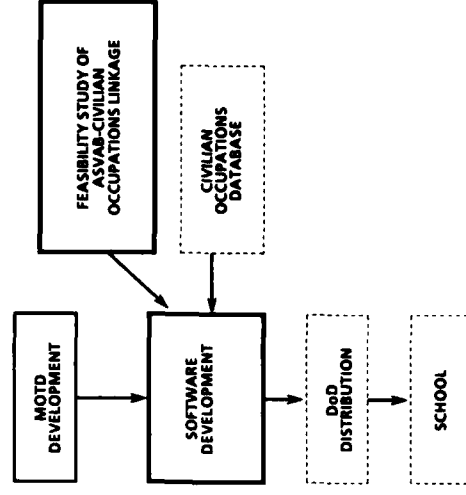
have one or more, and are familiar with their use. This effort will design and develop a software package that includes the MOTD along with a search strategy through which this information can be accessed.

The product of this effort will be a software package (or packages) constituting a military career information system (MCIS) that operates on stand-alone microcomputers. User-friendly, menu-driven software will permit use of the system by even computer naive persons. The access strategy will be based on number of factors, one of which will be scores on the Armed Services Vocational Aptitude Battery (ASVAB). This latter feature will encourage students to take the ASVAB, thus furthering the DoD High School Training Program.

This effort will constitute another significant step in OASD's program to make reliable military career information widely available. OASD will be able to disseminate the software as a service to educational institutions and the American youth

population. Schools receiving the MCIS will profit by having enhanced career information programs while being assured of readily available, reliable, and accessible military career information.

P. E. 99000N
MIPR-85-T91



ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB)

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The Armed Services Vocational Aptitude Battery (ASVAB) is the principal enlistment screening and classification test used by the

armed services. It is administered to service applicants at Military Entrance Processing Stations (MEPS) and at other sites. To ensure that ASVAB-based selection and assignment decisions are accurate, the validity of the ASVAB as a predictor of school and job performance must be demonstrated. NPRDC, in cooperation with other service laboratories, contributes to the ongoing improvements to the ASVAB by performing appropriate research according to various needs dictated by the present and forecasted manpower supply pool and the present and anticipated manpower requirements of the services.

The objectives of this effort are to (1) validate the ASVAB as a tool

for improving selection standards for school assignment, (2) assist in a joint effort with the other services to develop new items and improve alternate forms of the ASVAB, and (3) validate the ASVAB against job performance criteria.

The approach is a continuation and expansion of previous ASVAB development and validation efforts and of similar research on the Navy Basic Test Battery (which the ASVAB replaced). Student performance data are collected from Navy schools and are related to ASVAB test scores.

Recommendations are made concerning changes in qualifying scores or combinations of tests that would reduce school attrition or provide larger numbers of school-qualified personnel than result from present selection standards. Job-related performance measures in selected Navy schools will be identified as criterion measures to supplement the currently used final school grade and pass-fail criteria. ASVAB scores will be related to these and to other

measures of on-job performance.

NPRDC has assisted in all phases of the development of ASVAB Forms 10-13, which are used for the production testing program, and Form 14, which is for the student testing program. With the introduction of the new Forms 10-14 in October 1984, the reference population was also changed. Prior to October 1984, the interpretation of ASVAB scores was based on the World War II reference population. New norms have been developed based on analysis of data collected on young men and women between the ages of 16 and 23 reported in Profile of American Youth, 1980, Nationwide Administration of the Armed Services Vocational Aptitude Battery. Scores on the ASVAB are now reported in terms of the contemporary 1980 reference population.

In addition, a study was completed which supported the notion that validation data, obtained on an ASVAB selector composite designed for a specific Navy job, is generalizable to a large number of diverse Navy jobs. Another project involving the computerized testing of

perceptual and reasoning skills was administered to a large number of incoming Sonar Technician students. Preliminary results indicate the tests possess reasonable reliability and the examinees expressed enthusiasm for the computerized mode of administration.

FY86 efforts will focus on publishing findings from the gender study, validation of new test types against job performance measures, responding to five consumer requests for validation studies, systematically validating the ratings within each of the eleven Navy occupational families (one family at a time), and improving school performance data used for ASVAB validation.

P.E. 99000N

WR-1012, WT-B1008

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JOINT SERVICE ADAPTABILITY SCREENING

Principal Investigator:

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Periodically, the military services experience attrition among first-term enlistees at what are judged to be excessive rates. Each service has attempted to control or reduce such attrition using a variety of approaches, including improved screening and selection procedures. In this regard, the services have conducted an investigation of self-report background or biographic information to improve screening by identifying applicants who are most likely to have difficulty dealing with military life.

NPRDC's work in this area resulted in the development and validation of a biodata questionnaire, the Recruit Background Questionnaire (RBQ), which showed value in predicting losses among both Navy and Marine Corps first-term enlistees. A 1982 Government Audit Office

study suggested the RBQ as an appropriate point at which to start development of a single instrument that could be used by all services. Subsequently, NPRDC was tasked by the Office of the Secretary of Defense (Manpower Reserve Affairs and Logistics) to be lead service in developing such an instrument.

The global objective of this project is to improve enlisted screening by differentiating applicants in terms of their adaptability to military service. For this study, adaptability is defined in terms of completion of initial term of service. The specific objective is to develop a biodata questionnaire that can be used by all services, to validate the instrument against attrition criteria, and to compare it to existing instruments and procedures.

A biodata questionnaire, suitable for use by all services, was developed. Two experimental versions of the questionnaire, the

Armed Services Applicant Profile (ASAP), were constructed and administered to nearly 200,000 applicants for enlistment. Applicant test data has been matched against accession records to identify applicants who actually enlisted.

Additional research has been undertaken to explore the problem of applicants' faking or distorting their answers to ASAP items. ASAP items have been administered to Navy recruits to identify instructional sets that inhibit faking.

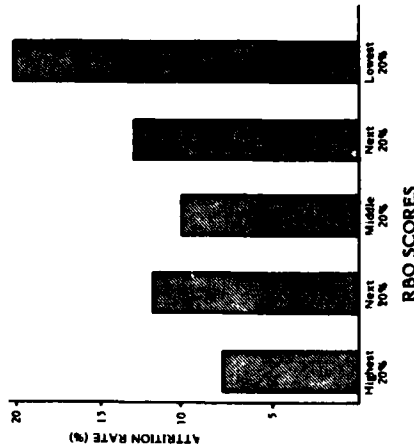
In FY86, the ASAP accession cohort will be tracked to identify those who attrite. Loss data will be analyzed for those who attrited during basic training, and during the first 180 days of service. Separate scoring keys will be developed by military service, gender, and high school diploma status. Common or cross-service keys will also be developed. In addition, the experimental faking data will be analyzed to refine methods of minimizing applicant self-report distortion.

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MIPR-85-T51

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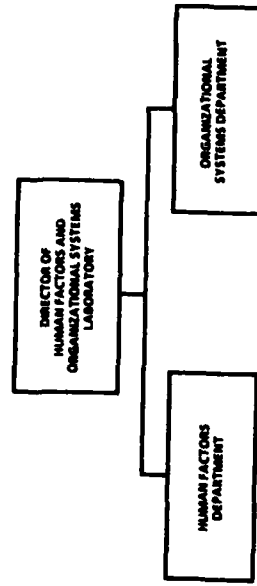
HUMAN FACTORS AND ORGANIZATIONAL SYSTEMS LABORATORY

Director: Robert E. Blanchard

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This laboratory is concerned with developing and conducting an R&D program to advance the behavioral technologies supporting an improved understanding of man's interaction with other individuals and complex hardware systems. The program addresses social, technical, and physical environmental factors for enhancing performance and improving the quality of working life.

This laboratory is organized into two departments.



The human factors department develops and conducts R&D to extend knowledge of human processes underlying human-machine functions to optimize the design, development, operation, and maintenance of Navy human-machine systems. The organizational systems department develops and conducts R&D addressing organizational effectiveness and performance of military and civilian personnel. Individual and organizational processes are assessed to enhance motivation and performance. Techniques and strategies are developed and applied to facilitate improved quality and productivity and to design and evaluate command organizations. Major research and development projects include:



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BRAIN MECHANISMS OF HUMAN COLOR VISION: IMPLICATIONS FOR DISPLAY SYSTEMS

Principal Investigator:

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Our understanding of color processing in the human visual system is limited because it is based primarily on psychophysical studies with small numbers of subjects and on physiological recordings in animals. Few studies have properly examined the activity of the human brain engaged in processing color-coded information. This project, which is a new start for FY86, will use neuroelectric and neuromagnetic recording techniques to describe the processing of computer-generated color stimuli by the human brain.

Our limited understanding of brain processing of color means that we may use color-coded computer displays (CCCDs) inefficiently in critical Navy command/control and tactical

consoles. The increasing amounts of information conveyed by CCCDs may overload the human operator and impair decision-making.

Clinical and paper-and-pencil tests tell us little about the dynamic processes that the human visual system uses to interpret and respond to CCCDs. Proper selection of personnel for work with such displays requires information about the sensitivity of the brain mechanisms that underlie color processing.

Therefore, the Navy needs normative data describing the color-processing mechanisms of the human visual system that are engaged by operators of CCCDs. Furthermore, the Navy needs objective and cost-effective methods to measure color processing in individuals in order to select and train capable personnel for working with CCCDs and for monitoring their on-job performance. Unlike psychophysical testing, brain wave

recording is objective and may be automated for rapid visual assessment.

The human eye contains three types of photosensitive cells (cones), each of which is sensitive to light in different regions of the spectrum. The opponent-process theory of color vision incorporates three mechanisms for color-coding: red/green (RG), blue/yellow (BY), and luminance (L). The spectral sensitivity of each mechanism is a particular combination of the sensitivities of the three types of cones in the eye. We can devise stimuli that activate single cones or opponent mechanisms, and use such stimuli to identify brain regions that are important for processing hue and brightness. To do this we will map the electric and magnetic fields of

the brain that result from the activities of single mechanisms.

Scientifically, the proposed mechanisms will provide a needed test of opponent-process theory using evoked brain activity. The results of the mapping experiments will contribute to our understanding of the organization of the human brain for processing color-coded information. The methods developed for analyzing brain processing of color will provide improved assessment of individual differences. These methods will augment and improve the NPRDC-developed evoked potential battery, which has produced a predictor data base of nearly 1000 Navy and Marine Corps personnel.

P.E. 61152N

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TACTICAL PERFORMANCE TECHNIQUES MEASUREMENT

Principal Investigator:
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(619) 225-2081

Reports from operational commanders indicate deficiencies in individual and team performance that reduce combat readiness. However, the lack of opportunity to observe and measure operator performance in a realistic environment has hampered efforts to identify sources of the operational problems. Methodologies for measuring combat performance and establishing performance standards are required to enable operational commanders to assess the proficiency of their assets. Guidelines for determining individual and team performance levels are inadequate or do not exist.

The objective of this effort is to advance the human factors technology base for command and control by developing improved

techniques for measuring combat system performance and by developing measures of effectiveness. Results of this effort will have direct applications to readiness assessment, training, and design of advanced systems.

The approach is to focus on electronic warfare (EW) combat readiness. Detailed diagnostic data on individual operator time and accuracy in identifying emitters were collected to assess current levels of EW proficiency. Background data were correlated with observed performance to indicate how proficiency is influenced by experience and training. These relationships suggest the necessary types and frequency of refresher training required to maintain operator proficiency. EW operator performance standards for time and accuracy were developed using the Delphi technique. Comments have been provided to OP-956 and COMNAVSURFPAC

along with suggestions for improved performance measurement and measures of effectiveness.

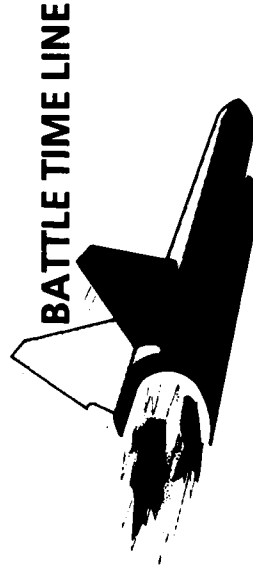
The FY85 effort assessed current levels of EW operator proficiency, generated EW operator performance standards, and made recommendations to decrease existing deficiencies and establish EW readiness within the Navy.

FY86 work will center on developing a methodology to

assess the performance of the six-man EW team and developing performance standards for the EW Supervisor. Also, a Delphi study was conducted on Tactical Action Officers to validate the standards set by senior EWs.
P.E. 62757N
525-601

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BATTLE TIME LINE



EW REPORT	JAMMING & DECEPTION	WEAPONS ACQUISITION	WEAPONS RELEASE
			
EW REPORT		JAMMING & DECEPTION	WEAPONS ACQUISITION
		WEAPONS RELEASE	

MINUTES

COMPUTER-ASSISTED FAULT DETECTION AND RECOVERY IN PROPULSION SYSTEMS

Principal Investigator:

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This project is concerned with the difficulties experienced by engineering department personnel in coping with the operation of ship propulsion systems. Problems are evidenced by explosions and fires, inability of ships to meet operational schedules, and failures of ships to pass operational propulsion plant examinations.

Our studies indicate that the most severe propulsion unit operating problems aboard ship result primarily from inability of personnel to handle system malfunctions. In turn, this appears to be the consequence of incorrect allocations of functions to personnel. Personnel are increasingly assigned tasks for which they are poorly suited or which are truly beyond their

human physical capabilities to handle. It is simply not possible for an operator to detect an impending malfunction by continuously observing the behavior of thousands of constantly fluctuating variables, and, within a fraction of a second, diagnose its cause and initiate critical corrective actions.

In FY84/85, this program directed efforts toward exploring the increased use of computers to assist the operators of these complex shipboard systems. Approaches included the use of interactive color-graphic displays, computer simulators for training, and the use of expert systems for fault-diagnosis in real-time.

In FY85, work began on the development of artificial intelligence methods for automated fault detection and diagnosis, to be applied to one of the subsystems of the ship gas

turbine engine unit. The reduction gear lube oil subsystem was selected as the application for this exploratory work. Prototype computer programs have been constructed that automatically "learn" the upper and lower limits of normal for the values of system variables, such as temperature, pressure, speed, etc. In addition, the programs are capable of adapting to changes in the system that occur over periods of time. These programs, therefore, can adapt to different climates and components and to the wear-and-tear of components, by continually redetermining the limits of normal for the values of system variables. The programs can detect impending malfunctions in real-time, make real-time diagnoses, and, as malfunctions evolve, give realistic probability estimates as to the possible causes of the evolving malfunction.

FY86 work is underway to enable these computer programs to cope with systems where the variables are constantly influenced by random factors. In such systems, the symptoms resulting from a malfunction will differ in

timing and severity in each and every instance of its occurrence.

The results of this research will be computer control systems that can automatically "learn" to improve their performance over time as they gain increasing experience on line. The burden of malfunction detection and diagnosis will shift to the computer, where it belongs, allowing the operator greater freedom and time to assess the overall situation and determine the proper response.

P.E. 62757N
525-601-025

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DECISION AIDING IN COMBAT SYSTEMS

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Susan Hearold
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To meet the expected threat in the 2000 time frame while also reducing the skill level requirements for command and control (C2) personnel, advanced systems are relying increasingly on aids and automation. If these aids are to function effectively, they must be properly interfaced with the operators and decision-makers who will use them. Careful design of this interface will assure payoffs in increased combat effectiveness. Poor design can degrade potential systems capability. Important research issues in this domain are

(1) the role of automation in C2 systems, and (2) design concepts for intelligent (knowledge-based) interfaces and decision aids.

The objective is to advance the human factors technology base for C2 by developing improved

decision aiding and human-computer interface concepts. The goal is to improve the speed and accuracy of decision-making.

This project concentrates on the interaction between combat system operator/commanders and the automatic and aided functions of advanced combat systems. This effort extends the development of a prototype knowledge-based aid, Intelligent Tactical Assistant, (ITA) for situation assessment/contact identification. Interface concepts developed for this laboratory system are being refined and graphic displays added using more sophisticated hardware.

In FY86, the major focus of this research will be on the dynamics of an interface to support collaborative efforts of the user and the computer. Some questions that arise are (1) under what conditions shall the assistant interrupt the user?, (2) what are

the best forms for user-assistant dialogue?, (3) how much adaptation and flexibility is required in the C2 system interface?, and (4) how does one evaluate the performance of the new partnership?

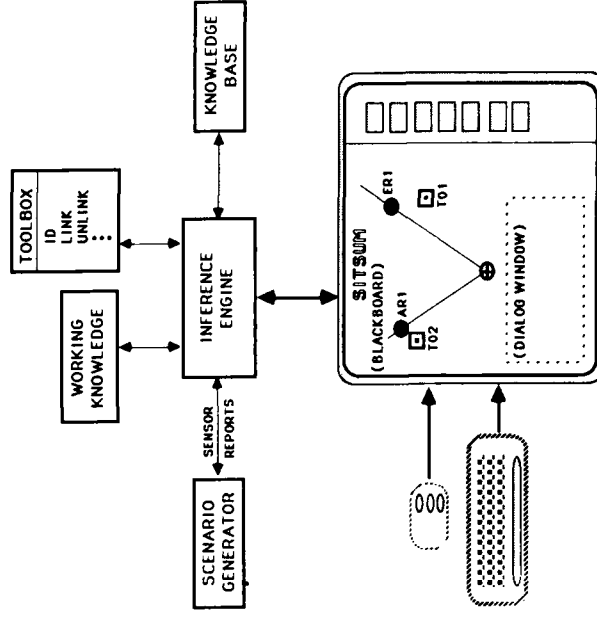
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ITA SCHEMATIC

HUMAN FACTORS ENGINEERING FOR SOFTWARE DEVELOPMENT

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The area of software

development is a major concern for all the military services. Initial software development and maintenance costs throughout the life cycle far outstrip the hardware costs. The objective of this project is to investigate methods by which software development time and costs can be reduced through a better knowledge of the cognitive processes and limitations that constrain software development.

An area being studied is the programming task itself. The trend for the military to rely on highly structured programming languages such as ADA and Pascal, place special emphasis on programmer ability to organize and plan to a detailed level. The languages permit rapid and smooth execution of such plans once they are established. It is the

establishment of a well-thought-out approach that is difficult for programmers, especially novices. Some languages, such as C, provide programmers much latitude in redefining functions and operations.

This latitude stresses the

memory of programmers to remember idiosyncratic differences that he/she has introduced earlier and can cause extreme problems for debugging of software maintenance. The introduction of parallel processing computers will make the programming task much more difficult because of the need to prioritize and coordinate the operations that are occurring. This project is investigating the cognitive processes stressed by extant programming practices and the potential techniques or technologies which might be used to support them.

The great interest in using expert systems to supplant the shrinking number of personnel

available to man the Navy's ships will likely result in attempts to do so in many areas. The problem is that the creation of a supporting knowledge base for each expert domain involves a very intense and protracted effort by "knowledge engineers." The process of eliciting expert knowledge so that it may be captured in computer-based representations is not well-defined.

The population of qualified knowledge engineers is probably not sufficient to meet the needs of the military and industry both. It is necessary that the process of knowledge elicitation be facilitated through a better understanding of how information is represented and used by experts. An understanding of this can lead to better ways of tapping expert knowledge efficiently as well as building knowledge representations that are faithful to those of the expert.

NPRDC is currently examining the loosely formed area of knowledge elicitation in an attempt to (1) provide an organized framework within

which the field can be discussed and examined, and (2) examine and evaluate current products that are offered as ways to create knowledge domains with respect to their adequacy for use in military applications.

P.E. 62757N

525-601-027

FUTURE TECHNOLOGIES --BIOPSYCHOMETRICS

Principal Investigator:

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The rapid worldwide accelerated development of technology makes it mandatory that the Navy keep abreast of developments that may pose unexpected threats or provide unanticipated opportunities.

Weapon systems are becoming more sophisticated and difficult to operate, maintain, and repair. The individuals who must operate and maintain the systems are not improving in capability and there is considerable evidence that the quality as well as the quantity is diminishing. It is thus necessary to try to find and exploit all possible means of improving the use of available personnel. Some of the technological developments of various agencies in the U.S. and abroad may prove to be useful in enhancing the selection,

classification, training, motivation, and performance of Navy personnel. Evidence mounts which indicates that in the performance of combat-related cognitive tasks, such as detection and tracking by radar operators, performance is variable in quality.

The objective of this project is to identify and create new technologies or innovations that will prove useful to the Navy in solving some of its existing or anticipated problems in manpower and personnel. Specifically, techniques will be developed to (1) assess the capabilities and readiness of personnel to perform sensitive tasks using techniques such as neuroelectric and neuromagnetic recordings so that personnel not able to perform up to standard will not be assigned, and (2) provide real-time performance measures to detect declining performance and to replace personnel no longer

effectively performing their cognitive tasks.

During FY85, a command/control combat operator task (Air Defense Radar Simulation) was implemented, along with enhanced biopsychometric (i.e., neuroelectric and neuromagnetic) data recording capability. This task was used to assess decision-making performance under varying workload conditions. An extensive neuroelectric/neuromagnetic behavior data base was obtained during "field" recording of Marine Corps recruit personnel. Preliminary results showed that high performers had larger brain wave amplitudes than low performers. The biopsychometric predictors were better able to predict on-job performance than were the paper-and-pencil test scores.

In FY86, multimodal, multitask target detection conditions will be examined, along with patterns of biopsychometric data that differentiate high from low levels of performance. Outyear work will

include assessing biopsychometric personnel readiness indicators and validating biopsychometric performance predictors.

P.E. 62763N

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NEUROELECTRIC ASSESSMENT SYSTEM FOR NAVAL AVIATION PERSONNEL

Principal Investigator:

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Attrition from naval aviation training creates a significant non-productive cost to the Navy. Traditional methods of student selection have not substantially altered attrition rates since the end of World War II. New techniques for selection that will complement traditional methods are required.

The objectives of this project are (1) to identify neuroelectric measures that will contribute to the selection of individuals for naval aviation training and reduce attrition, and (2) to develop an automated, rapid procedure for neuroelectric measurement that can be used to assign individuals to groups with known probability of aviation training success.

The approach is to administer neuroelectric (event-related potential, ERP) tests to student aviators and flight officers at

various stages in naval aviation training. Test results will then be related to training criteria, and tests most predictive of training success will be combined with behavioral tests concurrently being developed at the Naval Aerospace Medical Research Laboratory (NAMRL), Pensacola, Florida, into a selection battery.

This project began in FY84. An NPRDC NOVA 2/10 computer-based data acquisition system was installed at NAMRL. Data acquisition was accomplished on 21 Naval and Marine Corps officers who were awaiting aviation training. Two laboratory technical notes document the results of this preliminary study. The results demonstrated ERP reliability and sensitivity to individual differences. Methodological and data analysis questions were further examined at NPRDC.

Results were reported in the open literature and in laboratory technical notes. The NOVA 2/10 computer was

replaced in FY85 with an NPRDC MASSCOMP data acquisition and analysis system. NAMRL also took custody of their own MASSCOMP computer and all operational software was exchanged between NPRDC and NAMRL. Data acquisition following a modified protocol based on recent NPRDC findings was resumed at NAMRL.

Plans for FY86 include continued data collection and analysis using current protocols. The goal is to establish a

neuroelectric data base adequate to test against training performance criteria.
P.E. 62763N
528-001-002

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SHIPBOARD NUCLEAR WEAPONS SECURITY (SNWS) SYSTEM

Principal Investigator:

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An advanced shipboard nuclear weapons security (SNWS) system is being developed by the Naval Surface Weapons Center, White Oak (NSWCWO) to provide upgraded protection against unauthorized access to special weapons. The human element is a key factor affecting system capabilities and must be given appropriate consideration throughout the development cycle, especially the upgrading of personnel capabilities commensurate with improvements planned in the advanced security system hardware capabilities.

The SNWS development program covers near-, mid- and long-term development phases over a 10-year period. Initial human factors support has involved identification of specific problems related to the quantity

and quality of existing security forces and equipment. Major effort has been directed toward development of behavioral model capabilities for simulation of guard force and adversary performance in typical security scenarios. Future work will involve continuing analyses of human factors implications of candidate SNWS design configurations, development of advanced shipboard training capabilities, and determination of integrated man-machine performance testing provisions.

The work has proceeded generally in accordance with phased human factors task plans, involving continued advisory consultation to NSWCWO. Several major objectives have been achieved. Completion of a shipboard questionnaire survey (44 ships) helped to establish the basis for subsequent development of specific SNWS design concepts to counter

indicated areas of weakness.

An advanced graphics display is now operational for laboratory evaluation purposes at NSWCWO. A Navy training plan for SNWS was approved for implementation by CNO (OP-112) in July 1983. Initial training courses are nearing completion in the application areas of Shipboard Security Command Orientation, Nuclear Weapons Security Officer, Shipboard Security Specialist, Security Force Orientation, and Shipboard Security Engagement Tactics.

Software for automation of entry control and security force management functions has been incorporated as part of an upgrade package for the Shipboard Nontactical ADP (SNAP) program. This software package is now being distributed by the Navy Management Systems Support Office for fleet use.

During FY86, the human factors effort will continue to investigate and support innovative SNWS concepts. Related advanced technology work at NPRDC

(microcomputers, interactive videodisc, etc.) will be applied where feasible in support of training and technical documentation development plans.

P.E. 99000N
WR-W0032

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SURFACE SHIP COMBAT SYSTEMS CONCEPT FORMULATIONS

Principal Investigator:

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The primary goal of this subproject is the development of man-machine interface (MMI) design concepts for advanced command and control systems on surface combatants.

The main development effort is focusing on design concepts for the platforms and missions projected in the year 2000 time frame. Initial work is directed to the combat system design for a future frigate (FFX). The end products of the work will include MMI design recommendations and preliminary specifications for key manned stations in the FFX combat information center and associated spaces, supported by data from human factors engineering analyses and trade-off studies.

Work has been progressing within the problem definition and

analysis phase. Included is an investigation of projected requirements: (1) define from authoritative Navy sources the expected operating environment for small combatants in the mid-term time frame, including the nature and densities of the threats they may expect to encounter, (2) define representative deployment and mission scenarios, and (3) define critical requirements and constraints relating to MMI design. Emphasis in this investigation is being placed on developing a working definition of the projected combat information management tasks that will be required of the combat direction systems and an early sense of the probable constraints on equipment, work space, and manning that can be used in accomplishing these tasks.

Concurrent with the above efforts, capabilities and shortcomings of present similar ship classes are being identified through (1) a

review of relevant fleet documents, such as CONARs, fleet exercise reports, and OPTEVFOR assessments, (2) interviews with knowledgeable fleet personnel, and (3) a review of problem-definition investigations in related R&D programs. The focus of this task is on FF-1040, 1052, FFG-7, and DD-963 class ships. The product of this task is a definition of critical MMI deficiencies and lessons learned from the current system.

Work is also progressing on identifying information requirements to support combat operations on the FFX. Emphasis is on the requirements to support a combat system optimized for ASW.

The technical steps are as follows:
(1) define the context for FFX operation by developing a general descriptive network depicting ASW operational functions at the battle group level, (2) within that network, identify and elaborate those functions pertinent to the role of FFX in ASW operations, (3) develop a baseline description of current surface ASW operations and capabilities, assuming 1985 technology and generalized across FF-1052, FFG-7, and DD-963 platforms, (4) project changes in

the baseline descriptions owing to changing technologies, threats, tactics, training, and manning resources, (5) develop "strawman" descriptions of ASW functional sequences for the FFX assuming technology of the mid-term and projected candidate equipments, and (6) for each function, identify the information requirements, including input sources, required attributes, processing, display, and transfer needs.

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SUBSURFACE SYSTEM OPERABILITY

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The U. S. Navy considers the performance of present submarine combat systems to be significantly below predicted performance and inadequate to meet the increasing threat. This discrepancy is likely to widen as more complex weapons and sensors are incorporated into future submarines unless the "operability" of the combat system is enhanced. One key element of operability is the effectiveness of the interface between the users and the combat system.

Consequently, major improvements in information processing and man/machine interface designs are considered critical to the improved operability of future combat systems.

The primary goal of the Subsurface System Operability Project is to develop and implement advanced operability evaluation methodologies, tools

and environments to assess proposed advanced work station designs. The evaluations will be performance-based, i. e., display/control interface designs will be evaluated using interactive prototypes in dynamic environments to collect user performance data.

In FY85, project personnel (1) established liaison with the Naval Underwater Systems Center (NUSC) and NAVSEA PDS-350 to coordinate the human factors R & D program with the new operability initiatives established by OP-02 for system acquisition, (2) reviewed the literature on the use of color in complex information displays, (3) reviewed the Concept of Operations (COOP) and Type A System Specification Documents from a human factors engineering perspective, (4) enhanced the Display Authoring program for prototyping display formats, and (5) began work on modeling decision maker performance in order to quantify the effect of

human decisions in combat system effectiveness.

The focus in FY86 will be to continue development of a Combat Commander Model that will result in (1) realistic, part-mission simulations, (2) measures of effectiveness and measures of performance, and (3) a model of the combat commander. In addition, work will begin on developing a quickly reconfigurable, dynamic,

scenario-driven work station that interacts with a simulated combat environment and user/operator.

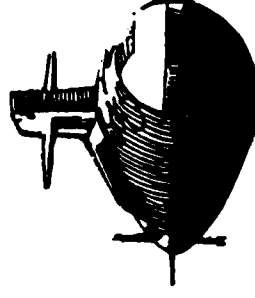
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INFORMATION MANAGEMENT FOR NAVAL BASES AND STATIONS

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When analyzed as a business, Naval bases and stations would be placed among the very largest of businesses in the Fortune 500, with gross revenues involved in over a billion dollars. Yet less than .5% is expended annually to improve information management and accounting. This is extraordinarily low compared to other operations with similar revenues. As a consequence, the Navy's information management systems have become antiquated and are no longer able to provide accurate and timely information for the volume of work to be handled. These facts have become highlighted in several unfortunate incidents recently that reflect poorly on the Navy's ability to manage and account for its assets. The Bases and Stations Information System (BASIS) project is a Navy-wide effort, headed by

COMNAVDAC, to produce standard data processing systems to meet the basic functional needs of all naval bases and/or stations. The mission of BASIS is to provide accurate and timely information to the various management function levels of naval organizations. The objective of the project is to produce systems that afford management control, optimize productivity, and minimize operating costs.

NPRDC, with its experience in providing support to the human engineering design of shipboard information systems, is now providing assistance to the BASIS project to ensure the inclusion of human factors considerations in the design of the user interface and the selection of hardware. One of the main areas of NPRDC's activity is the development of user interface standards to be used across the several application areas under development. The standards are being prepared in keeping with the findings of

research on human performance and productivity on computer systems. Standards based upon empirical results are more likely to be accepted by design engineers and software developers. It is anticipated that a much more consistent, thoughtful, and easy to use interface will result.

The objectives of NPRDC's efforts are to establish design requirements for effective and efficient user-oriented information systems and to provide assistance and consultation in the design, development, and implementation of the system.

The project will develop and maintain information systems architectures. Included is the determination of the functional areas to be provided and the information flow necessary to support those functions. The analysis includes concern for the methods used to make it easy for users to move among functional areas within BASIS as well as to interchange information between other systems and BASIS.

In FY85, work was completed in the development of user

interface standards for screen design and command language to be used within BASIS. Work was also accomplished in developing a taxonomic structure for the decision tasks and responsibilities at the command level of bases and stations.

In FY86, more emphasis will be given to determining the information requirements and decision styles that exist at the command level and how these might be accommodated by an information system like BASIS. Interviews and surveys will be conducted to determine the relative frequencies, types, and importance of decisions requiring dependency on the kind of information that could be maintained within an information system.

P.E. 63701N

Z1771-HF011

PROPULSION CONTROLS

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Work during the early phases of this program was conducted as a part of the DDG-51 contract design effort. In the present instance, NPRDC was involved in the definition of the propulsion control system interface for the ship.

In FY84, contract design drawings were developed at NPRDC for seven consoles. These drawings defined the propulsion control interface requirements. Two of these consoles were for local control of the gas turbine engines in the engine room. Four were for installation in the central propulsion station. One of the four is for centralized control of the propulsion system, which includes the four gas turbine engines, fuel systems, lube oil systems, and auxiliary support equipment. The second of the four

is for centralized control of the generators and power distribution system, weapon systems, CIC, and housekeeping.

The third console is for use by the engineering officer of the watch (EOOW) for monitoring the propulsion system. The fourth serves as the damage control console in damage control central, which occupies space in the central propulsion control station. The last or seventh console serves as the damage repair console at the location of damage repair station 2 in the forward area of the ship.

Engineering drawings developed for the seven consoles are serving as contract design drawings for procurement of the DDG-51 propulsion control system.

In FY85, work was devoted to monitoring the human factors engineering aspects of contractor performance in the development of the DDG-51 propulsion control

system. Design features of each of the seven consoles, as developed by the contractor, were reviewed. Technical notes containing design recommendations were published.

In FY86, work on the project continues to be devoted to the monitoring of contractor performance.

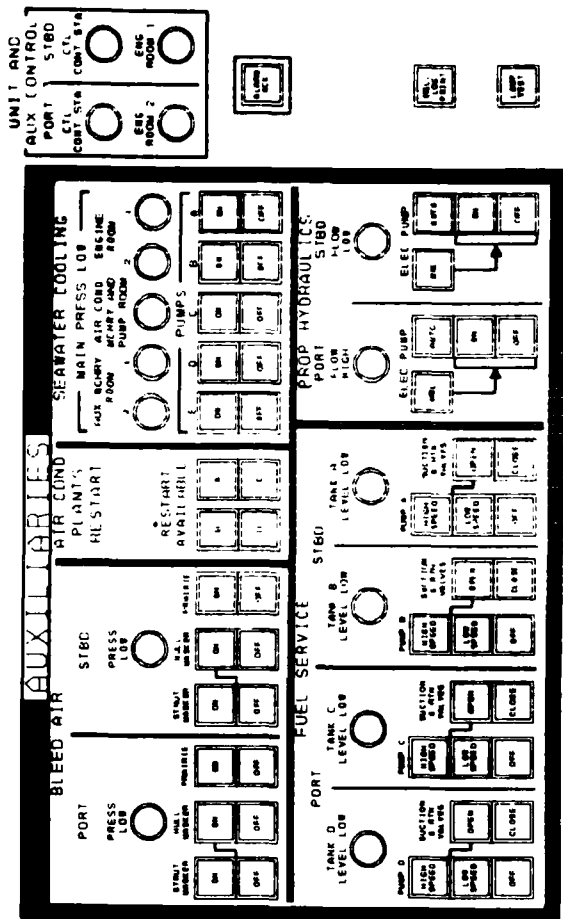
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FIELD TEST OF THE PERSONAL ELECTRONIC AID FOR MAINTENANCE

Principal Investigator:

Robert Smillie

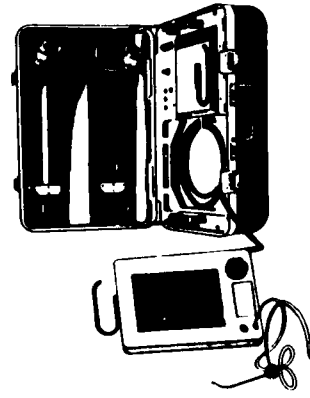
(619) 225-6617

Compared to a paper-based system, a user-oriented, computer-based technical information delivery system should improve the organization of and access to the information needed to support the performance of maintenance tasks. This project will evaluate the

Personal Electronic Aid for Maintenance (PEAM), a prototype computer-based job aid. The effectiveness of electronically delivered technical information will be compared to that of paper-based documentation for meeting the information needs of maintenance technicians.

PEAM is a portable micro-processor with a 5x7 inch electroluminescent panel display and an eight function keypad. There is a speech recognition module that allows the user to verbalize the eight commands and a text-to-speech synthesizer that

produces an audio output of the screen text upon user request.



Personal Electronic Aid for Maintenance

The PEAM project began as a joint service exploratory development by the Naval Training Systems Center (NTSC) and the Army Project Manager for Training Devices. In FY80, NTSC initiated the concept definition of PEAM. In FY81, NTSC completed the hardware and software development specifications and initiated the design and development of PEAM. In FY82 a memorandum of understanding between NTSC and the Army Research Institute was signed

establishing responsibilities for the full-scale engineering

development phase. In FY85,

NPRDC initiated the Navy PEAM

evaluation on the NATO

Seasparrow Surface Missile System (NSSMS).

Expected benefits of PEAM

over the existing paper-based maintenance documentation include: (1) greater versatility in the way information can be organized and accessed, (2) reduced search time for technicians by providing only the requested information to perform a maintenance task, and (3) quicker update and storage capabilities.

Maintenance on the NSSMS

involves use of technicians at various levels of maintenance expertise; hence, PEAM must be compatible with the 3-M maintenance reporting system.

The device for delivering the information must be rugged and usable both in internal ship spaces with minimum access space as well as on the weather decks with hostile environmental factors. Further, the device must allow for hands-off operation where

maintenance is a two-handed operation.

Tasks required for the Navy evaluation of PEAM include (1) the design of a field test of PEAM's maintenance information delivery system to be conducted onboard ship using NSSMS as the target system, (2) the development of software to transcribe a subset of existing NSSMS technical data into a PEAM readable format, (3) the use of PEAM prototype devices to conduct a pretest that evaluates the feasibility of the test design, as well as the hardware and software capabilities of PEAM, (4) the conduct of a field test using PEAM for maintenance of NSSMS onboard DD-963 class destroyers, and (5) the analysis of data and the providing of results.

Accomplishments to date

include (1) the development of a test plan, (2) the development of a NSSMS data base for PEAM, and (3) the identification and development of NSSMS maintenance task scenarios for the evaluation.

P.E. 99000N

MIPR-13ARI-85-56

INFORMATION MANAGEMENT AND BATTLE GROUP EFFECTIVENESS

Principal Investigator:
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Effective U. S. naval warfare is heavily dependent on the performance of carrier-centered battle groups. These groups require the successful coordination of independent surface and air units through the complex interaction of key aircraft and sensor managers, warfare commanders, and the composite warfare commander. Although significant advances have been made in developing complex weapons and communications systems to support battle group effectiveness, relatively little research has been directed at how these independent systems are coordinated by the combat systems teams to achieve successful organizational decision-making. This research project applies and extends principles from organizational science to systematically address

coordination and organizational problems within the battle group scenario.

The research focus is to examine the battle group as an information management and decision system. In this sense, the battle group has informational input from environmental scanners or sensors that it must process or transform into effective decisions. These decisions then must be translated into specific tactical actions that are implemented by operational units. The system must process information in an accurate and timely manner and must coordinate information exchange across relevant parts of the total system.

FY86 projects will include an assessment of tactical situation agreement between both in-port battle exercises and at-sea battle group evaluations. More specifically, assessments will be made to determine the degree to

which different nodes and key coordination points have identical information at the same points in time as to the exact location of both contacts and other ships in the battle group. It is anticipated that the tactical picture may vary across different nodes as a result of procedural and system breakdowns as well as other types of problems. Secondary analyses will then be conducted to attempt to identify potential explanations for poor information coordination. A final project will test and evaluate the application of sociotechnical models within the battle group area. These types of models have proven to be very useful in (1) identifying system problems, (2) suggesting alternative organizational designs, and (3) developing important systems measures of effectiveness (MOEs). An attempt will be made to develop sociotechnical models for different coordination points in the battle group as well as an overall model centering on the primary integration point at the composite warfare commander position.

P.E. 63701

Z1771-HF004



MANAGEMENT METHODS FOR QUALITY IMPROVEMENT

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An increasing number of organizations, private and public, are attempting to implement quality programs to improve productivity. The quality management (QM) approach selected for this project is based on a participative management philosophy and Statistical Process Control (SPC). QM helps

employees improve the processes that produce a product or service through the use of statistical methods (e. g., control charts). The widespread use of QM is credited as a major factor in the rapid, post-war turn around of Japanese industry. While QM methods have been successful in private American companies, few systematic implementation attempts have occurred in the public sector.

One objective of the project is to assist the Naval Air Rework

Facility, North Island (NARF-NI) in the design and implementation of a pilot QM program. Other objectives include investigating the impact of QM on organizational change, evaluating the effectiveness of the program as a productivity enhancing technique in a public sector organization, and documenting the program so that it can be transported to other Navy organizations.

Activities at NARF-NI in FY85 have focused on two major areas, training and organizational change. In the training area, NPRDC developed and taught a course that introduced a structured approach to problem solving based upon

Shewhart/Deming Plan-Do-Check-Act Cycle and included an introduction to the graphic methods used in SPC. NPRDC also developed a course to train NARF-NI personnel to teach the above mentioned course, thereby developing an in-house (and

consultant) capability.

In the organizational change area, a management structure is being developed that addresses two critical components of a QM intervention, viz., cooperation and communication. Cooperation is being pursued by forming Quality Management Boards (QMBs) composed of members that represent each department in the organization (e.g., quality assurance, production control).

Communication is being enhanced by both the interdepartmental structure of the QMB (lateral communication), and by organizing QMBs at all levels in the organization with each board having one member from the next higher and next lower level boards (linking pins) to provide vertical communication. At the shop level, Project Teams are organized to deal with specific problems.

Membership of a team is determined by the problem under consideration and the departments that should be involved. Problems may be identified and dealt with at any level of the organization but must be communicated through the QMB system.

In FY86, work will focus on the further development of the QMB/Project Team system.

Additional training requirements have been identified with respect to developing the skills required to work in teams (QMB and Project Teams). Some of the requirements thus far identified include how to conduct effective meetings, team building, participative management and developing interpersonal skills. NPRDC will continue to collect pre- and post-implementation data to assess short-term impacts on such measures as job and organizational characteristics, management style, organizational commitment, job impediments, role ambiguity, worker involvement, etc. Finally, outcome measures will also be obtained on such variables as turnaround time, number of quality defects, overtime, sick leave, etc.

P.E. 63739N
R1885

EFFECTIVE STRATEGIES FOR IMPLEMENTING NEW TECHNOLOGY

Principal Investigator:

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Productivity in an organization results from an effective combination of management, people, and technology.

Technology is rapidly changing and increasingly important, but implementations of new manufacturing technologies are scattered. The fact that implementations are fewer than expected seems to be caused by a focus on the hardware that ignores the organizational problems.

The goal of this project is to ensure that the Navy gets the expected productivity benefits and return on investment from new technologies. Effective implementation strategies and methods for productivity improvements are being developed and will be tested in Navy industrial activities. These strategies begin with the

conceptualization stage that matches a problem and technology, go through the implementation stage, and include an evaluation stage that checks the effectiveness of the implementation.

NPRDC is currently monitoring implementations at Navy industrial activities to identify the problems caused by new technologies and to develop possible solutions to those problems. Later NPRDC will actively participate in planning and executing several implementations.

The project is monitoring three types of technology implementations: intra-departmental, inter-departmental, and green-field. In an intra-departmental implementation, workers are trained in a specific technology that usually replaces an existing method of work. NPRDC studied the implementation of office

automation in three activities. The significant problems identified were (1) insufficient management commitment and (2) lack of personnel and material resources.

Now, NPRDC is extending its research to monitor inter-departmental and green-field implementations. An inter-departmental implementation involves more than one part of the organization. Changes occur in communication and in process flow patterns. The implementation may require team-building to resolve problems in process flow. NPRDC's research focuses on a CAD/CAM

implementation. The planning for the implementation has just begun. The problems it faces will tell us about organizational impediments to new technology Navy activities.

More complicated changes occur in a green-field implementation, where an entirely new organization is designed around the technology. Planning for a green-field requires consideration of process flows, quality control, organizational

designs, job analysis, and retraining. NPRDC's research will look at a new composite materials building. The job designs and descriptions have been made and the work flows are complete. The research will identify problems that arise when people begin work and will determine ways the design can be improved.

In each of these implementations, NPRDC will develop productivity measures that can be used to evaluate the implementation's effectiveness and will lead to better productivity planning in the future.

P.E. 63739N
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IMPLEMENTING NEW QUALITY MANAGEMENT TECHNIQUES IN NAVY MAINTENANCE ORGANIZATIONS

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The Navy is currently working to increase the size of the fleet while minimizing any corresponding increases in the maintenance budget. As part of this effort to achieve and maintain an increased service capacity, the Navy Aviation Logistic Center has initiated the use of new quality management methods in the Naval Air Rework Facilities (NARFs). These methods are based on Statistical Process Control (SPC) techniques.

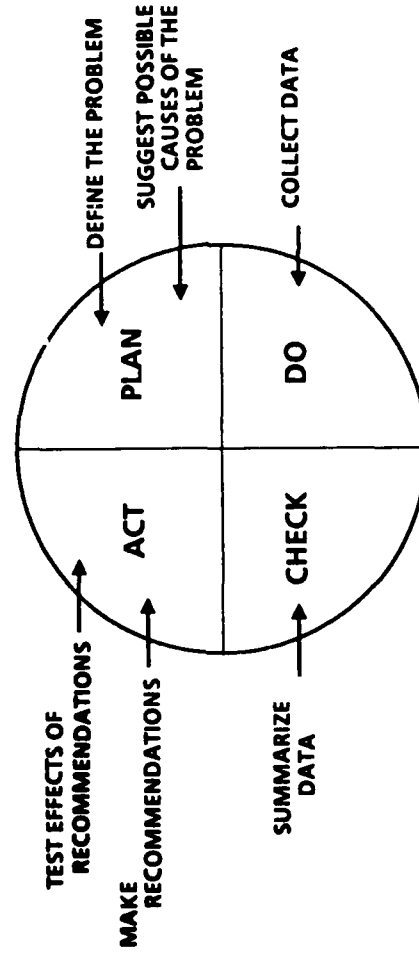
The implementation of new quality management methods based on the SPC approach requires major changes in NARF management and work practices. These methods require a high degree of intra-organizational communication and cooperation to improve work processes. Traditional hierarchical structured organizations (e.g., NARFs)

frequently contain many barriers to effective communication and cooperation. The successful implementation of the quality management methods will require that NARFs have the capacity to identify and eliminate barriers to communication and cooperation.

The objective of this project is to develop an approach for the assessment of communication and cooperation barriers to the

new quality management methods. The assessment approach is intended to enable Navy maintenance organizations to identify and address communication and cooperation problems related to implementation of the new quality management methods.

In FY85, a set of candidate barriers has been developed and assessment instruments identified for possible use by Navy maintenance organizations.
 P.E. 99000N



Structured problem-solving cycle associated with statistical process control.

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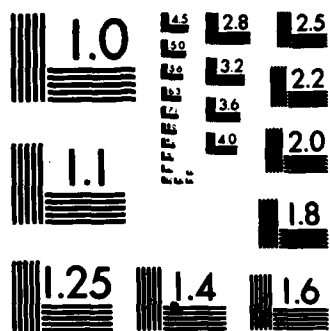
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IMPROVED EFFECTIVENESS OF INTERMEDIATE MAINTENANCE ACTIVITIES

Principal Investigators:

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Operational readiness of Navy surface ships depends on the effectiveness and responsiveness of intermediate maintenance activities (IMAs), both ashore and afloat. The individual IMAs are embedded in a much larger intermediate maintenance system that includes Readiness Support Groups (RSGs), Naval Supply System Command (NAVSUP), Naval Sea System Command (NAVSEA), and other Navy organizations. While some of the constraints to IMA effectiveness lie within the control of individual IMAs, many of the constraints are due to problems in the larger intermediate maintenance system beyond their control. Thus, a two-pronged attack on both kinds of

constraints is needed to improve the Navy's intermediate maintenance program.

In FY84, project personnel systematically analyzed the operation and management of the pump repair system at SIMA, San Diego, which included the pump shop and its staff support functions and primary assist work centers. They also generated recommendations on how to reorganize the pump repair system to enhance pump shop productivity.

During FY85, NPRDC (1) assisted SIMA, San Diego with the implementation of the above recommendations, (2) evaluated the impact of reorganization on pump shop productivity, and (3) completed a preliminary analysis of impediments to productivity among the afloat IMAs. This work will be extended during FY86 to include the application of lessons learned at the pump shop in the

SIMA at San Diego to other shops at the SIMA and to shops in afloat IMAs.

In addition, COMNAVSURFPAC has tasked NPRDC, during FY86, to determine the major impediments limiting the effectiveness of the SURFPAC IMA community and to recommend changes in policy, technology, and management practices that will minimize these impediments. NPRDC will also assist COMNAVSURFPAC in the implementation and evaluation of anticipated policy changes.

Working closely with SURFPAC staff, key IMA personnel, and fleet customers, NPRDC will develop a detailed model of the overall intermediate maintenance system. This model will be used to identify key impediments to IMA effectiveness. After impediment identification, alternative methods of minimizing these impediments will be evaluated by a SURFPAC task group. The most promising alternative will be recommended to COMNAVSURFPAC for implementation.
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PEARL HARBOR NAVAL SHIPYARD PRODUCTIVITY IMPROVEMENT PROJECT

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In previous efforts, an enhanced performance measurement and reporting (PMR) system was developed and programmed by Pearl Harbor Naval Shipyard (NAVSHIPYDPEARL) and the Navy Personnel Research and Development Center. This system was designed to overcome a number of deficiencies and inaccuracies in the shipyard's existing management information system (MIS) and was used to support the test and evaluation of a group wage incentive system for shipyard production workers. The PMR system uses existing MIS data to provide more accurate measures of work group performance and also permits information in the data base to be reviewed and corrected, if necessary.

The PMR system was implemented in one shop at NAVSHIPYDPEARL and evaluated. Based on this evaluation, several desirable changes were identified. The primary objective of the current effort is to make the PMR system available to other shops within NAVSHIPYDPEARL's Operations Department.

During FY86, final programming changes will be incorporated into the PMR system, PMR documentation will be completed, and users will be given training to help them understand information presented on PMR reports. PMR training will stress the ways in which supervisors and managers throughout the shipyard can use PMR reports to fulfill their current information needs.

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Accurate measurement of work group performance enables more effective management of people.

RELATIONSHIPS BETWEEN MANAGEMENT PRACTICES AND ORGANIZATIONAL PERFORMANCE

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Organizational researchers and practicing managers have increasingly concerned themselves with issues related to productivity and performance. Specifically, questions have arisen as to why some organizations seemingly perform at a higher or more effective level than others, even though the organizations under scrutiny are similar in terms of structure, size, personnel composition, and function.

Requested by the Naval Air Rework Facility at Alameda, California, the purpose of the present study is to examine the relationship between a number of management practices and both individual and organizational performance. To accomplish this goal, two large naval industrial organizations participated in the study, representing high and low performance effectiveness as

defined by institutional criteria.

During FY85, interviews were conducted with managers at both locations, the results of which were used to identify management practices currently in use at each location. Between facility analyses of this information indicated that the two organizations were highly distinguishable. Managers in the more effective work setting were reported engaging in proactive, ongoing development activities, having a clear understanding of the structure and purpose of their organization, experienced a relatively high degree of coordination of work flow, and possessed adequate authority and information to perform their respective managerial functions.

Within facility management practice differences (i.e., between departments) focused on the extent to which (1) top management was aware of significant departmental

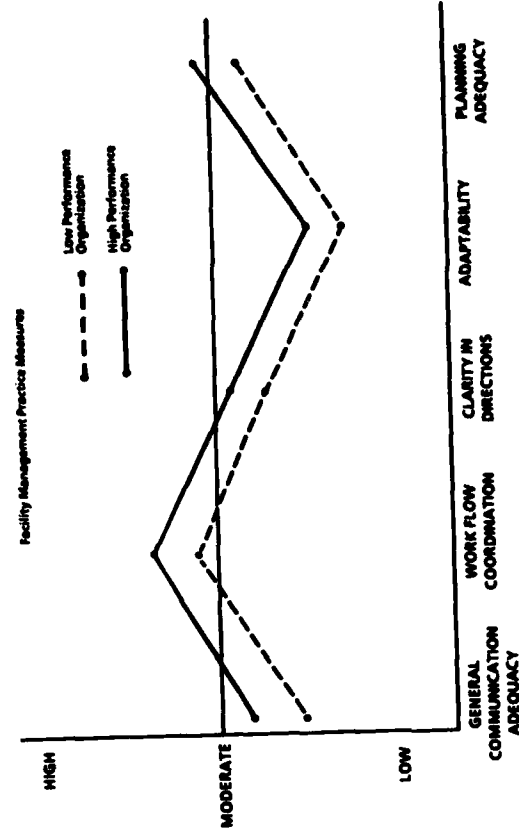
problems, (2) conflict existed regarding top management directives, (3) departments could effectively respond and adapt to changes, (4) authority is delegated consistent with the job demands of the manager, and (5) planning and scheduling are effectively accomplished.

To date, the results of this work have been presented to top management in each of the participating organizations. Additionally, managers in the less effective of the two facilities are currently using these findings as the basis for development of a proactive management training program.

FY86 plans include (1) the preparation of final briefings of findings and recommendations to sponsor organizations, (2) the preparation of technical reports, (3) the development and evaluation of management development programs, and (4) the expansion of this study in terms of assessing the generalizability of findings to the larger Navy industrial community.

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SUCCESSFUL INTEGRATION OF RETURNING NSAP PERSONNEL

Principal Investigator:

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Navy laboratories provide science advisors to serve as field team members of Navy operational commands. These one- to-two year assignments are coordinated through the Navy Science Assistance Program (NSAP) and provide an opportunity for outstanding Navy scientists and engineers to share their expertise with operational forces while, at the same time, gaining an appreciation of current technical and manpower problems facing fleet operations.

There is evidence to suggest that Navy laboratories may not be successfully integrating returning NSAP field team members into their respective organizations. The impact is (1) potential job dissatisfaction for returning personnel, (2) potential degradation of the capability of

NSAP to attract qualified personnel in the future, and (3) a failure of Navy laboratories to effectively use the critical knowledge and skills of returning NSAP field team members with regard to current operational problems in the fleet.

This research project is developing a model of NSAP assignments as an integral part of the career progression of Navy

laboratory engineers and scientists. This model will then be used to generate recommendations for improving the successful integration of returning NSAP field team members. In addition, cases of successful and unsuccessful integration of returning personnel will be reviewed to identify important organizational and managerial actions that facilitated effective reentry.

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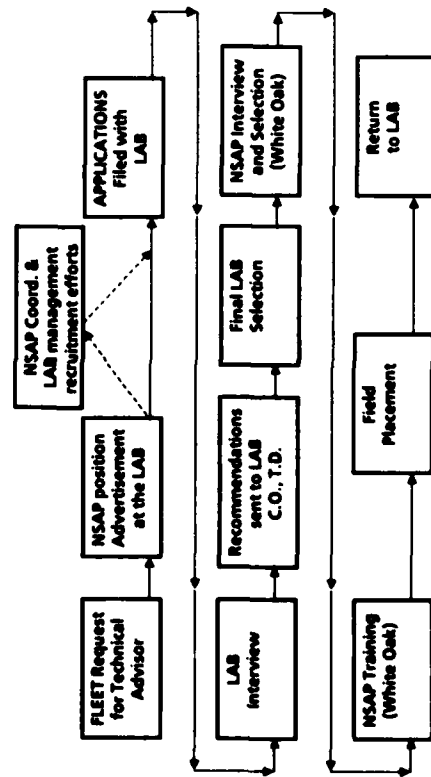


Diagram of the NSAP participation process

THE EFFECTIVENESS OF THE DOD INCENTIVES AWARD PROGRAM

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The purpose of the Federal Incentive Awards Program is to motivate government employees to improve performance and to increase creativity by rewarding those whose job performance and adopted ideas benefit the government and are substantially above normal job requirements and performance standards. In FY84, \$196.3 million were distributed to federal civilian employees. While this amount was only 3/10ths of 1% of the federal civilian payroll, a return of more than \$1.05 billion in measurable benefits was received (\$5.35 for every dollar awarded).

The cost savings indicated are only part of the return to the Government, since they do not cover many contributions for which dollar amounts cannot be identified. Different federal

organizations have differentially effective incentive award programs. Further, participation rates in even the most effective programs leave room for improvement. The purpose of the present research effort is to assess the effectiveness of the DoD Incentive Awards Program as a motivational strategy and to identify the most effective organizational structures for optimally using incentive awards to increase employee involvement and participation. An expected outcome will be a set of recommendations on the legislative, regulatory, and administrative factors required to increase effectiveness of the DoD Incentive Awards Program.

The approach will consist of identifying highly effective and less effective incentive awards programs in private as well as public sector organizations. Criteria defining effectiveness will be the first order of business (e.g.,

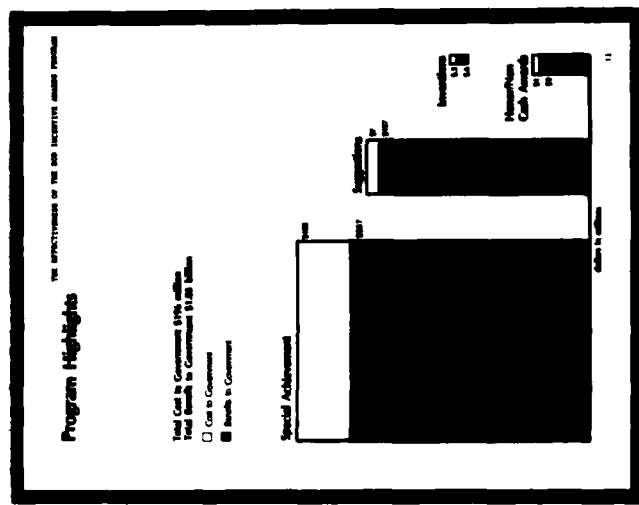
the number of awards distributed as a ratio of the number of employees, profit, quality and productivity indices, number of employees, and the number of improvement suggestions). Where appropriate, these organizations will be compared on various characteristics, such as size, type of industry, centralized vs. diffuse structure, incentive system organization and practices, type of participation methods emphasized and used, technological changes, training policies, employee perceptions, and various outcome measures (i.e., turnover, absenteeism, amount of awards granted). Selected organizations will include those with a history of success using the kinds of tools currently available under Federal incentive awards guidelines, and those using tools not available under those guidelines, such as found in private sector organizations.

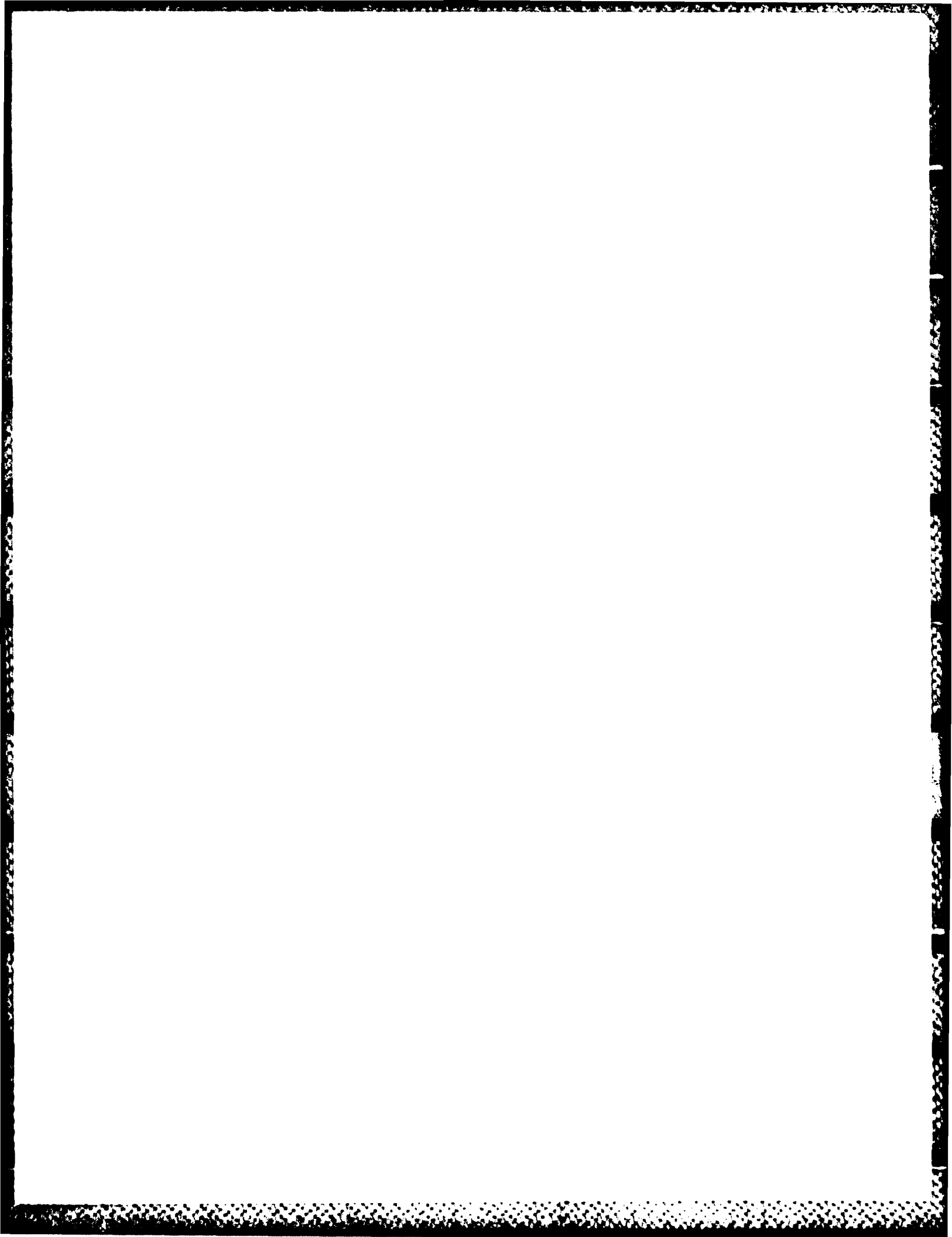
The results of this study will identify the organizational and individual factors which contribute to an effective incentive awards program. This information will be used to provide program managers

with recommendations to increase employee involvement in incentive programs, to provide guidelines for effective incentive programs, and to provide additional strategies that governmental organizations can use to implement a successful incentive awards program that will result in reduced government costs.

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