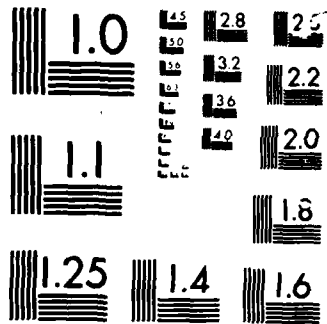AD-A168 009 A SUMMARY OF THE FOUNDATION RESEARCH PROGRAM FISCAL   1/1
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

A SUMMARY OF THE

FOUNDATION RESEARCH PROGRAM

May 1986

Report for the Period

1 October 1984 to 30 September 1985

Approved for Public Release; distribution unlimited

Prepared for:
Chief of Naval Research
Arlington, VA 22217

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NAVAL POSTGRADUATE SCHOOL
Monterey, CA 93943

RADM R.H. SHUMAKER   DEAN D.A. SCHRADY
Superintendent   Provost

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Arlington, Virginia 22217.

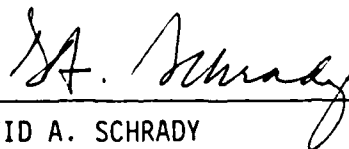   Reproduction of all or part of this report is authorized.

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                                            Research Administration

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17 COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Research Program

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Thirty projects of Independent Research/Independent Exploratory Development were funded by the NPS Foundation Research Program. This research was in the areas of Computer Science, Administrative Sciences, Operations Research, National Security Affairs, Physics, Electrical and Computer Engineering, Meteorology, Aeronautics, Oceanography, and Mechanical Engineering. A tabulation in the Appendix identifies the area of research and the investigator(s). The category of independent research or independent exploratory development is also identified for each research task.

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OVERVIEW OF THE NPS FOUNDATION RESEARCH PROGRAM FY 1985

The principal thrust of the research and exploratory development program at the Naval Postgraduate School (NPS) stems from its mission:

> To conduct and direct advanced education of commissioned officers, and to provide such other technical and professional instruction as may be prescribed to meet the needs of the Naval Service; and in support of the foregoing to foster and encourage a program of research in order to sustain academic excellence.

A portion of the research performed at NPS is conducted through grants from the Chief of Naval Research. These funds provide the basis for the NPS Foundation Research Program reported here. Additional research sponsored by other sources as well is reported annually in A Summary of the Naval Postgraduate School Research Program.

A major goal of the Foundation Research Program is to strengthen the base of technology at NPS and to conduct research in areas of science and technology of interest to the Navy. Specific objectives include:

* sponsoring research efforts of junior faculty enabling them to establish a strong research program in their chosen field.

* allowing experienced faculty to change the course of their research programs.

* providing the opportunity for the accomplishment of meritorious research projects that have no sponsor, and

* increasing the general research capability of the Naval Postgraduate School through capital equipment procurement.

These objectives are pursued with the ultimate goal of stimulating the highest quality research program at NPS in support of the educational program received by students.

The Foundation Research Program is administered internally by a Research Council comprised of selected faculty members. The function of the Research Council is to properly implement the goals and objectives of the program with a view toward approving meritorious proposals submitted by the NPS faculty.

This report describes the accomplishments of the Foundation Research Program for FY 1985. The summaries of the research efforts are organized by academic departments. Some projects are oriented toward initiating and conducting scientific and applied research of a long-range nature in areas of special interest to the Navy. Other efforts are for conducting exploratory development deriving from scientific program areas of current Navy interest.

TABLE OF CONTENTS

DEPARTMENT

OF

COMPUTER SCIENCE

Title: Portable Software, Formal Semantics, and Limited
                  Resource Systems

Investigator: D. Davis, Associate Professor of Computer Science

Sponsor: NPS Foundation Research Program

Objective: To develop a methodology for describing computing
                  resources abstractly, that is, independently of
                  their implementation, as a framework for creating
                  portable reusable computing resources.

Summary: This work is a continuation of work begun in the pre-
                  vious year. Last year, a theoretical framework was
                  developed for describing computing resources abstract-
                  ly, using techniques from the theory of abstract data
                  types. During the past year, this framework has been
                  used to guide the design and implementation of a
                  number of abstract components of a typical computing
                  system, as a test of the practical feasibility of the
                  methodology we have developed. Specifically we de-
                  signed and implemented an abstract processor. The
                  unique characteristic of this processor's design is
                  that its functional features, that is, "what" fea-
                  tures it provides, are described independently of
                  "how" these features are realized. In fact the first
                  realization of this processor was written in software.
                  The significance of this characteristic is that pro-
                  grams written to run on this abstract processor have
                  the same portability properties as programs in a high
                  level language. The only difference in realizations
                  of the abstract processor is a difference in efficien-
                  cy, there can be no difference in meaning or function-
                  ality. We feel this work is a forward step in solving
                  the problem of portability, since it provides
                  a means for defining and implementing resources in a
                  pure form. Currently, computing resources are de-
                  signed and implemented as a complex mixture of "what"
                  we wish to have abstractly with "how" we can realize
                  it.

Publications: D. Davis, "A Formal Method for Specifying Computer
                  Resources in an Implementation Independent Manner,"
                  NPS Technical Report, NPS52-84-022, December 1984.

                  D. Davis and J. Yurchak, "The Specification, Design
                  and Implementation of an Abstract Processor," forth-
                  coming.

Conference Presentation:	D. Davis, "Resource Abstration and Validation," Verkshop III Conference on Verification, Pajaro Dunes, February 1985.
Theses Directed:	J. M. Yurchak, "The Formal Specification of an Abstract Machine: Design and Implementation," Master's Thesis, December 1984.

R. Griffin, "An Algorithm to Test for Confluence in a System of Left to Right Rewrite Rules," Master's Thesis, December 1984.

N. Lilly, "An Algebraic Specification Language and A Syntax Directed Editor," Master's Thesis, December 1984.

J. E. Hunter, "The Formal Specification of a Visual Display Device: Design and Implementation," Master's Thesis, June 1985.

U. Ozkan, "A Survey of Properties of Relations Which Have the Confluence Property," Master's Thesis, June 1985.

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Title: Inferences Between Statistics on a Database

Investigator: N.C. Rowe, Associate Professor of Computer Science

Sponsor: NPS Foundation Research Program

Objective: Formulation of relationships between different
                        kinds of statistics on a finite data universe, in
                        particular bounds on statistics, and the testing
                        of results and the value of results by computer
                        simulations and other experiments.

Summary: Appropriate computer science methods for reasoning
                        about already-calculated statistics on a database
                        were explored in two areas: (1) regression models,
                        where an application of the artificial-intelligence
                        concept of "inheritance" was formulated, and (2)
                        bounds on set-intersection and set-union sizes,
                        where a new and comprehensive theory of bounding
                        methods was developed. The former problem is im-
                        portant in statistical analysis of large databases,
                        and the latter is important in database query
                        language design.

Publications: N.C. Rowe, "Antisampling for Estimation: An Over-
                        view," IEEE Transactions on Software Engineering,
                        SE-11, 10 (October 1985), 1081-1091.

                        N.C. Rowe, "Inheritance of Regression Models," NPS
                        Technical Report NPS52-85-013, Computer Science
                        Department, September 1985.

                        N.C. Rowe, "Absolute Bounds on Set Intersection and
                        Union Sizes from Distribution Information," NPS
                        Technical Report NPS52-85-014, Computer Science
                        Department, September 1985.

Title: The Effects of Real-Time Display Generation on the
                  Architecture of Graphics Display Systems

Investigator: M. J. Zyda, Assistant Professor of Computer Science

Sponsor: NPS Foundation Research Program

Objective: The effects of special purpose VLSI architectures
                  on the design of the graphics display system will
                  be evaluated, with special attention to data input/
                  output rates, human interaction, and currently
                  available graphics display system functionality.
                  Several graphics algorithms that have the potential
                  for VLSI implementation will be identified and
                  studied, with the goal being a characterization of
                  the changes necessary in the architecture of the
                  graphics display system required by VLSI based,
                  real-time display generators.

Summary: The research quarters covered by this proposal are
                  1 January 1985 to 31 March 1985, and 1 July 1985 to
                  30 September 1985. The following work has been
                  carried out:

                  The first objective of the study was to examine the
                  proposed architecture of one real-time display gen-
                  erator, the contour surface display generator
                  (Zyda, 1984a). Part of this objective has been car-
                  ried out in the form of four technical memoranda
                  (Zyda,1984b), (Zyda,1985a), Walker,1985a), and
                  (Walker,1985b). The first of these memoranda ex-
                  amined the feasibility of producing a real-time con-
                  tour surface display generator. The second, third
                  and fourth memoranda were studies of the architec-
                  ture of the contour surface display generator, and
                  its intended application. Part of these studies
                  was the development of a modeling methodology for
                  evaluating the physical parameters inherent to both
                  the application, and the architecture.

                  The second objective of the study was to examine
                  the input and output parameters obtained from the
                  system model in order to determine exactly how that
                  display generator can be interfaced to a graphics
                  display system. This study was carried out in
                  (Walker,1985a) and (Walker,1985b).

                  The third objective of the study was the identifica-
                  tion of other graphics algorithms with the potential

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for implementation in VLSI. This work has begun
through the efforts of several current thesis stu-
dents (see list below). The studies being carried
out are cursory examinations of these algorithms
for their distributability among multiple processors.
Part of these studies will be an attempt to determine
if the changes proposed for the graphics system for
the contour surface display generator are applicable
to other real-time display generators.

Publications: M. J. Zyda, "Workstation Graphics Capabilities for
the 1990's and Beyond," NPS Technical Report, NPS52-
85-012, September 1985

R. A. Walker and M. J. Zyda, "A Systems Architecture
for Real-Time Contour Surface Display Generation,"
NPS Technical Report, NPS52-85-012, August 1985.

R. A. Walker and M. J. Zyda, "An Integrated Systems
Architecture for Real-Time Contour Surface Display
Generation," NPS Technical Report, NPS52-85-010,
August 1985.

M. J. Zyda, "The Use of VLSI Technology for the Real-
Time Generation of Graphics Displays: A Proposal,"
NPS Technical Report, NPS52-85-002, March 1985.

M. J. Zyda, "The Feasibility of a Multiprocessor for
Real-Time Contour Surface Display Generation," NPS
Technical Report, NPS52-84-025, December 1984.

M. J. Zyda, Algorithm Directed Architectures for Real-
Time Surface Display Generation, D. Sc. Dissertation,
1984.

Conference   M. J. Zyda, "Engineering Workstations: Graphics Cap-
Presentation: abilities for the 1990's and Beyond," Engineering
Workstations Conference, Institute for Graphic Com-
munication,February 3, 4, and 5, 1985.

M. J. Zyda, "The Use of VLSI Technology for the Real-
Time Generation of Graphics Display," Naval Air-Weap-
onry Signal Processing Research Workshop, December
13 and 14, 1984.

Theses Directed: M. Sahintepe, "A Graph Theoretic Algorithm for Con-
tour Surface Display Generation," Master's Thesis,
June 1985.

R. A. Walker, "An Integrated Systems Architecture for Real-Time Contour Surface Display Generation," Master's Thesis, June 1985.

M. E. Gaddis, "The Fractal Geometry of Nature: Its Mathematical Basis and Application to Computer Graphics," Master's Thesis, December 1985.

K. Coomes, "Ray Tracing Algorithms in Computer Graphics Applications: Comparisons and Implementations," Master's Thesis, March 1986.

P. Hogan, "Surface Construction via the Triangulation of Contour Slices," Master's Thesis, December 1985.

S. Mungsing, "A Software Implementation of an Interactive System for Three-Dimensional Modeling and Layout," Master's Thesis, March 1986.

A. Jones, "Surface Construction via the Triangulation of Contour Slices: User Interaction Techniques," Master's Thesis, June 1986.

P. Collins, "Fractal Geometry and Its Application to Computer Graphics," Master's Thesis, June 1987.

DEPARTMENT

OF

ADMINISTRATIVE SCIENCES

Title: Group Decision Support System: An Advisory System
         for Bargaining and Negotiation

Investigator: T. X. Bui, Assistant Professor of Information
         Systems

Sponsor: NPS Foundation Research Program

Objective: To develop algorithms for supporting group decision
         making and negotiation, and implement them in a
         computer-based decision support system for geogra-
         phically dispersed players.

Summary: A consensus seeking algorithm for group decision
         support system--the Negotiable Alternatives Identi-
         fier (NAI)--was developed which can be used together
         with the techniques of aggregation of preferences.
         Departing from individual and cardinal rankings of
         alternatives, NAI uses differential techniques to
         group ranked alternatives into three classes of
         preferences: the most preferred, the preferred and
         the least preferred sets of alternatives. Within
         each class, infinitesimal differences in preferences
         between alternatives make it more confident for the
         decision makers to trade them. As a result, a col-
         lective decision that may not be necessarily unani-
         mous, yet essentially acceptable by all can be
         suggested.

         The developed algorithm was implemented on an IBM-PC
         XT and interfaced with Co-op, a Decision Support
         System (DSS) for cooperative multiple criteria group
         decision making. Early tests performed with students
         in a DSS class showed encouraging results.

Publications: T. X. Bui, "NAI: A Consensus Seeking Algorithm for
         Group Decision Support System," Proceedings of the
         IEEE International Conference of Man, Systems, and
         Cybernetics, 11-16 November 1985, Tucson, Arizona.

         M. Jarke, T. X. Bui and T. Jelassi, "Micro-Mainframe
         DSS for Remote Multiperson Decisions," in M. Jarke,
         Managers, Micros and Mainframes, Chichester, England,
         John Wiley and Sons, to appear, 1986.

Conference   T. X. Bui, "Bargaining and Negotiation Issues in
Presentation: Group Decision Support Systems," NYU-University of
         Paris Dauphine IX, Workshop on Group Decision Support
         System, January 1985.

Title:	High Performing Systems in the Military: Defining Excellence in the Operational Forces
Investigators:	R. T. Harris, Associate Professor of Management and R. A. McGonigal, Associate Professor of Management
Sponsor:	NPS Foundation Research Program Naval Military Personnel Command (NMPC-6)
Objective:	To identify and describe the salient attributes of high performing military organizations and to determine the consensus views held by senior leaders within the military of what contributes to "excellence" in military organizations.
Summary:	Patterned after the bestseller, In Search of Excellence: Lessons from America's Best Run Companies, this major research project involves the examination and description of high performing military organizations. A series of studies have been undertaken, each focused on a different military community and each aimed at locating and describing excellence within that military community. Seven studies are completed. Three of the reports have received widespread positive visibility within their respective communities. Three more studies are currently in progress. The ten studies include: Navy surface ships, Navy fighter and attack squadrons, Navy hospitals, Navy operational staffs, Army combat arms battalions, Air Force fighter squadrons, and Marine Corp battalions and air squadrons. Generally, each study is conducted as a graduate thesis project involving one or more students from the communities/service being studied. The transcripts of interviews conducted will be compiled and reported in a series of NPS technical reports.
Publication:	G. G. Gullickson, R. D. Chenette and R. T. Harris, "Excellence in the Surface Navy," NPS Technical Report, NPS54-84-026, October 1984.
Conference Presentations:	R. T. Harris, "Excellence and High Performance in the Military," Organizational Studies Symposium, Stockholm School of Economics, Stockholm, Sweden, 16 November 1984.
	R. T. Harris, "Excellence and Change in Bureaucratic Organizations," University Associates Human Resource Development 1985 Conference, San Francisco, 28-29 March 1985.

Title: J. Simonsen, D. Hoopengardner and H. Frandsen,
                "Excellence in the Combat Arms," <u>Master's Thesis</u>,
                December 1984.

                S. Sigler, "Excellence in the VP Navy," <u>Master's
                Thesis</u>, December 1984.

                J. Norton, "Excellence in Navy Health Care,"
                <u>Master's Thesis</u>, December 1984.

                M. Pierce and R. Porter, "Excellence in the Surface
                Coast Guard," <u>Master's Thesis</u>, December 1984.

                H. Forde, "Excellence in Tactical Fighter Squadrons,"
                <u>Master's Thesis</u>, June 1985.

                H. Coffman, "Essence of Excellence: Lessons from
                Naval Executives about Superior Performing Tactical
                and Readiness Staffs," <u>Master's Thesis</u>, June 1985.

Title: Task Definition, Decision-Criteria and Uncertainty
                    Reduction: The Role of the Agency Budget Office

Investigator: J. L. McCaffery, Professor of Public Budgeting,
                    Department of Administrative Sciences

Sponsor: NPS Foundation Research Program

Objective: To explore the behavior of budget offices with the
                    intention of developing stable sets of inventories
                    applied to budget decision-making. This is an on-
                    going project focused on the Department of Navy
                    Budget Office and the Department of Defense Planning-
                    Programming-Budgeting system with comparisons made
                    to other budget offices and processes.

SUMMARY: During this reporting period background research on
                    issues impacting on budget office routines has led
                    to an assessment of various phases of contemporary
                    budget reforms. This paper will be published in the
                    International Review of Public Administration, under
                    the title "The Road to Reform of Process" in January
                    1986.

                    A second paper focused on the executive budget pro-
                    cess comparing routines in Canada and in California
                    to see what sets of behavior were stable across very
                    different institutional settings. This paper was
                    presented at a symposium at the University of Calif-
                    ornia, Berkeley. A revised version of this paper is
                    under consideration by the Policy Studies Journal.

                    Two further presentations extending this research
                    are scheduled for this year, one on comparative
                    budget systems at the Western Social Science Associ-
                    ation in April 1986 and one on organizational strate-
                    gies for increasing productivity at the Western
                    Political Science Association in March 1986.

Publications: J. L. McCaffery, "The Road to Reform of Process,"
                    International Journal of Public Administration,
                    forthcoming.

                    J. L. McCaffery, "Crossing Cultural Boundaries - Two
                    Budget Systems," Policy Studies Journal, in review.

Conference   J. L. McCaffery, "Comparison of State and Provincial
Presentations: Budget Systems with Ontario and California Used as
                    Models," Workshop on Comparative Canada/U.S. Public
                    Policy, University of California, Berkeley, 22-23
                    April 1985.

Title: An Evaluation of Leasing as a Financing Strategy
                    Within the Navy

Investigator: J. G. San Miguel, Professor of Accounting

Sponsor: NPS Foundation Research Program

Ojbective: The aim of this research was to evaluate the cost
                    effectiveness of leasing as an alternative financing
                    strategy for the Department of the Navy specifically,
                    and the Department of Defense generally. This evalu-
                    ation of the efficacy of leasing was twofold: first,
                    from the point of view of DON in achieving its overall
                    objectives for the program for which the equipment
                    was leased, and second, from the view of the overall
                    operation of the U.S. government.

Summary: Recently both the Department of the Navy and the
                    Department of Defense initiated plans to lease capital
                    equipment as opposed to the use of appropriated funds
                    to purchase capital equipment. Congress, the General
                    Accounting Office, and the public have expressed con-
                    cern on this initiative. Although usually far more
                    complex, most leasing arrangements between an owner
                    of capital equipment and someone who wishes to use the
                    capital equipment are viewed as a "rental" arrangement.
                    The DON's lease arrangements for thirteen ships for
                    its Military Sealift Command are long-term contracts
                    for "transportation services." The length of lease
                    and renewable options, tax benefits, cancellation pro-
                    visions (DON guarantees for legal fees and lost interest)
                    involved in the agreements are extremely more complex.
                    An exhaustive study of the extant literature was com-
                    pleted and numerous personal interviews conducted with
                    individuals within DON and others knowledgeable in
                    leasing and the shipbuilding industry.

Thesis Directed: R. E. Ratcliff, "A Framework for the Procurement of
                    Assets Through Leasing Arrangements," Master's Thesis,
                    December 1984.

Title:	Coupling Symbolic Reasoning and Numerical Computing Systems
Investigator:	T. R. Sivasankaran, Assistant Professor of Management Information Systems
Sponsor:	NPS Foundation Research Program
Objective:	Modeling and designing symbolic-numeric interfaces for an expert system. The long-term objectives include development of methods to integrate various technologies like expert systems, decision support systems, data base management systems and other operational systems into a single organizational computer system.
Summary:	The period covered by the sponsor was only two months. This time was spent in reviewing literature related to the research topic and developing a first-cut conceptual model for coupling the symbolic planning and numerical execution in an expert system in the domain of actuarial science.
Publication:	T. R. Sivasankaran and M. Jarke, "Coupling Expert Systems and Actuarial Pricing Models," Proceedings of the Workshop on Coupling Symbolic and Numerical Computing in Expert-Systems, Bellevue, Washington, August 1985. To be included in forthcoming publication by North-Holland Publishing Company.
Conference Presentation:	T. R. Sivasankaran and M. Jarke, "Coupling Expert Systems and Actuarial Pricing Models," Workshop on Coupling Symbolic and Numerical Computing in Expert Systems, Bellevue, Washington, August 1985.

Title:	Application of Spreadsheet Programs to Manpower Modeling
Investigator:	T.G. Swenson, Assistant Professor of Administrative Sciences
Sponsor:	NPS Foundation Research Program
Objective:	To demonstrate the utility of spreadsheet programs as decision aids in the manpower, personnel and training areas of study.
Summary:	The project resulted in the identification and demonstration of a wide variety of spreadsheet applications to Manpower, Personnel and Training areas such as: 1) Trend analysis, 2) Manpower Planning, 3) Markov analysis, 4) Economic analysis of training, 5) Compensation analysis, 6) Selection and Recruiting evaluation, 7) Promotion Planning, 8) Utility analysis, and 9) Productivity analysis.
Theses Directed:	H.T. Styron, "The Application of Microcomputer Spreadsheets to Produce the U.S. Army Five Year Field Grade Officer Promotion Plan," Master's Thesis, Dec. 1984.
	G.T. McCannel, "A Cost Determination Model for the *Functional Context Training* Revision of Basic Electricity and Electronics Training," Master's Thesis, Dec. 1985.
	P.R. Stahl, "In Search of Combat Readiness in the U.S. Marine Corps," Master's Thesis, Dec. 1985.

Title:	Use of the Rasch Model in Sequential Testing
Investigator:	R. A. Weitzman, Associate Professor of Psychology
Sponsor:	NPS Foundation Research Program
Objective:	To improve the efficiency and the applicability of sequential testing for selection of school or job applicants through the use of the Rasch item-response model.
Summary:	Sequential testing for selection requires estimation of the proportion of examinees in each test-score group who get an item right. The Rasch model provides such an estimate. This research has developed the procedure and is in the process of applying it to the real data and preparing a report of the results.
Publication:	R. A. Weitzman, "The Rasch Model Plus Guessing," in progress. Will be submitted to the Journal of Applied Psychology for possible publication.

DEPARTMENT

OF

OPERATIONS RESEARCH

Title: A Study of the Projective Algorithm for Linear
                          Programming

Investigator(s):   G. G. Brown, Professor of Operations Research and
                          R. K. Wood, Assistant Professor of Operations Research

Sponsor: NPS Foundation Research Program

Objective: To develop and analyze a prototypic projective linear
                          programming algorithm

Summary: This work has been conducted jointly with Professor R. D.
                          McBride at the University of Southern California. A
                          algorithmic barrier function variant of the projective
                          linear programming algorithm has been implemented and
                          tested. Testing on medium - scale problems has verified
                          controversial claims of low iteration counts. However,
                          total solution times are long since solution of the
                          symmetric linear system of equations at each iteration is
                          difficult. Current research efforts are directed at
                          speeding up these solutions using an incomplete Cholesky
                          factorization with iterative improvements.

Publications: None

Conference   R. K. Wood, "Implementing the Projective Linear
Presentations: Programming Algorithm ", ORSA/TIMS Joint National
                          Meeting, Boston, Massachusetts, April 29 -May 1, 1985.

                          G. G. Brown, R. D. McBride and R. K. Wood, "Computational
                          Methods in the Projective Linear Programming Algorithm,
                          "ORSA/TIMS Joint National Meeting, Atlanta, Georgia
                          November 4-6, 1985.

Thesis Directed: G. W. Bretschneider, "An Implementation of The
                          Projective Algorithm for Linear Programming," Master's
                          Thesis, September 1985

Title:	An Approximate Solution Technique for the Constrained Search Path Moving Target Search Problem
Investigator(s):	J. N. Eagle, Associate Professor of Operations Research J. R. Yee, Adjunct Professor of Operations Research
Sponsor:	NPS Research Foundation Program (for J. N. Eagle only)
Objective:	To develop an easily implemented approximate solution procedure for the constrained search path moving target search problem.

Summary:	A search is conducted for a target moving in discrete time among a finite number of cells according to a known Markov process. The searcher must choose one cell in which to search in each time period. The set of cells from which he can choose is a function of the cell chosen in the previous time period. The problem is to find a searcher path, i.e., a sequence of search cells, that minimizes the probability of not detecting the target in a fixed number of time periods. The problem is formulated as a nonlinear program and solved for a local optimum by a simple implementation of the convex simplex method.

Publications:	J. N. Eagle and J. R. Yee, "An Approximate Solution Technique for the Constrained Search Path Moving Target Search Problem," NPS Technical Report NPS55-85-015, October 1985.
Conference Presentations:	None
Thesis Directed:	M. Segal, "Two New Approximate Solution Techniques for a Moving Target Problem when Searcher Motion is Constrained", Master's Thesis, September 1985

Title:	Multicommodity Network Flow Optimization
Investigator(s):	R. E. Rosenthal, Associate Professor of Operations Research
Sponsor:	NPS Foundation Research Program
Objective:	To develop efficient solution methodology for very large scale multicommodity network optimization problems.
Summary:	Multicommodity network flow optimization has long been identified as an important problem area in civilian and military logistics applications. An algorithm developed by the investigator has achieved approximate solutions on some to the largest problems of this type ever attempted. These problems were based on data supplied by the Army Armament, Munitions and Chemical Command.
Publications:	None
Conference Presentations:	None
Thesis Directed:	None

DEPARTMENT

OF

NATIONAL SECURITY AFFAIRS

Title: Soviet-American Conceptual Modeling

Investigator: Robert B. Bathurst, Adjunct Professor, National
                    Security Affairs

Sponsor: NPS Foundation Research Program

Objective: To develop and test a method for uncovering and
                    teaching differences in reasoning, value systems
                    and patterns of behavior between roughly socially
                    equivalent groups of Americans and Soviets.

Summary: The project was successful in perfecting and in
                    demonstrating a method for revealing and study-
                    ing unconscious cultural barriers to international
                    understanding. With the help of the research
                    funds, a major colloquim was held with participant
                    experts of international standing. Following,
                    with the aid of the grant, two workshop-laboratories
                    were held with internationally known ex-Soviet
                    experts participating. The result was the creation
                    of a format for seminars and laboratories to
                    educate Americans involved in diplomacy, education
                    or business in patterns of behavior which they can
                    expect from Soviet counterparts as well as in
                    patterns of behavior which they can expect among
                    their own colleagues. The method is now being
                    applied in Washington, D.C., where sessions are
                    being organized for training high-level government
                    officials. Plans are under way for further
                    demonstrations and sessions in New York and
                    Florida. The method appears adaptable for many
                    situations and groups.

Publications: "On Soviet Linguistics: Expropriating Utopia,"
                    an article directly related to the results of
                    this study is being published in a book entitled,
                    Soviet Deception, edited by Brian Dailey and
                    Patrick Parker, to be published in the fall of
                    this year. An article about the games appeared
                    in Community Spirit, October 1985, written by
                    Pamela Benda. Other materials and articles will
                    be forthcoming.

Title: Soviet Involvement in Caribbean

Investigators: R. Looney, Associate Professor of National Security
                Affairs, and J. Valenta, Associate Professor of
                National Security Affairs

Sponsor: Naval Postgraduate School Foundation

Objective: Determine to the extent possible, conditions
                surrounding Soviet involvement in the Caribbean.

Summary: Found it was possible to profile the environment
                surrounding Soviet involvement in the Caribbean.
                Discriminant analysis profile of countries where the
                Soviet Union was involved differed significantly from
                those countries where Soviet involvement was not
                present.

DEPARTMENT

OF

PHYSICS

Title:	Radiation Effects on Infrared Materials and Devices
Investigator:	K.C. Dimiduk, Assistant Professor of Physics
Sponsor:	NPS Foundation Research Program
Objective:	To study the effects of electron irradiation on infrared semiconductor materials and devices.

Summary: The effect of radiation damage due to 30 MeV electrons on bulk semiconductors and certain devices was studied. The bulk material experiments were conducted on mercury cadmium telluride, used to make infrared detectors, and the related substrate material cadmium telluride. Wafers were cooled to approximately 100K and irradiated to fluences of 10^{13} e/cm^2 to 6×10^{15} e/cm^2. Measurements of conductivity or resistivity, mobility and carrier concentration at various temperatures were used to assess the effect of the irradiations.

The devices chosen for study were emitters and detectors used for fiber optic systems. Preliminary measurements were made on long wavelength (1.3 micron) InGaAsP LEDs and InGaAs photodiodes. From this it was determined that additional work was needed to establish a measurement technique. That was done using shorter wavelength GaAsP LEDs since they were considerably cheaper. These LEDs turned out to be significantly softer than earlier LEDs reported in the literature, indicating that the GaAsP work was important to pursue. Currently, additional 1.3 micron devices of the original composition are being studied using the techniques developed on this project under an outside supported follow-on project.

Publications:	K.C. Dimiduk, C.Q. Ness and J.K. Foley, "Electron Irradiation of GaAsP LEDs," Transactions on Nuclear Science, Volume NS-32, Number 6, pp. 4010-4015, December 1985.
Conference Presentations:	K.C. Dimiduk, C.Q. Ness, and J.K. Foley, "Electron Irradiation of GaAsP LEDs," 1985 Annual Conference on Nuclear and Space Radiation Effects, Monterey, CA, July 1985.
Theses Directed:	C.Q. Ness, "Electron Irradiation of Light Emitting Diodes," Master's Thesis, December 1984.
	C.P. Bauer, "Electron Irradiation of n-Type Cadmium Telluride," Master's Thesis, March 1985.
	D.G. Morral, "Electron Irradiation of p-Type Mercury Cadmium Telluride," Master's Thesis, June 1985.

Theses Directed   J.K. Foley, "30MeV Electron Beam Irradiation Effects
(cont.):   on GaAsP LEDs, " <u>Master's Thesis</u>, June 1985.

TITLE:	The Interaction of Electromagnetic Waves with Periodically Rough Surfaces on Conductors
INVESTIGATOR:	N. E. Glass, Adjunct Teaching Professor
SPONSOR:	NPS Foundation Research Program
OBJECTIVE:	To develop mathematical tools to analyze the interaction of electromagnetic waves with rough conducting surfaces, for the purpose of studying resonant absorption and field enhancement at such surfaces. To study, theoretically, Smith-Purcell radiation from electron beams above grating surfaces, for the purpose of generating soft x-rays.
SUMMARY:	An exact theory of the scattering of electromagnetic waves, with resonant excitation of surface-polaritons, from conducting bigrating surfaces was numerically fit to the results of recent experiments, and was then compared to the predictions of a standard perturbation theory. Many of the discrepancies between the experiment and perturbation theory were narrowed or eliminated by the exact theory. The perturbation theory's degree of error in predicting the surface profile was determined. A new perturbation theory was derived analytically, which permits the calculation of the scattering intensity, through a 4x4 matrix equation, at points corresponding to 2-polariton excitations (around mini-gaps in the surface-polariton dispersion relation).
	An exact expression for the intensity of Smith-Purcell radiation from electrons travelling above a bigrating surface, of finite conductivity, was also developed. This is the first such calculation which permits the electron beam to have an arbitrary orientation parallel to the surface and the first to consider a doubly periodically corrugated surface. The result is a set of interference terms not seen in the case of a classical grating. This work will allow one to determine the extra enhancement in the radiated intensity due to the simultaneous resonant excitation of two surface-polaritons.
PUBLICATION:	N. E. Glass and A. A. Maradudin, "Polariton Resonant Absorption in a Bigrating" Exact Theory Compared to Recent Experiments and to Perturbation Theory," Optics Communications, accepted for publication.

CONFERENCE
PRESENTATION: The results of this research will be given in an
invited-review-paper, to be presented by A. A.
Maradudin, at the forthcoming International Laser
Science Conference in Dallas, TX 18-22 Nov 1985.

TITLE: The Pumping of Photochemical Species in the Middle
Atmosphere by Acoustic-Gravity Waves

INVESTIGATORS: Steven F. Nerney, Associate Professor of Physics
and G. W. Adams, Senior Research Professor of
Physics at Utah State University.

SPONSOR: NPS Foundation Research Program

OBJECTIVE: To purchase an office-based computer system
compatible with those used at USU in conjunction
with the HF radar program as well as the
photochemical modelling program at USU.

SUMMARY: The AT&T PC 6300, Bernoulli Box, Micom Modem and
Epson printer are all installed in my office.
Preliminary work has been done on photochemical
pumping of minor species by passing gravity waves.
The concentrations of minor species have been
plotted as a function of time based on a simple
computational scheme which solves the differential
equations for those concentrations. We are just
beginning this study.

CONFERENCE
PRESENTATIONS: "Modelling Mesospheric Chemical Pumping Due to
Temperature Variations," R. A. Armstrong, S. F.
Nerney, and G. W. Adams was presented by Dr.
Armstrong at the spring meeting of the American
Geophysical Union.

DEPARTMENT

OF

ELECTRICAL AND

COMPUTER ENGINEERING

TITLE: Ultra-An Ultra-Reliable Real Time Processor

INVESTIGATOR: Larry Abbott, Assistant Professor of Electrical
                    and Computer Engineering

SPONSOR: NPS Foundation Research Program

OBJECTIVE: The research is a continuation of research into
                    an integrated approach to system fault
                    tolerance. The approach optimizes the system
                    reliablity by simultaneously satisfying hardware
                    and software reliability requirements.

SUMMARY: In this reporting period we have completed the
                    preliminary design of the fault tolerant
                    computer and real time operating system. We
                    have completed the detailed design of the fault
                    tolerant voter and rotary multiplexer. A VLSI
                    design of the rotary multiplexer has been done.
                    We have also begun the development of
                    reliability assessment tools for evaluating the
                    analysis of fault tolerant techniques for
                    implementing the fault tolerant computer in
                    VLSI.

CONFERENCE
PRESENTATION: L. W. Abbott, "A Synergistic Fault Tolerant
                    Computer Design for an N-Version Programming
                    Environment", Nineteenth Annual Asilomar
                    Conference on Circuits, Systems, and Computers,
                    Pacific Grove, California, November 6-8, 1985.

TITLE: VLSI Circuit Design - A Silicon Compiler
                        Approach

INVESTIGATORS: D. E. Kirk, Professor of Electrical and Computer
                        Engineering, H. H. Loomis, Jr. Adjunct Professor
                        of Electrical and Computer Engineering

SPONSOR: NPS Foundation Research Program

OBJECTIVE: To utilize the MacPitts silicon compiler to
                        investigate architectural alternatives for
                        signal processing operations, including making
                        comparisons between the circuits generated and
                        those obtained by a hand-crafted approach, and
                        to enhance the capabilities of MacPitts.

SUMMARY: Four designs have been completed, two designs of
                        a 16-bit pipeline adder and two designs of a
                        pipelined multiplier (one 8-bit and one 16-bit).
                        Two of these designs were obtained by a custom
                        approach using computer-aided design tools
                        whereas the other two designs were obtained by
                        using MacPitts. Comparisons indicate that the
                        MacPitts designs are somewhat slower, and less
                        dense, but not so much as to make this approach
                        infeasible. As a result of these comparisons,
                        several areas for improvement have been
                        indicated and efforts are continuing to
                        implement appropriate modifications.

PUBLICATION: VSLI Design Using a Silicon Compiler
                        Approach, D. E. Kirk and H. H. Loomis, Jr.
                        NPS Technical Report, in progress.

THESES DIRECTED: Silicon Compiler Design of Combinational and
                        Pipeline Adder Integrated Circuits, MSEE
                        Thesis, A. O. Fioede III, June 1985.

                        VSLI Design with the MacPitts Silicon
                        Compiler/R. C. Larrabbee, MSEE Thesis, Sept.
                        1985.

                        VLSI Design of a Sixteen Bit Pipelined
                        Multiplier Using Three Micron NMOS
                        Technology, MSEE Thesis, R.J. Simchik, Jr.,
                        June 1985.

TITLE: Inherent Tracking Errors of a Monopulse Radar

INVESTIGATOR: Hung-Mou Lee, Assistant Professor of Electrical
                    and Computer Engineering

SPONSOR: NPS Foundation Research Program

OBJECTIVE: To study the inherent angular tracking errors of
                    monopulse radars and to develop, based on the
                    findings of this study, countermeasures against
                    this type of radar.

SUMMARY: A radar is designed for tracking a point target
                    but is always used for tracking a complex target.
                    This will result in errors in the estimated
                    target location by the radar. This type of
                    error has been discussed over the previous 25
                    years without its origin being recognized.
                    Related problems have been over-simplified and
                    journal publications have been infested with
                    erroneous claims. This research is intended to
                    point out the inadequacies in previous work and
                    to lay the foundation for future developments in
                    this area.

THESES DIRECTED: Dae Hyun Park, "Inherent Tracking Error in an
                    Amplitude Comparison Monopulse Radar," Master's
                    Thesis, December 1984.

                    Sopon Bumroongpol, "Angular Tracking Error in a
                    Phase Comparison Monopulse Radar: A Critical
                    Review and Extension of the Phase Front
                    Distortion Approach," Master's Thesis, December
                    1984

TITLE:	High-Speed, High-Accuracy Integrated Operational Amplifiers
Investigator:	Sherif Michael, Assistant Professor of Electrical and Computer Engineering
Sponsor:	Foundation Research Activity
Objective:	To develop high-speed, high-accuracy integrated operational amplifiers using the composite operational amplifier techniques previously proposed by the reseacher. One major goal of the research was to develop a micro and a macro-computer-model of the different operational amplifiers to be used in designing and evaluating the new composite amplifier.

Summary:

An intensive survey of currently available state-of-the-art technology for designing fast, accurate operational amplifiers (op amps) was completed. Based on the result of that survey, it was found that using the composite amplifier approach would yield the best results. The research examines and discusses the feasibility of utilizing composite op amps to overcome the inherent inability of the IC op amps to simultaneously perform in a very fast, very accurate mode. The novel designs developed were also found to provide enhanced stability, decreased sensitivity to circuit element variations and significant extension in bandwidth. Computer simulations of the constructed op amps using the two developed micro and macro models were found to be agreeable to the extensive experimental results. Results in both linear and non-linear applications were demonstrated. These optimum novel designs not only offer significantly improved AC and DC performance over currently available devices, but also make no new demands on technology, since they only require the devices that can be produced with currently available linear monolithic techniques.

Publications:

S. Michael and P. Gariano, "Micro and Macromodeling of Integrated Operational Amplifiers and Their Use in Developing and Evaluating New Composite Op Amps," Proceedings of Midwest Symposium on Circuits and Systems, Louisville, KY., August 1985.

S. Michael and P. Gariano, "Optimization of
High-Speed, High-Accuracy Integrated Operational
Amplifiers," Proceedings of Midwest Symposium on
Circuits and Systems, Louisville, KY., August
1985.

S. Michael and P. Gariano, "Application of
Precision, High-Slew Rate Op Amps in Active
Networks," Proceedings of Midwest Symposium on
Circuits and Systems, Louisville, KY, August
1985.

Conference   S. Michael, "Micro and Macromodeling of
Presentation: Integrated Operational Amplifiers and Their Use
                  in Developing and Evaluating New Composite Op
                  Amps," Midwest Symposium on Circuits and
                  Systems, Louisville, KY, Auguat 1985.

                  S. Michael, "Application of Precision, High-Slew
                  Rate Op Amps in Active Networks," Midwest
                  Symposium on Circuits and Systems, Louisville,
                  KY, August 1985.

Theses Directed: A. Luczak, "Composite Operational Amplifiers and
                  Their Use in Improving Bandwidth, Speed and
                  Accuracy in Active Networks," Master's Thesis,
                  June 1985.

                  P. Gariano Jr., "Generation of an Optimum High
                  Speed, High Accuracy Operational Amplifier,"
                  Master's Thesis, September 1985.

TITLE: Vector-Valued Image Processing

INVESTIGATOR: C. W. Therrien, Associate Professor of
                    Electrical and Computer Engineering

SPONSOR: NPS Foundation Research Program

OBJECTIVE: To explore the use of multichannel signal models
                    for the analysis of color images and other
                    multiple frequency band sets of images.

SUMMARY: Work was begun on developing multichannel two
                    dimensional (2-D) signal models for images. The
                    research focused on linear predictive (all-pole)
                    models. Several important relations linking
                    multichannel images to other multidimensional
                    signals were discovered. An algorithm based on
                    the models to segment color images was developed.
                    Work was begun on multichannel 2-D spectral
                    estimation. This work seeks to develop
                    model-based high resolution methods for the
                    estimation of spectra and cross spectra in 2-D

PUBLICATION: C. W. Therrien, "Multichannel Filtering Methods
                    for Color Image Segmentation," Proc. IEEE Comp.
                    Soc. Conf. on Computer Vision and Pattern
                    Recognition, 19-23 July 1985, San Francisco

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DEPARTMENT

OF

METEOROLOGY

Title: Satellite Remote Sensing of Marine Atmospheric
                  Boundary Layer (MABL) Chaaracteristics

Investigator: P. A. Durkee

Sponsor: NPS Foundation Research Program

Objective: This was the first of a multi-year effort to investigate
                  remote sensing techniques applicable to the marine
                  atmospheric boundary layer.

Summary: This year's effort was devoted to implementing software
                  for data analysis and radiative transfer routines. The
                  investigataion emphasized the effects of particles above
                  the MABL, variable wind speed, and MABL depth. A
                  technique to detect particles above the MABL was
                  developed and tested. This technique uses dual-wave-
                  length, satellite-detected, radiance measurements to
                  estimate variations in the slope of the aerosol particle
                  size distribution. Distributions of varying slope,
                  in turn imply variations of particle type and origin.

Publications: P. A. Durkee, D. R. Jensen, E. E. Hindman and T. H.
                  Vonder Haar, "The Relationship Between Marine Aerosol
                  Particles and Satellite-Detected Radiance", Journal of
                  Geophysical Research, forthcoming.

                  P. A. Durkee, "Aerosol Characteristics Inferred from
                  Dual-Wavelength Radiance Measurements", Journal of
                  Geophysical Research, in progress.

Conference
Presentation: P. A. Durkee, "The Vertical Distribution of Marine
                  Aerosols Inferred from Dual-Wavelength Radiance Measure-
                  ments", Topical Meeting on Optical Remote Sensing of
                  the Atmosphere, Optical Society of America, Incline
                  Village, NV, 15-18 January 1985.

                  P. A. Durkee, E. E. Hindman and T. H. Vonder Haar,
                  "Marine Boundary Layer Characterization from Satellite-
                  Detected Aerosol Optical Depth", IAMAP/IAPSO Joint
                  Assembly, Honolulu, HI, 5-16 August 1985.

Title: Investigation of the Structure and Evolution of the
                    Coastal ABL using an Acoustic Doppler Sodar System

Investigator: W. J. Shaw

Sponsor: NPS Foundation Research Program

Objective: The objective of this work was to initiate surface-based
                    remote sensing and high-resolution radiosonde data
                    acquisition capabilities for the atmospheric boundary
                    layer which will ultimately yield insight into: the
                    relationship between inversion wind shear and ABL
                    small-scale structure and entrainment energetics; ABL
                    structure resulting from inhomogeneities of the coastal
                    region; and the relationship between the structure of the
                    coastal ABL and larger-scale weather systems.

Summary: The primary task in this effort was the calibration of
                    the NPS sodar for the measurement of the acoustic
                    refractive index structure parameter, C_T^2. This was

                    accomplished by two methods: (1) an in situ technique
                    (described in deRouge's thesis) in which C_T^2 was generated

                    from similarity theory of atmospheric surface layer
                    turbulence and compared directly with system output and
                    (2) NPS anechoic chamber measurements of the sodar
                    antenna's near-field acoustic phase and amplitude
                    distrubution for a given imput voltage. This two-
                    dimensional distribution is then Fourier-transformed
                    to obtain the antenna far-field gain pattern. Transducer
                    efficiencies for acoustic/electrical conversion were
                    measured using a calibrated microphone. This information
                    provides the second calibration. Additional substantial
                    effort was given to the revision of software for the
                    Beukers W8000RP radiosonde system obtained through this
                    funding. The system now works properly and reliably.
                    Together the sodar and radiosonde systems now provide
                    excellent quantitative measurements of the mean and
                    turbulent structure of the ABL.

Thesis Directed: E. deRouge, "An Investigation of the Atmospheric Boundary
                    Layer over the Arctic Ocean using Sodar". Master's Thesis,
                    September 1985.

DEPARTMENT

OF

AERONAUTICS

Title: Metallized Fuel Ramjet Combustion

Investigators: A. Gany, NRC Postdoctoral Associate and
                              D. W. Netzer, Professor of Aeronautics

Sponsor: National Research Council/NPS Foundation Research
                              Program

Objective: Conduct fundamental experimental and analytical
                              studies to enhance the understanding of the
                              combustion behavior of ramjets that utilize large
                              mass fractions of metal within the solid fuel.

Summary: Thermochemical evaluation of fuel candidates
                              for ramjet propulsion was made in terms of the
                              theoretical heat of combustion per unit mass and
                              per unit volume of the fuel. Compared with the
                              commonly used hydrocarbons, the main advantage of
                              using metals or metal compounds is their much
                              higher energy density, which is of great signifi-
                              cance in volume limited systems. For practical
                              use, boron has the highest energy density of all
                              elements (almost three times higher than that of
                              hydrocarbons). However, several boron compounds
                              exhibit similar theoretical performance,
                              especially boron carbide and the high borides
                              of aluminum, magnesium, and silicon.

                              Combustion phenomena of highly metallized, boron
                              containing, solid fuels in solid fuel ramjets
                              (SFRJ) were studied by means of high speed photo-
                              graphy using a windowed two-dimensional SFRJ
                              combustor. The experiments indicated the
                              existence of a gas phase diffusion flame of the
                              volatile fuel ingredients within the boundary
                              layer above the fuel surface. It was also
                              revealed that material is often emitted from
                              the surface in the form of large pieces and
                              segments. Flow impingement on the surface may
                              cause surface heating and glowing by chemical
                              reactions, which promote the high speed ejection
                              of hot particles and the emittance and disinte-
                              gration of large glowing segments and pieces
                              from the fuel surface layer to the gas stream.

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Publications: A. Gany and D. W. Netzer, "Thermochemical Evaluation of Fuel Candidate, for Ramjet Propulsion", in Proceedings of the 27th Israel Conference on Aviation and Astronautics, pp. 210-219, February, 1985.

A. Gany and D. W. Netzer, "Combustion Studies of Metallized Fuels for Solid Fuel Ramjets", AIAA-85-1177, AIAA/SAE/ASME/ASEE 21st Joint Propulsion Conference, July 8-10, 1985.

A. Gany and D. W. Netzer, "Fuel Performance Evaluation for the Solid-Fueled Ramjet", NPS Report 67-84-012, October, 1984.

Conference   A. Gany and D. W. Netzer, "Thermochemical Evaluation of Fuel Candidate, for Ramjet Propulsion," 27th Israel Conference on Aviation and Astronautics, February 1985.

A. Gany and D. W. Netzer, "Combustion Studies of Metallized Fuels for Solid Fuel Ramjets," AIAA/SAE/ASME/ASEE 21st Joint Propulsion Conference, July 8-10, 1985.

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Title: Composites Reliability Certification Methodology

Investigator(s):   Edward M. Wu, Professor of Aeronautics and
                                S. H. Own, Research Professor of Aeronautics

Sponsor: Naval Air Systems Command
                                NPS Research Foundation

Objective: The objective of this program is to conduct
                                coordinated experimental and analytical investi-
                                gations which will provide test methods, data,
                                and theories contributing to the rational devel-
                                opment of certification methodology for fiber
                                reinforced composites structures.

Summary: Application of fiber reinforced composites to
                                gain performance improvement in advanced struc-
                                tures requires theory and materials data for
                                design and for certification. We address the
                                accept or reject process based on the expected
                                composite strength and durability of the com-
                                posite by quantifying the statistical strength
                                and life of composite under uniaxial stress and
                                under combined stress.

                                Specifically, this program includes treatment
                                of:

                                (a) Uniaxial probabilistic strength and life
                                    including model identification, single
                                    fiber filament testing and single filament
                                    composite testing.

                                (b) Combined-stress probabilistic strength and
                                    life including theoretical modeling, experi-
                                    mental data generation and computer software
                                    implementation for applications.

Conference   S. H. Own, "A Statistical Formulation of Com-
Presentation: posite Strength Distribution: Fiber, Matrix,
                                and Interface ," Gordon Research Conference on
                                Composites, Santa Barbara, CA, Jan. 13-17, 1986.

DEPARTMENT

OF

OCEANOGRAPHY

Title: The Tropical Oceanic Boundary Layer

Investigator: R.W. Garwood, Jr., Associate Professor of
                    Oceanography

Sponsor: NPS Foundation Research Program

Objective: The objective of this project is to understand the
                    role of the mixed layer in the dynamics of the
                    tropical ocean. The main thrusts of this research
                    are to develop (i) a numerical model and, (ii)
                    climatological data base for model initialization and
                    verification.

Summary: An oceanic model for tropical application has been
                    developed to include the interaction of planetary
                    rotation and Reynolds stress, and the
                    thermodynamic/hydrodynamic effects of the absorption
                    of solar radiation which penetrates the ocean
                    surface. The steady-state version of this model has
                    been tested in the equatorial Pacific Ocean, and
                    should be an important contribution to the
                    understanding of the role of turbulent mixing in the
                    distribution of properties in the equatorial oceans.
                    It has already explained the zonally asymmetrical
                    distribution of mixed layer depth in the equatorial
                    Pacific Ocean.

                    A data base for the climatological atmospheric
                    forcing for the Atlantic Ocean has been assembled,
                    enabling a test of the model in the tropical
                    Atlantic. This test demonstrated the potential for
                    the interaction of planetary rotation and Reynolds
                    stresses to mediate the climatological mixed layer
                    depth in the tropical Atlantic Ocean.

Publications: R.W. Garwood, Jr., P. Muller and P.C. Gallacher, "A
                    Model for the Equilibrium Mixed-Layer Depth in the
                    Equatorial Pacific," Tropical Ocean-Atmosphere
                    Newsletter, Number 30, pp. 10-11, March 1985.

                    R.W. Garwood, Jr., P. Muller, and P.C. Gallacher,
                    "Wind Direction and Equilibrium Mixed Layer Depth in
                    the Tropical Pacific Ocean," Journal of Physical
                    Oceanography, 15, pp. 1332-1338, October 1985.

Publications (cont'd):	R.W. Garwood, Jr., and P. Muller, "Modelling of the Equatorial Mixed Layer," submitted to <u>Oceanological</u> <u>Data</u>, 9 pp., 1985.
Conference Presentation:	P.C. Gallacher, R.W. Garwood, Jr., and P. Muller, "Wind Direction and Equilibrium Mixed Layer Depth: General Theory," IAMAP/IAPSO Joint Assembly, Honolulu, Hawaii, August 1985.
Thesis Directed:	J.F.F.A. Gaspar, "The Equilibrium Mixed Layer Depth in the Tropical Atlantic: The Rotation Stress and Penetration of Radiation Effects," <u>Master's</u> Thesis, June 1985.

DEPARTMENT

OF

MECHANICAL ENGINEERING

Title: The Turbulent Boundary Layer: Small-Scale Structural
                 Characteristics and Eddy Motions

Investigator: P. M. Ligrani, Associate Professor of Mechanical
                 Engineering

Sponsor: NPS Foundation Research Program

Objective: To study small-scale fluid motions in the near-wall
                 portions of turbulent boundary layers.

Summary: Purchase of equipment and design of new facility to
                 allow study of near-wall turbulent motions. Study
                 of needed type of data acquisition system. Develop-
                 ment and analysis of subminiature hot-wire sensors
                 with spatial resolution.

Publication: P. M. Ligrani, "Subminiature Hot-Wire Sensor Con-
                 struction," Naval Postgraduate School Technical
                 Report, NPS69-84-010, November 1984.

Conference   P. M. Ligrani, "Subminiature Hot-Wire Sensors and
Presentation: Resolution of Small-Scale Turbulence," Fifth Sympos-
                 ium on Turbulent Shear Flows, Cornell University,
                 New York, August 7-9, 1985.

Title: Optimal Control of Robotic Mechanisms

Investigator: D. L. Smith, Associate Professor of Mechanical Engin-
                    eering

Sponsor: NPS Foundation Research Program

Objective: To investigate the application of optimal control
                    theory to the control of robotic mechanisms.

Summary: Computer-based controllers operating optimal control
                    algorithms are capable of coordinating robotic
                    motions in complex mechanisms. This work is aimed at
                    identifying the research issues surrounding this type
                    of control.

                    A table-top manipulator arm and a programmable con-
                    troller were selected and purchased. A data acqui-
                    sition system has been designed and is being
                    installed. A nonlinear simulation of the arm, the
                    hydraulics, and the rudimentary built-in controller
                    has been developed. Test cases have been identified
                    to validate simulations and optimal control logic.

Theses Directed: D. Lewis, "Modeling of Low-Speed Motion of Rigid,
                    Revolute Mechanisms," Master's Thesis, December 1985.

                    W. McCarthy, "Simulation of High-Speed Motion of
                    Rigid, Revolute Mechanisms," Master's Thesis, Dec-
                    ember 1985.

INVESTIGATOR INDEX

APPENDIX

Summary Title	Investigator	Type Funding
COMPUTER SCIENCE		
Portable Software, Formal Semantics, and Limited Resource Systems	D. Davis	6.1
The Effects of Real-Time Display Generation on the Architecture of Graphics Display Systems	M.J. Zyda	6.2
Inferences Between Statistics on a Database	N.C. Rowe	6.1
ADMINISTRATIVE SCIENCES		
Group Decision Support System: An Advisory System for Bargaining and Negotiation	T.X. Bui	6.1
High Performing Systems in the Military: Defining Excellence in the Operational Forces	R.T. Harris R.A. McGonigal	6.1
Task Definition, Decision-Criteria and Uncertainty Reduction: The Role of the Agency Budget Office	J.L. McCaffery	6.1
An Evaluation of Leasing as a Financing Strategy within the Navy	J.G. San Miguel	6.1
Coupling Symbolic Reasoning and Numerical Computing Systems	T.R. Sivasankaran	6.2
Application of Spreadsheet Programs to Manpower Modeling	T.G. Swenson	6.1
Use of the Rasch Model in Sequential Testing	R.A. Weitzman	6.1

Summary Title	Investigator	Type Funding
OPERATIONS RESEARCH		
A Study of the Projective Algorithm for Linear Programming	G.G. Brown R.K. Wood	6.1
An Approximate Solution Technique for the Constrained Search Path Moving Target Search Problem	J.N. Eagle J.R. Yee	6.1
Multicommodity Network Flow Optimization	R.E. Rosenthal	6.1
NATIONAL SECURITY AFFAIRS		
Soviet Involvement in Caribbean	R. Looney J. Valenta	6.1
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