SUMMARY OF RESEARCH

ACADEMIC DEPARTMENTS

1989 - 1990

OFFICE OF THE ACADEMIC DEAN
UNITED STATES NAVAL ACADEMY
ANNAPOLIS, MARYLAND

SUMMARY

OF

RESEARCH

1988-1989

COMPILED AND EDITED

BY

PROFESSOR FRED M. FETROW

ENGLISH DEPARTMENT

DECEMBER 1989

UNITED STATES NAVAL ACADEMY

ANNAPOLIS, MARYLAND

21402

Foreword

The role of research at the Naval Academy is to maintain an atmosphere of scholarly excellence in which midshipmen seek knowledge. Discipline and curiosity are both essential to a naval officer, as to any educated man or woman, and the balance of these traits determines the character of our graduates.

In the nearly two decades since the Research Office was created, progress can be measured by the growth in research budgets, papers, books, and presentations. Naval Academy faculty and midshipmen have seized the opportunities to do research provided by local and nearby facilities, research courses, sabbaticals, and travel support.

The information presented in this report describes the research projects and productivity of our faculty and midshipmen for the 1988-1989 academic year. Each of sixteen academic departments in five divisions presents the details of its efforts. The history of the budget and productivity is presented in Figures 1 and 2, showing the growth of research by our faculty.

This growth parallels the increase in civilian faculty Ph.D.s to ninety-two percent and growth of the programs of research chairs, which has recently remained steady at six. These chairs are sponsored by various Naval Systems Commands, Naval Operations and the Chief of Naval Research. Our research funding is distributed over basic research, exploratory and advanced development, as well as O&M,N funds which contributed to the recent increase in support for newer faculty, and are administered by our Naval Academy Research Council. Additional operating funds were devoted to supporting forty-six faculty members' efforts in instructional development, largely devoted to exploiting the computers acquired by our faculty and midshipmen. Our major reimbursable sponsor, after the Chief of Naval Research, continues to be the David Taylor Research Center, whose Annapolis and Carderock Laboratories supported the work of eighteen of our faculty for a total of $297,000. The Naval Research Laboratory funded sixteen faculty members' research this year, under our Cooperative Program, for a total of $199,660.

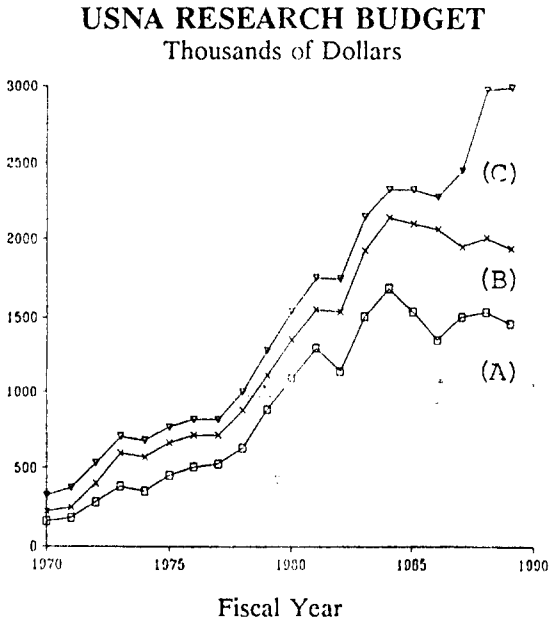


Figure 1. The growth of the research budget since 1970 reflects contributions programs such as the (A) sponsored projects of individual faculty, (B) research chairs, and (C) Academy-wide programs.

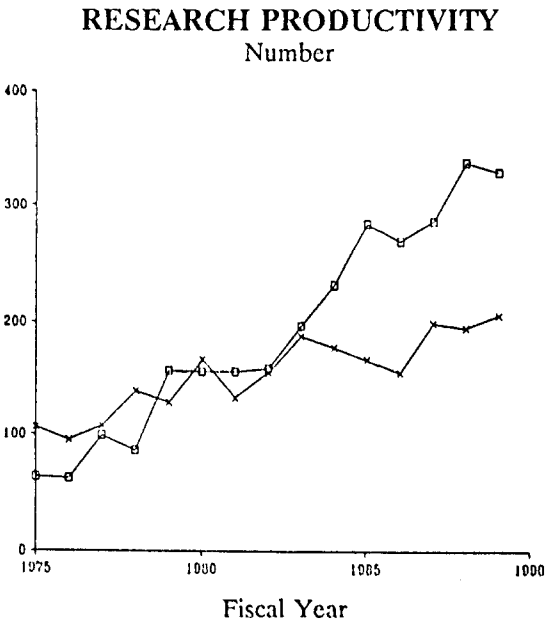


Figure 2. The productivity of faculty and midshipmen, measured through publications (x) and presentations(□), has increased with the research budget.

FOREWORD

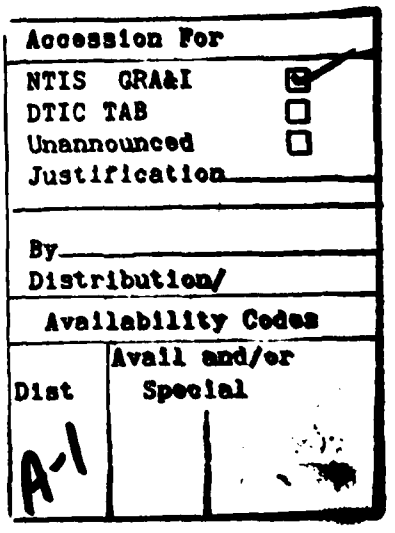
Midshipmen participation in research at the Naval Academy continues with one hundred and sixteen research courses reported, eight Trident Scholars (with thirteen selected for the coming year) and nearly one hundred midshipmen using summer leave time to work with a dozen Navy, DoD, and Federal Laboratories.

Collaboration continues with renewed Memoranda of Understanding between the Naval Academy and Chief of Naval Operations in Manpower, Personnel and Training, the Naval Space Command, the Naval Facilities Engineering Command, and the Naval Supply Systems Command. In addition to research chair holders, the Naval Academy hosted visiting faculty from the Marine Corps Research, Development and Acquisition Command under the Naval Scientist Training and Exchange Program (NSTEP), the Royal Naval College, the David Taylor Research Center, Naval Academy Preparatory School, St. Johns College, Southern Illinois University, Brookings Institute, University of Delaware, Center for Naval Analyses, University of Oregon and from various other institutions under the Intergovernmental Personnel Act. This active visiting professor program, along with our sabbatical and travel programs, keeps the Naval Academy in the mainstream of naval and academic research activity.

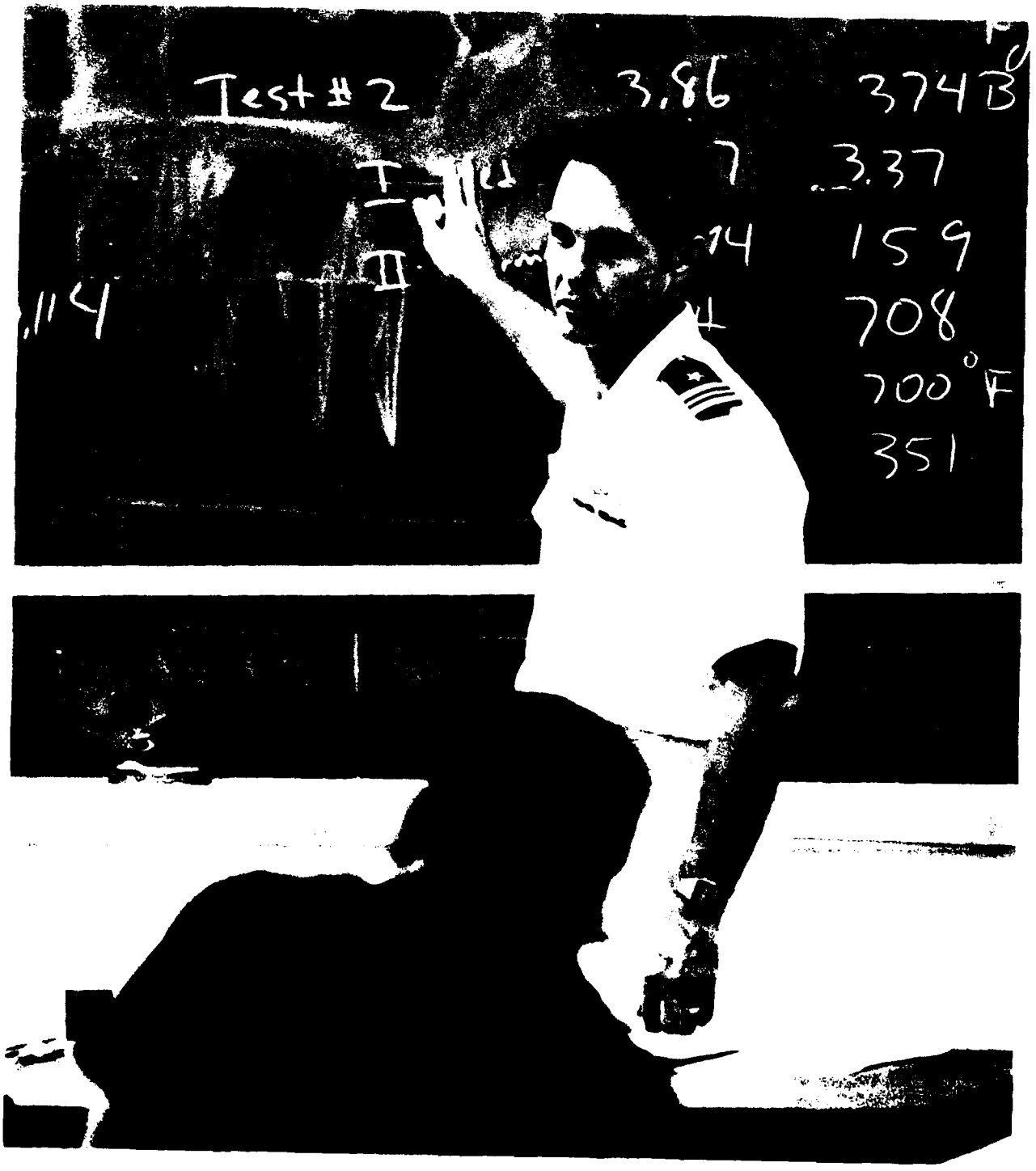
ROBERT H. SHAPIRO
Academic Dean and Provost

CARL S. SCHNEIDER
Associate Dean for Research

Contents



Division of
Engineering and Weapons



DEPARTMENT OF

Aerospace Engineering

Commander Vernon C. Gordon, USN
Chairman

Another year of growth has highlighted the research program within the Aerospace Engineering Department. The faculty has continued to conduct research over a broad spectrum. This research is of extreme importance to the faculty and the Academy. It maintains a faculty knowledge base on the cutting edge of current technology and leads to stimulating discussion and real world problems for the classroom.

Midshipmen have been actively involved in the research program as well. Through the Trident Scholar Program one of our midshipmen scholars has investigated methods of turbulent drag reduction. In our special design courses other midshipmen have expanded their fundamental knowledge through detailed application of engineering principles in creative ways. This creative, logical problem solving is the end goal of any good engineering program.

Sponsored research continues to keep the faculty active. Studies of aeroelastic phenomena, remotely-piloted vehicle performance, ship hull structural design, computer-aided engineering, and helicopter aerodynamics have been ongoing. In addition, faculty members are investigating composite structure problems and small satellite design. This diverse research program is indicative of an energetic and active faculty.

The Naval Space Command-sponsored Satellite Tracking Facility is nearing completion. The dish and tracking equipment have been installed. The computer control consoles are almost in place, and the facility should be operational by fall semester. This facility will add a new dimension to the astronautics curriculum. Students will be able to do hands-on work with active spacecraft. It also holds promise for some useful faculty research in several departments.

The mentorship program between the Academy and Anne Arundel County schools grew to six students in the Aerospace Engineering Department this year. These students were active in computer

finite element code generation, wind tunnel experimentation, and flight simulation evaluation. The program will continue next year with seven new students.

An active and extremely productive year has ended. Next year promises to bring more challenges. The amount of state-of-the-art equipment available to researchers has expanded. This will allow Aerospace faculty members to work in more complex and intriguing areas of research. The sabbatical program is very active. One faculty member returns from a semester of study, and a second will be spending a year at NASA/Goddard working on spacecraft design programs. All of this activity leads to continued improvement in our classroom teaching environment.

Sponsored Research

Flow Distribution in the Exhaust System of the ICR Engine

Researcher: Associate Professor John E. Allen
Sponsor: David Taylor Research Center, Annapolis Laboratory

An experimental program to investigate flow conditions in an intercooled regenerative (ICR) engine exhaust is being conducted. A scale model test facility has been constructed, and preliminary cold flow measurements have been made. The complex 3-D flow modelling continues, and a detailed data collection effort to validate the model will be conducted. The result will provide the Navy a detailed flow and temperature distribution model for use in design of marine gas turbine systems.

Low Speed Aircraft Performance

Researcher: Professor Bernard H. Carson
Sponsor: Naval Research Laboratory

Thrust characteristics of three model propellers were measured during powered wind tunnel tests. These tests typify those used in the flight test phase of the Navy's LAURA (Low Altitude/Airspeed Unmanned Research Aircraft) program. Tests were conducted under actual flight conditions with propellers installed on a prototype powerplant system. Results of the tests will enable engineers to predict flight test performance of this class of vehicles during the flight test phase in 1989.

Astronautics Curriculum Development

Researcher: Visiting Professor John F. Clark
Sponsor: Naval Space Command

The Naval Space Command has provided funding for support of laboratory development for the Astronautics Program at the Naval Academy. A 12-meter x-y satellite tracking facility is currently being installed at the Academy for use in Aerospace laboratories. The purpose of this task is to develop new and novel laboratory experiences for use in the academic classroom in support of astronautics education. A preliminary set of experiments has been developed. These experiments will be used and refined during next academic year.

Prevention of Free-Edge Delaminations in Composite Laminates Under Torsional Loading

Researcher: Assistant Professor Walter K. Daniel
Sponsor: Naval Academy Research Council (ONR)

Structures fabricated from composite materials tend to delaminate (individual layers separate) at free edges. The objective of this effort was to develop techniques to predict where and at what load such delaminations will occur, and then develop methods to prevent the failures. The direct application for this research is to improve the operating performance and fatigue life of a composite bearingless rotor hub system. The methodology was to develop finite element models, use the results to predict failure locations and loads, and then verify the models with experiments. MSC/NASTRAN was acquired and installed on the Aerospace Engineering Department ComputerVision computer-aided design system. Technical support built a custom fixture to test composite beams in the Aerospace Engineering torsion machine. Specimens representative of thin plates were fabricated using the University of Maryland autoclave; the specimens were tested at the Naval Academy. The results of this task will be presented at the American Society for Composites technical conference in October 1989. In the future, the project will be extended to thick beams, and then to delamination suppression schemes.

Bending-Torsion Flutter of High-Aspect-Ratio Nonuniform Composite Wing

Researcher: Assistant Professor Gabriel W. Karpouzian
Sponsor: Naval Academy Research Council (ONR)

This project in the area of aeroelasticity is concerned with flutter solutions of high-aspect-ratio nonuniform wings. It constitutes an extension of an earlier NARC project in which wing properties were considered uniform, and will give analytical solutions to more realistic wing flutter problems. The work formulates the asymptotic equations for high-aspect-ratio wing flutter of nonuniform distribution of internal and structural properties. The asymptotic solutions will result in solving a set of ordinary/partial differential equations for flutter eigenvalues and mode shapes. Two-dimensional aerodynamics will be used. An attempt to utilize existing three-dimensional aerodynamic codes will be made. The work aims at broadening the existing theory for uniform wings and making it more applicable to wings of various configurations.

Hull-Superstructure Interaction

Researcher: Assistant Professor Michael D. A. Mackney
Sponsor: David Taylor Research Center and
Naval Academy Research Council (ONR)

This research in the area of ship structural design is concerned with studying the behavior of the ship's hull and its interaction with the superstructure. This complex, three-dimensional, non-linear elastic phenomenon is of considerable interest to ship designers seeking to improve the structural integrity and performance of vessels operating in variable environmental conditions.

In order to improve the stability, radar cross section, and general structural performance of warships in particular, composite and sandwich materials having low modulus and non-linear characteristics are being considered. Since these materials can be designed to incorporate stiffness and strength in specific directions, a knowledge of the load transmission and diffusion paths in the hull and superstructure is required for a variety of geometries.

This continuing study is comparing simplified hull-superstructure models using two purpose-written preprocessors and the GIFTS finite element program, evolving the parametric investigation. The sensitivity analysis of the parameters under review will require the design and writing of a post-processor to GIFTS.

Since a complete understanding of the hull-superstructure phenomenon cannot be made entirely from numerical studies, work is continuing in defining the experimental program. Following the detailed parametric studies, a revised "likely configuration" model is being designed from which the study may be concluded.

The second preprocessor has been developed and implemented on a personal computer in True BASIC. It is being further developed for implementation on a high-end engineering workstation, on which the finite element processor is being implemented.

The research is continuing along the planned directions, but with some delays in setting up the new workstation, and in implementing the system and processing software.

USNA Satellite Earth Station Facility

Researchers: Professors George F. Pieper and William J. Bagaria
Sponsor: Naval Space Command

The USNA Satellite Earth Station Facility provides the Naval Academy with a ground station capable of receiving signals from many orbiting spacecraft. The operation of the station and the satellite signals obtained from that operation will be used in several courses of instruction. Satellites will be tracked and signals analyzed at VHF, S, C, and K telemetry bands. The system will be fully operational in October of 1989.

Computer-Aided Hull Design and Model System

Researcher: Professor David F. Rogers
Sponsor: United States Coast Guard

This is the continuation of a multi-year program to investigate computer-aided design for ship hulls and towing tank models. The prime area of study is improvement of ship hull fairing techniques and data manipulation techniques. The Coast Guard will ultimately integrate the modifications into an overall ship design system.

Viscous Drag Reduction for Slender Surface Craft

Researcher: Midshipman 1/C David B. Walker, USN
Advisers: Professor Maido Saarlas, Professor Roger H. Compton
and Visiting Professor David Coder
Sponsor: Trident Scholar Program

Based on current work being performed at NASA/ Langley Research Center, David Taylor Research Center, and the Naval Academy, the project continues extending the knowledge base for the application of surface riblets (longitudinally grooved surfaces) to marine vehicles to reduce the fluid mechanical drag. The investigation extends into new ideas such as studying the drag reduction effectiveness of riblets with air emission, polymer injection, and unsteady flow conditions.

Measurements of drag and flow visualization were used to assess the effects of altering the flow structure near the wall and the outer flow with the above mentioned techniques. Based on the results of the experimental work, an assessment for potential use of riblets for various flow situations was performed.

Independent Research

Weight Reduction of Suspension Components Using Hollow Bar Stock

Researcher: Professor William J. Bagaria

This research is aimed at reducing the weight of vehicle suspension components by using hollow instead of solid bar stock. Since suspension components are primarily under torsional loads, hollow stock can significantly reduce the weight. A weight reduction of at least 50% is the object of this research. To date, the stress equations for torsion bars, axle shafts, and helical springs have been developed. A set of test springs has been fabricated from hollow stock. The springs are being instrumented for testing. Work is continuing to achieve experimental verification of the theoretical equations.

Spacecraft Design

Researchers: Assistant Professor Walter K. Daniel, Professor George F. Pieper, Commander Vernon C. Gordon, USN, and Midshipman 1/C Michael J. Breslauer, USN

This effort is an outgrowth of course development for the astronautics track, the EA470 Spacecraft Design course, and the participation of the Aerospace Engineering Department in two student design programs. In student projects for EA470 and faculty projects, the goal has been to develop a complete spacecraft system design. The missions considered are usually of interest to the Navy or NASA, but have not yet been studied by those organizations. Assistant Professor Daniel has published a paper regarding the design of a small satellite for use in astronautics education. This design is applicable to the Special Purpose Inexpensive Satellite Program funded by the Office of Naval Research and supported by the Naval Space Command. Assistant Professor Daniel and Professor Pieper will present a paper regarding the design of an unmanned interstellar probe that is based upon a midshipman design from the Universities Space Research Association Advanced Design Program. Current research includes design of a small spacecraft that uses solar-electric propulsion for inner solar system exploration (Assistant Professor Daniel and Commander Gordon) and the numerical solution for solar sail trajectories to Mars (Midshipman 1/C Breslauer and Assistant Professor Daniel).

Naval Academy Rotor Test Facility Flow Model Study

Researcher: Associate Professor Gerald F. Hall

The rotor test facility at the Naval Academy has been modeled to scale with plexiglass to provide flow visualization of the complex flow within the actual test facility. The model is currently being completed with installation of the drive tower and motor mechanisms. Flow visualization testing will begin on completion of power system installation.

A Comparison of the Induced Velocity Field of an Advanced Technology Rotor at Moderate and Extreme Operating Conditions as Calculated by a State-of-the-Art Numerical Method for Two Different Wake Geometries

Researcher: Associate Professor Gerald F. Hall

The design process for an aircraft or any of its components can be time consuming and costly. Extensive test procedures are normally required along the way to validate the design at prescribed benchmarks. For state-of-the-art rotors this can mean huge amounts of wind tunnel and flight test time to determine the performance envelope. As a result, in an attempt to minimize the expense of hardware testing within an interactive design loop, numerical analysis capable of modeling to a high degree of accuracy the complete system in question (i.e., the complete rotor, the complete helicopter, etc.) is being more and more utilized. CAMRAD (Comprehensive Analytical Model of Rotorcraft Aerodynamics and Dynamics) is such an analysis directed toward advanced rotorcraft design. Since CAMRAD is also state of the art, it must be continuously evaluated even as it is used in the design process for advanced rotorcraft.

Research Course Projects

Feasibility Study of Flying Wings for Remotely-Piloted Vehicle Applications

Researcher: Midshipman 1/C Steven S. Lambrecht, USN
Adviser: Professor Bernard H. Carson

Numerous studies in the past have demonstrated the superiority of the flying wing configuration over conventional aircraft configurations in certain applications, due to lower drag. This technology became highly developed in the immediate post WWII era, but was subsequently abandoned for a variety of reasons, some budgetary, and others political. With the recent interest in military remotely-piloted vehicles, it is appropriate to reexamine this configuration in this specialized application.

Integration of Propeller Design With Numerically Controlled Milling Techniques

Researcher: Midshipman 1/C Frank C. Salcedo, USN
Adviser: Professor Bernard H. Carson

The U.S. Navy is presently conducting extensive studies into the feasibility of using Remotely-Piloted Vehicles (RPV's) for long endurance reconnaissance and decoying missions. Such vehicles will be required to operate optimally for long durations and at low speeds. One problem area that has emerged in these studies is the lack of a technical base needed to design efficient propellers in this flight regime. Thus a separate study has been undertaken to rectify this. This study will require, among other things, the manufacture of numerous test propellers, which can be done most efficiently by applying computer-aided manufacturing techniques. The Naval Academy has numerically controlled machines suitable for this purpose. However, the software required to translate parameters developed in a propeller design into machine instructions does not presently exist.

Design Course Projects

A number of Astronautics Track students participated in a year-long special design program to produce papers that were submitted in student competition. These students were supervised by Professor George F. Pieper, Assistant Professor Walter K. Daniel, Dr. Stephen Paddack (NASA), and Mr. Harold Fox (APL).

Solar Sail

Midshipmen 1/C Michael J. Breslauer, Sean B. Foley,
Paul D. Montanus, and Christian H. Post, Jr., USN
(AIAA Student Spacecraft Design Competition)

Project Longshot ...A Mission to Alpha Centauri

Midshipmen 1/C J. Curtis West Jr., Sally A. Chamberlain,
Neftali Pagan, and Robert E. Stevens II, USN
(NASA/USRA Student Conference)

Publications

CARSON, Bernard H., Professor, "Wind Tunnel Tests of Unmanned Aircraft Propellers," Division of Engineering and Weapons Report EW-10-88, August 1988.

Thrust characteristics for three model propellers are presented, as determined from powered wind tunnel tests. The test propellers typify those scheduled for use in the flight test phase of the United States Navy's LAURA (Low Altitude/Airspeed Unmanned Research Aircraft) program. Tests were conducted under actual flight conditions with the propellers installed in the prototype powerplant system, so that any installation losses were included globally in the results.

Experimental results are presented both in graphical form and as empirical formulas amenable to computerized data reduction from telemetered flight test data. Emphasis was placed on establishing error margins and applying necessary corrections to these results in an effort to enhance their reliability and thus minimize uncertainties in extracting aircraft performance parameters from flight test data.

These results are applied to a representative flight vehicle as a means of demonstrating their applicability, and several operational aspects are discussed in light of the present findings.

CARSON, Bernard H., Professor, "Teaching Ideal Fluid Flows With Personal Computers," Division of Engineering and Weapons Report EW-17-88, November 1988.

The subject of ideal fluid flows forms the basis for much of theoretical and applied aerodynamics and is therefore an indispensable element in an accredited curriculum in aerospace engineering. Traditionally, students encountering this subject for the first time have been diverted from full understanding by the level of mathematics required for even simple flow configurations, and the general difficulty in graphically portraying such flows by classical methods.

In recent times, more and more students enter this course in possession of their own personal computers, and a great predisposition toward using them. In this paper the author presents the results of an approach to teaching this subject that makes use of the finite difference flow calculations. This allows the student graphically to visualize each flow of interest as he or she progresses through the course. The algorithm itself is straightforward and an easy one to master conceptually, and the students have little difficulty creating and modifying their own programs as the need arises. This approach also serves as a natural transition from classical flow methodology to the modern field of computational aerodynamics.

A number of examples are presented and discussed. This methodology provides a means of calculating pressure distributions with ease, and can be applied to virtually all flows encountered in potential fluid flow theory, including those derived from conformal transformations.

DANIEL, Walter K., Assistant Professor, "Design of a Small Satellite for Use in Astronautics Education," *Proceedings* of the Second Annual AIAA/USU Small Satellite Conference, Utah State University, Logan, Utah, September 1988.

The Naval Academy is pursuing a small satellite project to provide midshipmen with hardware and ground control experience. The concept is for a lightweight, gravity-gradient stabilized satellite to be deployed from a Get Away Special canister; the payload would be two small, low resolution imagers (one visible and one infrared). The 40-foot diameter ground station antenna being installed at the Naval Academy can receive a power of 10 milliwatts from a satellite that uses an omnidirectional antenna and is in a typical Space Shuttle orbit. Approximately 5 to 7 watts of power are constantly available to the payload of up to 10.4 lb (4.7 kg). Thermal control is largely passive, but some heating will be required during the longest eclipses. Once in orbit, the spacecraft would be used in astronautics courses for such assignments as orbit determination, decoding telemetry, and processing images.

KARPOUZIAN, Gabriel N., Assistant Professor, "Flutter of High Aspect Ratio Wing With Static Elastic Coupling," Applied Mechanics and Engineering Sciences Conference *Abstracts,* University of California, Berkeley, California, 20-22 June 1988, p. 40.

Modern flutter analyses are performed mostly by computer codes comprising structural methods coupled to lifting-surface aerodynamics. While useful, these numerical approaches may tend to obscure the salient features underlying the flutter phenomenon and its dependence on the critical combination of certain parameters. A theoretical approach, based on asymptotic analysis, has been developed to identify the fundamental criteria corresponding to these critical combinations and the associated domains of the flutter dynamics, thus contributing to an understanding of the essential coupling mechanism in the flutter and structural dynamic instabilities. The theory represents a significant departure from the classical treatment of bending-torsion flutter problems, in that two distinctly different structural dynamic domains and the parameters distinguishing them are clearly identified. The scope of the theory is extended to include wing structures built up from composite materials. These elongated, beam-like structures produce strong coupling between torsional and flexural deformation and their moments, enough to alter significantly the flutter solutions.

MACKNEY, Michael D.A., Assistant Professor, "HULGEN 3 - A Preprocessor for Hull-Superstructure Interaction Study of an Enhanced Model," Division of Engineering and Weapons Report EW-14-88, September 1988.

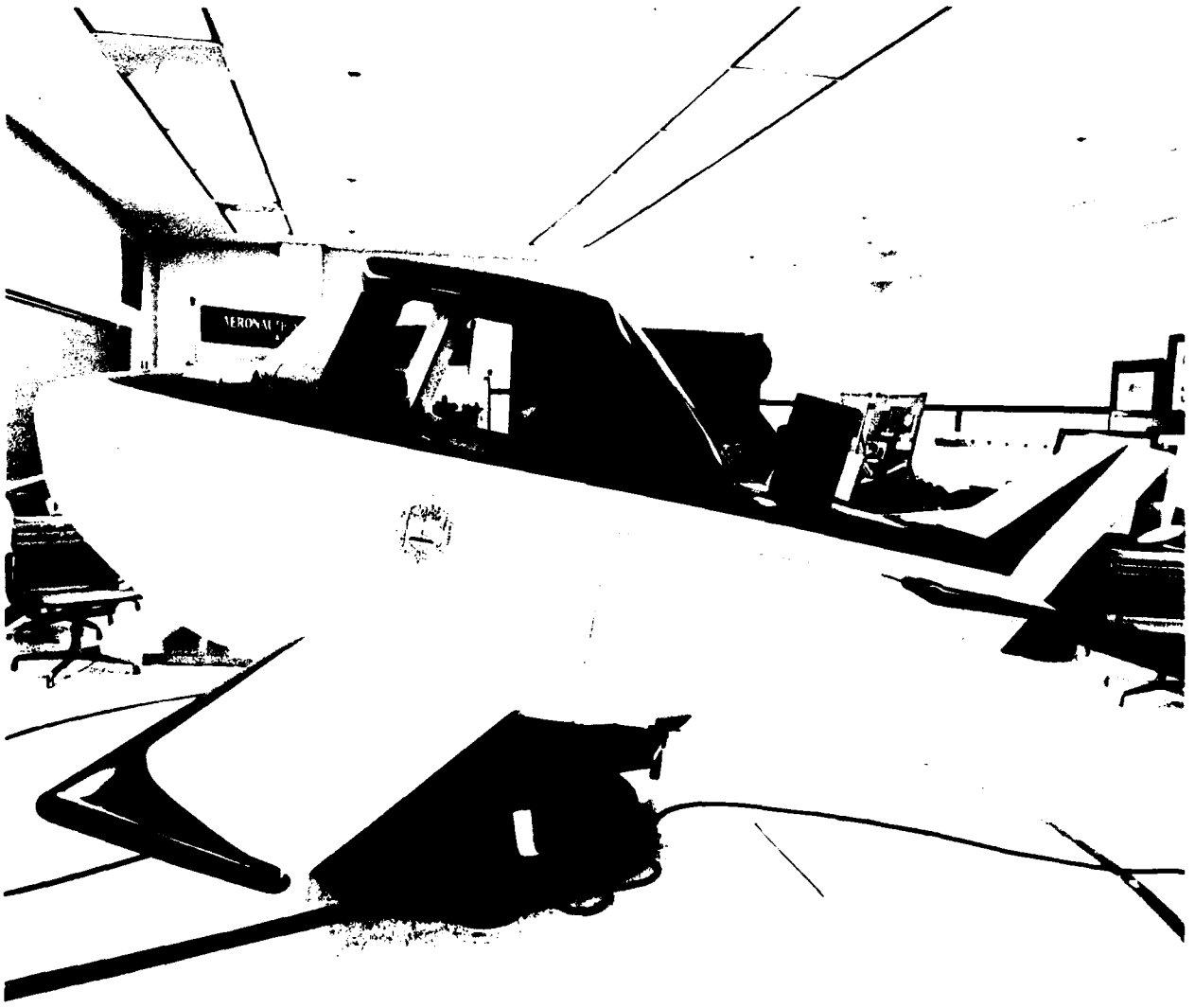
This report describes the continued improvements made to the hull-superstructure model in order to study interaction. A second superstructure has been added, together with more intermediate decks and bulkheads in the hull and superstructure units; both superstructures can be independently positioned. A preprocessor is being written in True Basic which will generate formatted data for subsequent processing by the GIFTS finite element system. The enhanced model has resulted in an increase in all the parameters used to describe the simplified model. The preprocessor allows rapid, error-free generation of the large database required for the many models to be analyzed.

Presentations

BAGARIA, William J., Professor, and Vernon C. GORDON, Commander, USN, "Astronautics Track Update," Naval Space Command Annual Review meeting, U.S. Naval Academy, Annapolis, Maryland, 27 April 1989.

KARPOUZIAN, Gabriel N., Assistant Professor, "Bending-Torsion Flutter of High Aspect Ratio Wing with Static Elastic Coupling," Pan American Congress of Applied Mechanics, Rio de Janeiro, Brazil, 3 January 1989.

KARPOUZIAN, Gabriel N., Assistant Professor, "Flutter of High Aspect Ratio Wing with Static Elastic Coupling," Applied Mechanics and Engineering Conference, University of California, Berkeley, California, 20 June 1988.



DEPARTMENT OF

Electrical Engineering

Professor Ralph P. Santoro
Chairman

Research and scholarly activity are fundamental to the vitality and viability of a discipline. This is particularly applicable to electrical engineering, which is broadly based and rapidly expanding. Research helps both faculty and midshipmen keep abreast of advancing technology and ultimately improves the effectiveness of the academic environment by encouraging a modern and relevant curriculum.

Funding for our research activities comes from the Naval Research Laboratory, the David Taylor Research Center, and from within the Naval Academy. Research topics supported by the Navy laboratories during the past year included digital signal processing applications to non-destructive testing, ultrasonic transducer characterization for non-destructive testing applications, characterization of radiation-hard microelectronic devices, and homo-polar machine propulsion systems. Naval Academy funding supported faculty work on instructional development. This faculty research contributes directly to our operating forces and provides relevant topics which benefit the professional as well as the academic development of our midshipmen.

Sponsored Research

Investigation of Gravity Effects on Ejection Speed in the Homo-polar Machine

Researcher: Assistant Professor Patricia E. Burt
Sponsor: David Taylor Research Center, Annapolis Laboratory

There has been much progress in the field of electric propulsion for the Navy's ships. Current research aims at incorporating homopolar machine concepts into these propulsion systems. One of the critical technologies deals with the current collector. A major problem in the use of the current collector is the sudden ejection of the liquid metal at a critical rotational speed. The cause of this failure is not completely understood. There are several theories which have been proposed, and first order model calculations exist for several of them. The purpose of this investigation was to extend this analysis to include orientation effects, specifically gravitational. A driven current collector has been developed which allows observation of the process of ejection, as well as collection of data on the rotational speed at which ejection occurs and the torque experienced by the rotor under rotation and during ejection. For various liquids, and eventually liquid metals, data have been taken under a variety of different circumstances. The operation of the machine has been refined to remove several unexpected complications which hindered the analysis of the results.

Circuit Simulation and Signal Processing with Turbo Pascal

Researcher: Associate Professor David S. Harding
Sponsor: Naval Academy Instructional Development Advisory Committee

The main objective of this project was to design and implement several computer exercises for use in EE322, Signals & Systems, taught to junior electrical engineering majors. Four such exercises were introduced into the course during the fall semester of 1988. The educational objectives include reinforcement and extended understanding of topics and concepts introduced from the text and the furthering of computer skills. The topics chosen for these computer exercises involve signal processing, frequency response, and filtering. The student is required to write some PASCAL routines and to use others written by Borland Software Company. Typically, a signal or signals are simulated on the computer and then processed in some way; for example, filtered. In each case plots are generated and hard copies made.

The Electrical Engineering Department's Electronic Classroom is used for the Signals & Systems course. This classroom contains twelve Zenith 248 computers and several printers for use by the midshipmen. Each computer is equipped with the necessary software such as Turbo Pascal 4.0. Students have access to the Electronic Classroom during evening study hours for work on their computer exercises. All enrolled midshipmen have their own Zenith 248 in Bancroft Hall, as well as copies of Turbo Pascal, site licensed at the Naval Academy. Thus, adequate resources exist to work on the assigned computer exercises.

Characterization of Ultrasonic Transducers

Researchers: Professor Antal A. Sarkady and
Associate Professor (retired) Herbert M. Neustadt
Sponsor: Naval Research Laboratory

The aim of this research is to develop electric circuit models and measurement systems required to characterize ultrasonic transducers. The precise characterization is required to improve inspection of welds in naval shipyards. During the last year, seven transducers were characterized and modeled. The results of this study are outlined in an article currently in preparation.

SOS (Silicon on Sapphire)

Researcher: Associate Professor Tian S. Lim
Sponsor: Naval Research Laboratory

The object of the program is to gain an understanding of the effect of SOS materials preparation on the radiation hardness of high-density integrated circuits. The principal means of achieving this is the measurement of interface charge density using the high-voltage capacitance-voltage technique. In addition, the researcher is studying the change in MOSFET parameters as a function of radiation. An attempt will be made to correlate the changes in the Silicon/Sapphire interface with changes in MOSFET parameters.

Development of a Fiber Optics Course for the Electrical Engineering Major

Researcher: Assistant Professor R. Stephen Weis
Sponsor: Naval Academy Instructional Development Advisory Committee

The objective of this work is to create a fiber optics instructional laboratory to teach future naval officers to understand and intelligently employ fiber optic systems in the fleet. The laboratory will be a valuable asset in several ways. First, at the advanced undergraduate level it will provide a means of reinforcing and applying previously learned electromagnetic theory. Second, it will provide a resource for fiber optics demonstrations for several courses. Third, it would be available and could be adapted for use in training other naval personnel during short summer courses. The specifications for a laboratory work station have been developed, and the Hewlett-Packard Company is giving the Naval Academy the required equipment to begin teaching. A computer program has been developed to facilitate visualizing the modes of electromagnetic field propagation in fiber optic wave guides.

Independent Research

Computer-Aided Economic and Operational Analysis of an Airport Runway Lighting System

Researcher: Assistant Professor William Rynone

A Fixed Base Operator (airport operator and manager) is concerned with all operating costs, including runway and taxiway lighting. These costs include installation, maintenance, and electricity. Electricity costs vary with the number and intensity of lights and the number of hours per night that the system is utilized. The number of hours of utilization is a function of the season of the year. Each of these costs can be evaluated by the computer program written for this project.

The installation of a runway lighting system requires that the electrical characteristics of the installed cable and the lights perform within guidelines specified by both the Federal Aviation Administration and local electrical codes. This program enables the user to predict the voltages and currents at any location within the entire system. With this information, total electrical requirements that must be supplied by the main electrical distribution box (and thus its adequacy) can also be determined. The specification of the necessary gauge of cable is also facilitated by using this program.

Engineering Analysis and Design of a New Runway Lighting System for Lee Airport in Edgewater, Maryland

Researcher: Assistant Professor William Rynone

The report reviewed the existing runway lighting system, analyzed the overall system requirements for a new lighting system to conform to F.A.A. specifications, and estimated costs for materials, installation, and operation of the system. This report and its corresponding computer programs took several months of part-time effort to complete. It was reviewed by the Anne Arundel County electrical inspectors during their monitoring of the system installation.

Aircraft Marker Beacon Receiver Antenna

Researcher: Assistant Professor William Rynone

A marker beacon receiver aboard an aircraft is used to assist the pilot during an instrument approach. Most marker beacon antennas are surface mount units. High performance aircraft (commercial and business jets, military aircraft, and corporate aircraft), where higher equipment cost can be justified, utilize flush mount antennas to minimize drag, thereby increasing aircraft performance. Several flush mount marker beacon antennas for use in light aircraft have been built and tested. The complexity and cost of these units is such that they may be constructed and afforded by most light aircraft owners.

Design and Construction of a Marker Beacon Test Set

Researcher: Assistant Professor William Rynone

Most general aviation aircraft owners are uncertain whether their marker beacon receiver is operational. It is usually used when making an instrument approach to landing. The aircraft operator does not normally test this specialized electronic system until it is needed in performing an instrument approach to landing. A low cost test set would be a valuable "tool" for pilots who perform instrument approaches. This design and construction project is approximately half completed.

Research Course Projects

Digital Modulation Delay

Researcher: Midshipman 1/C Robert A. Kovalchik, USN
Adviser: Professor Ralph P. Santoro

A programmable digital delay line that samples a 20-20KHz band-limited audio signal at 60KHz and delays it from 1ms to 4 seconds has been designed and constructed. The design is centered on a 12-bit analog-to-digital converter and a 265K word DRAM delay memory. The application of the device is for high quality musical special effects.

Signal Aquisition Through Microprocessor Control

Researcher: Midshipman 1/C Robert A. Kovalchik, USN
Adviser: Professor Ralph P. Santoro

This work is an extension of the project entitled "Digital Modulation Delay" to include microprocessor control of the signal acquisition process and to provide general purpose digital signal processing for the acquired signal. This extended device can be operated in a stand-alone mode or through a personal computer by means of an RS232 communication port. A 68000 microprocessor with up to 512K bytes of ROM for firmware and up to 8 Mbytes of RAM provides for intelligent control for the device which is based on the NUBUS structure.

Publications

NORTHAM, Don Y., Assistant Professor, "Minimum Variance Estimation Bounds For Chirped Sinusoids," DSC Technical Report R88-023, 17 August 1988, (Unclassified, distribution limited by Director, National Security Agency).

This report presents the Cramer-Rao lower bounds on unbiased maximum-liklihood estimates of the signal parameters Ω, θ, and μ where

$$x(t) = b\cos(\Omega t + 0.5\mu t^2 + \theta) + w(t)$$

represents a linear-chirp signal with additive, white, gaussian noise. The parameter b is assumed to be known. (The assumption of known amplitude simplifies the analysis but is not required for the result.) The approach and notation used follow those of Rife and Boorstyn [IEEE Trans. IT, Vol. IT-20, No. 5, 1971], who solved the constant frequency (no chirp) problem. This report extends the work of Rife and Boorstyn to linear-chirp signals. The analysis is outlined and the results, variance bounds, and correlation coefficients for the parameters are summarized.

NORTHAM, Don Y., Assistant Professor, co-author, "A Comparison of Several Frequency Estimators For Signals With A Linearly-Swept Frequency," DSC Technical Report R88-031, December 1988, (Unclassified, distribution limited by Director, National Security Agency).

This report summarizes results of a simulation study of estimators for the two parameters (initial frequency and frequency rate) that define the frequency (as a function of time, over one interval) of a linearly-swept sinusoid in the presence of additive, white, gaussian noise. It is based on the results of the report cited above. The parameter-estimation techniques studied include a maximum-likelihood algorithm, an algorithm based on the Fast Fourier Transform, an algorithm based on the analytic-signal representation (in effect, an FM discriminator), and an algorithm that employs the Wigner-Ville distribution. The Wigner-Ville method is shown to be superior to the others over a wide range of values of signal-to-noise ratio, initial frequency, and frequency rate.

RYNONE, William J., Assistant Professor, "Does Your General Aviation Airport Need Runway Lights?," *General Aviation News*, **40, 26** (December 1988), 6, 7, 12, 14.

Many airport operators are unfamiliar with both the economic and technical considerations involved in the analysis, design, and purchase of a airport runway lighting system. This article provides guidance for individuals to assist in evaluating their airport lighting needs. Addressed are topics such as type of equipment required, installation, and operating costs. It was written on a level so that a person with a non-technical background could make informed decisions regarding needs and cost tradeoffs for a relatively expensive capital investment.

RYNONE, William J., Assistant Professor, "Spins... Why Me?," *General Aviation News*, **40, 24** (November 1988), 7.

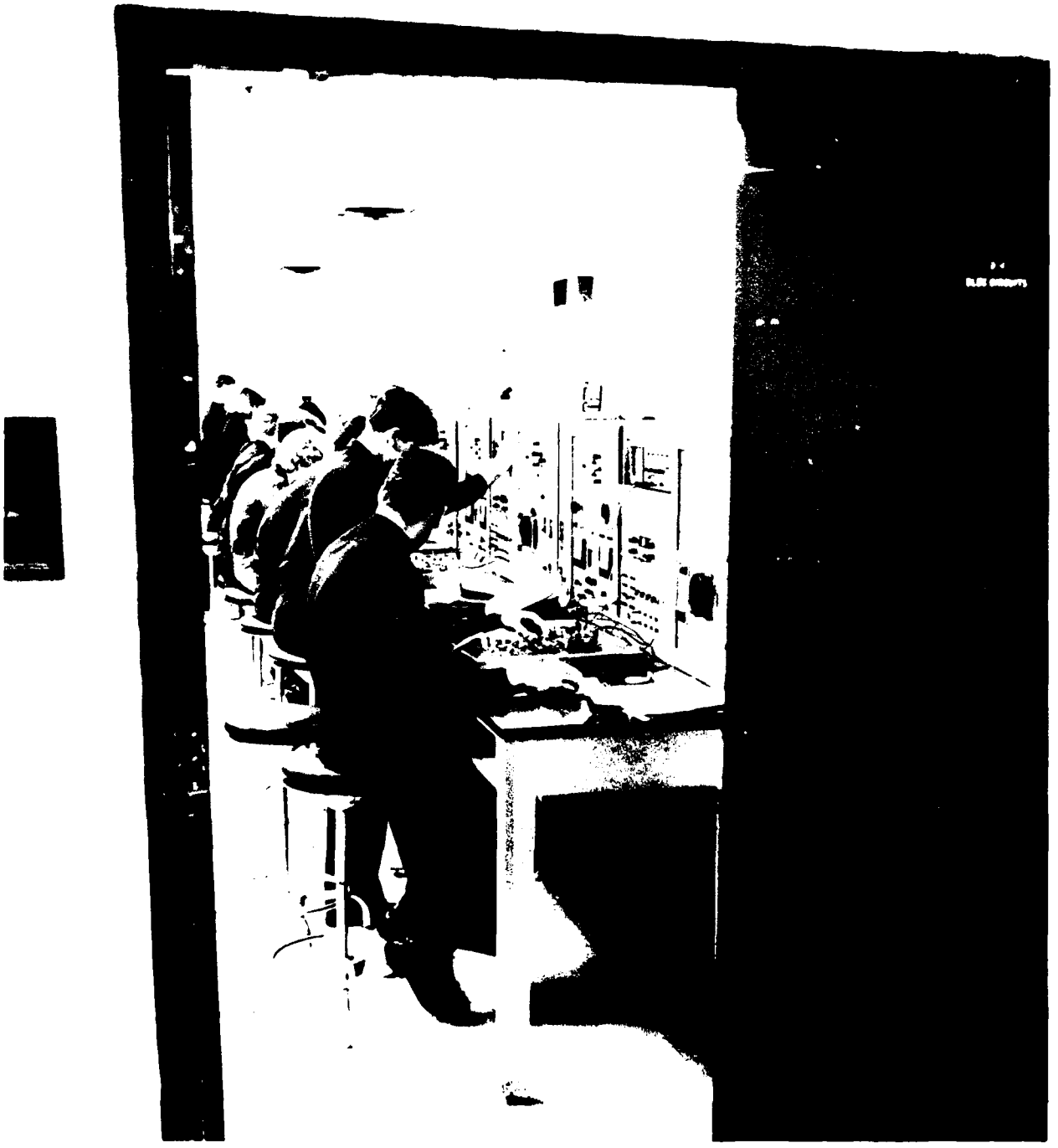
Many pilots have not experienced a "spin" aerobatic maneuver. The thrust of this article is to reassure the uninitiated that a spin is neither dangerous nor difficult to perform. Additionally, the article attempts to convince the reader that knowledge of this maneuver will assist the pilot in improving his/her flying abilities. Description of the "spin" execution and recovery are detailed so that the novice will be aware of what to expect.

RYNONE, William J., Assistant Professor, "Control," *General Aviation News*, **40, 12** (June 1988), 12.

This article deals with the growth of F.A.A. regulations that restrict the operation of general aviation aircraft. Specifically, it investigates the effects upon the general aviation pilot in operating within the proposed (by the F.A.A.) new and expanded "Terminal Control Areas (T.C.A.'s)." The proposed expansion of the T.C.A.'s includes a horizontal expansion from a 15 miles radius to a 30 miles radius and an increase in altitude from 7,000 to 12,000 feet. Additional expensive electronic equipment will be required to be installed in all general aviation aircraft operating in these T.C.A.'s.

WEIS, Robert S., Assistant Professor, "Fabry-Perot/Solc Filter With Distributed Bragg Reflectors: A Narrow-Band Electro-Optically Tunable Spectral Filter," *Journal of the Optical Society of America*, **5**, **9** (September 1988), 1565-1570.

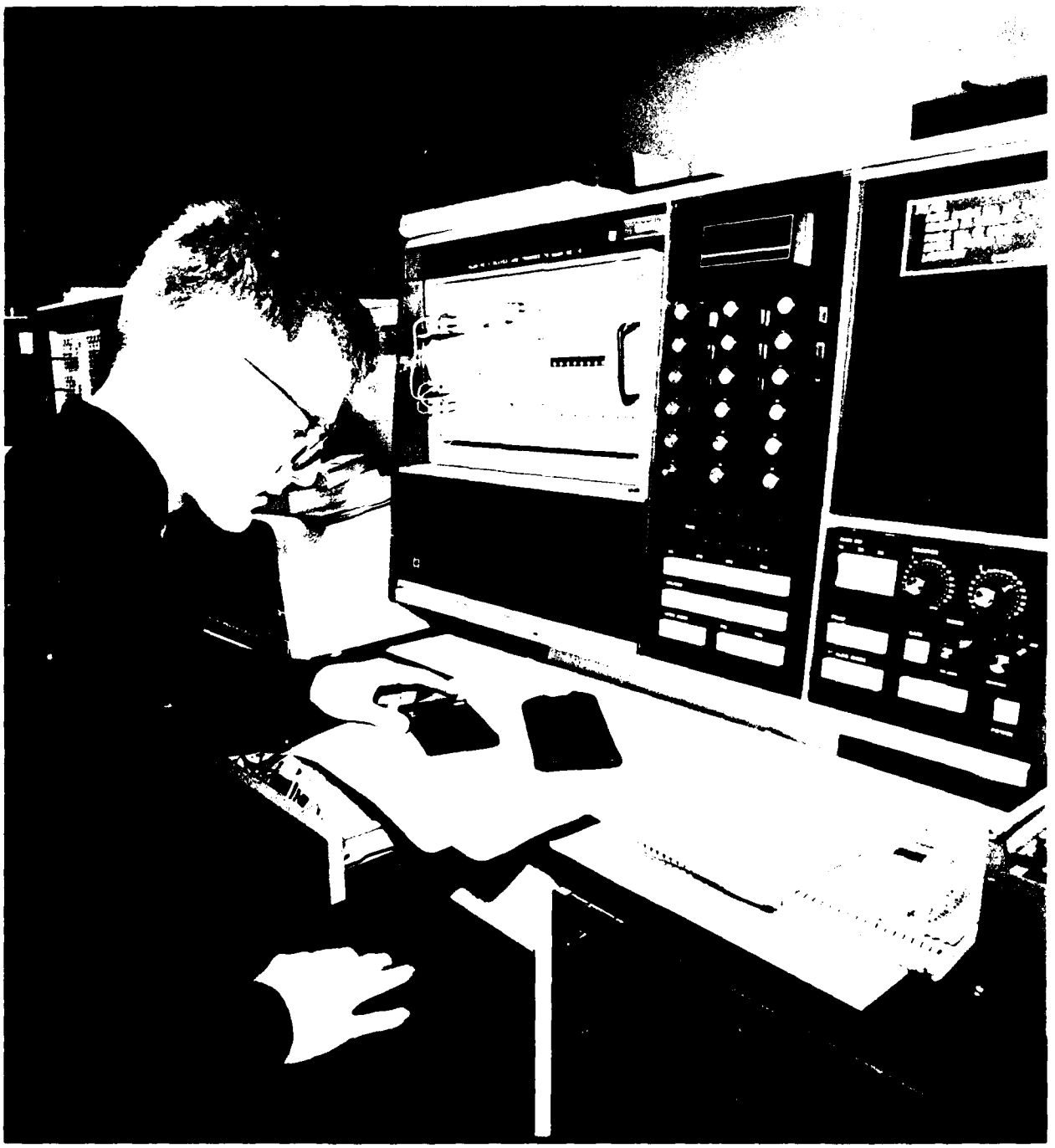
A new narrow-band (typically 0.01 nm) spectral filter called the Fabry-Perot/Solc filter, which combines the characteristics of the Fabry-Perot etalon and the folded Solc filter, was introduced recently. The design of the Fabry-Perot/Solc filter is extended to include narrow-band end reflectors to produce high-finesse spectral filters. The narrow-band end reflectors can be implemented as distributed Bragg reflectors, thus permitting tailoring of the spectral characteristics of the filter. Sample designs are presented, including one filter with an effective finesse of 5420.



Presentations

BURT, Patricia E., Assistant Professor, "A Robust Integral Processor," Fourth International Conference on Systems Research, Informantics, and Cybernetics, Baden-Baden, West Germany, 15-21 August 1988.

SARKADY, Antal A., Professor, co-author, "Online Wear Particle Monitoring Based on Ultrasonic Detection and Discrimination," Fall Conference of the American Society for Nondestructive Testing, Anaheim, California, 19-23 September 1988.



DEPARTMENT OF

Mechanical Engineering

Professor Joseph D. Gillerlain, Jr.
Chairman

Research in the Mechanical Engineering Department encompassed several areas of specialization within the broad field of mechanical engineering. These areas included thermodynamics of internal combustion engines, fluid dynamics, spacecraft mechanical and thermal design, and materials science. Specific objectives of the current research varied from computer modeling of thermodynamic cycles to advanced composites and ceramic materials research. Research was supported by a variety of sponsors, including the Office of Naval Research, the Nuclear Regulatory Commission and the David Taylor Research Center. The Academic Dean funded several faculty members on instructional development projects. In addition, some faculty pursued unfunded research in areas of personal interest.

Research efforts at the Naval Academy are driven by the need for faculty to stay abreast of rapidly changing technology and to introduce subsequently that new technology into their courses. Some updating of course material is also facilitated by seminar speakers and visiting professors. A visiting professor from David Taylor Research Center under a memorandum of understanding and a visiting professor from Southern Illinois University, under the Secretary of the Navy Fellows Program, taught fluid mechanics courses in the department this past year. The efforts of the mechanical engineering faculty to become more effective classroom teachers through their research activities are reflected by their numerous publications and presentations at national and international conferences.

Sponsored Research

Effect of Impact Loading On the Mechanisms of Crack Propagation in Ceramic Matrix Composites

Researcher: Professor Dennis F. Hasson
Sponsor: Office of Naval Research

Advanced strong and toughened ceramic matrix composite materials are impact tested in an instrumented drop tower to determine the effect of impact loading at both ambient and low and high temperatures. The effect of temperature on the crack propagation mechanism is under study. Materials include ceramics with discontinuous fibers, glass matrix materials with continuous fibers, ceramic matrix materials with continuous fibers, and ceramic matrix materials with a hybrid mix of fibers. Tests at 1000°C have been performed. The results will be analyzed and presented at symposia and in journal articles. Supporting optical and scanning electron microscope fractography will also be performed.

Impact Behavior of Advanced Aluminum Alloys

Researcher: Professor Dennis F. Hasson
Sponsor: Naval Surface Warfare Center, White Oak Laboratory

Instrumented impact of advanced aluminium alloys has been performed. The materials result from various powder metallurgy processes such as mechanical alloying. The data are reduced and analyzed. Supporting metallography and scanning electron microscope fractography are also performed, and the results applied to an Advanced Materials Program database.

DCI Drop Test Study

Researcher: Professor James A. Joyce
Sponsor: Battelle Memorial Institute, Columbus Laboratory

Ductile cast iron is a proposed material for use in casks to transfer and store commercial nuclear power plant fuel waste. This material can fracture brittlely under conditions of high loading rate and low temperature. Tests are being conducted to evaluate the potential usefulness of this material for nuclear waste cask applications.

Nuclear Containment Flaw Acceptability Development

Researcher: Professor James A. Joyce
Sponsor: U.S. Nuclear Regulatory Commission

The ASME Section II has been developing new standards for acceptance of older nuclear plants which fail Charpy Surveillance requirements. Recent research done at the U.S. Naval Academy has shown that these standards are not acceptable and would not assume continued safe operations. Serious controversy has developed, and much work is being expended by many people to resolve this situation. Both experimental and analytical work is funded by the U.S. Nuclear Regulatory Commission at USNA and David Taylor Research Center to substantiate the present work and to develop new procedures for containment vessel integrity verification.

Air Standard Gas Turbine Cycles

Researcher: Professor Vincent J. Lopardo
Sponsor: Naval Academy Instructional Development Advisory Committee

An interactive program was developed for use on the personal computer, and several modifications were included to broaden the software's ranged application. The program uses air as an ideal gas with variable specific heats and USES units. The program may be used for the air standard Brayton Cycle, Brayton Cycle with regeneration, Brayton Cycle with Reheat, Air Standard Brayton with two stage compression, Brayton Cycle with 2-stage compression and regeneration, Air Standard Brayton with two stage compression regeneration, and reheat.

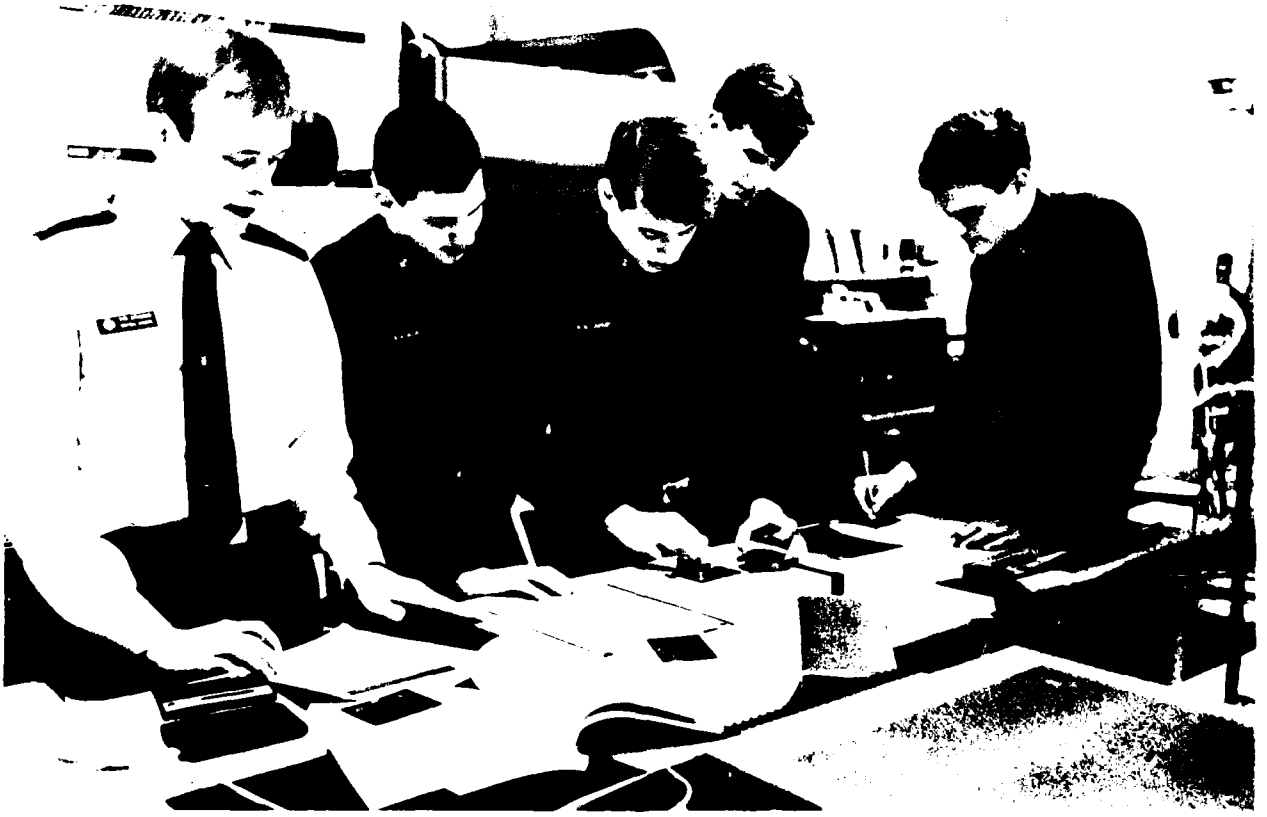
Condition-Based Maintenance

Researcher: Professor Russell A. Smith
Sponsor: Naval Sea Systems Command

The objective was to review state-of-the-art in condition-based maintenance to determine opportunities and need for supporting this technology in undergraduate curricula.

It was identified that the technology rests strongly on computer-based data collection and analysis. The most widely developed application occurs in vibration monitoring, where accelerometers and sequal processing software have been highly effective in identifying and isolating faults in rotating machinery. A second application is the dynamic calculation of system-wide performance indices such as overall plant efficiency or specific fuel consumption.

Finally, it was noted that the Mechanical Engineering curriculum should give increasing attention to support of this technology through continued emphasis on instrumentation in the laboratory environment and with increasing emphasis on use of computers in the laboratory.



Independent Research

Fractal Scaling in the Wake of a Circular Cylinder

Researcher: Assistant Professor Shirley T. Fleischmann

In the past few years chaos theory has emerged as one of the most promising new mathematical tools to describe non-linear systems. Turbulent fluid flows and fluid-structure interaction are non-linear problems, for which chaos modeling and fractal geometry hold great promise. Flow around circular cylinders is a classic problem; yet a problem which is not fully understood. The flow is very well documented and can be separated into distinct flow regimes characterized by the appearance of the wake. As the Reynolds number increases, disturbances at smaller and smaller scales enter the wake progressively.

The present research is focused on evidence of fractal scaling in the progressing of flow around cylinders--beginning with the first appearance of the periodic wake and extending to the transition to turbulence in the boundary layer. Evidence was found for a 3-frequency transition to turbulence (chaos) which parallels the transition to turbulence reported for Taylor-Couette flow. Future research will involve a verification of the transition to turbulence modeling and an extension of the modeling for flow around stationary cylinders to the highly non-linear problem at flow-induced structural vibration.

Combined Fracture Test Standard Data Development

Researchers: Midshipman 1/C Ronald T. Snudz, USN, and
Professor James A. Joyce

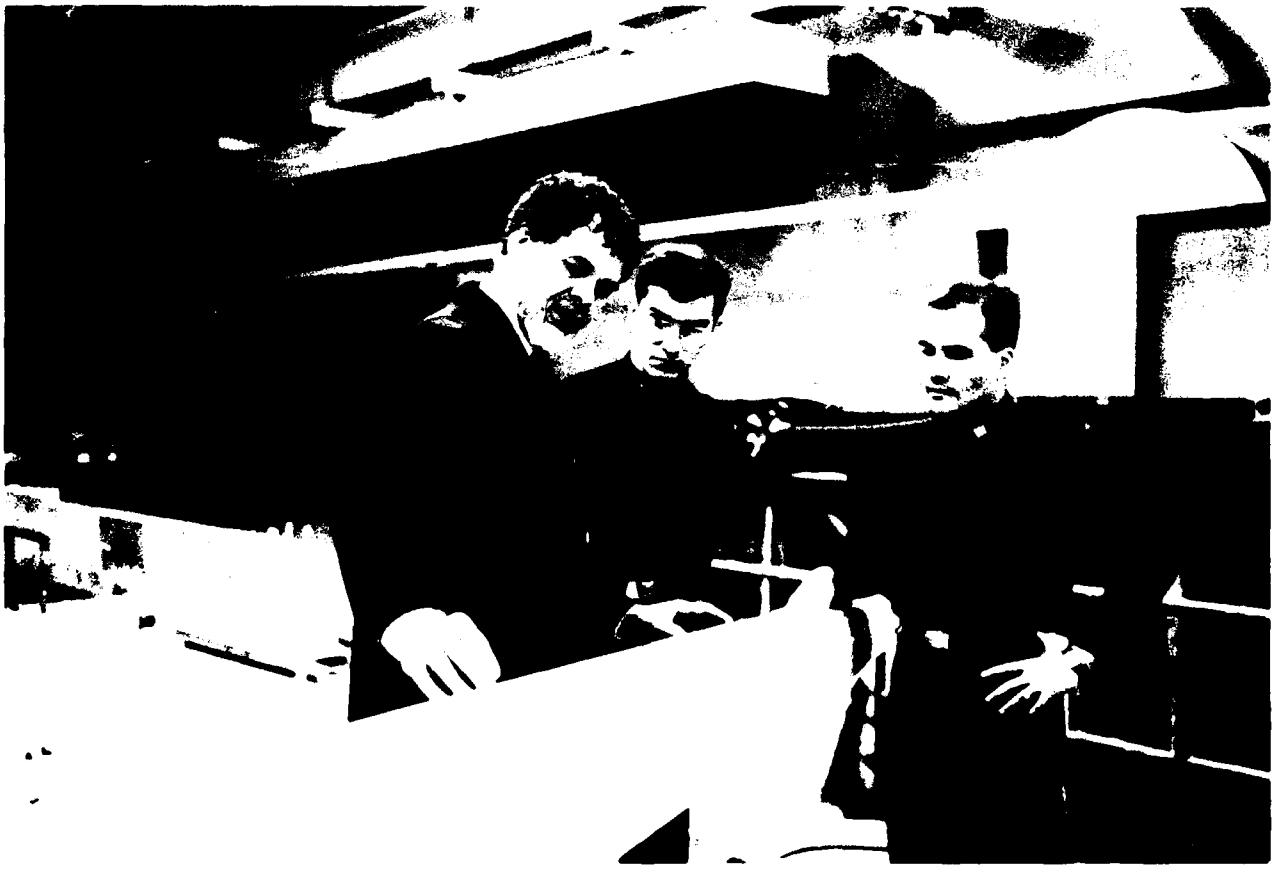
A new American Society for Testing and Materials test standard for fracture mechanics has proposed several changes in specimen type and crack size. These changes appear reasonable from an analysis point-of-view, but need verification experimentally. This work is developing some of the data needed before these changes can be incorporated in the new ASTM standard.

Research Course Projects

On Line PC-Based Internal Engine Combustion Measurements and Analysis

Researcher: Midshipman 1/C Robert P. Saunders, Jr., USN
Adviser: Professor Eugene L. Keating

The analysis of an internal combustion engine is an extremely difficult task. A spark ignition engine can operate in excess of 10,000 rpm and is influenced by many factors. Because of the speed at which reactions occur during a cycle and the many variables, simply reading a value off a dial or meter cannot accurately describe what is happening inside the engine. Through the use of a computer functioning as a data sampler and data analyzer, accurate analysis of what is occurring inside the engine is obtained. One software package available that will perform these functions is the ECA 872 Engine Cycle Analyzer, written by Power and Energy International, Inc. This software is a personal computer-based operator interactive engine analyzer and cycle simulator that can make a mechanical analysis and determine combustion performance of a running engine. It is intended to use this software to make analyses of engines in Rickover Hall. The purpose of this project was to investigate the operation and capabilities of the software package.



Publications

ADAMS, Alan J., Professor, "Descriptive Geometry and Geometric Modeling," *The Engineering Design Graphics Journal*, **52**, 3 (Autumn 1988), 1-11.

The combination of descriptive geometry with geometric modeling provides new possibilities for creative design. This paper suggests a modern, integrated approach to give a foundation for spatial reasoning and computer solutions to geometry problems. This is necessary for working in the computer-aided design environment available to the engineering profession today. It also prepares one for later study in advanced geometric modeling and computational geometry related to curve, surface, shape, and solid model definitions.

Vectors are used to represent points, lines, and planes in space. Operations such as dot-product, cross-product, and scalar triple product computer expand the traditional methods of descriptive geometry problems. The computer expands the traditional methods of descriptive geometry through its ability to analyze rapidly large amounts of data, to improve accuracy, and to solve complex problems.

The definitions of geometric concepts such as points, lines, and planes are discussed from both a graphical and mathematical point of view. Although commercial software can also be used to generate solutions to typical problems, students must first learn to cope with the three-dimensionality of a design problem, especially when a computer does the graphics display work.

Geometry is still the proper foundation for an engineering or technology education. It should be a package of descriptive, analytical, and computational methods based on spatial reasoning and three-dimensional geometric modeling.

BLANK, David A., Lieutenant Commander, USN, co-author, "Conjugate Conduction-Convection Heat Transfer Model For Four-Stroke Heat-Barrier-Piston Engines," *Numerical Heat Transfer*, **A, 15** (1989), 357-382.

A numerical model for conjugate conduction-convection heat transfer in a four-stroke heat-barrier-piston engine has been developed. The system boundaries were extended beyond the flow to fixed distances within the piston and cylinder linings. The model was used to simulate the compression stroke and fuel injection portion of the power stroke of a four-stroke engine cycle. Final runs involved a 20 x 26 mesh to solve the conjugate heat transfer problem in the large region made up of the flow field and a thin portion in the adjacent cylinder linings. A smaller mesh was used for other flow field calculations inside the interior boundary of the cylinder linings and piston. The engine was modeled with the fuel injector co-located with a single valve, making possible an axisymmetric solution. The effects of swirl were not considered. It was found to be convenient to divide the flow field into three regions: one fixed in space with time, one utilizing a stretching and compressing computational mesh, and one moving with time without stretching-compressing.

FLEISCHMANN, Shirley T., Assistant Professor, "A Study of Flow-Induced Vibrations On Cylinders," *Ocean Engineering*, **15, 3** (1988), 249-259.

The purpose of this experiment is to measure the increased steady drag on cylinders vibrating due to flow-induced periodic forces in cross flow. Geometric factors and flow characteristics which affect lock-in or wake capture are also identified. Measurements are made for circular cylinders and for square cylinders at 0° and at 45° angles of attack. Results are over a Reynolds number range of 4000-8000. Lock-in occurs for the circular cylinder and for the square cylinder at a 45° angle of attack. In both cases a drag increase is measured; however, the drag increase for the circular cylinder is far more amplitude and frequency dependent than it is for the square cylinder. Lock-in does not occur for the square cylinder at 0° angle of attack; instead, the flow field causes a twisting motion, and a drag decrease is observed. The sharp edge (to define the flow separation point) and the orientation to the flow direction for non-circular shapes are identified as geometric factors important to lock-in. Near-flow field disturbances--specifically the presence of a transition to turbulence point in the near wake and the initial spacing of the vortices in the near wake--are identified as flow field characteristics which strongly affect the drag coefficient.

FLEISCHMANN, Shirley T., Assistant Professor, "On the Importance of Mathematical Visualization Skills to Engineering Problem Solving," *Proceedings* of 1988 ASEE Annual Conference, pp. 2176-2178.

Mathematical modeling of physical systems is a key step in the engineering problem-solving process if precise predictions are to be made about those systems. A visual understanding (mental pictures) of the mathematics involved is fundamental to the modeling process and is also necessary for the estimation of results. Many of today's students lack visual understanding of mathematics. Such students are often able to solve a problem analytically if the model is given; however, they are unable when no visual cue is provided. A sample test for visual skills is presented, and reasons for the current lack of visual skills are explored.

FLEISCHMANN, Shirley T., Assistant Professor, "Using The Laboratory To Teach Engineering Problem Solving," *Proceedings* of 1988 ASEE Annual Conference, pp. 2169-2171.

Classroom work typically (and necessarily) involves mainly modeling and solution; often solution methods are emphasized once a model has been posed. The laboratory offers an opportunity to broaden the problem solving experience to involve elements of the remaining steps. This idea is illustrated using an approach developed for the laboratory as part of a first engineering fluid mechanics course.

HASSON, Dennis F., co-author, "Fracture Strength and Toughness due to Impact of Fibre-reinforced Glass Matrix Composites," *Proceedings* of the Ninth International Symposium on Metallurgy and Materials Science, 5-9 September 1988.

Ceramic matrix composites with continuous fiber in glass matrices were tested with instrumented impact apparatus. The composite architectures were unidirectional (0°) and crossply (0/90°) laminates; interlaminare and edge on orientation specimens were tested. An orientation dependence was observed. The CMC material with a weaker fiber/matrix interfacial bond had longer fiber pullout and hence, due to the frictional sliding mechanism, higher dynamic work to fracture. In the fracture toughness discussion it is suggested that the use of the dynamic rupture work is a more meaningful parameter than the linear elastic stress intensity factor for laminated composite materials.

HASSON, Dennis F., co-author, "Nondestructive Evaluation of Temper Embrittlement in HY80 Steel," Review of Progress in *Quantitative Nondestructive Evaluation*. Vol. 7b, eds. Donald O. Thompson and Dale E. Chimenti. New York: Plenum Press, 1988, .

This study shows that magnetic and magneto acoustic properties of HY80 appear to be influenced by temper embrittlement. A preliminary model has been developed based on the concept that the same segration of tramp materials at grain boundaries that causes temper embrittlement also increases grain boundary resistance to domain wall motion. This increased resistance of grain boundaries to magnetic domain wall motion causes an increase in the number of larger AE events generated by magneto-acoustic emission as observed experimentally. Additional testing is required to broaden the science base for this work and is to include characterizing stress effects and temperature effects. Also, test samples from an HY80 casting having different metallurgical characteristics such as grain size and impurity concentrations are being obtained for comparison of measurement results.

JOYCE, James A., Professor, co-author, "Ductile Crack Extension in Compact Specimens at Limit Load," *Proceedings* of the Seventh International Conference on ICF7 Fracture, Houston, Texas, 20-24 March 1989, pp. 349-358.

The deformation field of a cracked specimen fabricated from a highly ductile material is affected by the geometry of the specimen far from the crack tip and by the details of loading. In this case crack extension is defined by plastic rotation of specimen or structure sublements, i.e., specimen halves, and occurs strictly at limit load; it cannot be predicted with single-parameter singularity solutions. Definition of the boundary between elastic-plastic behavior in which singularity parameters might control crack extension and plastic behavior where structure deformation defines crack extension is an important problem in ductile fracture mechanics.

In a first step towards such a distinction, limit load equations reported in the literation for compact specimens [C(T)] are reviewed, modified as needed, and then used to predict the measured load versus crack extension behavior of compact specimens of different size, initial crack length, and type of steel.

JOYCE, James A., Professor, "Recent Developments in Drop Tower J Integral Testing of Elastic Plastic Structural Steels," *Proceedings* of the Seventh International Conference on Fracture, Houston, Texas, 20-24 March 1989, pp. 197-204.

During the past six years a test method has been developed for dynamic testing of fracture mechanics specimens which is specifically designed for application to the upper transition temperature range. The method uses drop tower loading rates of 2.5 m/sec and obtains a J_{Ic} or a J-R curve using an analytical key curve approach verified by initial and final crack length measurements obtained from the fracture surface. A J-R curve is obtained from each specimen and contains crack growth corrections so that it is directly comparable with static results obtained in accordance with the ASTM E1152 J-R curve test method. Static test results have shown that the J at cleavage initiation (which is presently an unstandardized quantity) is specimen a/W independent throughout the ductile to brittle transition, but of course demonstrates considerable statistical scatter in the vicinity of the ductile upper shelf.

Dynamic J-R tests have shown an increase in J_{Ic} with test rate for most, but not for all, materials. Separation of J into elastic and plastic components shows that the elastic J component increases with loading rate in a fashion consistent with the materials tensile sensitivity to loading rate, but the plastic J component decreases with loading rate--an apparent visco-plastic phenomena. For A106 steel the plastic J decrease exceeds the elastic J increase and the upper shelf toughness falls--while the other materials have demonstrated a relatively larger increase in the elastic J component and a smaller decrease in the plastic J component, giving an overall increase in upper shelf toughness.

JOYCE, James A., Professor, "Development of a Criterion for the Effect on the J-R Curve of Elastic Unloadings," *Fracture Mechanics: Eighteenth Symposium*, ASTM STP 945, D. T. Read and R. P. Read eds., American Society for Testing and Materials, Philadelphia, Pennsylvania, 1988, pp. 647-662.

A criterion is proposed which allows estimation of the fraction of cyclic damage which would be expected from a given number of partial or complete unloadings applied during the course of a J-R curve fracture toughness test. The criterion requires both geometry and materials inputs, but for the special case of a steel compact specimen, an upper-bound criterion is developed and presented graphically.

Data from a series of compact specimens of a 3% nickel alloy steel are used to verify both the model used and the resulting fractional damage criterion developed.

WU, Chih, Professor, "Engineering Performance Bound of an Irreversible Heat Engine," *The Journal of Energy Conversion and Management*, **28, 3** (1988), 207-209.

The maximum power and efficiency at the maximum power of an irreversible heat engine are treated. The time factor is considered in the energy exchange between the heat engine and its surroundings. Literature in time-energy conversion is surveyed. It is found that the efficiency of the irreversible heat engine at its maximum power provides an engineering performance bound for practical engineers.

WU, Chih, Professor, "Finite-Time Thermodynamics and its Potential Naval Shipboard Application," *Naval Engineers Journal*, **101, 1** (January 1989), 35-39.

Maximum power and the efficiency at the maximum power of an irreversible heat engine are treated. When time is explicity considered in the energy exchanges between the heat engine and its surroundings, it is found that there is a bound on the efficiency of the real heat engine at the maximum power condition. This bound can guide the evaluation of existing naval shipboard energy conversion or influence design of future shipboard heat engines.

WU, Chih, Professor, "Power Optimization of a Finite-Time Carnot Heat Engine," *The International Journal of Energy*, **13, 9** (1988), 681-687.

The power output of a simple, finite-time Carnot heat engine is studied. The model adopted is a reversible Carnot cycle coupled to heat sink by heat transfer. Both the heat source and the heat sink have finite heat-capacity rates. A mathematical expression is derived for the power output of the irreversible heat engine. The maximum power output is found. The maximum bound provides the basis for designing a real heat engine and for a performance comparison with existing power plants.

WU, Chih, Professor, "Probabilistic Modeling and Finite-Element Formulation for Thin Lubrication and Gap Heat Conduction," *Journal of Computers and Structures*, **30, 4** (1988), 875-882.

As two rough surfaces approach each other, the in-surface asperities begin to contact at a discrete number of points. The real contact increases as the applied load increases. The degree of contact, which is a strong function of the number and nature of surface asperities, has a significant influence on the heat conduction behavior across the contacting gap and on the carrying capacity of a lubricated bearing.

This paper presents a stochastic finite element formulation in which effects due to the interference of asperities are included in the form of a truncated probability density function. The conventional heat conduction equation and Reynold's equation are modified. The work introduces the finite element method into the realm of stochastic processes and may help to resolve such problems as gap heat conduction and film lubrication where discrete microscopic effects cannot be ignored, and where using each finite element as a continuum fails.

Presentations

ADAMS, Alan J., Professor, "Geometric Modeling," ASEE Engineering Design Graphics Division, New Harmony, Indiana, 21 November 1988.

HASSON, Dennis F., Professor, "Impact Behavior of Fiber-Reinforced Glass and Ceramic Matrix Composites," Canadian Institute of Metallogists, Montreal, Canada, 17 August 1988.

JOYCE, James A., Professor, co-author, "Adhesive Fracture Testing," Twenty-first National Symposium on Fracture, Annapolis, Maryland, 28-30 June 1988.

JOYCE, James A., Professor, co-author, "Application of the J-Integral and the Modified J-Integral to Cases of Large Crack Extension and High Toughness Levels," Twenty-first National Symposium on Fracture, Annapolis, Maryland, 28-30 June 1988.

JOYCE, James A., Professor, "Extension and Extrapolation of J-Resistance Curves/Status as of November 1988," ASTM Com[illegible] Meeting, Atlanta, Georgia, 7 November 1988

JOYCE, James A., Professor, "J_d/J_m Resistance Curves--Summary and New Results," USNRC J Applications Meeting, David Taylor Research Center, Annapolis, Maryland, 23-24 August 1988.

JOYCE, James A., "Extrapolation of J-Resistance Curves for Flawed Vessel Analysis," ASME Boiler and Pressure Vessel Committee Meeting, Colorado Springs, Colorado, 30 August 1988.

JOYCE, James A., Professor, "J-R Extrapolation Effects on J/T Analysis of Flawed Vessels," J_d/J_m Working Group, David Taylor Research Center, Annapolis, Maryland, 10 January 1989.

JOYCE, James A., Professor, co-author, "Ductile Crack Extension in Compact Specimens at Limit Load," Seventh International Conference on Fracture, Houston Texas, 20-24 March 1989.

JOYCE, James A., Professor, " Recent Developments in Drop Tower Testing of Elastic Plastic Structural Steels," Seventh International Conference on Fracture, Houston, Texas, 20-24 March 1989.

JOYCE, James A., Professor, "Evaluation of the Effects of Reverse Loading Cycles on the Crack Growth Resistance of an HSLA Steel," Third CF/CRAD Meeting on Research in Fabrication and Inspection of Submarine Pressure Hulls, Halifax, Nova Scotia, Canada, 7 June 1989.

SMITH, Russell A., Professor, "State-of-the-Art in Algorithms and Data Collection Techniques for Accident Reconstruction," Society of Automotive Engineers/Col. Stapp Car Crash Conference, Atlanta, Georgia, 16 October 1988.

WU, Chih, Professor, "Power Simulation of an Irreversible Direct Gas-Cooled Nuclear Reactor Plant," ISMM International Conference of Mini-and Microcomputers, Miami Beach, Florida, 14-16 December 1988.

WU, Chih, Professor, "Power Optimization of a Central Tower Solar Thermal Electric Plant," Manila International Symposium on the Development and Management of Energy Resources, Manila, Philippines, 26-29 January 1989.

WU, Chih, Professor, "Computer Graphic Simulation of the Production and Consumption of Energy Reserve," Manila International Symposium on the Development and Management of Energy Resources, Manila, Philippines, 26-29 January 1989.

WU, Chih, Professor, "Computer Graphical Simulation and Design of Real Steam Power Plants," International Symposium of Computer Applications in Design, Simulation, and Analysis, Reno, Nevada, 22-24 February 1989.

WU, Chih, Professor, "Potential Application of Satellite Education in China," Fourth World Conference on Continuing Engineering Education, Beijing, China, 17-19 May 1989.

DEPARTMENT OF

Naval Systems Engineering

Commander Michael D. May, USN
Chairman

The Naval Systems Engineering Department conducted scholarly research and professional development most vigorously in all three disciplines of naval architecture, marine engineering, and ocean engineering during the academic year 1988-1989. Faculty members and midshipmen took part in numerous sponsored research activities, including the Trident Scholar Program. A number of faculty members participated in nonfunded research and directed senior midshipmen in their research activities, utilizing the excellent laboratory and computer facilities available to this department.

The department continued to participate actively in professional society meetings and conferences, both nationally and internationally. Research results have been published in journals and other technical publications, or presented at national and international seminars. The outcome of the department's deep involvement in research by the civilian and military faculty members is reflected in the academic environment in the classroom for professional and major courses.

Research themes of the department faculty were varied. They include nuclear power plant sensor calibration, wave group studies, computer-aided design, beach erosion studies, maintenance and inspection strategies, ship stability and motion, life support systems, reliability centered maintenance, dosimeter response, viscous drag reduction, and wave energy conversion.

Research funding was made available from many sources including department operating funds and contracts and grants from various research organizations such as the Naval Academy Research Council, Office of Naval Research, Defense Advanced Research Projects Agency, N. I. Army Corps of Engineers, Naval Facilities Engineering Command, Defense Systems Management College, David Taylor Research Center, Naval Coastal Systems Center, Naval Sea Systems Command, and the Naval Medical Command.

Sponsored Research

Development of a Single Method for the Response Time Testing of Temperature, Pressure, and Neutron Sensors used in Nuclear Power Plant Reactors using Perturbation Method

Researcher: Assistant Professor Steven A. Arndt
Sponsor: Naval Academy Research Council (ONR)

A nuclear reactor has associated with it many sensors used as inputs to safety and control systems. It has been long recognized that these sensors need to be calibrated and checked on a regular basis. Up until the late 1970's these tests and calibrations were done primarily on the sensors' static property (e.g., sensitivity or drift). In the last 10 years a realization has been made that to ensure the safe and efficient operation of these reactors, the dynamic properties of these sensors must be periodically tested. The most important of these dynamic properties is the response time of the sensor to a change in the parameter it is measuring. The most important such sensors are the pressure, temperature, and neutron sensors. The Nuclear Regulatory Commission recently mandated testing of the response time of pressure, temperature, and neutron sensors in safety systems in all commercial nuclear power plants. However, there still does not exist a universally accepted way of measuring the response time of these sensors in-situ.

A method for in-situ testing of temperature sensors (mainly RTD's) was developed in the late 1970's which used a voltage perturbation in the sensor line to artificially heat the sensor, to simulate the effect of a step change of the temperature seen by the sensor.

The simulated response time is then converted to true response time by looking at the transfer functions of the sensor to a true step response and that of the simulated step. This analysis will be a simple algebraic one in frequency space. These methods are now used in a small fraction of nuclear power plants in this and other countries.

Methods using the perturbation techniques have been developed by the author and others for pressure and neutron sensors. These have not found use in the industry because of their complexity and the fact that they have not yet been proven, among other reasons.

Wave Group Studies

Researchers: Professor Thomas L. Dawson, Assistant Professor David L. Kriebel, and Louise A. Wallendorf, Ocean Engineering
Sponsor: Office of Naval Research

Wave group statistics were evaluated based on data obtained in the Naval Academy's large wave towing tank, for the purpose of evaluating exiting wave group theories, and developing an empirical description of wave group properties. The project was completed in FY88 with USNA report entitled "Experimental Study of Wave Groups in Deep-Water Random Waves." A follow-up study has been started under ONR sponsorship to consider wave group properties for deep-water breaking waves.

An Integrated Computer-Aided Hull Form Design Package for Mission Effectiveness Analysis at the U. S. Naval Academy

Researchers: Professor Bruce Johnson, Associate Professor Gregory J. White, and Assistant Professor Nickolaos Glinos, (Computer Science Department)
Sponsor: Defense Advanced Research Projects Agency (DARPA)

This project is a collaborative research with industry effort to enhance an existing computer-aided hull form design analysis used by two recent Trident Scholars and all the Naval Architecture majors in the Class of 1988. The existing system was developed under contract by Design Systems and Services, Inc. and SAIC, Inc., both of Annapolis. The current contract calls for members of the Naval Academy faculty to work with the developers of the system to integrate the hull geometry codes with the various analysis codes proposed for the new system. These analysis codes include an existing slender body resistance code which requires improvements in the sinkage and trim calculations, a set of resistance codes based on historical databases, a linear seakeeping code to be developed by SAIC, a non-linear seakeeping code to be developed by super-computer, a simplified structural design and analysis code to be developed by Professor White, and various design criteria evaluation codes to be developed by the whole team. The project is funded for three years, ending in September 1990.

Engineering Methods for Cross-Shore Beach Profile Response

Researcher: Assistant Professor David L. Kriebel
Sponsor: U. S. Army Corps of Engineers

This project involves an extended literature search to summarize available methods for predicting erosion and accretion of open-coast sand beaches in response to wave and water level conditions. Results will be summarized in a recommended set of methods [state of the art] which can be published as a design manual by the Corps of Engineers.

Single Point Mooring Model Test

Researcher: Assistant Professor David L. Kriebel
Sponsor: Naval Facilities Engineering Command

Model tests will be carried out in the USNA large towing tank to supplement experiments completed in 1988. The purpose of the experiments is to determine viscous damping coefficients for a Naval combatant, as well as a Naval Auxiliary ship, while undergoing slow "fish tailing" motions as a single point mooring in wind and currents. The laboratory results will be used in a numerical model to simulate these low-frequency ship motions and, in turn, to simulate forces on the moving line and anchor.

Defense Maintenance Inspection Strategies

Researcher: Associate Professor Robert H. Mayer, Jr.
Sponsor: Defense Systems Management College

An inherent responsibility of the defense establishment is to maintain numerous defense facilities (e.g., men, money, material). The facility inspection is the first line of defense against deteriorating equipment and structures. Facility claimants must necessarily choose among facilities to inspect, intervals between inspections, and type and extent of such inspections. Given budgetary and other resource limitations, inspection data will be more limited and less reliable than desired.

The purpose of this research effort is to explore development of a stochastic, techno/economic decision model which accounts for facility deterioration, life-cycle costs and benefits, and inspection resource constraints to assist program managers in these critical inspection decisions.

An Experimental Investigation into the Stability and Motions of a Damaged SWATH Ship

Researcher: Professor Bruce C. Nehrling
Sponsor: David Taylor Research Center, Annapolis Laboratory

The objective of this experimental work was to observe the stability and seakeeping characteristics of a dead-in-the-water scale model of the SWATH T-AGOS 19 before and after simulated flooding had occurred.

A 1:22 scale model of the T-AGOS 19 was tested in three separate conditions: intact, with simulated flooding of the starboard strut and demi-hull near the stern, and with simulated flooding of the starboard strut and demi-hull toward the bow. In each of these three conditions the untethered model was subjected to both moderate and severe, irregular, long crested seas. In each sea state the model was positioned to experience head seas, following seas, and beam seas. Roll and pitch motions were measured with a gyroscope. The general behavior of the model was observed and recorded on video tape.

Life Support Concepts for Navy Undersea Special Warfare Applications

Researcher: Associate Professor Marshall L. Nuckols
Sponsor: Naval Coastal Systems Center, Panama City, Florida

As part of the continued effort to develop improved life support capabilities for the Navy Special Warfare community, the following areas were evaluated to identify potential design concepts:

1) Review the design history and past performance of divers' cold water gloves, and recommend a glove configuration for the Diver Thermal Protection System (DATPS);

2) Evaluate design alternatives and recommend design options for upgrading the Dreager Lar V Oxygen Rebreather to give a 4-hour mission capability in cold water;

3) Evaluate a passive thermal protection system alternative using a suit/intersuit concept to maintain diver thermal protection during prolonged, cold-water missions;

4) Evaluate the long term storage behavior of LiOH used in closed-circuit UBA's; and

5) Review CO2 canister performance data for the Draeger Lar V when using HP Sodasorb, and recommend alternative absorbents.

Reliability Centered Maintenance

Researcher: Associate Professor Kenneth L. Tuttle
Sponsor: Naval Sea Systems Command

As Coordinator for the EN300 course and as Director of the Marine Propulsion Labs, the researcher intends to use fleet type maintenance monitoring equipment in the labs to introduce current maintenance practices to both engineer and non-engineer alike. The labs being fitted to demonstrate and teach equipment condition monitoring are the 71 series GM Diesel Lab and the Steam Plant.

The Behavior and Capabilities of Lithium Hydroxide Carbon Dioxide Scrubbers in a Deep Sea Environment

Researcher: Midshipman 1/C Jennifer R. Jaunsen, USN
Adviser: Associate Professor Marshall L. Nuckols
Sponsor: Trident Scholar Program and Naval Coastal Systems Center

Lithium hydroxide, an alkali-metal hydroxide which is gaining increased acceptance in the diving community for carbon dioxide absorption, was investigated for long-term storage behavior. In addition, methods for predicting canister durations using canister weight gain and exit gas stream temperatures were explored. Control canisters containing 86.5 gm of anhydrous lithium hydroxide (LiOH) were injected with 3.5% carbon dioxide in air mixtures to give a gas dwell time of 1.8 sec at 1.0 ATA, 27 degrees C. Chemical utilization recorded for canister breakthrough (defined as 0.5% carbon dioxide in canister effluent gas stream) was 93.4 $\pm$ 0.5%. Exit gas stream temperature and canister weight gain at breakthrough were 80.5 $\pm$ 1.1 degrees C and 35.2 $\pm$ 1.0 gm, respectively. The good repeatability shown by these control canister tests was not observed with lithium hydroxide that had been stored in an unsealed shipping container for approximately 2 years. Under the same test conditions as the control canisters, chemical utilization for the stored LiOH varied from 49.5% to 95.8% with a mean of 75.3%. Although lower than the control canister tests, the exit gas stream temperatures recorded at breakthrough were found to be repeatable at 44.0 $\pm$ 0.3 degrees C. The performance degradation seen for the stored LiOH is attributed to absorbed moisture during storage; pre-test canisters weighed approximately 28% more for the stored LiOH, However, degradation was found to be reversible by drying the LiOH for 24 hours at 55 degrees C prior to testing.

Evaluation of Bubble Dosimeter Response to Neutron Radiation

Researcher: Midshipman 1/C Eric J. Reilly, USN
Adviser: Professor Martin E. Nelson
Sponsor: Trident Scholar Program and Naval Medical Command

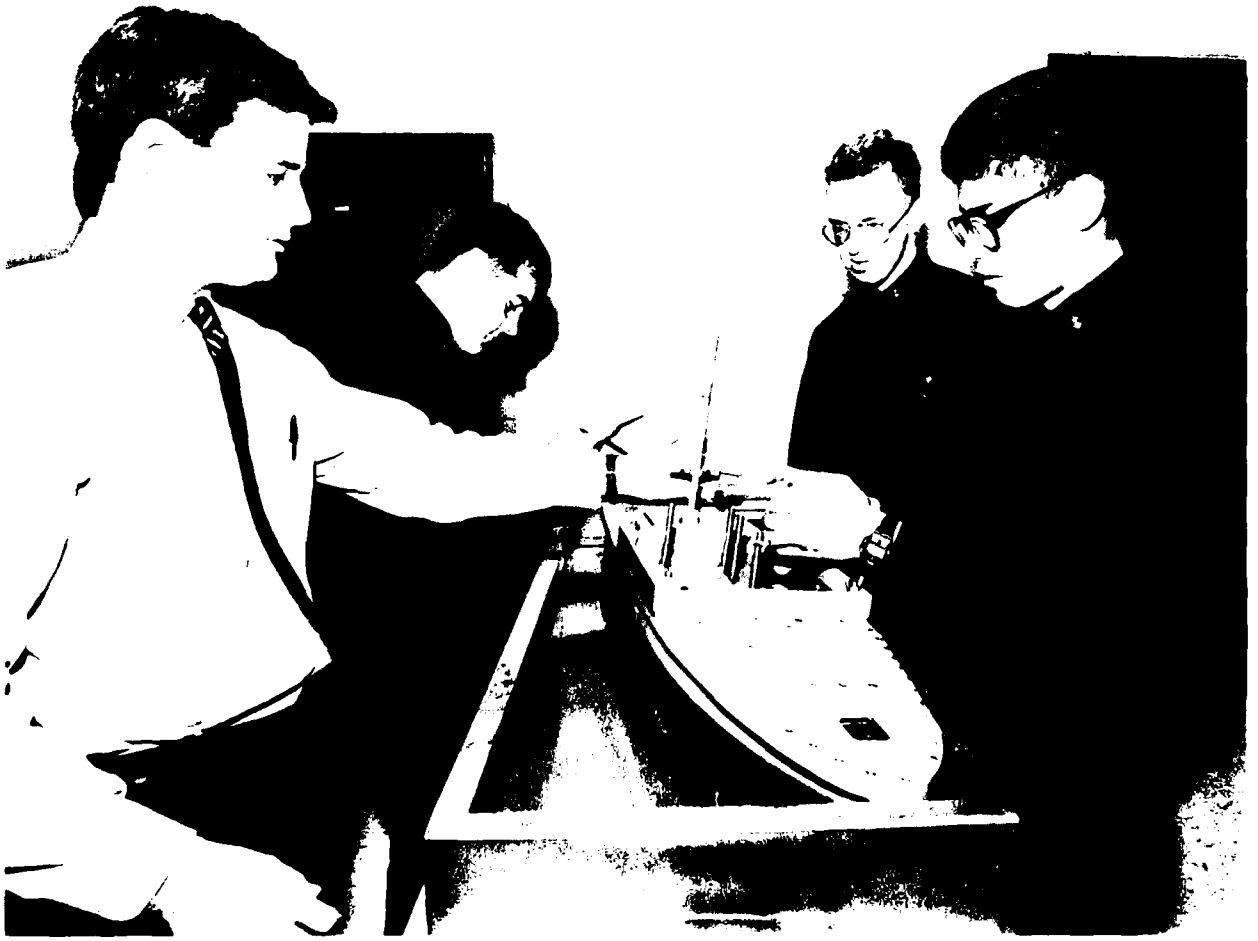
The primary objectives of this investigation were to determine the sensitivity of the bubble dosimeter with respect to time, and to compare its response with other neutron detection devices. The effects of the dosimeter's response of storage time before exposure and time from exposure to reading were quantified. Since the bubble detector is a re-usable system, the residual effects of multiple OSE were also studied. The measurements made with the bubble dosimeters were compared to those made with the following neutron detection systems AN/PDR-70, TLD, NE-213, and TEPC. The AN/PDR-70 and TLD are both in current shipboard use, while the TEPC and NE-213 have been limited to laboratory usage thus far.

In addition, a bubble spectrometer was irradiated with different neutron sources including Californium-252, Plutonium-Berrylium and the 14 mv neutron generators. The results obtained were then compared with the MCNP shielding code.

Viscous Drag Reduction for Slender Surface Craft

Researcher: Midshipman 1/C David B. Walker, USN
Advisers: Visiting Associate Professor David W. Coder, Professor Roger H. Compton, and Professor Maido Saarlas (Aerospace Engineering Department)
Sponsor: Trident Scholar Program

The objective of the research is to investigate viscous drag reduction methods that can be applied to surface craft. These methods include the injection of microbubbles, riblet surfaces, and various transition control devices. Experiments were performed in the USNA towing tank with two single rowing shells to provide hull shapes for which the viscous resistance is the most dominant component. Resistance, sinkage, and trim were measured for speeds up to 20 ft/sec. The major results and conclusions are as follows: the microbubble injection experiment failed to produce an overall vehicle drag reduction. Because of the increase in the residual resistance with air injection, it is difficult to ascertain whether the viscous component was actually reduced. Riblet surfaces produced up to 3 to 4 percent overall vehicle drag reduction, which is consistent with previous results with rowing shells and predicted values. While the overall vehicle drag is increased with the addition of a trip wire to the bare hull at low velocities, there is a drag reduction up to 2 to 3 percent at the high velocities. The maximum drag reduction of about 6 percent was obtained with riblets and a trip wire for the maximum velocity of 20 ft/sec. It appears that results for the combination of riblets and trip wire are additive across the velocity range of the experiment.



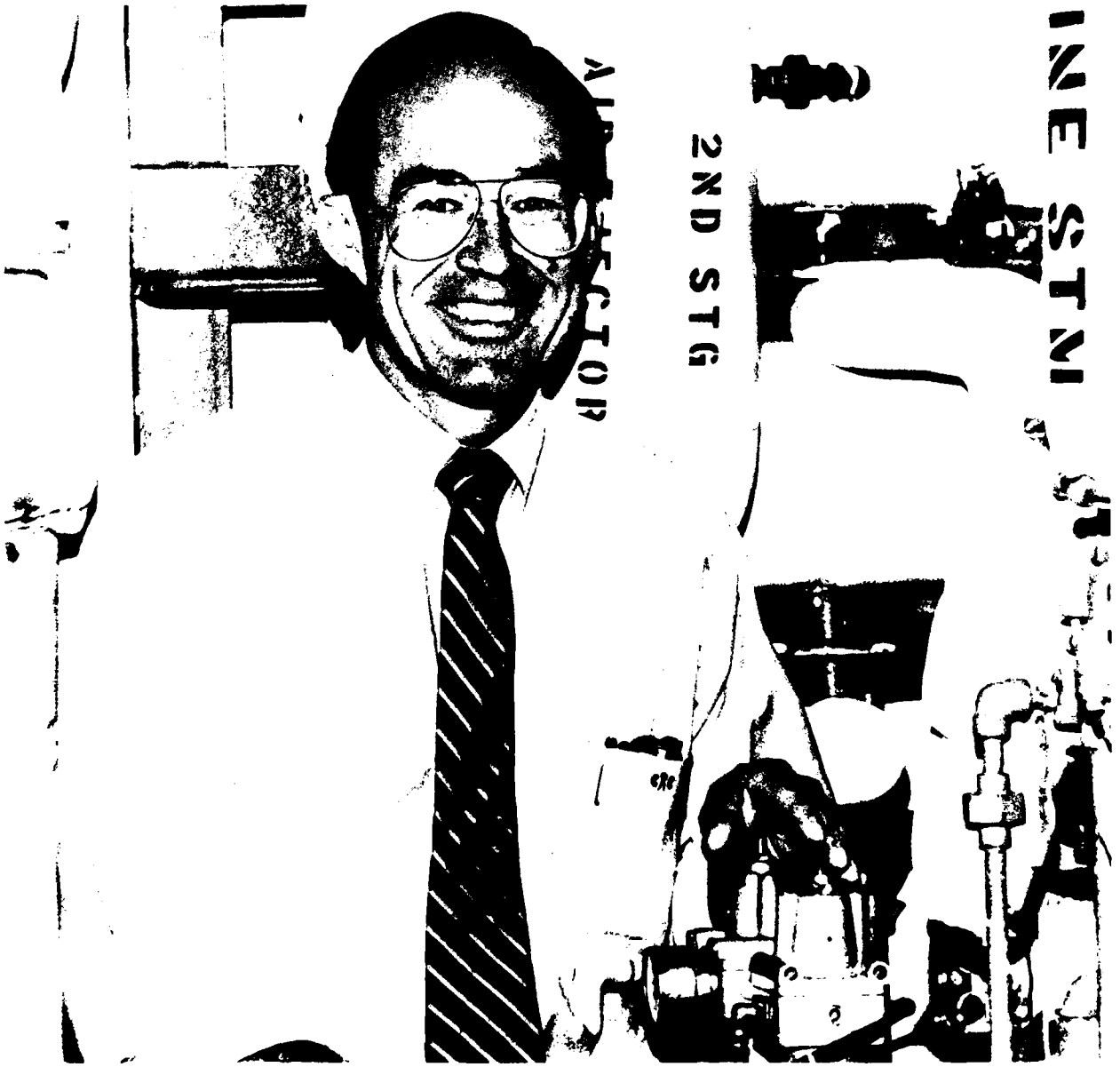
Independent Research

Computer-Aided Turbine Analysis

Researcher: Associate Professor Keith W. Lindler

The purpose of this project was to develop a user-friendly computer model which could be used to study gas turbines. The principal goal was to provide an "easy-to-use" educational test. A student spending 2 hours with this software is able to gain a better insight into the performance of gas turbines than could be obtained from hours of calculations using air tables.

In the fall of 1988, the program was successfully used by 2 sections of EN361 and at least 2 sections of EN300. In the spring semester, the program was used by all EN300 sections.



Research Course Projects

Static Stability and Survivability of SWATH-A

Researcher: Midshipman 1/C James H. Darrell, USN
Adviser: Professor Roger H. Compton

The object of this project was to analyze the static stability and survivability of SWATH-A and to make predictions on how the actual ship would respond in the open ocean. Two hydrostatic tests were performed. An inclining test was conducted in the U.S. Naval Academy's 120-foot towing tank to confirm the vertical location of the model's center of gravity, KG. The value obtained for KG closely agrees with the established value. A righting arm experiment was performed in the Academy's ballasting tank, and the ship's righting arm was determined through 180 degrees of inclination. Two sets of data were collected to confirm repeatability. The values for righting arm were plotted against heel angle. The experimental points show that the maximum righting arm occurs at 39 degrees of heel and the angle of vanishing stability is 78 degrees.

The survivability tests were conducted in the Academy's 380-foot towing tank. The model was ballasted to simulate the effects of a 100-knot beam wind according to the U.S. Navy criteria and exposed to an irregular, computer-generated 1:48 scale NATO Sea State 9. Next, additional ballast was added to simulate statically six inches of ice accumulation, again according to the Navy's criteria, and subjected to the same sea state. The ballast was located to simulate the actual iced-ship's KG and LCG but not its gyradius, for the ice should not significantly affect the gyradius. In both tests, the model was free-floating and dead in the water to simulate a propulsion casualty. Videotapes recorded the model's response; slowing the tape down by the square root of the scale factor showed that SWATH-A has excellent stability under the tested adverse conditions.

The Resistance of a Transom Stern, Hard Chine, Semi-Planing Craft

Researcher: Midshipman 1/C Richard B. Eitel, USN
Adviser: Professor Roger H. Compton

The object of this project was to investigate the resistance characteristics of a transom stern, hard chine, semi-planing hull in a variety of conditions. The model used for this analysis was from the USNA Yard Patrol Series developed in 1981 and was designated YP-81-5.

The parameters studied were the effects that speed, displacement, and waves, as well as combinations of these parameters, had on resistance and running attitude. For these experiments, the model was ballasted not only for displacement but also for pitch radius of gyration. The displacements used were model equivalents of 130 and 170 long tons of salt water. The model was tested in sea state three at both displacements and up to Froude number of 1.09 in the lower displacement and to 0.63 in the higher displacement. These experiments were all conducted at the USNA Hydromechanics Laboratory.

Operation of the Nuclear Data 9900 Computer with a NG-213 Liquid Scintillation Detector in a Mixed Radiation Field

Researcher: Midshipman 1/C Christopher Fischahs, USN
Adviser: Professor Martin E. Nelson

While the original objective of this project was to evaluate the NE-213 liquid scintillation detector in a mixed radiation field by using the Nuclear Data 9900 computer, several complications in the system revealed the need for a comprehensive overview on how the system and the software operate together. Despite these complications, a thorough understanding of the liquid scintillation detector and the Integrated MCA Control System software has shown a great potential for providing accurate results for the measurement of fluence and energy spectra from gamma and neutron sources.

Resonance in the signals, improper wiring in the computer itself, and limited written instructions on the use of the software made this project become a problem-solving task. In order to correct these problems and make the software operate properly, the entire system had to be traced and tested. Finally, after correcting the ele :trical and mechanical problems, system spectra measurements began by using sources for which the outcome was known. By using Sodium-22 gamma sources, a gamma spectrum was obtained that indicated the system was operating properly. While several other spectra tests proved not entirely satisfactory, the causes and possible solutions to these problems were determined. Finally, in an effort to provide for continuations of this project from its current status, current results are documentation of the entire system, including basic principles, software usage capabilities, and calibration of the instruments.

Drive System for the McCormick Wave Energy Conversion Turbine

Researcher: Midshipman 1/C Arthur R. Lyman, USN
Adviser: Professor Michael E. McCormick

Field testing of the McCormick wave energy conversion turbine on the floating system, KAIMEI, in the Sea of Japan revealed that the gear drive system for the turbine was somewhat unreliable and rather difficult to maintain. A more compact and less complicated drive system was designed and constructed using "off the shelf" gears, bearings, and seals. The drive system was then attached to a 0.5-meter, 15kW McCormick turbine for use in the CNO Wave Energy Project to be conducted in San Francisco Bay. The drive system is over-designed by more than a factor of two and, without experiencing failure, should be able to deliver a peak power of 40 kW.

Effect of Thickness on Finn Class Centerboards

Researcher: Midshipman 1/C Ransom R. Rogers, USN
Adviser: Professor Roger H. Compton

The objectives of this research into how thickness affects the performance of the Finn class centerboards were (1) to determine if different size boards perform differently and, if they do, to determine which board to use in what conditions, and (2) to provide information to our Olympic Finn class sailors that might help them in future Olympic competitions.

The experiment consisted of towing a Finn over a range of speeds (2-8 ft/s) and drift angles (0-4 degrees) for each of three board thicknesses (1/4", 5/16", 3/8"). The model was locked in heel at an angle of 0 degrees.

The range of speeds was decided on by referring to C.A. Marchaj's book, *Aero-Hydrodynamics of Sailing*. Marchaj estimates that the maximum velocity made good that can be reached by the Finn is only 3.75 knots, which converts to approximately 5 knots of forward velocity, or 8 ft/sec.

The thickness of the various boards was based solely on the limitations of the class rules. The rules allow the thickness to vary between "as small as can be made" to a maximum of 10mm, or approximately 3/8 inch. The Naval Academy Finn used in the testing already had a 5/16 inch board, so a board above and below this value were constructed in order to perform the test.

The data were taken and converted to lift and drag. Then curves of L/V2, D/V2, and L/D versus speed were made in the comparison between the three boards.

An Experimental Study of Ship Resistance in Shallow Water

Researcher: Midshipman 1/C James H. Schwappach, USN
Adviser: Professor Roger H. Compton

The basis for this research is a cooperative effort sponsored by the International Towing Tank Conference (ITTC) to compare results of similar tests carried out in different tanks. Specifically, the ITTC requested data on: total model resistance; wave pattern and spectra, including solutions, sinkage, and trim; wave profile at the hull; and flow observations. In addition, the researcher compared results of shallow water tests run with a false bottom to those run in an "emptied" tank. Scale effects were also studied by running two different model sizes. Further, experimental results were compared to analytical predictions using the standard methods of Schlichting and Landweber.

Pneumatic Wave Energy Conversion

Researcher: Midshipman 1/C Matthew S. Scribner, USN
Adviser: Professor Michael E. McCormick

The Navy has expressed interest in using a pnuematic wave energy converter to power remote stations and bases. A model of a floating pneumatic wave energy system was designed, constructed, and tested in the Coastal Engineering Laboratory. Four test configurations were studied to determine the optimum for conversion efficiency. The floating, front-facing system was the most efficient. Because of wave diffraction, this configuration converted more wave energy than was incident in a crest width equal to the beam of the system. The prototype of the system will be tested on site at the Fort Point Coast Guard Station in San Francisco Bay.

The Stem Spray Problem of the YP 676 Class

Researcher: Midshipman 1/C John M. Wolfe, USN
Adviser: Professor Roger H. Compton

The original design of the YP 676 Class Yard Patrol Craft called for steel construction; thus the lines plan were molded lines; that is, they represented the dimensions from inside the shell plating. However, when wood became the hull material used, the 2-1/4 inch wood planking added 4-1/2 inches to the breadth and resulted in an extremely blunt bow which causes excessive bow spray. This spray reaches upward as much as 5 feet at the design speed of 12 knots. One possible solution to the problem is the addition of a fiberglass fairing to the bow which will sharpen the stem. The objective of this project is to complete testing and evaluation of a 1/6 scale model of the fiberglass fairing and to explore other possible solutions which may prove to be more economically of structurally feasible.

Publications

ARNDT, Steven A., Assistant Professor, "An Analysis of Radiation Sensor Noise," *Proceedings* of the Seventh Power Plant Dynamics Control and Testing Symposium, University of Tennessee, Knoxville, Tennessee, April 1989, pp. 52.01-52.22.

Over the past several years, research has been conducted to determine whether use of radiation detection noise is a useful tool in analyzing the response time and other important characteristics of radiation sensor performance. It has been shown by the author and others that the use of radiation detection noise analysis is very useful in determining changes in the responses of ion chamber type radiation sensors. The sensitivity to sensor failure of degradation in these methods of analysis has been shown to be quite good, but the lack of a complete analytical model that could be solved to determine the theoretical changes has thus far limited the technique. At present the only way to determine the cause of the sensor degradation is by expert analysis. Attempts to quantify the changes in radiation detection noise spectrum by use of a root mean square Descriptor by Jacquat, et al. met with only limited success, because there was not sufficient theoretical analysis to support the choice of Descriptor fields.

In this paper the author introduces a complete analytical simulation of an ion-chamber type radiation detector, including charge transport, charge collection, and cable properties. The simulation identifies methods to determine the effects of specific changes in detector and cable property that will decrease the performance of the detector, and cable property that will decrease the performance of the detector system. The mode will be baselined with laboratory and power plant measurements of ion chamber type detectors as well as non-standard type detection systems.

ARNDT, Steven A., Assistant Professor, "A Phase Plane Analysis of Nuclear-Coupled Density Wave Oscillation in the Axial and Azimuthal Modes," *Proceedings* of the Seventh Power Plant Dynamics, Control and Testing Symposium, University of Tennessee, Knoxville, Tennessee, April 1989, 19.01-16.

Due to the recent power oscillation event at the LaSalle number 2 nuclear power plant, there has been a renewed interest in the effect of nuclear-coupled density-wave oscillations in Boiling Water Reactors (BWR). This effect, due to coupling of thermal-hydraulic and neutronic power in BWR's, can lead to non-linear limit cycle oscillations in core power. Traditional analysis of this instability problem has been mainly focused on frequency-domain linear models. These methods are limited in their ability to predict oscillation in the highly non-linear regions (large limit cycle oscillation).

Recently large amplitude limit cycle oscillations have been studied with nonlinear BWR models. The use of Phase Plane Analysis for the study of nuclear-coupled density-wave oscillation was employed by Lee and Onyemaechie to determine phase-plane trajectories during the approach to a limit cycle. Their method used a singular perturbation framework to anchor the limit cycle trajectories. Their analysis gave very important results, but was limited to only the axial mode.

There has been a great deal of concern that the oscillation seen at the LaSalle 2 event may have been in the azimuthal as well as the axial mode. Observations of the data taken at the Caorso Plant test involving large-amplitude oscillation leads the author to believe both axial and azimuthal oscillations are possible.

In this paper the methods developed by Lee and Onyemaechie are expanded to include the azimuthal modes. The model was benchmarked against the Caorso test, and then used to try to determine if the LaSalle 2 data would fit a possible azimuthal and axial mode.

CODER, David W., Visiting Associate Professor, "The Scaling of Mean Velocities in the Turbulent Boundary Layer Flow of an Appended Body of Revolution for Reynolds Numbers from 20 Million to 1000 Million," *Proceedings* of the Seventeenth Symposium on Naval Hydrodynamics, The Hague, Netherlands, August-September 1988.

Measurements of the velocity profiles in the turbulent boundary layer of an appended body of revolution at three locations on the parallel midbody and near the stern aft of the appendages were obtained over the Reynolds number range (based on body length) from about 20 million to about 1000 million. The difference in mean velocity as a function of the difference of Reynolds number for a given location along the body and distance from the surface are compared with similar information obtained using an axisymmetric potential flow/boundary layer computer program. The calculated differences show good agreement with measured differences for the profiles on the parallel midbody but are larger than measured differences for the inner radii at the stern. This disagreement is presumably due to the presence of the appendages and can cause an error when extrapolating lower Reynolds number nominal wakes for full-scale propulsion design.

CODER, David W., Visiting Associate Professor, co-author, "Velocity-Similarity-Law Analysis of Turbulent Boundary Layers on an Axisymmetric Body in High Reynolds Number Uniform Flow," *Proceedings* of the Symposium on Hydrodynamic Performance Enhancement for Marine Applications, Newport, Rhode Island, October-November 1988.

Turbulent boundary layer velocity profiles obtained at three stations on the parallel midbody of a body of revolution and for eight different body length Reynolds numbers between about 10 million and 1000 million are analyzed. The profiles are curve-fit to the power-law form, and the exponents and boundary layer thicknesses are obtained. These power-law experiments are lower than typical values reported for flat plate boundary layers and considerably lower than those for pipe flow. The boundary layer thicknesses were used to nondimensionalize the profiles for a velocity-similarity-law analysis. Values of local skin friction coefficient (Cf) were determined from a curve-fit of values inferred from the inner variable form of the log-law for the few points in the log-law region for low Reynolds numbers. Subsequent analysis using the outer variables form of the log-law and Coles wake function yields values of the wake parameter A that are higher than typical values reported for flat plate boundary layers and considerably higher than those reported for pipe flow.

COMPTON, Roger H., Professor, "Ship Survivability, An Experimental Study," Division of Engineering and Weapons Report EW-15-88, September 1988.

A totally free, dynamically ballasted model was subjected to severe (NATO SS9) irregular, long crested waves to assess the DIW survivability of the corresponding prototype ship. All ship-wave headings were studied. The responses of the model were recorded from several viewpoints on videotape. An edited (to 20 minutes) and narrated videotape was delivered to the sponsor, Naval Sea Systems Command.

DAWSON, Thomas H., Professor, David L. KRIEBEL, Assistant Professor, and Louise A. WALLENDORF, Ocean Engineer, "Experimental Study of Wave Groups in Deep-Water Random Waves," Division of Engineering and Weapons Report EW-18-88, December 1988.

Results from a laboratory study of wave groups in random seas are presented for Bretschneider and JONSWAP sea states. A distinction is made between general crest-envelope crossings of a threshold level and those involving groups of two or more wave crests. Measurements show that the average duration of occurrences of the groups and the interval between them are significantly greater than the values found for general envelope crossings. Non-linear effects of enhanced crest amplitudes are found to influence average intervals at high threshold levels. Average envelope durations and intervals are shown to be consistent with standard crest-envelope theory of random waves when used with parameters derived from truncated amplitude spectra and measured wave-height statistics. Probability density distributions for envelope durations and intervals are shown to be described approximately by Gamma functions. Average durations and intervals for groups of two or more wave crests are also shown to be related to the corresponding envelope statistics.

JOHNSON, Bruce, Professor, "The Scholarship Program of the American Society of Naval Engineers," *Naval Engineers Journal*, **100, 5** (September 1988), 76-79.

This article summarizes the history and current activities of the ASNE Scholarship Program. It traces the beginning of the Scholarship Program and discusses the evolution of the present committee, of which the author is chairman. The funding for the program is included, as well as a list of past scholarship winners and committee members.

KRIEBEL, David L., Assistant Professor, "Non-Linear Diffraction by a Vertical Cylinder," *Proceedings* of the Twenty-first International Conference on Coastal Engineering, Malaga, Spain, June 1988, pp. 17-31.

A theoretical solution is developed for the interaction of second-order Stokes waves with a large vertical circular cylinder in water of finite depth. The solution is obtained in terms of the velocity potential, such that any kinematic or dynamic quantity of interest may be derived, consistent to the second perturbation order. In this study, the second-order wave field around the cylinder is determined, showing the modification of the incident Stokes waves by wave-wave and wave-structure interactions, both in the reflection-dominated up-wave region and in the diffraction-dominated down-wave region. The theory is then compared to experimental data for wave runup and rundown amplitudes on the cylinder, as well as for wave crest and trough envelopes in the up-wave and down-wave regions.

LINDLER, Keith W., Assistant Professor, "MHD Design Exercise Using Spreadsheets," *Proceedings* of the ASEE Annual Conference, Portland, Oregon, June 1988, pp. 2146-2150.

One of the electives taken by marine engineers at the United States Naval Academy is "Undersea Power Systems." One of the power systems analyzed in this course is magnetohydrodynamics (MHD). In class, equations are presented for the calculation of the pressure and temperature at any location for a constant velocity MHD generator duct. The continuity equation is then used to calculate the cross-sectional area at any location in the duct. The sides of the duct are electrodes from which power can be drawn. In order to calculate the rate of power production, it is necessary to determine the surface area of each electrode. Computer spreadsheets are extremely useful for this application.

LINDLER, Keith W., Assistant Professor, "A Computer Program for the Study of the Rankine Cycle," *Proceedings* of the ASEE Annual Conference, Portland, Oregon, June 1988, pp. 762-767.

The United States Naval Academy is currently making a strong effort to incorporate the computer as an important teaching aid in all of its engineering programs. The author has written a BASIC computer program called "RANKINE" which is now being used as a teaching tool in several thermodynamic classes at the Naval Academy. The computer program can be used to perform various parametric studies on Rankine steam power cycle. In a two-hour laboratory period, a student running the user friendly computer program is able to gain a better insight into the performance of the Rankine cycle than could be obtained by days of tedious calculations using steam tables.

LINDLER, Keith W., Assistant Professor, co-author, "A Computer-Aided Design Approach to the Optimization of Control Strategies for Desiccant Air Conditioning," *Proceedings* of the ASME Solar Energy Division Meeting, San Diego, California, April 1989, pp. 71-76.

The authors have written a user friendly computer program for the study of control strategies for a desiccant dehumidifier. In order to allow for the study of advanced control strategies, the desiccant cooling system was broken down into the following components: load, dehumidifier, regenerator (heat exchanger), evaporative coolers, and heat source. In order to perform a simulation, one simply inputs the parameters control strategy to be analyzed. The output of the program includes complete energy summaries (solar energy used, auxiliary energy consumed, cooling provided, overall COP, etc.), as well as an indication of the comfort provided to ASHRAE standards.

LINDLER, Keith W., Assistant Professor, "The Second Law Analysis: When is it Useful?," *Alternative Energy Sources VIII.* New York: Hemisphere Publishing Corporation, 1989, pp. 847-856.

Recently there has been an increased interest in the application of the second law of thermodynamics to various energy systems driven by solar energy. A distinction is usually made between first law and second law analysis. It is often shown that conclusions regarding the efficiencies of components and themodynamic cycles are completely different when the two analyses are compared. It is claimed that the second law analysis yields more meaningful results than those of the first law. This paper examines the first and second law analysis in order to determine the range of engineering problems for which the second law should be used for system optimization.

MCCORMICK, Michael E., Professor, "Hydrodynamic Coefficients of a Monolithic Circular Offshore Structure," *Earthquake Engineering and Structural Dynamics*, **18** (March 1989), 199-216.

Expressions for both the rectilinear and rotational inertial and damping coefficients for a circular monolithic tower of uniform radius are derived. The analysis matches the fluid velocity, derived from potential theory, with the structural velocity in sway. That is, the motions of the tower are assumed to be in a vertical plane. The analysis is then applied to a tower composed of (lumped-mass) elements, where the expressions for the added-mass and damping coefficients are shown to be functions of wave number. The added-mass is shown to be a product of two wave systems: a traveling wave system, which is responsible for the radiation damping, and a standing wave system, called the evanescent system, which is attached to the structure.

The added-mass of the evanescent system is negative for small wave numbers, while that of the traveling waves is positive. The negative sign simply means that the inertial force of the evanescent waves is 180 degrees out of phase with that of the traveling system. Furthermore, it is shown that the contributions of the two wave systems to the total added-mass of the structure counteract each other, resulting in a total added-mass which varies gradually with the wave number.

Finally, the analysis is applied to an experiment, and results of the analysis and the experiment are found to agree rather well.

MCCORMICK, Michael E., Professor, co-author, "Status of the United States of America's Ocean Energy Recovery Activities," *Proceedings* of the Twenty-first International Conference on Coastal Engineer-ing, Costa del Sol, Spain, June 1988, pp. 154.1-154.3.

The state of the art of ocean energy recovery activity in the United States is described. The technologies discussed in the paper include extraction of wave, tidal, ocean thermal, and ocean current energy. This status report is intended to provide a description of the various ocean energy technologies and an assessment of potential benefits that might be expected and potential problems that might be encountered.

MCCORMICK, Michael E., Professor, co-author, "The Backward Bent Duct Buoy--An Improved Floating Type Wave Power Device," *Proceedings* of the Oceans 1988 (MTS/IEEE) Conference, Baltimore, Maryland, Vol. 3 (1 November 1988), pp. 1067-1072.

For the past 20 years or so, the wave power electric generator has been used in the navigation tail-tube buoy; however, application of the generator to the other buoy shapes was restricted because of difficulty in fitting an air chamber in the buoy.

The Backward Bent Duct Buoy (BBDB) configuration solved this problem. Furthermore, the design has significantly increased the wave power conversion efficiency over the tail-tube buoy.

The BBDB is applicable to navigation aids (including light buoys and lightships), telemetering buoys, military warning buoys, and other utility buoys. It can also be used as offshore station-keeping buoys, with or without moorings. By up-scaling the BBDB, floating wave power generators are created that can supply power to both island and coastal communities. The energy costs of such systems is estimated to be about 38 yen/kWh for islands in the subtropic zone such as the coastal waters of the United Kingdom, Ireland and western Australia.

MCCORMICK, Michael E., Professor, "An Analysis of Offshore Structural Dynamics with Non-Proportional Damping," Division of Engineering and Weapons Report EW-6-88, June 1988.

A method of analysis of the non-proportionally damped motions of fixed offshore structures in waves is presented. The damping considered is that due only to radiation, and is assumed to be linear. Since both the radiation damping and the added-mass are frequency dependent, the damping is, by nature, non-proportional. Hence, the standard normal mode analysis cannot be used. In order to isolate the modes, the matrix equation of motion of the assumed lumped-mass system is first transformed into a first order equation. The complex eigenvectors and eigenvalues for the underdamped system are then obtained through matrix iteration. The displacement of each mass is obtained in deterministic seas.

One of the most important results of this analysis is the demonstration of the ability of the technique to predict the movement of the nodal points over time. That is, the nodal points move up and down the centerline of the structure over each period. This means that the analyst can predict the positions of maximum stresses and strains over each cycle, a capability that the standard normal mode technique lacks.

NEHRLING, Bruce C., Professor, and Steven W. ENZINGER, Naval Architect, "An Experimental Investigation into the Stability and Motions of a Damaged Swath Ship," Division of Engineering and Weapons Report EW-16-88, November 1988.

The results of these experiments indicate that the T-AGOS 19 has sufficient stability to survive the damage conditions and sea states which were modeled. However, the vessel's structural integrity, operational performance, and maneuvering ability would all be adversely affected by the severe motions experienced by the ship. Finally, it should be noted that while these limited tests did not produce a capsizing, there is absolutely no guarantee that this ship will be able to survive all possible combinations of waves, wind conditions, displacement and center of gravity variations, and damage scenarios.

NELSON, Martin F., Professor, co-author, "An Evaluation of the BD-1OOR Neutron Bubble Dosimeter Sensitivity To Neutron and Gamma Sources in a Mixed Field," *Proceedings* of the Twenty-second Topical Meeting on Instrumentation of Health Physics Society, San Antonio, Texas, December 1988, pp. 260-267.

The purpose of this paper is to present data gathered in the evaluation of the BD-1OOR neutron bubble dosimeter done at the University of Maryland and the Naval Research Laboratory. The performance of twelve detectors has been followed over fourteen exposure-recharge cycles under a wide range of exposure conditions. Included in this paper are the results from tests on dose rate dependence, neutron energy dependence, gamma exposure, and recharge cycle performance. A statistical analysis of the performance of the dosimeter is also presented. During the data collection, the need for an automatic bubble reader was confirmed. Several automatic bubble reading methods have been investigated at the University of Maryland, and the results are included in this paper.

NUCKOLS, Marshall L., Associate Professor, co-author, "Thermal Modelling of Electro-Mechanical Cables for ROV Applications," *Proceedings* of Oceans 1988, Baltimore, Maryland, Vol. 4 (31 October-2 November 1988), pp. 1271-1275.

Recent trends in the ROV industry have been toward deeper and more powerful vehicles. Because of the critical role of the umbilical cable in the systems, efforts have been made to optimize cable design and reduce cable diameter. Unfortunately, the design goals of more power and smaller cable diameter can lead to cables with a high resistive heat loss. If the vehicle is operated with a significant quantity of cable wrapped on the winch drum, overheating and cable damage may occur. This paper describes a computer model developed to evaluate overheating concerns and to assist in cable design.

The analysis technique is particularly beneficial in conducting cable sensitivity analysis, which identifies the critical design and environmental parameters related to cable core temperature. The cable designer can use this method to help specify acceptable cable designs for particular ROV applications. The paper includes an example application of the model to an ROV umbilical cable.

NUCKOLS, Marshall L., Associate Professor, co-author, "Liquid-Filled Suit/Intersuit Concept: Passive Thermal Protection for Divers," *Proceedings* of the International Hazardous Diving Symposium, Bethesda, Maryland, 13-16 December 1988.

Active thermal protection methods are being considered for Navy divers during prolonged missions in 29 degrees F-40 degrees F water. Previous estimates for heating requirements during low activity dives range from 300-500 watts per diver. This power level will create a significant storage requirement on prolonged missions, where up to 24 kW-hrs could be required for diver heating alone.

One means of reducing or eliminating active heating requirements is investigated here. This concept, referred to as the Liquid-Filled Suit/Intersuit, consists of a double-walled drysuit with a good passive thermal undergarment. A low conducting fluid is pumped into the interspace between the drysuit layers to improve the insulating qualities of the garment during periods of low diver activity. Prior to high activity, where metabolic heat production is high and good mobility is required, the liquid is drained from the suit, giving a garment comparable in insulation to the present Passive Diver Thermal Protection System (PDTPS). Applications for this concept should be found in the Navy Special Warfare community, where minimal surface support is available, and the EOD community where long, in-water decompressions might be required.

NUCKOLS, Marshall L., Associate Professor, and Richard M. MILLER, Midshipman 1/C, USN, "Project Squid: A Human-Powered Submersible," *Proceedings* of Intervention '89, San Diego, California, 12-16 March 1989, pp. 117-121.

Recently, a new area of engineering study has been established at the Academy to prepare naval officers for the demanding role of designers and operators of undersea vehicles. This training is being supplemented with hands-on design experiences in vehicle design. One vehicle project is described which has provided positive learning experiences for the students in two major forms. First, it allowed the students to apply the knowledge they gained in their engineering courses to solve a practical problem. Second, working as subsystem designers, the students were placed in a situation where they had to meet deadlines and coordinate their efforts to solve interfacing problems. In short, they saw the "real world"--an experience rarely experienced at the undergraduate level.

NUCKOLS, Marshall L., Professor, "Life Support Concepts for Navy Underwater Special Warfare Applications," Division of Engineering and Weapons Report EW-12-88, 25 August 1988.

As part of the continued efforts to develop improved life support capabilities for the Navy Special Warfare community, the following areas were evaluated to identify potential design concepts:

(1) Review the design history and past performance of divers' cold water gloves, and recommend a glove configuration for the Diver Active Thermal Protection System (DATPS).

(2) Evaluate design alternatives and recommend design options for upgrading the Draeger Lar V Oxygen Rebreather to give a 4-hour mission capability in cold water.

(3) Evaluate a passive thermal protection system alternative using a suit/intersuit concept to maintain diver thermal protection during prolonged, cold-water missions.

(4) Evaluate the long term storage behavior of LiOH used in closed-circuit UBA's.

(5) Review CO_2 canister performance data for the Draeger Lar V when using HP Sodasorb, and recommend alternative absorbent.

NUCKOLS, Marshall L., Associate Professor, "Midshipman Elective Laboratory Training Program--1988: Naval Coastal Systems Center, " Division of Engineering and Weapons Report EW-13-88, 30 August 1988.

During the 1988 summer intersessional period, nine midshipmen 1/C spent a 4-6 week period at the Naval Coastal Systems Center in Panama City, Florida, to participate in ongoing research and development projects. This pilot program with NCSC was initiated this year to broaden the Elective Laboratory Training Program at the U. S. Naval Academy to include a wider cross-section of Navy research and development activities. The intent of the Laboratory Training Program is to allow midshipmen to apply their academic training and to enhance their awareness of the development and application of new technology for defense support.

This report consolidates the individual midshipmen research reports submitted following their TDY at the Naval Coastal Systems Center. An assessment of this program is made and recommendation for future midshipmen research is suggested.

Presentations

JOHNSON, Bruce, Professor, and Nikolaos GLINOS, Assistant Professor, (Computer Science), "Database Requirements for Hull Form Design," Workshop on Artificial Intelligence for Marine Systems Design, Rutgers University, New Brunswick, New Jersey, 10-11 January 1989.

KRIEBEL, David L., Assistant Professor, "Nonlinear Diffraction by a Vertical Cylinder," Twenty-first International Conference on Coastal Engineering, Malaga, Spain, 23 June 1988.

KRIEBEL, David L., Assistant Professor, "Dune Erosion Modeling," U.S. Army Coastal Engineering Research Center, Vicksburg, Mississippi, 22 August 1988.

LINDLER, Keith W., Assistant Professor, "A Computer-Aided Design Approach to the Optimization of Control Strategies for Desiccant for Air Conditioning," ASME Solar Energy Division Meeting, San Diego, California, 2-5 April 1989.

LINDLER, Keith W., Assistant Professor, "MHD Design Exercise Using Spread Sheets," ASEE Annual Conference, Portland, Oregon, 19-23 June 1988.

LINDLER, Keith W., Assistant Professor, "A Computer Program for the Study of the Rankine Cycle," ASEE Annual Conference, Portland, Oregon, 19-23 June 1988.

MCCORMICK, Michael E., Professor, co-author, "Performance of the Counter-Rotating Wave Energy Conversion Turbine System," EUROMECHANICS COLLOQUIUM on "Energy from Ocean Waves," Bristol, England, 28 September 1988.

MCCORMICK, Michael E., Professor, "Sea Test Results of the Backward Bent Duct Buoy and Its Applications for Various Uses," EUROMECHANICS COLLOQUIUM on "Energy from Ocean Waves," Bristol, England, 28 September 1988.

MCCORMICK, Michael E., Professor, "Three-Dimensional Singularity Theory," Civil Engineering Seminar, The Johns Hopkins University, Baltimore, Maryland, 29 November 1988.

NUCKOLS, Marshall L., Associate Professor, "Thermal Modelling of Electro-Mechanical Cables for ROV Applications," Oceans 1988, Baltimore, Maryland, 2 November 1988.

NUCKOLS, Marshall L., Associate Professor, "Liquid-Filled Suit/Intersuit Concept: Passive Thermal Protection for Divers," International Hazardous Diving Symposium, Bethesda, Maryland, 13 December 1988.

NUCKOLS, Marshall L., Associate Professor, "SQUID: Results of a Midshipmen Design Experience," USNA Naval Systems Engineering Seminar Series, Annapolis, Maryland, 26 October 1988.

NUCKOLS, Marshall L., Associate Professor, "Underwater Habitats Revisited," Johns Hopkins University Civil Engineering Seminar Series, Baltimore, Maryland, 8 November 1988.

NUCKOLS, Marshall L., Associate Professor, "Passive Thermal Protection for Divers," Diver Thermal Protection Workshop, Toronto, Canada, 1 February 1989.

NUCKOLS, Marshall L., Associate Professor, "Project SQUID: A Human-Powered Submersible," Intervention 1989, San Diego, California, 15 March 1989.

NUCKOLS, Marshall L., Associate Professor and Jennifer JAUNSEN, Ensign, USN, "Experimental Observations in the Absorption of Metabolically Produced Carbon-Dioxide," 1989 Undersea and Hyperbaric Medical Society Annual Scientific Meeting, Honolulu, Hawaii, 7-11 June 1989.

WHITE, Gregory J., Associate Professor, "Life Expectancy of Hull Structures of Boats," 1989 Life Structures: The Role of Physical Testing, Joint Institute of Structural Engineers/Building Research Establishment International Seminar, Brighton, England, 24-26 April 1989.

WHITE, Gregory J., Associate Professor, "Estimation of Structural Service Life of Ships," 1989 American Society of Naval Engineers, ASNE Day, Washington, DC, 4-5 May 1989.

DEPARTMENT OF

Weapons and Systems Engineering

Professor E. Eugene Mitchell
Chairman

Research within the Weapons and Systems Engineering Department continued to provide the faculty with an environment for professional growth and the opportunity to remain abreast of today's rapidly advancing systems technology. Additionally, every graduating Systems Engineering major participated in independent research, design, and development projects which reinforced the essential interface between academics and practical application.

Every faculty member, both civilian and military, participated in independent research directed toward areas of interest to the U. S. Navy, or supported midshipmen research programs in an advisory capacity. Faculty research areas included reduced complexity mathematical modeling, dynamic modeling of gas turbines, advanced shock isolation techniques, and several investigations involving computer control and computation methods, as well as software and hardware application to specific systems problems.

Strong emphasis continues on the faculty-midshipman relationship during the student independent research course. Each midshipman was assigned both an administrative and a technical adviser. These advisers not only provide support of a technical nature, but also emphasize planning, schedule development, and effective oral and written presentations. Thus, the student is introduced to all aspects of the research process. Typical examples of the forty-five midshipmen research topics include robotic systems, detection, tracking, and targeting systems (some with direct application to weapons systems), analog and digital control systems, and even a completely functional blackjack dealer.

Funding for research activities has been available from multiple sources, including grants and contracts from various federal agencies and naval laboratories, as well as funding from within the Naval Academy. This year's sponsors include the Naval Academy Research Council, the David Taylor Research Center, the Naval Surface Warfare Center, and the Naval Research Laboratory.

Sponsored Research

ET100 Firmware Modification and 80386 Software Evaluation

Researcher: Associate Professor C. George Brockus
Sponsor: Naval Academy Research Council (OMN)

The problem investigated in this project consists of two separate parts. The first deals with the modification of the firmware for an existing microcomputer system. The second deals with the investigation of potential applications for 32-bit microcomputers.

Among the microcomputers used by the Weapons and Systems Engineering Department, the ET100 Learning Computer and the Z-100, S-100 bus system are very useful in a course sequence. The firmware of the former is based on the CP/M-86 operating system, and differs in detail from the MS-DOS operating system software used on the latter. The annoying differences are a deterrent to learning, thus the ET100 firmware needs modification.

The department's move from the 8-bit world to the 16-bit world was not on the leading edge of the state-of-the-art; rather, it was a catch-up operation. Since the Z-248's were made obsolete by the INTEL 80386 before they were acquired, the move to the 32-bit world should begin immediately.

The firmware for the ET100 was obtained previously on floppy disk and was available for modification. An 80386 system was obtained in part, with the arrival of other parts pending. When this acquisition is complete, and the system has been assembled, the work on the second part of the problem can begin.

Portable PC Control of Mosaid SRT-1 Simple RAM Tester

Researcher: Professor Robert DeMoyer, Jr.
Sponsor: Naval Research Laboratory

A primary means to determine the degradation of random access memories (RAM's) due to radiation is to perform experiments on a linear accelerator. Patterns are loaded into a RAM, and errors are detected by a commercial RAM tester.

The work undertaken has been to control remotely the RAM tester, a device originally designed for manual operation only. As a result of this work, a terminal outside the test cell controls a portable personal computer which, in turn, controls the RAM tester. Specially designed interface circuitry, including a programmable delay line, has made possible the new capability of the determination of read access time.

Fiber-Optic Current Sensor Development

Researcher: Lieutenant Commander Joseph P. Gilio, USN
Sponsor: David Taylor Research Center, Annapolis Laboratory

Recent developments of fiber optic sensors have increased potential applications for shipboard systems. A coil of single mode polarization preserving fiber was constructed and used to measure current flow. Source stability and fiber connectivity problems were investigated.

Shock Isolation Using Active Magnetostrictive Elements

Researcher: Associate Professor Robert S. Reed
Sponsor: Naval Surface Warfare Center

Materials with a high degree of magnetostriction have been developed at the Naval Surface Warfare Center. Devices have been constructed and tested to demonstrate the ability of this material actively to modify the vibration characteristics of structures. The effort reported here demonstrates the ability of these materials to isolate a platform in the presence of high shock inputs at the base using magnetostrictive elements with appropriate feedback. A vibrator was constructed using a highly magnetostrictive material. Models were developed, and experiments were completed to predict and verify the performance of the vibrator. The magnetostrictive vibrator was placed on a small laboratory vibrator, so that base motion could be input. Acceleration feedback was added to reduce the amplification at the mechanical resonance frequency. The test demonstrated that the mechanical behavior of the vibrator could be successfully controlled using the magnetostrictive actuator.

Hybrid Computation Using a PC-Based Simulation Language and a Single Board Signal Processor

Researcher: Associate Professor Robert S. Reed
Sponsor: Naval Surface Warfare Center

The standard practice in the design of control systems (such as missile guidance systems) has been to interface existing hardware to a hybrid analog computer and then to study the effects of parameter variation on controller performance. Because of the high degree of digital computer modelling, the ability to make use of existing hardware in the development of control systems is very limited. This effort focuses on interfacing a high speed digital signal processor with a powerful modelling program in order to bring actual hardware into the controller development process.

Dynamic Simulation of a 2.5 MW Recuperated Gas Turbine Generator Set Engine

Researcher: Associate Professor Jerry W. Watts
Sponsor: David Taylor Research Center, Annapolis Laboratory

A simulation language ACSL (Advanced Continuous Simulation Language--from Mitchell & Gauthier Associates) was used to obtain a dynamic model of a shipboard genset engine. Known teststand transients were run using the model. Both onload and off load transients compared favorably between the teststand data and the computer model.

Determination of Composite Material Microbuckling Using Mechanical and Optical Methods

Researcher: Midshipman 1/C Matthew L. Welborn, USN
Adviser: Associate Professor Olaf N. Rask
Sponsor: Trident Scholar Program

The behavior of composite materials in compression was studied using a combination of strain gauges and optical methods. The optical method consists of the creation of a composite material on an optical flat, so that the microbuckling under study can be visually observed in reflected light. The mechanical wavelength so measured is used in the calculations to estimate the amplitude of microbuckling. It was found that the strain associated with the microbuckling exceeds that predicted by an order of magnitude. The strain due to the bending, and this new strain is not measurable with strain gauges larger than the wavelength of the microbuckling.

Independent Research

Reduced Complexity Mathematical Models of Systems

Researcher: Associate Professor Thomas E. Bechert

The purpose of this research project is to develop techniques for obtaining mathematical models of subsystem interconnections using a degree of complexity which is appropriate for the analysis or computer simulation being conducted. It is assumed that a detailed model is available for each subsystem. The coupling effects of interconnecting these subsystems generally result in new dynamic modes of operation. The characteristic speeds of some of these resulting dynamic modes may be outside the range of interest for a particular investigation. In this event, computational and conceptual advantages may be obtained by use of a reduced order mathematical model which eliminates these unwanted modes, while retaining the modes of interest. Furthermore, insight into the coupling effects may result from retention of the models of the individual subsystems, instead of subsuming them into one model of the overall interconnection.

This project builds upon the Component Connection Model (CCM) work reported by Wasynczuk and DeCarlo in 1981. That work retained one state model for each individual subsystem's dynamics, separate and distinct from the algebraic equations which model the interconnection of those subsystems. Using the CCM technique, an investigator may identify which subsystems are most strongly associated with which modes of the composite system by observing the migration of the system's eigenvalues as a connectivity parameter varies from zero to unity. Using singular perturbation techniques, the present ongoing research seeks to quantify the sensitivity of each system mode in response to model-order-reduction of selected subsystems or groups of subsystems. The CCM method is first used to identify candidate groups of subsystems for model order reduction. The investigator then observes the migration of the system's eigenvalues as the singular perturbation parameter (mu) varies from unity to zero, for the candidate subsystems. Each mode's sensitivity to the candidate model order reduction is then measured by the extent of migration of its eigenvalue. This information is invaluable for determining the suitability of the mathematical model which would result from the candidate model order reduction.

Radar Backscatter Effects of Chaff Dipoles

Researcher: Lieutenant Commander Jeffrey M. Conley, USN

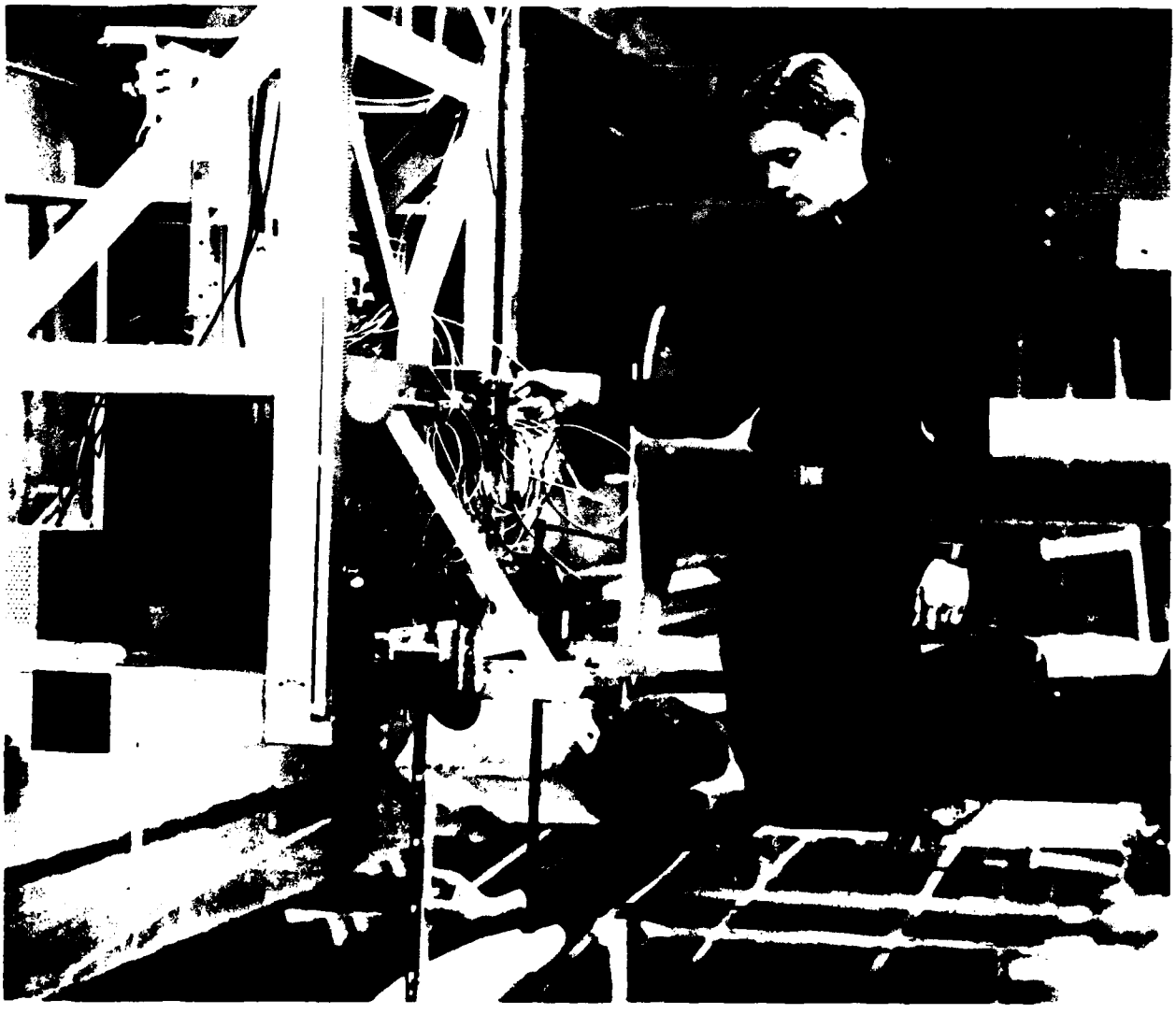
Efforts based on the researcher's masters thesis were continued using software programs to model the cumulative effects of chaff dipoles as they lay on the ocean surface with respect to their radar cross section (backscatter). Use of a VAX or "in office" PC was required to analyze further this phenomenon based on differing effects of grazing angles (elevation of search/track radar) to include multipath effects. The software involves using matrix calculations requiring significant computation time (CPU time) and will be conducted as time permits. The effects of sea state and wind will be factored into the analysis.

Research Course Projects

Human Tracking Response Analysis

Researcher: Midshipman 1/C Barry J. Gittleman, USN
Adviser: Associate Professor Terrence E. Dwan

Engineers often spend a great deal of time analyzing and simulating mechanical, electrical, fluidic, or combinational systems. The most accurate model of the newest high-tech aircraft would be incomplete without incorporating a model of the pilot who will be at the controls. Humans exhibit many unique and widely varying characteristics which must be taken into account in systems design. The project examines results of two experiments currently being conducted at the United States Naval Academy in an attempt to develop transfer functions for human tracking response. One experiment tests one-dimensional sine-wave tracking to determine time or frequency delay, and the other tests two-dimensional random tracking response. Psychological effects are being taken into account in both experiments to avoid biases due to fatigue, practice, or environmental effects.



Design Course Projects

Each Systems Engineering major enrolls in ES402, Systems Engineering Design, during his or her senior year. This course is the capstone of the Systems Engineering curriculum. The student is required to propose, design, construct, test, demonstrate, and evaluate a system of particular interest to himself and to other student researchers.

Associate Professors Olaf N. Rask and Robert S. Reed provided the course coordination and administrative effort, and were assisted by Associate Professors Thomas E. Bechert, C. George Brockus, Terrence E. Dwan, and Jerry W. Watts, and by Professors Robert DeMoyer, Kenneth A. Knowles, and E. Eugene Mitchell, who provided technical and systems design assistance and expertise for the listed design course projects.

The results of academic year 1988-1989:

Small Scale Analog Computer

Midshipman 1/C Kenneth D. Bates, USN
Adviser: Lieutenant Commander Wesley C. Stanfield, USN

Grape Shooting CIWS

Midshipman 1/C Faustino M. Baysic, USN
Adviser: Commander Dennis L. Worley, USN

Computer Music Analysis

Midshipman 1/C Brett M. Bekken, USN
Adviser: Captain Thomas H. Rich, USMC

Robotic Lab Technician

Midshipman 1/C Leopold B. Blum IV, USN
Adviser: Lieutenant Commander Wesley C. Stanfield, USN

Automatic Beverage Dispenser

Midshipman 1/C Brian J. Britton, USN
Adviser: Lieutenant Commander Charles R. Hendrickson, USN

Robotic Satellite Servicer

Midshipman 1/C Erik A. Burian, USN
Adviser: Lieutenant Commander Harold H. Cummings, USN

Sun-Seeking Model Rocket

Midshipman 2/C Todd E. Carlson, USN
Adviser: Visiting Professor Robert H. Small

Electro-Magnetic Suspension System for Brain Surgery

Midshipman 1/C Alexander B. Chao, USN
Adviser: Lieutenant Commander Harold H. Cummings, USN

Laser Range Finder

Midshipman 1/C Harold R. Cornwall, USN
Adviser: Lieutenant Commander William D. Randall, USN

Infra-Red Light Tracker
Midshipman 1/C Lino Covarrubias, Jr., USN
Adviser: Lieutenant Commander David S. Hilder, USN

Touch Tone Remote Control
Midshipman 1/C Anthony P. Cox, USN
Adviser: Lieutenant Commander John K. Callahan, USN

Mobile Visual and Sonic Security Unit
Midshipman 1/C Jay G. Crabtree, USN
Adviser: Lieutenant Commander David O. Drew, USN

Automatic Mailing System
Midshipman 1/C Kenneth J. Dyer, USN
Adviser: Lieutenant Commander Charles R. Hendrickson, USN

Single Board Computer
Midshipman 1/C Fred T. Fagan III, USN
Adviser: Lieutenant Commander Charles R. Hendrickson, USN

Human Tracking Response Analysis
Midshipman 1/C Barry J. Gittleman, USN
Adviser: Commander Dennis L. Worley, USN

Ultrasonic Automated Tracking Device
Midshipman 1/C Ingar A. Grev, USN
Adviser: Lieutenant Commander David O. Drew, USN

Digitally Controlled Active Silencer
Midshipman 1/C Carlos A. Grez, USN
Adviser: Lieutenant Commander Harold H. Cummings, USN

Wire Guided Rocket
Midshipman 1/C Shawn P. Hendricks, USN
Adviser: Lieutenant Commander David B. Barrett, USN

Platform for Fire Extinguisher System
Midshipman James W. Holly, USN
Adviser: Captain Thomas H. Rich, USMC

Voice Recognition
Midshipman 1/C Steven A. Kalderson, USN
Adviser: Lieutenant Commander David B. Barrett, USN

Hybrid Computer
Midshipman 1/C Carl A. Lahti, USN
Adviser: Lieutenant Commander William A. Mason, USN

Infra-Red Search/Tracker
Midshipman 1/C Edward R. Martinez, USN
Adviser: Lieutenant Commander William D. Randall, USN

Laser Targeting Device Using Vision and Mirrors

Midshipman 1/C Thomas M. Mathis III, USN
Adviser: Lieutenant Commander William D. Randall, USN

Magnetic Levitation of a Steel Ball

Midshipman 1/C Robert Memmesheimer, USN
Adviser: Lieutenant Commander William D. Randall, USN

Gemini Robot

Midshipman 1/C John C. Mohn, Jr., USN
Adviser: Lieutenant Commander William A. Mason, USN

Robotic Blackjack Dealer

Midshipman 1/C Stephen Newell, USN
Adviser: Lieutenant Commander Joseph P. Gilio, USN

Path Following Vehicle Using Magnetic Field of Wire

Midshipman 1/C Thad E. Nisbett, USN
Adviser: Lieutenant Commander John K. Callahan, USN

Magnetic Suspension

Midshipman 1/C Craig D. O'Brien, USN
Adviser: Commander Dennis L. Worley, USN

Remote Control Firefighter

Midshipman 1/C John M. Petit, USN
Adviser: Lieutenant Stanley H. Shoun, USN

A Radar Deceiver

Midshipman 1/C Mark E. Petz, USN
Adviser: Lieutenant Commander John K. Callahan, USN

Automatic Fire Truck

Midshipman 1/C Matthew J. Piacitelli, USN
Adviser: Lieutenant Stanley H. Shoun, USN

Race Car Controller

Midshipman 1/C Gregory D. Potteiger, USN
Adviser: Captain Thomas H. Rich, USMC

Manipular Arm

Midshipman 1/C Christopher D. Quilty, USN
Adviser: Lieutenant Commander Harold H. Cummings, USN

Fluid Level Control

Midshipman 1/C William M. Redman, USN
Adviser: Lieutenant Commander Wesley C. Stanfield, USN

Drink Delivery System

Midshipman 1/C Peter J. Rieg, USN
Adviser: Lieutenant Commander Joseph P. Gilio, USN

Satellite Docking
Midshipman 1/C Dale M. Rohrbach, USN
Adviser: Lieutenant Commander Harold H. Cummings, USN

Muscle Stimulation
Midshipman 1/C Paul P. Ryan, USN
Adviser: Lieutenant Commander David B. Barrett, USN

Automatic Sail Trimmer
Midshipman 1/C James B. Schroder, USN
Adviser: Lieutenant Commander Joseph P. Gilio, USN

WBGT (humidity) Index Meter
Midshipman 1/C Michael D. Shoup, USN
Adviser: Lieutenant Commander David S. Hilder, USN

Radar Detector/Deceiver
Midshipman 1/C Matthew S. Tysler, USN
Adviser: Lieutenant Commander John K. Callahan, USN

Telephone Scrambler
Midshipman 1/C Raymundo J. Villar, USN
Adviser: Lieutenant Stanley H. Shoun, USN

Infra-Red Wireless Speaker System
Midshipman 1/C Kevin P. Voss, USN
Adviser: Lieutenant Commander Jeffrey M. Conley, USN

Maze Following Micromouse
Midshipman 1/C James P. Waters III, USN
Adviser: Lieutenant Commander Wesley C. Stanfield, USN

High Speed Warning Device
Midshipman 1/C Michael A. Windland, USN
Adviser: Lieutenant Commander David O. Drew, USN

Foot Pressure in Running Shoe, Expert System
Midshipman 1/C Carol J. Womack, USN
Adviser: Commander Dennis J. Worley, USN

Publications

BECHERT, Thomas E., Associate Professor, "System Compensation," *Proceedings* of the 1989 Pittsburgh Conference on Modeling and Simulation. May 1989, pp. 2075-2079.

A set of software which the author developed to encourage a systematic design approach for the cascade compensation of feedback control systems is described. The software provides convenient numerical and graphical comparison of candidate designs. Performance results for the uncompensated and compensated systems are displayed for both step response and frequency response comparisons. These displays provide a rational basis for the engineer's design selection. Hard copies of these displays become useful exhibits for the engineer's design report.

This work is limited to continuous-time systems using cascade compensators. It is further limited to phase-lead or phase-lag compensators: those with a transfer function which includes one zero, one pole, and a constant gain. For a frequency response design application, the engineer typically seeks values for the zero, the pole, and the gain, which will satisfy design specifications for phase margin and for steady-state accuracy. With these specifications as inputs, design equations embedded in the software are solved for the required parameter values, provided a value for gain-crossover-frequency is furnished by the user. Performance results of successive runs guide the engineer to an appropriate value for this crossover frequency within a few minutes. An example is included to illustrate use of the design software.

BECHERT, Thomas E., Associate Professor, "Reduced Order Modeling of Interconnected Subsystems," *Proceedings* of the 1989 Pittsburgh Conference on Modeling and Simulation, May 1989, pp. 2093-2100.

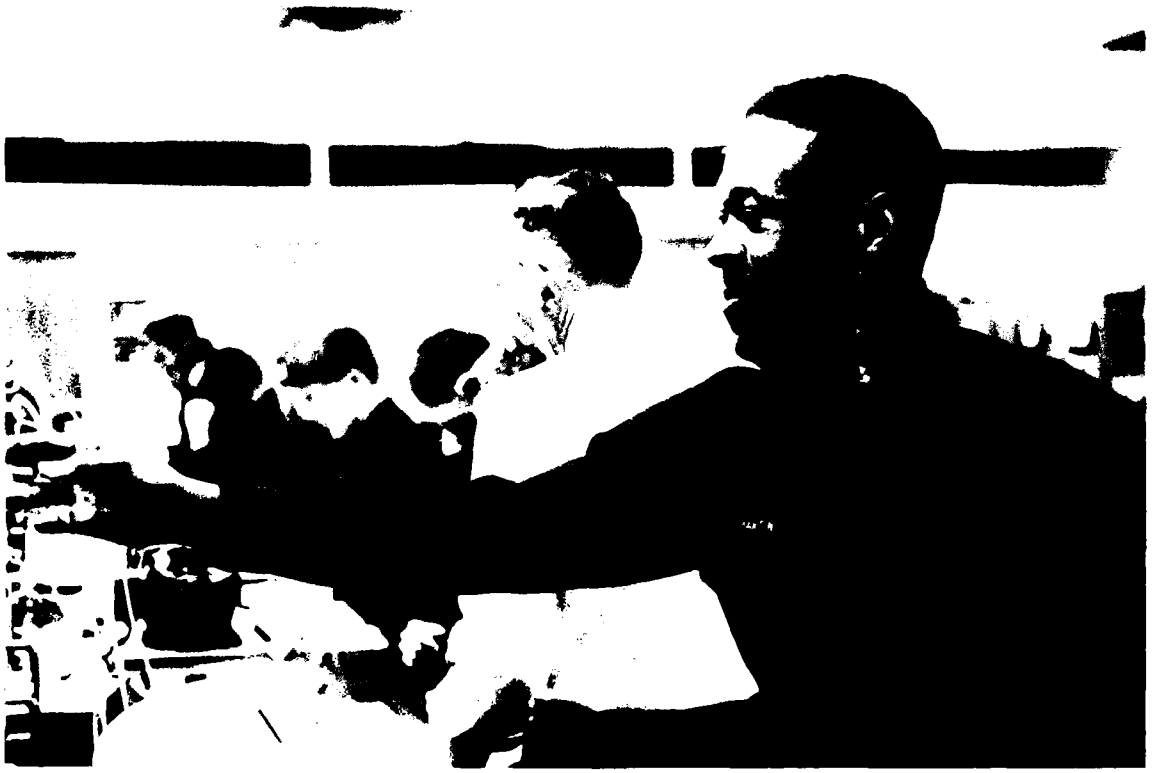
Techniques for obtaining mathematical models of subsystem interconnections using a degree of complexity which is appropriate for the analysis or computer simulation being conducted are addressed. It is assumed that a detailed model is available for each subsystem. The coupling effects of interconnecting these subsystems generally result in new dynamic modes of operation. The characteristic speeds of some of these resulting dynamic modes may be outside the range of interest for a particular investigation. In this event computational and conceptual advantages may be obtained by use of a reduced order mathematical model which eliminates these unwanted modes, while retaining the modes of interest. Furthermore, insight into the coupling effects may result from retention of the models of the individual subsystems instead of subsuming them into one model of the overall interconnection.
This paper builds upon the Component Connection Model (CCM) work reported by Wasynczuk and DeCarlo in 1981. That work retained one state model for each individual subsystem's dynamics, separate and distinct from the algebraic equations which model the interconnection of those subsystems. Using the CCM technique, an investigator may identify which subsystems are most strongly associated with which modes of the composite system, by observing the migration of the system's eigenvalues as a connectivity parameter varies from zero to unity. Using singular perturbation techniques, the present paper quantifies the sensitivity of each system mode, in response to model-order-reduction of selected subsystems or groups of subsystems. The CCM method would first be used to identify candidate groups of subsystems for model order reduction. The investigator then observes the migration of the system's eigenvalues as the singular perturbation parameter (mu) varies from unity to zero for the candidate subsystems. Each mode's sensitivity to the candidate model order reduction is then measured by the extent of migration of its eigenvalue. This information is invaluable for determining the adequacy of the mathematical model which would result from the candidate model order reduction.

BROCKUS, C. George, Associate Professor, "Scaling the Equations for Polynomial Least Mean Squares Curve Fitting," *Modeling and Simulation, Volume* **19**, Instrument Society of America, November 1988, pp. 2077-2081.

The polynomial curve fitting of measured data, to minimize errors in a least mean squares sense, is a useful procedure in any experimental environment. The estimation of the coefficients of those polynomials by means of the Moore-Penrose pseudo inverse is a well-known method. Any computer center, or any high quality software environment available to the scientist, provides various algorithms to calculate numerical solutions for problems of that nature.

While the polynomial equations to be used are nonlinear, the least squares process is linear in the coefficients of those equations. The matrix equations which describe the ensemble of measurements are classically formed in the nature of a Vandermonde matrix. Such matrices are notoriously ill conditioned. Thus, the matrix inversion which is required in the solution is a challenging problem.

The magnitude scaling technique, which is proposed here to be applied to this problem, provides substantial relief in improving the conditioning of matrices. Therefore it is expected that the application of this technique will provide better quality in the numerical results of the procedure.



Presentations

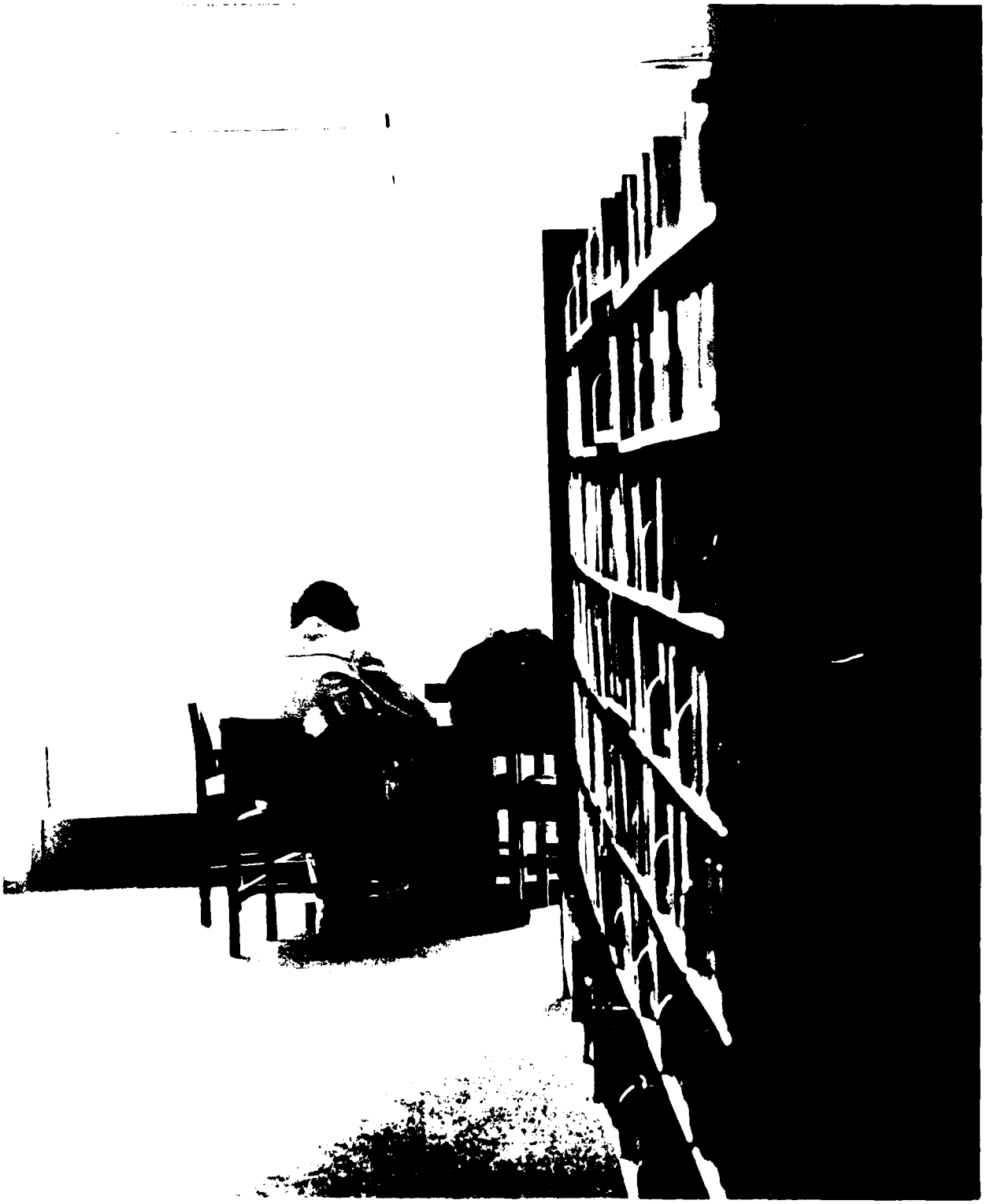
BECHERT, Thomas E., Associate Professor, "System Compensation," Twentieth Annual Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, 5 May 1989.

DWAN, Terrence E., Associate Professor, "Comments on System Identification using MATLAB," Twentieth Annual Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, 4-5 May 1988.

REED, Robert S., Associate Professor, "Shock Isolation Using Magnetostrictive Elements," Fifty-ninth Shock and Vibration Symposium, Sandia National Laboratories, Albuquerque, New Mexico, 18-20 October 1988.

REED, Robert S., Associate Professor, "Hybrid Computation Using a PC-Based Simulation Language and a Single Board Signal Processor," Twentieth Annual Conference on Modeling and Simulation, University of Pittsburgh, Pittsburgh, Pennsylvania, 4-5 May 1989.

Division of English and History



DEPARTMENT OF

English

Lieutenant Colonel Laurence W. Mazzeno, USA
Chairman

The English Department faculty continued to cover an extensive chronological span and wide diversity in the topics of its research efforts ongoing during 1988-1989. The Naval Academy Research Council sponsored projects ranging from fourteenth-century tail-rhyme romances through seventeenth-century political poetry to contemporary American fiction. Other NARC-funded researchers have studied traditional cultural history, the theoretical roots of modernism, and reader response theories for literary analysis. Independent research has ranged similarly widely to include specific authors (Dante, Arnold, Milton), unique subjects (history of drama at the Naval Academy), bibliography work, and interdisciplinary studies (rhetorical analysis of mathematical proofs). This variety represents not just the interests of individual researchers, but the collective vitality of the faculty--a strength manifest in the continuing high quality of classroom instruction in the diverse discipline of English.

Further evidence of those strengths came in the form of publications and presentations during the recent academic year. The English Department was responsible for over forty published works this year--including book manuscripts, critical articles, and original creative writing. The same faculty presented their ideas as delivered papers on more than thirty occasions. This interchange with colleagues across the nation keeps the faculty abreast of current work in the discipline and further enhances the reputation the group has already won for the Naval Academy. Again, the publications and presentations are the outward manifestations of the excellence of the undergraduate program in humanistic education that continues in service to the mission of the Naval Academy.

Sponsored Research

Allure of Islands: Poems

Researcher: Associate Professor Nancy Prothro Arbuthnot
Sponsor: Naval Academy Research Council (OMN)

"Allure of Islands" is a collection of semi-narrative lyric poems about an island in Maine and its smaller satellite islands. Interweaving historical fact with personal commentary, the poems seek to expand the concerns of lyric poetry outward from the self. Often they link a bit of island lore or a story about an early inhabitant to the present, as they strive to convey a sense of place and the importance of place to a knowledge of self.

The different settings of the poems--headland, mudflat, meadow, cove, pond, bay, church meeting room--and the variety of characters--musician, botanist, lobsterman, basketball player, sailor, museum guide, children--attempt to convey the depth and richness, as well as the narrowness, of small town life, once a significant aspect of American literature. Throughout the collection, the poems make statements about life through image and metaphor and story; they are, in other words, lyric poems with a narrative line, about how we find and place ourselves in the world.

W. C. Heinz's The Professional: The Denial of Play and the Subversion of Genre

Researcher: Associate Professor Neil Berman
Sponsor: Naval Academy Research Council (OMN)

This project will place W. C. Heinz's *The Professional*, perhaps the finest American novel in the boxing sub-genre, in its most important and appropriate critical context: the literature of sport and play. Most contemporary sports fiction is essentially transforming in that the joy, freedom, and creativity of mature play are at least partially recoverable and, further, the most important thematic concerns derive from but are not necessarily a part of the play sphere inherent in a particular sport. In *End Zone*, for example, Delillo uses college football to talk about nuclear technology and the decay of language. Similarly, Robert Coover's subversive agenda in *The Universal Baseball Association* includes politics, history, and schizophrenia. Boxing is a curious exception to this generalization in that fiction which uses boxing at its narrative center is not only realistic in style and technique, but also and more crucially, naturalistic as well. W. C. Heinz's *The Professional*, recently brought back into print, certainly conforms to the naturalistic impulse in boxing fiction, a longstanding and rich tradition that includes Jack London, Ernest Hemingway, and, more recently, Budd Schulberg and Leonard Gardner. Each of these writers shares a vision in his boxing fiction which largely excludes women, attempts some recovery of the play-attitude through male camaraderie in and about the ring, and ultimately denies even the possibility of play. Play in the fiction of these writers cannot be recovered; it is illusionary.

Edward Young: An Eighteenth-Century Literary Career

Reseracher: Assistant Professor Stephen N. Brown
Sponsor: Naval Academy Research Council (OMN)

Edward Young (1683-1765) was a literary figure of greater stature in eighteenth-century England than modern scholarship has recognized. In a literary career spanning half a century (1710-1762), Young distinguished himself in tragedy, verse satire, meditative-religious verse, and the prose essay; his productions at times reflected, but as often anticipated, his century's well-noted changes in literary taste. When Alexander Pope died in 1744, Young, in the midst of publishing his vastly popular and influential poem *Night-Thoughts* (1742-1746) and at the height of his contemporary reputation, was justly considered by many the great poet's successor. His career, while not as distinguished as that of another versatile talent of the age, Henry Fielding, is as representative of the diversity of eighteenth-century literary life. This project takes Young's career itself as an object of inquiry, aiming at a comprehensive description of how the poet conceived his own career, how his life took shape around his artistic productions. The description takes account of social, political, and personal pressures bearing upon that production. Because Young's achievement was so diverse, it touches upon many aspects of eighteenth-century culture; this study thus offers a fresher view of the period than that afforded through studies of major figures such as Pope or Fielding.

The process of integrating the materials of recent research continues. The manuscript should be ready for submission to Cambridge University Press by September 1989.

Stylistic Trends and Characteristics of Style in the Music, Art, and Literature of the Baroque

Researcher: Associate Professor Marlene C. Browne
Sponsor: Naval Academy Research Council (OMN)

The purpose of this research was to begin a detailed study of the music, art, and literature of the Baroque period, to examine the development of trends and characteristics of the Baroque as they move from Italy to Germany, Flanders, Holland, France, and England. Such an approach leads to an examination of not only the music, art, and literature, but also the influences of science, religion, philosophy, and politics on those art forms.

This area of formal investigation represents a new study for the researcher; therefore, she placed emphasis on works that could provide a broad background for understanding. These works provided the researcher with some insight into the characteristics which constituted a revolution in style of the art in Rome during the final years of the sixteenthth century. By learning about the origin of Baroque art and by following its growth and movement from Italy to England, the researcher began to acquire vocabulary that will help in the framing of a definition for the term Baroque. Once the researcher has investigated the music and literature of this period, she expects to be able to formulate that definition.

The Place of the Cadence in Military Folklore

Researcher: Assistant Professor Carol Burke
Sponsor: Naval Academy Research Council (OMN)

The purpose of this project was to collect cadences from naval and marine officers and enlisted men, to categorize these, and to investigate the similarities among such familiar contemporary military lore and earlier sea chanteys and Negro hammer songs. This study looked at the cadence as a traditional, yet open, form influenced by the particular character of the company or division.

Practical in purpose, cadences or marching chants build morale, insure group cohesion, and ease strain by diverting attention from monotonous and often strenuous labor or training. As military tradition these verses are passed from company to company, division to division, service to service, even war to war, carrying with them certain attitudes toward the military life one has adopted and the civilian life one has left behind. Though cadences are a vital part of military folklore, they have received little attention from folklorists until recently.

Transcription of a collection of cadence calls is complete and computerized; the categorization and analysis of these lyrics is currently in progress.

The Theoretical Roots of Modernism

Researcher: Assistant Professor Bruce E. Fleming
Sponsor: Naval Academy Research Council (OMN)

This project is a study of the philosophical basis of that movement in the arts at the beginning of the twentieth century now known as Modernism. Research has focused on the works of Gertrude Stein, Virginia Woolf, T. S. Eliot, and Lytton Strachey, with a view to articulating what these writers and thinkers had in common. The point of view used here diverges from the more historical viewpoint usual in considerations of this period; an inquiry into the "theoretical roots" presupposes a consideration in terms of structural similarities of the works themselves rather than into the influences which produced these.

Research has so far revealed a striking structural similarity among the major works of these authors. All of them exhibit evidence of binary contrasts between authorial form and a manifold, usually conceived of as being part of the world outside, which is without form. It is this contrast that offers the best candidate for defining Modernism in a philosophical fashion, therefore arriving at its theoretical roots.

Reader Response Theory and Its Contribution to Composition

Researcher: Assistant Professor Mary D. Howland
Sponsor: Naval Academy Research Council (OMN)

The objective of this research is the study of key texts in Reader Response criticism in an effort to discover how the writing of frequent, short reader response essays can help students develop into better writers. The researcher has read works by Ingarden, Derrida, Fish, Barthes, and others in exploration of Reader Response theory. Journals such as *College English* and *College Composition and Communication* were consulted for articles having to do with correlation of reading and writing exercises. While relatively little has been published on the links between reading and writing as applied to the development of writing skills, the researcher is convinced that positive reinforcement through reader response techniques can strengthen writing abilities. Research continues, with the ultimate goal of an article for one or more of the composition journals.

The Vietnam War in American Literature

Researcher: Professor Philip K. Jason
Sponsor: Naval Academy Research Council (OMN)

The objective of this project is to contribute to the formation of critical opinion on the literature of the Vietnam War through independent assessments of that literature and by making available the assessments to other scholars. The Vietnam War, as well as its foreshadowing and aftermath, is one of the most significant events in contemporary history. The imaginative literature fashioned as a response to that experience--a literature often created by veterans--addresses the meaning of the war on many levels: political, military, philosophical, and psychological. A survey of this literature is one way of taking the psychic and moral temperature of American society during our period of involvement and since. As indicators of cultural values and as aesthetic achievements, the body of Vietnam War literature demands serious scholarly attention.

The researcher studied over sixty primary and secondary works: novels, volumes of poetry, short story collections, plays, memiors, and criticism. A series of critical essays has been undertaken based on this material. A dialogue with the community of scholars in this field has begun to generate material for an essay collection.

Two essays have been completed; the first will be included in an anthology to be published next year; the second is in circulation; a third essay is in draft. An early result of the work was a paper read at the Popular Culture Association meeting in April 1989. The researcher is also editing a collection of critical essays tentatively titled *Landing Zones: Approaches to the Literature of the Vietnam War*, the manuscript of which is to be delivered to the publisher in the fall of 1989.

The Founding and Failure of an American National Institute of Arts, Letters, and Sciences, 1868-1870

Researcher: Professor Allan B. Lefcowitz
Sponsor: Naval Academy Research Council (OMN)

The attempt in 1868 to found an American National Institute modeled on the French Institute failed. This failure leads to a series of questions about the way Americans came to organize their intellectual life after the Civil War.

The researcher's objective during the grant period was to gather the relevant materials, transcribe the minutes of the first meeting of the National Institute (still in manuscript at the New York Historical Society library), transcribe the correspondence on the organization (found in the Joy papers at Columbia University), gather ancillary materials--memoirs. biographies, and newspaper and journal notices, and prepare an introduction dealing with the specific content of the organization, the context in which it was founded, and its relevance to American social, cultural, and intellectual history. Finally it was the researcher's intent to prepare the findings as an article or monograph.

The materials were gathered and transcription begun, as well as further research in the general topic pursued. One surprising result was the discovery of an even earlier attempt to organize American cultural life on a national basis, though the earlier event was not cross-disciplinary. This discovery is important enough to warrant further investigation on its merits. In fact, before writing up the results of the work on the National Institute, it appears necessary to research the previous efforts; the researcher has applied for funding to do so.

The Writings of John James Audubon

Researcher: Assistant Professor Robert D. Madison
Sponsor: Naval Academy Research Council (OMN)

This project is a study of Audubon's writings, editing, and publishing work. It should result in materials for an edition in one volume of Audubon's representative writings. Research has also included a study of his last bird portraits--those which were not included in the famous double elephant folio, along with an analysis of the relation between the larger and small edition birds.

The End of The Human Predicament

Researcher: Commander Stephen V. Myslinski, USNR
Sponsor: Naval Academy Research Council (OMN)

Richard Hughes (1900-1976), probably best-known for his novel *High Wind in Jamaica*, *The Fox in the Attic*, and *The Wooden Shepherdess*, also wrote children's stories, radio and television scripts, short stories, magazine articles, and poetry. After his death, Indiana University's Lily Library purchased all the Hughes manuscripts. Of most interest are the unpublished chapters of his final, incomplete novel, which was to be the final volume of *The Human Predicament* trilogy, whose first volumes are *The Fox in the Attic* and *The Wooden Shepherdess*. Known as a slow writer, Hughes had written only 12 chapters, roughly a third of the last novel, before he died. The first two volumes deal with England and Germany during the Weimar Republic and end with Hitler's rise to power. The first two volumes suggest that Hughes had outgrown his original plan. The proof is in the notes and manuscripts which include 15 chapters of the third volume in fair copy. The correspondence indicates that Hughes planned to have at least four or five volumes in *The Human Predicament*.

The Artistry of John Irving's Novels

Researcher: Professor Charles J. Nolan, Jr.
Sponsor: Naval Academy Research Council (OMN)

The researcher has begun a thorough scrutiny of John Irving's novels and the criticism written about them to see if several ideas he has about the way Irving structures his works might enrich our understanding of this talented contemporary figure. Specifically, in two recent novels Irving seems to arrange his texts so that there are dramatic and bipolar shifts in tone. In his earlier works, Irving relied upon a three-part structure to shape his subject matter, and one of the best analyses of his recent *The Hotel New Hampshire* argues that Irving continues his tripartite method in it. But such a view fails to account for the tonal antithesis which is an important aspect of the novel's impact on its readers. *The Cider House Rules* also embodies tonal dichotomies, as Irving resolves the issues he addresses in that book. The questions of structure and tone (and other standard literary devices), then, are the energizing principles of the project and will be the focus of further research.

Orality, Literariness, and the Tail-Rhyme Romances

Researcher: Associate Professor Timothy D. O'Brien
Sponsor: Naval Academy Research Council (OMN)

The purpose of this project is to use recent developments in critical theory, as well as studies of the transition from an oral to a written culture, as ways of addressing the unrecognized complexity of English tail-rhyme romances composed in the fourteenth century. The plots of these romances are often formless; their characters invariably remain undeveloped; and they just as often lack a unifying theme. But the circumstances of their production are intriguing and worthy of study: these works were produced in an attempt to mimic some original, oral delivery. Thus, their literary status as written texts with oral authority is complex and highly suggestive, but it has received little attention from medieval scholars. This lack of attention is the result of uninventive critical approaches that are restricted mainly to source study and the search for meaning. Recent publication of Robert M. Jordan's *Chaucer's Poetics and the Modern Reader*, however, offers a fresh approach to the "inorganic form" of many Middle English narratives. The critical theory directing Jordan's study can also be used to achieve a fuller understanding of these fourteenth-century romances. Application of this theory to a reading of tail-rhyme romances, along with a study of the issues involved in the transition from oral to written culture, will enable the researcher to complete a substantial essay on one of these romances, *Sir Launfal*, and compose also an extended paper on the entire group of romances.

The Political Poetry of Sir William Davenant

Researcher: Associate Professor Michael P. Parker
Sponsor: Naval Academy Research Council (OMN)

Poet, playwright, and soldier, Sir William Davenant (1606-1668) is commonly recognized as one of the pivotal figures in seventeenth-century English literature. Because his career transcends so many disciplinary lines, however, it has defied conventional treatment: historians have ignored Davenant's poetry, and literary critics have overlooked the intensely political nature of his artistic achievement. This study proposes to reexamine the poems written by Davenant in the 1630's on the eve of the English Civil War. The working hypothesis is that these pieces, especially those collected in *Madagascar* (1638), provide a key to Davenant's political views in the latter half of the decade; in particular, they record the poet's attempts to forge an alliance between the Catholic and ultra-Protestant parties at court under the aegis of Queen Henrietta Maria. Individual poems advocate different projects, but the overall end of the collection is a meshing of the goals of two extreme and apparently opposed factions at court. This tentative alliance collapsed with the outbreak of the First Bishops' War in mid-1639, but the very attempt is of great significance. In its investigation of these poems and the milieu in which they were circulated, this study will cast a new light on Davenant's ambivalent position at court, as well as on the complex relationship between politics and poetry during the Caroline period.

Communicating in Mathematics and Composition Classes: An Interdisciplinary Approach

Researcher: Instructor Patricia P. Sine
Sponsor: Naval Academy Instructional Development Advisory Committee

Teachers and students in mathematics and composition classes have similar communication problems. In both classes, for instance, instructors struggle to convince students that words mean something, that what they write should make sense to the intended audience, and that they must care about writing in complete sentences, syntax, and order. Students wonder how they can get started, how much information they should include, and how to arrange it, and why they received the grades they did.

Because they do share important pedagogical concerns, teachers and students in the two disciplines can learn from each other. By analyzing the rhetorical elements of mathematical proofs, teachers and students can better understand the proof as a means of persuading an audience of the veracity of the problem. Applying current composition theory to the teaching of advanced college math, teachers can help students improve their communication skills by stressing the process of writing mathematical proofs, following the stages of prewriting (brainstorming, applying problem-solving strategies, and considering audience and purpose), drafting, and revising. Teachers can also apply composition theory to the grading of papers and error analysis. Composition teachers, in turn, can apply the visual teaching techniques of math instructors, who depend on diagrams and flow charts to make points clear to their students. Composition students can refer to the precision of mathematics when in doubt about finding the right word.

Air and Space: Stories

Researcher: Professor Molly B. Tinsley
Sponsor: Naval Academy Research Council (OMN)

The researcher set out to compose a fictional text of some length--either linked stories or a novella--which portrays military family life as a metaphor for contemporary life in general, whose pressures, challenges, and changes test any easy notion of *self* and *home*. Representations of the military in fiction more often than not focus on dramatic, life-and-death action rather than the daily domestic life behind the scenes. This project is a sequel to an earlier one which explored the possibilities of military family life as a subject for fiction. Through its central characters, the twin daughter and son of an Air Force pilot, this new project examines gender differences in the way each adjusts to a structured military environment and later, as each grows into adulthood, to society in general.

Through the continuous process of drafting and revising, two stories have been completed, the first concerning the twin siblings during adolescence, the second about the sister as an adult and her conflicts with her own daughter. The theme common to both is alienation: the first story suggests its causes; the second depicts results. In addition, in anticipation of future settings, this project has required research into contemporary history, a rereading of the events and issues of the sixties and seventies, when alienation became a social movement. The two completed stories, now being considered for publication, have become the seeds of a more complicated narrative currently in progress.

A Comprehensive Survey of Computer Software in English

Researchers: Professor David O. Tomlinson
and Associate Professor Harriet F. Bergmann
Sponsor: Naval Academy Instructional Development Advisory Committee

This project, which began in 1988 and is continued through 1989, is to collect, evaluate, and give written guidance about the use of as many software packages as are available in teaching Plebe or freshman English classes (HE101, HE111, HE112, HE111S, HE112V). That is, packages teaching basic reading, writing, vocabulary, grammatical, and composition skills, as well as those introducing literary genres, are being reviewed. The researchers are considering both commercial and public domain/shareware programs.

In the fall three Anne Arundel County high school students working in the Mentorship Program helped review word processing programs for ease of use. Their work aided in making recommendations to Computer Services about the character of the word processor midshipmen in the Class of 1993 should receive.

The first complete review was of style checkers, programs which can help a student polish writing style. The reviews of these software packages have been printed and distributed to (1) members of the English Department at the Naval Academy, (2) any interested members of other departments at the Academy (many will be applicable to technical writing), and (3) members of regional and state organizations (e.g., the College English Association and the Maryland Association of Departments of English) devoted to the teaching of English at the college level. In addition, the material has been put into the listserv files of the HUMANIST, an international academic organization which distributes information by computer from Hawaii to Jerusalem. It has also been listed on ISAAC and more than two dozen Baltimore and Washington electronic bulletin boards.

The selection and testing of software programs continues unabated.

A Critical Study of May Swenson's In Other Words

Researcher: Associate Professor Eileen Tess Tyler
Sponsor: Naval Academy Research Council (OMN)

During 1987-1988 summer research, a comprehensive bibilography of critical studies of Swenson's poetry was compiled, read, and evaluated. Close comparative analysis of the forty-three poems in *In Other Words* yielded observations and insights included in a preliminary draft of a critical article. This paper focuses on the integral relationship between subject matter and technique in these poems, as well as on the poetic logic of their arrangement in the volume itself. For Swenson, "Vision, potent, regenerative, lives in the bodies of words." Her central concern is to dramatize the act of observation and the vision--physical or transcendent--that it yields. Her explorations are threefold in nature: she investigates (1) the processes of observation and vision, (2) the natural and human objects of these processes, and (3) the rationale behind them. In doing so, Swenson uses with great skill traditional poetic resources such as plays on words, sensory imagery, and figurative language. She also employs innovative techniques adapted from photography, including montage and double exposure.

Teaching and Learning in China

Researcher: Assistant Professor Hardy C. Wilcoxon
Sponsor: Naval Academy Research Council (OMN)

The purpose of this project is to describe the impact of American teachers on Chinese attitudes toward the West, and to define some of the ways in which the teaching and learning of American literature in China has been affected by the cultural differences between Americans and Chinese. The work is an outgrowth of the researcher's Fulbright Lectureship experience in the People's Republic of China during academic year 1986-1987.

The method of research consisted primarily of polling several American teachers currently or formerly stationed in China. Since the results proved disappointingly sparse, the researcher relied mostly on his own perceptions and wit to record his impressions on the topic. The resultant essay, "Chinese Students and the Burden of the Past" is presently being considered for publication by *College English*.

The Haunted Inkbottle: Problems of Artistic Communication in Modernism

Researcher: Midshipman 1/C Daniel D. Catlin, USN
Adviser: Associate Professor David A. White
Sponsor: Trident Scholar Program

The purpose of this selective study of the literature and literary figures of the modern period is to analyze and understand the breakdown in artistic communication unique to the modern world. Whether in music, the visual arts, or in literature, the modern world has seen a drastic change in the relationship between the artist and his audience. Certainly the events of the age have brought changes in the audience, but the artists themselves seem the most mysterious facet of this recent phenomenon; modern artists seem incapable of communicating their art to the general public.

Three particular artist were specifically chosen for study because of their notable contributions to the art of the period, and for their universal acceptance as major figures in their respective genres. T. S. Eliot, James Joyce, and Tennessee Williams represented all three major genres of literature (poetry, prose, and drama), while they spoke for all three major English-speaking nations (England, Ireland, and the United States).

A complete reading of their most important works, coupled with a detailed biographical study of each of the authors was undertaken. Peripheral readings in criticism and psychology led to the establishing of a model which characterizes the conclusions of the study. The central problem of artistic communication in Modernism is the problem of the modern artist. Whether an artist relates his consciousness to his world--and ultimately to his audience--through physical, intellectual, or spiritual means is the crucial factor determining the success or failure of the artist in reaching the audience with his art.

Independent Research

Minority Reporting and Psychic Distance in the Poetry of Robert Hayden

Researcher: Professor Fred M. Fetrow

Robert Hayden (1913-1980), the first Black poet to serve as Consultant in Poetry to the Library of Congress (1976-1978), both experienced and expressed the role of the outsider, coping with personal demons of alienation, while chronicling in artistic objectivity modern man's wandering ways in a psychic no man's land. Perhaps because he was a minority in race, raised from infancy by foster parents, a convert to a religious sect of obscure and often misunderstood nature, and a dedicated artist in a society which does not much value poets, Robert Hayden found an affinity with others outside the mainstream of ordinariness or acceptability. As he often expressed his interest in poetic characterization in terms of "baroque" personalities, so he crafted many poems about those he called "outsiders, pariahs, losers." Such works range in content, coverage, and theme from psychological profiles of fictionalized characters (often exhibited through dramatic monologue), through several heroes from Black history, to personae in biographical revelation of the poet himself.

Study of these poems reveals not only much about the artist and his perception of the artist's role in society, but suggests as well the thematic paradox which Hayden found so intriguing: ironically, it is the outsiders who provide an inside view of society's values, its psychic energies, its most and least attractive features. This project has already resulted in a paper read at a major convention, and should culminate in a published article in revelation of Robert Hayden's work and his attitudes toward himself, his art, and his country.

Magill's Bibliography of Nineteenth-Century American Poetry

Researcher: Professor Philip K. Jason

Designed primarily as a resource for undergraduate students, this annotated bibilography of secondary sources has 1000 entries. The first section surveys general discussions of nineteenth-century literary culture, particularly those focused on poetry. The following sections address individual authors: William Cullen Bryant, Ralph Waldo Emerson, Henry Wadsworth Longfellow, John Greenleaf Whittier, Edgar Allan Poe, Oliver Wendell Holmes, Jones Very, Henry David Thoreau, James Russell Lowell, Herman Melville, Walt Whitman, Frederick Goddard Tuckerman, Emily Dickinson, Sidney Lanier, Stephen Crane, and Paul Laurence Dunbar. Within each author section, the general, biographical, stylistic, and thematic entries are followed by entries that examine individual poems. The bibliography emphasizes books and sections of books, paying less attention to periodical articles, since they are both less available and less accessible to undergraduate students. The Introduction provides an overview of the subject, along with suggestions for further research. The completed manuscript was delivered to the publisher during the summer of 1989.

Herman Wouk: A Critical Study

Researcher: Lieutenant Colonel Laurence W. Mazzeno, USA

The American novelist Herman Wouk has enjoyed a wide following among the general public, but his work has been disparaged by serious students of literature. This study concentrates on the two major themes that run through his ouevre: the problems of growing up Jewish in America, and the impact of World War II on American society. Special attention is being paid to the popular and critical response to Wouk's novels to determine the reasons for the dichotomy of opinion about their value as literature and as social commentary.

The Victorian Novel: An Annotated Bibliography of Criticism

Researcher: Lieutenant Colonel Laurence W. Mazzeno, USA

This research effort will result in a full-length annotated bibliography of selected works of criticism about sixty major Victorian novels; it will serve as a ready reference for students of the genre and of individual works.

A History of Drama at the U.S. Naval Academy

Researcher: Associate Professor Michael P. Parker

Dramatic performances have formed an essential part of life at the U.S. Naval Academy since 1846, when a production of *The Lady of Lyons* by a troupe of exuberant (and inebriated) midshipmen scandalized Annapolis society. This project charts the history of drama at the Naval Academy over the past 143 years, concentrating particularly on the period after the founding of the Masqueraders in 1907. It traces changes in the types of plays produced; the influence of Broadway and later of the film industry; the rise of the stage crew and the juice gang; and the fifty-year-long debate over the virtues of actresses versus female impersonators. This history complements the work of Jane McWilliams on drama in eighteenth- and early nineteenth-century Annapolis. In particular, it examines the formative influence exercised by the Academy on the performing arts in the city and considers the ways in which that influence has evolved during this century.

A Rhetorical Analysis of Mathematical Proofs

Researcher: Instructor Patricia P. Sine

The purpose of this research is to analyze the rhetorical structure of mathematical proofs, and to stimulate an exchange of ideas among mathematics teachers and writing teachers on possible strategies for developing reasoning and communication abilities. The investigation involves analysis of the literature on rhetorical theory, composition theory, and cognitive theory. The research, an outgrowth of a 1988 Instructional Development Project, also involves working with Professor Hanna of the Math Department to create appropriate proofs and to observe students writing proofs in math classes. Initial results indicate that teaching math proofs and teaching composition are similar in many ways, including using protocols, strategies, and audience analysis.

Dante's Use of the Topos of True Fame

Researcher: Major John M. Thomson, USAF

Research continues in the preparation of a scholarly paper tracing the way in which the classical topos of true and false fame functions in Dante's *The Divine Comedy*. The researcher has completed an initial draft, and is presently reviewing some of the more recent research on Dante.

Research Course Projects

A Study of Gilbert and Sullivan's Use of Tennyson's The Princess in Their Comic Opera Princess Ida

Researcher: Midshipman 1/C Shawn James, USN
Adviser: Lieutenant Colonel Laurence W. Mazzeno, USA

For several decades, Tennyson's long poem *The Princess* inspired his Victorian contemporaries both to emulation and parody. Gilbert and Sullivan chose to parody the conventions of male-female relationships and especially of female independence that Tennyson treated seriously in his poem. This study examines the songs in Gilbert and Sullivan's *Princess Ida* to show how they invert serious ideas that are at the heart of Tennyson's work.

The Ethical Ideals of Knighthood

Researcher: Midshipman 1/C Donald B. McNeill, Jr., USN
Adviser: Lieutenant Colonel Laurence W. Mazzeno, USA

This project provides a definition of the knightly ideal based on an examination of one of the most celebrated adventures of Arthurian legend, the search for Jesus Christ's Holy Grail, the recovery of which was alleged to offer special blessings to King Arthur's realm. The study focuses on the quest story as told in three works of Arthurial literature: the anonymous twelfth-century *Quest for the Holy Grail*; Wolfram von Eschenbach's twelfth-century romance, *Parzival*; and Alfred Tennyson's nineteenth-century "The Holy Grail" from his epic poem, *Idylls of the King*. The adventures of several knights are examined in detail: Sir Gawain, who fails in the quest; Sir Lancelot, who achieves only a limited vision of the Grail; and Sir Bors, Sir Perceval, and Sir Galahad, who find the Grail by adhering to a strict code of conduct both before and during their search. Careful comparison of these characters shows that total purity of intent and action (including spiritual purity) is the *sine qua non* for success in the quest, which is itself a metaphor for attainment of perfection in knighthood.

William Faulkner's Vision of Southern History

Researcher: Midshipman 1/C Jay F. Wigley, USN
Adviser: Assistant Professor Mary D. Howland

William Faulkner's Yoknapatawpha County saga explores the role a community's history plays in its contemporary life. All of his characters feel the "burden" of the tragic Southern past. This project attempts to discover the nature and the implications of that burden as seen throughout the author's work. Readings in a number of novels should provide an adequate amount of material from which to construct Faulkner's view of Southern history. The researcher's view of that vision is expressed in a critical essay in coverage of the topic.

Publications

ARNOLD, Karen L., Instructor, "Common Cause: A Poet and a Printmaker Create *The Inside Passage*, a Folio of Woodcuts and Verse of the Alaskan Wilderness," *Columbia Magazine*, (Fall 1988), pp. 48-51.

The article consists of a joint interview of the author and artist Aline Feldman about their work, and includes publication of Arnold's poetry and Feldman's prints.

BERGMANN, Harriet F., Associate Professor, co-author, *Style Checkers: A Review*. Annapolis, Maryland: United States Naval Academy, 1989.

This pamphlet is a comprehensive review of eleven style checkers, produced with the assistance of an Instructional Development Program grant for summer 1988. The authors collected, used, and reviewed the computer programs surveyed.

BERGMANN, Harriet F., Associate Professor, co-author, "Introduction to Style Checkers," *CHIPS* (January 1980), 24-25.

This is a condensation of the research on style checkers described above.

CLARIDGE, Laura, Assistant Professor, "Pope's Rape of Excess," *Perspectives on Pornography*, ed. Gary Day and Clive Bloom. London: Macmillan, 1988, pp. 129-143.

Recent criticism of Alexander Pope's *The Rape of the Lock* centers on Pope's "typical" eighteenth-century constriction of female freedom in the name of social order. The author suggests instead that Pope's poem defends the poet--and any male vision of potency--against a myth of excess sexual power that eighteenth-century men project onto women of that era. Even (perhaps ironically) so, Belinda's plot exceeds the narrative attempts at containment, so that female strength is exactly what is inscribed within the conclusion of the poem.

FETROW, Fred M., Professor, ed., *Severna Park: A History of the Area*, Nelson Molter. Severna Park, Maryland: 1988.

The book surveys the history, geography, and local lore of northern Anne Arundel County, with special attention to the north shore of the Severn River and the community of Severna Park and its environs. The author, former Head Librarian of the Maryland State Law Library in Annapolis, compiled his material over the years intervening between his first edition in 1968 and the publication date of his supplemented second edition. As editor, Fetrow had responsibility not just for the text itself, but for assisting with format, illustrations, layout, and proofing the final copy.

FETROW, Fred M., Professor, A Road by Any Other Name . . .," *Anne Arundel County History Notes*, **20, 2** (January 1989), 5-6.

As editor of this quarterly, the author from time to time contributes notes and brief articles primarily as filler material. The entry listed above fits that category; the reliability (and thus, validity) of oral history in the process of research is questioned and exemplified through the account of the search for the origins of specific place names and route designations. The article is probably one-half serious inquiry and one-half satiric commentary; the reader is left to discover which half is which.

FLEMING, Bruce E., Assistant Professor, "On Reading Ruskin," *Magill's Literary Annual*. Pasadena, California: Salem Press, 1988, pp. 621-624.

This piece is a critical review of an edition of Proust's prefaces to Ruskin, published under the above title and introduced by Johns Hopkins University professor Richard Macksey. Fleming finds that Macksey's emphasis on intertextuality is misplaced, suggesting instead that a more balanced account would take its cues from the vision of reading presented by Proust himself in the preface published under the title "On Reading."

FLEMING, Bruce E., Assistant Professor, "Beau Durham," *Washington Dance View*, **8, 1** (1988), 12-15.

The article describes and analyzes a number of dance performances at the American Dance Festival at Duke University (Durham, North Carolina) in 1988, including world premieres by Molissa Fenley and Anita Feldman, and performances by Modern Dance masters Paul Taylor and Erick Hawkins.

FLEMING, Bruce E., Assistant Professor, "Pound and Eisenstein on the Ideogram: Sketch for a Theory of Modernism," *Southwest Review*, 74 (1989), 87-109.

The essay considers the views and treatment of the Chinese Ideogram by two of the greatest Modernist masters, the poet Ezra Pound and the filmmaker Sergei Eisenstein. Both conceived of the ideogram as standing in a relation to the world closer than that of the normal one of language reference. The author suggests that this conception is central to the Modernist enterprise.

FLEMING, Bruce E., Assistant Professor, "An Essay in Seduction, or The Trouble With *Bovary*," *The French Review*, 62, 5 (April 1989), 764-773.

Fleming analyzes Flaubert's seminal anti-Romantic novel, *Madame Bovary*, suggesting that previous views of the title character as representing a personality who desires are incorrect. He analyzes what he calls Flaubert's "plot effects" and "character effects" that lead the reader to think of Madame Bovary as a real person, but proposes instead the novel is best read as what he calls an essay in seduction rather than as a story of realistic characters acting in a probable world at all.

FLEMING, Bruce E., Assistant Professor, "The Autobiography of Gertrude Stein," *The Gettysbury Review*, 2, 2 (Spring 1989), 213-225.

This is a short story, a fictional account of a man who had known the writer Gertrude Stein as a child and who returns to Paris many years later to visit her grave. The story is written in a derivative of the style of Stein's own work, *The Autobiography of Alice B. Toklas*.

HILL, John M., Associate Professor, "*Beowulf*, Revenge, and Superego Mastery," *Assays 5*. Pittsburg: University of Pittsburg Press, 1989, pp. 1-50.

Much commentary on *Beowulf* notes the strongly marked oppositions such as light and dark imagery, heroism and cowardice, terror and fame, niggardliness and generosity. A few readers have undertaken psychological studies of the energies involved in the poem's key opposition, that between Beowulf as hero and the various monsters, his adversaries. But none of these studies goes far enough to reveal the psychological dymanic underlying and destabilizing the world of the poem. That dynamic is intimately related to a dynamic of "loans"--of loaned energies and of loaned gifts and weapons in the heroic world, from father to son and from warband leader to retainer. This dynamic of loans further involves a strongly developed and aggressive super-ego, a sense of what is right and a willingness to do violence in the service of what is right, fitting, or good. The present study works out this dynamic in detail, centering the analysis on the vocabulary of "exchange"--of good exchanges, of bad ones, and of deadly ones.

JASON, Philip K., Professor, "Pan," *Masterplots II: World Fiction Series*. Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 1168-1172.

Hamsum underscores his intentions by identifying Lt. Glahn with Pan, a mythological figure associated with the forest, hunting, sexual energy, and a consequent magnetism. This identification is made most pointedly by the image of Pan on Glahn's powder horn, and in this way his destructive potential is foreshadowed: Glahn will use his gunpowder as a tool for a vengeance that is, in part, sexually motivated. Pan is often portrayed as goat-footed, a detail that may be psychoanalytically translated into both lameness (abnormal formation) and sexual potency (goatish). Hamsun brings these associations together through the lame doctor, Glahn's rival, and through Glahn's act of identification through self-mutilation: he shoots himself in the foot. Above all, Pan is a phallic deity whose legends are stories of seduction. Glahn's actions with Eva and Henriette dramatize this aspect. These women parallel the nymphs and shepherdesses of Greco-Roman mythology.

MADISON, Robert D., Assistant Professor, "The Strange Fowl of `Benito Cerno,'" *Melville Society Abstracts*, 70 (September 1987), 15-16.

This is a note on the relation of Melville's bird symbolism in "Benito Cereno" to his sources and whaling lore. The piece should enhance reader understanding and appreciation of the short story, as well as provide a better sense of Melville's background materials always lurking beneath the surface in his fiction.

MADISON, Robert D., Assistant Professor, "Hemingway and Selous: A Source for `Snows'?," *The Hemingway Review*, 8, 1 (Fall 1988), 62-63.

In this note the author considers Ernest Hemingway's use of biographical matter from the life of an African game hunter, suggesting that perhaps Hemingway found the genesis for his "The Snows of Kilimanjaro" in the career of a real hunter.

MADISON, Robert D., Assistant Professor, Editorial Assistant, Herman Melville, *Moby Dick*, ed. Harrison Hayford, et al. Evanston and Chicago: Northwestern University Press and the Newberry Library, 1987.

Madison as Editorial Assistant assisted with the textual editing of this recent, definitive edition of Melville's classic. This work should serve as the authoritative text of *Moby Dick* for the foreseeable future.

MAZZENO, Laurence W., Lieutenant Colonel, USA, "Henry James," *Critical Survey of Literary Theory*. Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 750-757.

This article outlines the major tenets of Henry James' critical theory of fiction, and highlights his insistence upon the importance of form, point of view, and other technical aspects of a work as criteria for judging its aesthetic value. The piece is intended to assist undergraduates in understanding James' writings.

MAZZENO, Laurence W., Lieutenant Colonel, USA, "Matthew Arnold, James Bryce, and the Idea of Democracy," *Matthew Arnold in His Time and Ours*. ed. Forrest Burt and Clinton Machann. Charlottesville, Virginia: University Press of Virginia, 1988, pp. 71-80.

In this essay the author discusses the conflicting views of democracy held by Matthew Arnold and James Bryce, two influential British writers whose works helped shape British attitudes about America during the latter half of the nineteenth century. Primarily intended as a corrective to the prevailing notion that Arnold was a liberal thinker, the article questions the existence of Arnold's supposed support of democratic values.

MAZZENO, Laurence W., Lieutenant Colonel, USA, "Nikos Kazantzakis, *The Last Temptation of Christ*," *Masterplots II: Foreign Authors Series*. Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 820-824.

This is a brief summary of the major action of the novel and a discussion of its principal themes; it is designed to help undergraduates understand the work.

MAZZENO, Laurence W., Lieutenant Colonel, USA, Editor, *The Arnoldian: Special Centenary Issue*, **15** (Winter 1988).

This special issue of *The Arnoldian* marks the centenary of the death of Matthew Arnold; it contains substantial articles by six eminent scholars and includes retrospective book reviews of important works of Arnold scholarship published in the twentieth century.

MAZZENO, Laurence W., Lieutenant Colonel, USA, Editor, *Nineteenth Century Prose*, **16**, **1** (Winter 1989).

This is the inaugural issue of a journal that serves as the follow-on to *The Arnoldian*. Like its predecessor, it serves an audience interested in Victorian and nineteenth-century literature, but its coverage is more expansive, as it will also include articles on various nineteenth-century prose figures, and reviews of recent scholarly monographs.

NOLAN, Charles J., Jr., Professor, "Teaching at Night--Teaching That Counts," *College Teaching*, **36** (1988), 147-148.

Being both a full- and part-time teacher has its joys and sorrows, but the experience provides a rare opportunity to grow as a teacher and as a person. The disadvantages are readily noted, if not easily resolved; but, compared to what can be learned from teaching at night, the disadvantages seem not so troublesome at all. The most interesting discovery is that evening college students really are different, especially in the way they bring their needs and psychological pasts into the classroom. As a result, teaching them is a tricky business, but one rewarded by the appreciation evening students show their professors and by the professional growth teaching them produces.

NOLAN, Charles J., Jr., Professor, Contributions to the Annual Bibliography of English Language and Literature. Volume 60. Eds. Elizabeth Erskine, Mary Jean DeMarr, and D. Gene England. Leeds, Great Britain: Modern Humanities Research Association, 1988.

Contributions to the Annual Bibliography come from a careful review of the many issues of fourteen journals ranging from *Anthropological Linguistics* to the *International Philosophical Quarterly*. The contributor examines and notes any article, edition, book, or thesis, published in any language, that has an important link to English and American language or literature and any ancillary work that bears significantly on those fields. The Annual Bibliography is one of the two major bibliographies in English studies.

O'BRIEN, Timothy D., Associate Professor, "The Shadow and *Anima* in *Sir Orfeo*," *Mediaevalia*, **10** (1988, for 1984), 235-253.

Critical commentary on the Middle English *lai*, *Sir Orfeo*, often remarks on the poem's psychological texture. Unfortunately, the poem's psychological significance has received no thorough or formal attention. Thus, the clearest discussions of the poem and of the apparently unmotivated actions of its characters depend upon the model of Patristic allegoresis. However, this model remains unsatisfactory because it oversimplifies the complex symbolic relationships among King Orfeo, Heurodis, his wife, and the fairy king, who intrudes from the other world of the poem. A Jungian model does preserve the poem's actual complexity and also defines more clearly than other critical approaches the poem's psychological significance.

The poem's basic event, then, is an internal one, what Jung calls *individuation*. This process involves, for the male, the recognition of the unconscious elements determining its behavior. Usually, what needs recognition are the *anima* and *shadow*, the female aspect of the male and the repressed, detestable element within that male psyche. The *anima* is the window onto the *shadow*. In these terms, Heurodis can be profitably understood as the *anima* of the psyche; the fairy king, as the *shadow*. Orfeo's behavior, thus, takes the shape of the process of recognizing and thereby freeing himself form the compulsive energy of these forces within him. The inextricable connection in *Sir Orfeo* between Heurrodis and the appearances of the fairy king, the detailed identification of Sir Orfeo with the fairy king, and Orfeo's stint in the wilderness all help to express this process of *individuation*.

PARKER, Michael P., Associate Professor, "Satire in Sextodecimo: Davenant, the Dwarf, and the Poliltics of `Jeffereidos'," Claude J. Summers and Ted-Larry Pebworth, eds., *"The Muses Commonweale": Politics and Poetry in the Seventeenth Century*. Columbia: University of Missouri Press, 1988, pp. 97-106.

Although highly regarded in the seventeenth century, "Jeffereidos," Sir William Davenant's mock-epic poem on the captivity of Queen Henrietta Maria's dwarf, has routinely been dismissed by modern critics as a peculiar, second-rate production. The disparity in critical reception is largely due to the disappearance of the political context in which the poem was written: few twentieth-century readers are attuned to the complex foreign policy issues and intricate court alignments that Davenant's poem addresses. Briefly stated, "Jefferedios" was composed at a delicate moment in Anglo-Spanish relations. Ambassadors from Madrid were in London to urge Charles I to conclude his two-year war with Spain, and the king seemed inclined to comply. Henrietta Maria, on the other hand, advocated that Britain forge an offensive alliance with France and prosecute the war with Spain more vigorously; Davenant's mock-epic champions her arguments. The poet uses the imprisonment of the royal dwarf by Dunkirk pirates to criticize the king's apparent truckling to Spain; the seemingly extraneous details of the piece prove to allude to very real persons and events. This reading of the poem suggests that the Caroline court tolerated a much wider range of political discussion and dissent than historians have hitherto realized. The study also expands our understanding of the position of court dwarfs, who served as lightning rods for dissatisfaction with the policies of their masters.

SINE, Patricia, Instructor, Assistant Editor, *Naval History: the Seventh Symposium of the U. S. Naval Academy*, ed. William B. Cogar. Delaware: Scholarly Resources, Inc.: 1988.

The above volume is a collection of the papers delivered at the Seventh Naval History Symposium conducted at the U. S. Naval Academy during 1987. Sine assisted the general editor in the compilation and proofing of the manuscript.

SMITH, David P., Lieutenant Commander, USN, "Pearl S. Buck," *Winners of the Nobel Prize for Literature*. Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 459-466.

This article is a summary of Pearl Buck's career, with special emphasis on her receipt of the Nobel Prize for Literature. The author examines the presentation of the award, Buck's award lecture, and the critical reception of the award. The piece also includes a short biography, as well as primary and secondary bibliographies.

SMITH, David P., Lieutenant Commander, USN, "Dionysius of Halicarnasus," *Critical Survey of Literary Theory*. Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 382-385.

This work presents a survey of the main critical and theoretical accomplishments of the subject, how his work was contemporaneously important, and his contribution to literary history.

SMITH, David P., Lieutenant Commander, USN, "Lucian," *Critical Survey of Literary Theory.* Englewood Cliffs, New Jersey: Salem Press, 1988, pp. 929-933.

A short study of the influence, reputation, and work of this early satirist, the article concentrates on Lucian's efforts to use satire as a method of determining literary worth.

SMITH, David P., I ieutenant Commander, USN, "The Pine Barrens," *Masterplots II: Nonfiction Series.* Englewood Cliffs, New Jersey: Salem Press, 1989, pp. 1168-1172.

This article is a critical examination of a leading prose stylist through attention to his best-known book. The author discusses McPhee as stylist, and examines the technique and organization of *The Pine Barrens* as typical of McPhee's work. Finally, the writer comments on McPhee's place in the contemporary world of non-fiction writing.

TINSLEY, Molly B., Professor, "Welcome Advance," *Prairie Schooner*, **62**, 3 (Fall 1988), 67-76. Awarded Best Fiction Prize for 1988.

The story takes place in Stockholm, Sweden, where the narrator's family has just weathered a difficult winter. The mother has been seriously ill; there is tension among the various family members, which is brought to a crisis during a dinner party to which the mother has invited a Hindu meteorologist. He refuses to partake of the meal when he discovers meat products have been used in its preparation. When the action is resolved, the young narrator has learned something about the transcience of things she has taken for granted.

TOMLINSON, David O., Professor, co-author, "The Style Checkers: Reviews of Thirteen Computer Programs Which Aid the Writing Process." (Produced Under an Instructional Development Grant at the United States Naval Academy, 1988). 40 pages.

The booklet contains a brief introduction to style checkers as well as thirteen of the popular style checking programs: Clearcut, Grammatik II, Grammatik III, Maxi-Read, Parse, PC-Style, Phrase Watcher, Pro-Scribe, "Punctuation" + Style, Readability 1.1, RightWriter 2.1a, RightWriter 3.0, and Styled.

Each review tells what tasks the program performs and how well it performs those tasks. The style checkers are rated poor, good, excellent, and superior, based on their capabilities and performance.

TOMLINSON, David. O., Professor, "Grammatik III," *Computing at USNA: A Computing Report* (November 1988), pp. 4-5.

The above is a brief article detailing the virtues and showing the shortcomings of one of the more impressive of the style checkers on the market.

TOMLINSON, David O., Professor, co-author, "MemoryMate, Version 3.01R," *Computing at USNA: A Computing Report* (December 1988/January 1989), pp. 4-5.

The article is a brief review of the free-form data base and its usefulness to teachers.

TOMLINSON, David O., co-author, "An Introduction to Style Checkers," *CHIPS: Professional Bulletin* (January 1989), 24-25.

The article serves as a general introduction to style checkers, explaining what capabilities and drawbacks they have. It uses Grammatik III and RightWriter 3.0 to show how much information such programs can generate.

TYLER, Eileen Tess, Associate Professor, "S. S. Van Dine," *Critical Survey of Mystery and Detective Fiction*, ed. Frank N. Magill, 4 vols. Pasadena, California: Salem Press, 1989, pp. 1634-1640.

This reference article focuses on the achievement of S. S. Van Dine (a pen name for Willard Huntington Wright, 1888-1939). It defines his contribution to American detective fiction, sketches his biography, analyzes his ideas about and work in the genre, and supplies a bibliography of writings by and about him.

S. S. Van Dine is a significant figure in the history of detective fiction, both as a theorist and as a practitioner of the genre. As a theorist, he articulated a strict code of "Fairness" in the plotting of the detective novel and enunciated important ideas about the nature of the genre's appeal. *The Benson Murder Case* (1926) and *The Canary Murder Case* (1927) attracted a new audience for detective fiction in the United States, bringing it to the attention and serious consideration of intellectual and sophisticated readers and initiating what has come to be known as the Golden Age of American detective fiction. In the 1920's and 1930's, Van Dine's Philo Vance novels were the most widely read detective stories in the United States. They inspired thirty-one motion pictures, filmed between 1929 and 1947, and a popular weekly radio series, *Philo Vance*, during the 1940's.

TYLER, Eileen Tess, Associate Professor, "Ellis Peters," *Critical Survey of Mystery and Detective Fiction*, ed. Frank N. Magill, 4 vols. Pasadena, California: Salem Press, 1989, pp. 1318-1324.

This reference article focuses on the achievement of British novelist Ellis Peters (1913-). It defines her contribution to contemporary detective fiction, sketches her biography, analyzes her ideas about and work in the genre, and supplies a bibliography of writings by and about her.

Ellis Peters' Felse family series and her chronicles of Brother Cadfael are in the British tradition of detective fiction writers such as P. D. James and Ruth Rendell. These writers' works, while displaying the careful and suspenseful plotting characteristic of the detective genre, frequently transcend the effect of pure entertainment and share with the traditional "literary" novel the aims of engaging in complex examinations of human character and psychology and achieving thematic depth and moral vision. Peters herself expressed her dislike for the distinction between detective fiction and serious novels and succeeded in interweaving traditional novelistic materials--love interests, the study of human growth and maturation, the depiction of communities and their politics--with the activity of crime solving. The Brother Cadfael chronicles are her most popular as well as her most impressive achievement, locating universal human situations in the meticulously particularized context of twelfth-century England. These novels are masterpieces of historical reconstruction; they present a memorable and likable hero, Brother Cadfael, and a vivid picture of medieval life, in and out of the monastery, in its religious, familial, social, political, and cultural dimensions.

WHITE, David A., Associate Professor, "Evelyn Waugh: The Early Years 1903-1939 by Martin Stannard," *Magill's Literary Annual*, I (1988), 293-297.

This first volume of a two-volume biography of the life of twentieth-century British novelist Evelyn Waugh begins by exploring the early influences that shaped the later novels. Much of the work focuses on the failed first marriage and Waugh's subsequent conversion to Roman Catholicism. The biography gives detailed accounts of the publication and public reception of the first novels and concludes on the eve of World War II with Waugh beginning a major transformation of his work to reflect what he saw as an altered world.

Presentations

ARBUTHNOT, Nancy Prothro, Associate Professor, "Remembering Richard Hugo," Western American Literature Annual Conference, Eugene, Oregon, 4-8 October 1988.

ARBUTHNOT, Nancy Prothro, Associate Professor, "'The Purpose of the Poem': The Image of the Mother in Wallace Stevens's Poetry," Northeast Modern Language Association Annual Conference, Wilmington, Delaware, 2 April 1989.

ARNOLD, Karen L., Instructor, "Kirsten's Epic: The Creation of a Character and Historical Research," American Scandinavian Association, Bethesda, Maryland, 7 January 1988.

ARNOLD, Karen L., Instructor, "Kirsten's Memoirs," Society for the Advancement of Scandinavian Studies Convention, Eugene, Oregon, 6 May 1988.

ARNOLD, Karen L., Instructor, "Old Jules," National Endowment for the Humanities Lecture Series, Elkridge Library, Elkridge, Maryland, 6 July 1988.

ARNOLD, Karen L., Instructor, "Letters of a Woman Homesteader," National Endowment for the Humanities Lecture Series: Florence Bain Senior Center, Columbia, Maryland, 29 September 1988; Taney Village, Hagerstown, Maryland 11 October 1988; County Library, Hagerstown, Maryland, 7 January 1989; Miller Branch Library, Ellicott City, Maryland, 3 March 1989.

ARNOLD, Karen L., Instructor, "The Professor's House," NEH Lecture Series, Bowie Library, Bowie, Maryland, 13 October 1988; Miller Branch Library, Ellicott City, Maryland, 20 March 1989.

ARNOLD, Karen L., Instructor, "Wind in the Willows," NEH Lecture Series, Wheaton Regional Library, Silver Spring, Maryland, 15 March 1989.

ARNOLD, Karen L., Instructor, "Through One Woman's Eyes: The Unpublished Diary of Elisabeth Schmidt," South Atlantic Modern Language Association, Washington, DC, 10 November 1988.

ARNOLD, Karen L., Instructor, "My Life: Isadora Duncan," County Library, Hagerstown, Maryland, 12 April 1989.

BERGMANN, Harriet F., Associate Professor, "Teamed Teaching: Reading *Uncle Tom's Cabin* and *Beloved*," Conference of College English Association, Middle Atlantic Group, College Park, Maryland, 4 March 1989.

BURKE, Carol, Assistant Professor, "The Soldier's Woman and the Woman Soldier: Military Marching Chants," American Folklore Society, Cambridge, Massachusetts, 29 October 1988.

BURKE, Carol, Assistant Professor, "Research in the Writing Center," Southeastern Writing Centers Association, Charleston, South Carolina, 5 March 1988.

BURKE, Carol, Assistant Professor, "Gifted Women," Northeastern Anthropological Conference, Albany, New York, 18 March 1988.

BURKE, Carol, Assistant Professor, "U. S. Naval Academy Folklore," Churchill Society, U. S. Naval Academy, Annapolis, Maryland, 18 January 1989.

BURKE, Carol, Assistant Professor, "Military Folklore," Vanderbilt University, Nashville, Tennessee, 17 February 1989.

CLARIDGE, Laura, Assistant Professor, "Frank O'Hara and Jackson Pollock: Interdisciplinary Intertexts," Smithsonian Resident Associates, Washington, DC, 24 October 1988.

CLARIDGE, Laura, Assistant Professor, Moderator, "Psychological Approaches to Literature Division," South Atlantic Modern Language Association, Washington, DC, 11-13 November 1988.

CLARIDGE, Laura, Assistant Professor, Moderator/Organizer, "Redefinitions: Exploding Binary Opposition in Gender Theory," Modern Language Association Convention, Special Session, Washington, DC, 30 December 1988.

CLARIDGE, Laura, Assistant Professor, "Men in Feminism," Women's History Month, Wofford College, Spartanburg, South Carolina, 29 March 1989.

FETROW, Fred M., Professor, "Minority Reporting and Psychic Distance in the Poetry of Robert Hayden," International Conference on the Outsider in Literature, Philosophy, and the Visual Arts, Atlanta, Georgia, 28 October 1988.

FLEMING, Bruce E., Assistant Professor, "Proust and Peirce on Time and Memory," South Atlantic Modern Language Association Conference, Washington, DC, 12 November 1988.

GILLILAND, C. Herbert, Jr., Associate Professor, "Castiglione's Courtier and the Modern Staff Officer," Joint Academy Conference on Constitutional Responsibilities of Military Officers, Washington, DC, 18 January 1989.

HILL, John M., Associate Professor, "Hrothgar's Noble Rule," Conference on New Perspectives in Viking Studies, University of Glasgow, Glasgow, Scotland, 1 September 1988.

HILL, John M., Associate Professor, "Fiction and Premontory Truth in Hardy's *Tess of the D'Urbervilles*," Conference on Narrative Literature, University of Wisconsin, Madison, Wisconsin, 7 April 1989.

JASON, Philip K., Professor, "'That Noise Is Always in My Head': Auditory Images in the Literature of the Vietnam War," Popular Culture Association Meeting, Saint Louis, Missouri, 7 April 1989.

LEFCOWITZ, Allan B., Professor, co-author, "Saving Remnants and Saving Everybody: Arnold, Bryce, and Bloom on Education," Conference in Celebration of the Centennial of Arnold's Death, Central State University, Wilberforce, Ohio, 9-10 November, 1988.

MADISON, Robert D., Assistant Professor, "The Nautical Writing of John James Audubon," American Culture Association/Popular Culture Association Annual Meeting, Saint Louis, Missouri, 8 April 1989.

MAZZENO, Laurence W., Lieutenant Colonel, USA, Panel Chair, "Submitting Materials to Victorian Scholarly Journals," Victorians Institute Conference, University of South Carolina, Columbia, South Carolina, 15 October 1988.

MAZZENO, Laurence W., Lieutenant Colonel, USA, co-author, "Saving Remnants and Saving Everybody," Central State University, Wilberforce, Ohio, 9-10 November 1988.

MAZZENO, Laurence W., Lieutenant Colonel, USA, "King Arthur in Story and Song," Churchill Society, United States Naval Academy, Annapolis, Maryland, 1 February 1989.

MCFADDEN, Jeffrey E., Lieutenant, USNR, "Agent Orange and the Derivative Morality of the Political-Military Decision Maker," Joint Academy Conference on the Constitutional Responsibilities of Military Officers, National Defense University, Washington, DC, 11 January 1989.

NOLAN, Charles J., Jr., Professor, "One Teacher's Lessons," Conference of the College English Association, College Park, Maryland, 4 April 1989.

O'BRIEN, Timothy D., Associate Professor, "Science and Satire in the *Summoner's Tale*," Sixth Annual Citadel Conference on Literature, Charleston, South Carolina, 24 February 1988.

O'BRIEN, Timothy D., Associate Professor, "Simple Machines, Science, and Chaucer's Summoner," Atheneum Society of the English Department, United States Naval Academy, Annapolis, Maryland, 5 December 1988.

PARKER, Michael P., Associate Professor, "A Year in the Old Navy," Churchill Society, United States Naval Academy, Annapolis, Maryland, 15 March 1989.

DEPARTMENT OF

History

Professor Craig L. Symonds
Chairman

Academic Year 1988-1989 was a seed-bed year for the members of the History Department. After last year's crop of five scholarly books, no monographs were published this year. There were, however, fourteen articles published, including Associate Professor Theodore Bogacz's important article on shell shock in the *Journal of Contemporary History*. In addition, faculty members sponsored five midshipmen research projects, six honors papers, delivered no fewer than thirty-eight scholarly papers at conferences, and authored countless book reviews for professional journals and newspapers. Finally, several faculty members were engaged during the year in major research projects that will yield fruit in the next few years.

Faculty research projects in the current academic year covered a wide range of topics. They ranged chronologically from Imperial Rome to cruise missile technology; geographically from the African Congo to China and Japan; and topically from strategy and tactics, to art, ideas, and philosophy. This wide range of topics is evidence of the breadth of scholarly interests in the department and the wide range of expertise within the faculty.

Several faculty members delivered multiple presentations in the past year, thus contributing to their growing reputations as recognized experts in their fields. Professor Robert Artigiani's work with the application of the thermodynamic model has brought him invitations to speak in Italy, Finland, Belgium, England, and Scotland in the past year. Professor Kenneth Hagan's work on modern naval tactics and the role of the supercarrier has triggered invitations from conferences in Canada, France, and Australia as well as this country. Lieutenant Commander Thomas Cutler's expertise on the Navy's role in Vietnam led to many invitations to speak from across the country. And Associate Professor Bogacz's several presentations on shell shock in World War I have made him a recognized expert on that subject.

Finally, three faculty members in particular were recognized this year for their excellent research in monographs and special studies. Assistant Professor Mary DeCredico received the Mrs. Simon Baruch University Award from the United Daughters of the Confederacy for the best monograph on southern history for her work on southern entrepreneurs during the Civil War. Lieutenant Commander Cutler received the Alfred Thayer Mahan Award for Literary Achievement from the Navy League of the United States for his work on the Navy in Vietnam. Associate Professor Richard Abels was nominated by the department as its candidate for the Excellence in Research Award sponsored by the United States Naval Academy Alumni Association.

Sponsored Research

The Evolving Relationship Between War and Society in Medieval England

Researcher: Associate Professor Richard P. Abels
Sponsor: Naval Academy Research Council (OMN)

This research project is a study of the interrelationship of warfare and societal development in England from the eighth century through the fourteenth century. The working hypothesis is that warfare shaped and reflected social relationships and political institutions. During this period, the meaning and functions of warfare and the manner in which it was waged were transformed by dramatic changes in societal, economic, and political organization. Conversely, the presence--one is tempted to say the "omnipresence"--of war forced the development of institutions of governance that would provide the foundations for the modern English nation-state. The research entails synthesizing recent scholarly work on specialized topics in medieval military history and a systematic analysis of primary sources, including archival materials on finance and recruitment of royal armies. It is expected that this project will eventually culminate in articles, conference presentations, and a booklength scholarly monograph.

Managing Complexity: Cruise Missiles and the Maritime Strategy

Researcher: Associate Professor P. Robert Artigiani
Sponsor: Office of the Chief of Naval Operations (OP-098)

In this study, the origins, development, and implications of cruise missile technology are analyzed using general evolutionary models. The goal is to determine if contemporary scientific models and mathematical tools can help predict the impact of new technologies on institutions, in this case the U.S. Navy. By examining the introduction of cruise missile technology on the Navy, it may become possible to understand how to manage the impact of other new technologies more skillfully.

A Question of Will Power: A Comparative Study of the Investigation and Treatment of War Neuroses in Austria, Germany, England, and America 1914-1922

Researcher: Associate Professor Theodore W. Bogacz
Sponsor: Naval Academy Research Council (OMN)

This research project involves an examination and comparison of the investigation and treatment of war neuroses (commonly called "shell-shock") in Austria, Germany, England, and America during and after the First World War. The "shell-shock" crisis of the First World War had the most profound implications both for the military and for civilian society. The mental breakdowns of tens of thousands of soldiers of all ranks and classes under the pressure of modern mechanized warfare threw into question not only medical diagnoses and treatments for insanity but also traditional ideas about courage, character, and moral responsibility. Furthermore, the crisis of war neurosis severely undermined older theories about the physiological origins of neuroses and hysteria; it also served to publicize the ideas of Sigmund Freud and his followers.

A comparative investigation of the manner in which Austria, Germany, England, and America responded to the "shell-shock" crisis of the First World War promises to reveal a good deal about their respective societies and cultures. Such a study would dramatically contrast differing national attitudes towards such fundamental questions as the diagnosis of mental illness and its treatment, the degree to which men are morally responsible for their acts, and ultimately definitions of bravery and cowardice in war. In particular, such a comparative perspective would reveal contrasting national attitudes toward a crucial agent of cultural change, namely Freudian psychoanalysis. This project was begun in the summer of 1988 and is still in the research phase.

Dictionary of Admirals of the United States Navy, Volume II, 1901-1918

Researcher: Assistant Professor William B. Cogar
Sponsor: Naval Academy Research Council (OMN)

This research will contribute to the second of what will be a multi-volume series on all admirals of the United States Navy, a continuation of the first volume, which covered the years 1862 through 1900. Like its predecessor, this product will include biographical and career information, as well as bibliographical information. The intent is to provide scholars with a reliable and convenient source on American admirals not presently available.

Caesar's Dalmation Policy

Researcher: Associate Professor Phyllis Culham
Sponsor: Naval Academy Research Council (OMN)

Previous work on the Greek inscription *RDGE*a-c has focused on recovering or restoring its text by using philological methods, or on the importance of its text (it is diplomatic correspondence) for the study of Roman law. It is more important to place the document in its g.ographical and cultural context. It can be used to shed light on the Adriatic community in antiquity, on the aspirations of Julius Caesar, and on Roman-Greek-"Barbarian" cultural contacts. The results have been included in a paper which will be submitted as a scholarly article.

Patriotism for Profit: Georgia's Urban Entrepreneurs and the Confederate War Effort

Researcher: Assistant Professor Mary A. DeCredico
Sponsor: Naval Academy Research Council (OMN)

The composition and character of Southern society during the antebellum and postbellum years have led to numerous studies on Southern distinctiveness. The majority of recent monographs have portrayed the South as a static, tradition-bound society. These studies argue that the planter elite kept the South stagnant by erecting social barriers which acted as constraints to the growth of an urban middle class.

In attempting to explain Southern "backwardness" or progress, historians have manifested a singular unwillingness to come to terms with the Civil War period. Several scholars have recognized the catalytic impact of the war on Southern development, but they have explained that impact in general terms, falling back on interpretations which deny any element of modernity in the antebellum South. Such treatment is curious, for all scholars acknowledge that the Civil War had a tremendous impact on every sector of Southern society.

This study addresses the gap in the literature by examining the Civil War mobilization experience in the South and the way the mobilization affected the dynamics of Southern society. More specifically, it explores urban Georgia's response to the demands of Confederate mobilization to show how the war years influenced entrepreneurs in Atlanta, Augusta, Savannah, and Columbus. By identifying and reconstructing the pattern of mobilization in a specific locale, it may be possible to gauge the impact of the war years on the broader pattern of Southern society.

NOTE: The book has been completed. An advance contract for publication has been received from the University of North Carolina Press, and the book will be published in the spring of 1990. The manuscript received the United Daughters of the Confederacy Mrs. Simon Baruch University Award as the outstanding monograph on Confederate History for 1988.

The Strange Political World of George Wyndham

Researcher: Associate Professor Nancy W. Ellenberger
Sponsor: Naval Academy Research Council (OMN)

This project examines the political attitudes of George Wyndham, the early twentieth-century Conservative politician whose service as a cabinet minister in the Balfour administration was followed by a gradual disillusionment with mainstream conservatism and the promotion of increasingly extreme rightwing causes. Too often Wyndham has been dismissed as a disgruntled Tory reactionary, emotionally and intellectually distressed by developments in the modern world that threatened the authority of the landed society to which he belonged. This study puts Wyndham into another context, that of the "radical right" in pre-war Britain. This group of activists believed that threats to Britain's international predominance and internal stability required a dynamic, "constructive" Conservative reponse. The movement contributed much to the climate of crisis in Edwardian Britain, and, as Oswald Mosley acknowledged, it was the intellectual forebear of his own fascist party.

The project is designed to produce an article for submission to a scholarly journal dealing with British history or modern European studies. Wyndham has been the subject of two biographies, as well as the volumes of letters published by his family. Although these works are repetitive and based on limited sources, they have chronicled the major facts of his life and career. This study will attempt something different by presenting in historical context a more thorough analysis of Wyndham's political views than has been undertaken before. Thus it will cast light upon a neglected aspect of Wyndham's own life. In addition, it will contribute to our knowledge of the heritage of British fascism, particularly among the aristocracy--a sensitive subject whose study is still in its infancy.

Women in the Navy

Researcher: Associate Professor Jane E. Good
Sponsor: Naval Academy Research Council (OMN)

The purpose of this project was to continue research on women in the Navy initiated during academic year 1987-1988. The project was two-pronged. Much of the work to date involved women midshipmen. Data from the eleven years women have been part of the Brigade of Midshipmen have been collected and analyzed. After several more years of data collection, it will be possible to write a comprehensive history of women midshipmen and officers. The second, related area of investigation was the background history of women in the Navy. The goal is eventually to include data on women midshipmen in a broader study of female naval officers. To date, this research has resulted in the publication of two articles (co-authored with Captain Karl M. Klein, USN), "Women in the Brigade," which appeared in the United States Naval Institute *Proceedings*, 114/4/1022 (April 1988), 103-108; and "Women in the Military Academies," *Physician and Sportsmedicine*, 17 (February 1989), 99-106.

Perry in Perspective

Researcher: Professor Kenneth J. Hagan
Sponsor: Naval Academy Research Council (OMN)

This research project focused on Captain Matthew C. Perry's expedition to Japan (1852-1854), viewing it in the context of overseas American naval operations in the decade of the 1850's, and the entire nineteenth century. By reviewing the pertinent primary and secondary sources, the researcher seeks to explain Perry's mission as an integral part of systematic overseas commercial and naval expansion in a vigorous decade.

The U.S. Supercarrier: Strategic in Origin, Tactical in Use

Researcher: Professor Kenneth J. Hagan
Sponsor: Naval Academy Research Council (OMN)

The objective of this project is to prepare a paper explaining the origins of the U.S. supercarrier in detail and briefly examine the ship's role in combat since World War II. The paper exposes the incongruity between conceived mission and actual use in the last forty years. For the future, it implies that for the next several years there will be an intense struggle in the U.S. Congress and Pentagon over whether to continue building supercarriers or to restructure the U.S. Fleet around electronically sophisticated surface ships.

By reviewing some of the pertinent primary and secondary sources, the researcher will construct the story of the evolution of the aircraft carrier as the lineal descendant of the battleship, and more remotely of Admiral Horatio Nelson's H.M.S. VICTORY, symbolically the ultimate line-of-battle ship.

Emergence of the Modern American Navy, 1865-1915

Researcher: Professor Frederick S. Harrod
Sponsor: Naval Academy Research Council (OMN)

In terms of the ships in the fleet and the use to which that fleet was put, the United States Navy in the twentieth century was clearly different from what it had been in the nineteenth century. Standard interpretations of the coming of the new Navy portray a story of considerable drama. As seen in this view, the Navy in the post-Civil War era entered a period of "doldrums," "stagnation," and "decay." During the 1880's it underwent a change described in almost religious terms--a "revival" or "rebirth," with Alfred Thayer Mahan appearing in 1890 as the prophet of seapower. With the 1890's, according to this view, the evolution was completed.

Such an interpretative framework, unfortunately, regards mileposts in the process of change as indications of a completed process. As a result, new ships spring forth at authorization or perhaps commissioning; new strategies become operational fact when written out. It seems likely, however, that this interpretation badly skews an understanding of the process of modernizing the Navy. Modernization of the Navy did not occur this rapidly or this neatly.

Examining the emergence of the modern Navy, therefore, involves the examination of interrelated topics over a prolonged time period. By its very nature the topic is a broad one, and the researcher sampled materials relating to a number of issues. By concentrating on the 1870's, the researcher found increasing evidence that historians have ignored a great deal of reformist and experimental activity. The darkness of the 1870's had more light than commentators usually grant. Perhaps chroniclers have been influenced by a desire to have a dramatic tale of the final emergence of the new Navy or perhaps they have equated the low budgets of that decade with a lack of activity. A better understanding of the activities of this period will provide an important perspective on the subsequent emergence of the new Navy.

Indexing the Maryland Gazette

Researcher: Professor John W. Huston
Sponsor: Naval Academy Instructional Development Advisory Committee

The purpose of the project was to commence indexing the *Maryland Gazette*, one of the few Colonial American newspapers which had continuous publication throughout the two generations preceding the American Revolution. Software was ordered and although not received during the formal period of the grant, indexing proceeded. Categories were established and midshipmen enrolled in two sections of Colonial American history utilized the newspaper and program for research, showing the application of modern technology towards understanding of eighteenth century society.

Computer-Aided Instruction in Logic

Researcher: Professor David E. Johnson
Sponsor: Naval Academy Instructional Development Advisory Committee

The objectives of this project are to procure and implement logic software for the philosophy courses at the Naval Academy that will assist the midshipmen in learning some basic features of logic outside of class time by using their own personal computers. The researcher searched through the computer literature, attended conferences on philosophy and computers, ordered and evaluated many programs, selected one program to test, and introduced that program into HP340, Philosophy of Science, in the fall semester of 1988. The awareness of the midshipmen in the fundamentals of informal logic improved as indicated in their discussion of the course texts and in their papers. This project is continuing, as the researcher finds software that is even more effective in achieving the aims of this project.

Religious Influence on Local Politics in Eighteenth-Century Virginia

Researcher: Assistant Professor John G. Kolp
Sponsor: Naval Academy Research Council (OMN)

Several recent studies of colonial Virginia have suggested that an evangelical counterculture arose in the 1760's and 1770's which challenged the Anglican, gentry-controlled society. This challenge, principally by the Baptists, apparently resulted in the rejection of all aspects of the traditional hierarchical social order. By implication, this distinct withdrawal from a wide variety of social functions also included the abandonment of participation in local political processes.

This project provides an initial investigation into this important connection between the apparent evangelical counterculture and local socio-political processes by (1) reviewing the recent literature on the subject, and (2) undertaking a preliminary investigation of these linkages in several colonial Virginia counties. Baptist church membership records from several counties have been gathered and collated with election pollbooks and other individual-level sources to determine the impact of evangelicalism on the political and social processes of eighteenth-century elections.

A preliminary report of this research was presented at the Missouri Valley History Conference.

Elections and the Political Communities of Colonial Virginia, 1728-1775

Researcher: Assistant Professor John G. Kolp
Sponsor: Naval Academy Research Council (OMN)

Elections to the eighteenth-century Virginia House of Burgesses have been of long-standing interest to historians because of the role they played in the early political careers of a number of America's Founding Fathers. Although these men were selected for office within their local county constituencies by a substantial portion of the adult male population, it has never been completely clear what meaning should be attached to these political events. What did this selection process prove? Was there any real difference among candidates? Did it really matter who won? Were these events merely social gatherings, or was something important being decided at these elections? Despite considerable attention by scholars in several books and numerous articles, the precise way these elections fitted into the social and political structure of colonial communities has remained obscure.

A preliminary answer to some of these important questions has been put forward in a recently-completed doctoral dissertation. Examination of surviving data on all elections for this period reveals a pattern of gradual decrease in electoral competitiveness over the fifty-year period, but also demonstrates substantial regional variation which does not fit traditional interpretations. Further, a number of themes emerge from detailed case studies of three counties, including the importance of tenants in the election process, the broad spectrum of issues colonial voters thought germane, the remarkable stability of voting behavior, the importance of previous officeholding to candidate success, and the role of local neighborhoods in defining electoral choice.

Additional research is being conducted, and the entire manuscript is being revised and edited.

Maritime Access and American Foreign Policy in the Era of Manifest Destiny

Researcher: Associate Professor Robert W. Love, Jr.
Sponsor: NAval Academy Research Council (OMN)

The project constitutes a re-examination of American foreign policy and peacetime naval strategy from the defeat of Van Buren (1840) to the election of Lincoln (1860) in an attempt to uncover whether the "post-Jacksonians" adopted Maritime Access as an objective of their naval operations and economic diplomacy. As it evolved from Adams to Jackson, Maritime Access as a goal of national foreign policy included the formal or informal acceptance by the Great Powers--and by American trading partners in Latin America and the Pacific--of American definitions of neutral rights; freedom of the seas; physical security for American merchant vessels, their masters, crews, and cargoes; and, perhaps most important, treatment in overseas markets equal to that conferred upon the Western maritime powers. The initial product of this research will be a conference paper and possibly a professional periodical article.

S. Wells Williams: Clio's Servant in Late Nineteenth-Century China

Researcher: Professor Philip R. Marshall
Sponsor: Naval Academy Research Council (OMN)

The purpose of this project is to examine all those elements in the career of S. Wells Williams that went into his production of *The Middle Kingdom* (1848), America's first full-blown historical work on China. The research is an effort to understand how a man wholly untrained in historical methods, with only the minimum of formal educational background, and totally wrapped up in the emotions of missionary work, could produce such a well-balanced, reasonable, and erudite work, well within the confines of what modern scholars would refer to as "good history." In so doing the researcher treats those key themes and ideas which Williams wished to leave with his American readers and analyzes his successes and failures in those objectives.

During the summer of 1988, primarily at the Library of Congress, all the publications of S. Wells Williams were read. In addition to his historical books and pamphlets, this included the introduction to his important works on the Chinese language and his *Chinese Commercial Guide*. Williams also printed his own and other essays each month, while at Canton or Macao, in a work called the *Chinese Repository*, 1833-1851. These essays, available in the Rare Book Room of the Library of Congress, were consulted. They illustrated very nicely the development of Williams' thought in his early formative years in China. A trip to Yale University was taken to review many of Williams' personal letters, especially significant in those years prior to the 1848 publication of *The Middle Kingdom* and during the period bracketing its 1883 revision.

The collection of material for an article has now been completed. Completion and submission to an appropriate historical journal is anticipated in the coming year.

The United States and the Japanese Presence in Latin America, 1939-1945

Researcher: Associate Professor Daniel M. Masterson
Sponsor: Naval Academy Research Council (OMN)

This project, now in the beginning stages, is being conducted jointly with Professor John Bratzel of Michigan State University. The aim is to research and write a book on the activities of the Japanese throughout Latin America during World War II. The book will deal specifically with Japanese espionage, the activities of the domestic Japanese population in Latin America, the counter-espionage efforts of the United States government, the internment program for Japanese aliens in Latin America, and the policies of the Latin American governments toward their Japanese populations. The researchers will be conducting research at the National Archives, the Federal Records Center, the Washington Navy Yard, and the Franklin Roosevelt Library at Hyde Park, New York. Eventually, as this project progresses, the researchers anticipate research in Peruvian, Mexican, and Brazilian archives.

The Changing Focus of Aprismo: Haya De La Torre, Alan Garcia Perez, and the Anti-Imperialist Tradition in Peru

Researcher: Associate Professor Daniel M. Masterson
Sponsor: Naval Academy Research Council (OMN)

This manuscript dealing with the international policy of Peru's APRA party was completed this past summer with funding from Naval Academy Research Council. It deals specifically with the anti-imperialist policies of APRA's only two leaders in this century, Victor Raul Haya de la Torre and Alan Garcia Perez. The particular focus of the manuscript is the change in emphasis during World War II from a strongly anti-U.S. policy during the 1930's to a position favoring the Good Neighbor Policy. This change was prompted by a sincere opposition to the forces of fascism in Latin America, but the change was also rooted in the APRA leadership hope that Washington would use its influence to have the Peruvian government legalize the then outlawed APRA party. The manuscript is now complete and has been submitted to a Latin American journal.

Colonialism, Capitalism, and Work in the Congo Basin: A History of Social Change in the Tshuapa District (Zaire), 1880's to 1960

Researcher: Assistant Professor Samuel H. Nelson
Sponsor: Naval Academy Research Council (OMN)

The study is a detailed and multi-dimensional examination of African social change at the local level during the first six decades of Belgian colonial rule in the Equateur region of Zaire, an area long ignored by historians. It traces a variety of social and cultural responses made by villagers of the Mongo ethnic group, as they adapted to meet changing economic, political, and social conditions triggered by international capitalism and colonial rule. In order to explore the past as it was experienced, perceived, and shaped by local African societies, and to overcome deficiencies in archival data, the researcher employs a methodology based on a history of changing work patterns. This approach is both descriptive and analytical, allowing a means to reconstruct the individual and daily experiences of the Mongo while linking social change to the demands and character of international capitalism and colonial policies. The manuscript is currently under revision, and it will be submitted for publication in the fall of 1989.

The Mind's Eye: An Intellectual History of Twentieth-Century American Photography

Researcher: Associate Professor David P. Peeler
Sponsor: Naval Academy Research Council (OMN)

This project is an examination of the growth of American photography in the twentieth century. It explores the ideas and values of leading American photographers, and the ways in which they brought those beliefs and values to fruition in their work. The project fills a gap in the existing scholarship, for while there is a substantial body of art criticism on the medium, there is no substantial scholarly treatment of the ideas associated with this broad swath of creative photography. The principal question is: In what ways did these creative individuals seek to resolve the tension that arose from working in a medium with an almost worshipful attitude towards objectivity, while daily seeing the evidence in their work that even the simplest fact cannot be presented without altering its "pure" objectivity in some way?

Out of Silence: Social Images of the Deaf in Nineteenth-Century France

Researcher: Associate Professor Anne T. Quartararo
Sponsor: Naval Academy Research Council (OMN)

This research project is an examination of the social, cultural, and sometime political forces that shaped the deaf community in France during the nineteenth century. This study of the deaf community will not only reveal the collective mentality of the nation's leadership group toward the deaf, but more important, will analyze the values of the deaf community as it interacted with the dominant hearing population. The researcher is first examining the period 1789-1815 in order to discuss how charity and perceptions of social deviance affected the deaf population. The second part of the project investigates the relationship between bourgeois and deaf culture in the period 1815-1880. How the deaf structured their lives and how the hearing community reacted to deaf culture will be studied through medicine, education, and welfare policy. The last segment of the project deals with the period 1880-1914 and how the issue of social integration directly affected the deaf community. During the 1988-1989 academic year, the researcher spent one month in Paris, France, conducting research on various parts of the project. Considerable archival work was completed on the revolutionary period.

Family Religion in Classical and Hellenistic Greece

Researcher: Assistant Professor Ronda R. Simms
Sponsor: Naval Academy Research Council (OMN)

The family was the basic social/political/economic unit in the ancient Greek polis (city-state). An understanding of its inner structure, traditions, activities, and goals is fundamental to an understanding of the polis itself. One aspect of the Greek family is of particular interest--its religion. Greek religious practices are difficult to research because there is so little evidence. Very little was actually written down. This is particularly true of family religion, where practices were handed down from father to son. Everyone knew what they were; hence, there was no need to describe or discuss them. This research project searches out the bits and pieces of information that do exist in the fourth-century orators, in the comic poets and other writers, and in inscriptions and archaeological remains. The end product is a conference paper.

The University of Paris and the French Social Order, 1500-1600

Reseacher: Assistant Professor James V. Skalnik
Sponsor: Naval Academy Research Council (OMN)

Population pressure in France in the mid-sixteenth century created an economy of scarcity and low real wages in that country. In response, elite groups sought to entrench themselves in their privileged positions to preserve their status and wealth from competition below. French society was gradually transformed, and the relatively open social order of France under Francis I (1515-1547) gave way to economic, social, and intellectual domination by closed and self-perpetuating oligarchies, a situation that was to last until the French Revolution. The University of Paris was affected by and assisted in this transformation. Its leaders also formed themselves into a closed elite by claiming ownership of the professorships and other offices they held. University intellectuals justified and solidified their privileged positions by developing a new ideology of the French social order. Rejecting the meritocratic ideals of academics in the early part of the century, they argued that a rigidly hierarchical social order was dictated by God and by reason. With the support of the King and the Church, this social ideal became normative for France. Changing social conditions dramatically altered the character of the University, and the University in turn helped justify the new social order. The project requires tracing the spread of venal officeholding in the University after mid-century, demonstrating its connection with changes in the quality and policies of the University, and analyzing the ideological writings of University Academics in the later 1500's.

Falkland Islands War, 1982: Lessons for the U.S. Navy

Researcher: Lieutenant Commander Don T. Sine, USN
Sponsor: Naval Academy Research Council (OMN)

Research to date, completed with the support of the Naval Academy Research Council, has provided data on the use of modern cruise missiles against warships of a major navy; VSTOL aircraft and helicopters in combat; merchant shipping employed in amphibious, logistic, mine countermeasure, and support roles; execution of tactical operations based on successful intelligence gathering; media and the need for limited censorship; and the influence of politics on the homefront. This information is being compiled in a series of articles that eventually will lead to a book-length manuscript.

The 1988 trip to England, however, showed that additional research is necessary to meet the investigator's objective. Revelations during the interview process led to the development of a more comprehensive list of possible interview subjects and the discovery of additional war collections that warrant review.

From Knowledge, Sea Power: A History of Research at the U.S. Naval Academy

Researcher: Associate Professor Jack Sweetman
Sponsor: Naval Academy Research Council (OMN)

The U.S. Naval Academy was founded in October 1845. Its mission has always been to prepare midshipmen to become professional officers of the naval service. It has therefore and rightly remained essentially an undergraduate, teaching institution. As a natural result of the relationship between classroom teaching and intellectual creativity however, the Academy has also been the scene of wide-ranging research activities, by both its faculty and, in recent years, midshipmen. It was, for example, as a lecture demonstration that in 1877 Ensign Albert A. Michelson began conducting the experiments to measure the speed of light that led him to become the first American to receive the Nobel Prize for Physics. Similarly, it was research done in support of the Academy's naval history course that, early in this century, brought the History Department the reputation it still enjoys as a center for the study of naval history. Since the 1960's, the development of a sponsored research program administered by the Naval Academy Research Council (NARC), the creation of research professorships, and the initiation of the Trident Scholars Program have greatly enhanced the research opportunities of faculty and midshipmen alike. No general history of research, broadly defined, at the Naval Academy now exists. The aim of this project is to produce such a history, approximately 10,000 words in length, describing significant research conducted at the Naval Academy from its foundation to the present and tracing the growth of the sponsored research program.

Independent Research

The Transformation of English Culture, 1910-1922: Tradition, Modernity, and the Great War

Researcher: Associate Professor Theodore W. Bogacz

This book will be a synthetic study with broad implications for the cultural and social history of modern England. The researcher will attempt to examine important aspects of English culture as they underwent radical change under the impress of total war. Among other areas of study are: the transformation of language during World War I; the reception of new views of psychology and mental illness as a result of the impact of the "shell-shock" crisis of the Western Front; the triumph of the "modernist" vision in the fine arts, as other styles failed to capture the nature of modern war; and ultimately, the growing acceptance of the conditions of "modernity" in English culture as a whole. The years 1910-1922 in England are seen as a period of profound cultural crisis and World War I as a radically modernizing force in all areas of English life. A major portion of the task in writing this book will be to chart the resistance to the final acceptance of the forces of modernity in English culture during these dramatic years. The researcher has completed the research, and is presently writing the manuscript.

Robert Blake

Researcher: Assistant Professor William B. Cogar

This work is an essay of approximately 6,000 words on one of England's most famous admirals, Robert Blake. During a life spanning the first half of the seventeenth century (1599-1657), Blake came to exemplify a fighting spirit no other English admiral would demonstrate until Nelson in the late eighteenth and early nineteenth centuries. First assuming command of a warship at the age of fifty, Blake quickly demonstrated to the radical government of the Interregnum that he was very able to lead and to lead very successfully. Furthermore, with his resounding success over Prince Rupert, over the Dutch in the First Anglo-Dutch War, and finally over the Spanish at Teneriffe, Blake became synonymous with naval success, as he inspired a succession of English naval commanders who contributed to Britain's naval superiority in the eighteenth century. This article is to be included in *Fighting Admirals*, edited by Professor Jack Sweetman, to be published by the Naval Institute Press in 1990.

The State's Navy: An Examination of the English Navy During the Interregnum

Researcher: Assistant Professor William B. Cogar

This work, a revision of a doctoral dissertation at Oxford University, has been accepted for publication by Gower Press of London, England. The work examines the administrative innovations and political sentiments within the English Navy, at sea as well as in the shore administration, during one of the most turbulent times in England's past. The volume is now nearing completion, and the final draft (two previous ones already finished) will be sent to London in July or August.

Naval History: The Eighth Naval History Symposium of the United States Naval Academy

Researcher: Assistant Professor William B. Cogar

This project involved the selection and editing for publication of some twenty of the best papers delivered at the Eighth Naval History Symposium, held at the United States Naval Academy in September 1987, of which the book's editor was the director. The papers from this symposium will be published by the U.S. Naval Institute Press and will appear in September 1989. This volume continues the tradition of publishing a representative sample of the finest and most scholarly papers delivered at what is now considered the premier forum on naval history in the world.

Gladstone and Disraeli

Researcher: Associate Professor Nancy W. Ellenberger

The researcher's sabbatical during fall 1988 was used to begin the research on a new, long-term project that compares the backgrounds, careers, ideas, and attitudes of Britain's two great Victorian prime ministers, Benjamin Disraeli and W. E. Gladstone. The careers of these two men from the 1830's to the last decades of the century spanned the years when Britain was the only global superpower and when industrialization and democratization were transforming her society at home. During this time Gladstone and Disraeli were at the center of affairs. Their decisions affected millions of people around the world. Their policies gave definition to the Liberal and Conservative parties. Their personal styles--so dramatically different--illustrate a broad range of Victorian attitudes and impulses. The lives of Gladstone and Disraeli provide a window for reviewing an enormous range of Victorian developments, and their successes and failures can still tell us much about the problems of leadership in an imperial democracy.

The Gladstone/Disraeli project will result in a dual biography for use in undergraduate survey courses in modern British history. The usefulness of such a book became apparent during the researcher's preparations for the United States Naval Academy's new course in Imperial Britain (HH330). During the sabbatical the researcher completed a survey of the resources available in Nimitz Library and the Library of Congress and reviewed some thirty biographical works on the two men. A classification of monographs and journal articles dealing with aspects of their policies and careers was begun, and eight subjects around which this comparative study could be organized were defined.

The History of the U.S. Navy

Researcher: Associate Professor Robert W. Love, Jr.

This study traces the history of the U.S. Navy from its origins in 1775 as the Continental Navy during the American Revolution, to the 600-ship fleet of Ronald Reagan's presidency. The study is composed of three parts: the Navy in the Age of Continentalism and Maritime Access; the Navy as an arm of one of the Great Powers; and the Navy as global policeman in the Cold War. The study demonstrates that the concept of "sea power" has little utility in explaining American naval policy or operations, and instead concludes that these are directly linked less to theories about the use of naval power than to specific foreign policies, domestic partisan politics, and ever-changing technology. No one theory embraces the influence of these forces on the development and use of the U.S. Navy by the executive branch. The manuscript is complete.

Adapting to Aids: A Study of the Social Impact of Aids in Mwanza, Tanzania

Researcher: Assistant Professor Samuel H. Nelson

This study will trace the social impact of AIDS in a small town in western Tanzania, an area afflicted with high rates of HIV infection. Plans are being made to work in collaboration with a local hospital in Mwanza. In preparation for the necessary fieldwork, general research into the epidemiological and social dimensions of AIDS is now being investigated.

The Origins of the Modern American General Staff

Researcher: Associate Professor William R. Roberts

Previous historians have argued that the American General Staff was patterned after the Prussian General Staff in order to make the American Army a more effective fighting force. This research project, however, has led to the conclusion that the staff reforms introduced at the beginning of the twentieth century represented the culmination of a long-standing struggle for power between line and staff officers, as well as another struggle for power between the secretary of war and the nineteenth-century commanding general. Supporters of the creation of the General Staff in 1903 wanted to strengthen the secretary and the line as much, if not more, than they wanted to improve the fighting skills of the Army. Their reforms provided a foundation for the growing bureaucratization of the military establishment in this century.

The final product of this research is to be a monograph that already has been accepted for publication by Greenwood Press.

Geographic Dimensions of Naval Security

Researcher: Lieutenant Maxwell Shaw, USN

This project is an examination of the factors that can be spatially quantified that contribute to and control the quantity and quality of national security. The focus is on the international naval and maritime factors in an effort at developing a naval security calculus. This will be compared and contrasted with A. T. Mahan's sea power thesis of 1890. There may also be a possible article for the Naval Institute *Proceedings* on the 100th Anniversary of *Influence of Sea Power on History, 1660-1783.*

Ramus and Reform

Researcher: Assistant Professor James V. Skalnik

This project is a book-length study of the transformation of French society in the sixteenth century, seen through the life and works of the humanist and educator Petrus Ramus (Pierre de la Ramee, 1515-1572). The study demonstrates that the meritocratic society of Renaissance France gave way to an oligarchic and hierarchical social order after about 1550, largely due to demographic growth and economic slowdown. The vexing problem of why "Ramism" was so popular in Europe is resolved by showing that Ramus developed an ideology of meritocracy which united many followers in opposition to the prevailing trend toward oligarchy. His efforts to put this theory into practice, although ultimately unsuccessful, constitute crucial chapters in the history of the French Reformed Church and of French education. The study draws extensively on unpublished material in Parisian archives and relies on the techniques of collective biography, computer-assisted analysis of sixteenth-century publication data, and the sociology of ideologies and *mentalites*. The researcher has completed and defended this study, his dissertation at the University of Virginia. He has arranged with Cambridge University Press to review the manuscript for publication.

The Last Cavaliers: Horse Cavalry in the Twentieth Century

Researcher: Associate Professor Jack Sweetman

Six great changes have occurred on the battlefield in the course of the twentieth century: the appearance of aircraft, armored fighting vehicles, automatic small arms, electronic communications, and nuclear weapons--and the disappearance of horse cavalry, traditionally the most prestigious combat arm. Conventional wisdom holds that World War One revealed cavalry to be an anachronism, but the issue is more complicated than that. Although the arm proved useless in the conditions of trench warfare that prevailed on the Western Front, it was extensively employed in the East, and some of the largest cavalry operations in history--those of the British Desert Mounted Corps--took place on the Palestine Front in 1917-1918. As late as the outbreak of World War Two, the army of every major power except Great Britain included horse cavalry, and the German army actually had more mounted units at the end of the war than at the beginning. This project will combine operational and institutional history within an essentially chronological framework to examine the technological and tactical developments that led to the gradual extinction of cavalry and the doctrines and means by which it attempted, unsuccessfully, to respond to the challenge these developments posed. A completion date cannot be predicted at present.

The U.S. Marine Corps: An Illustrated History

Researcher: Associate Professor Jack Sweetman

This work, coauthored with Lieutenant Colonel Merrill Bartlett, USMC, Retired, is designed to provide a concise but authoritative history of the U.S. Marine Corps from the foundation of the Continental Marines in November 1775 to the present. The narrative is to follow a chronological format. This researcher will contribute the chapters covering the period up to American intervention in World War One; Lieutenant Colonel Bartlett will contribute the remainder. The division was predicated on the assumption that the personal experience which Colonel Bartlett--twice winner of the Marine Corps Historical Foundation's prestigious, annual Heinl Award for the best article on Marine Corps history--brings to the project will become progressively more valuable as the narrative nears the present. The project length is approximately 60,000 words. The work will include numerous carefully-chosen illustrations and maps and appendices listing the Commandants of the Marine Corps, Marine Corps Medal of Honor recipients, and Battle Streamers. It is anticipated that the project will be completed by late 1989 or early 1990.

The Great Admirals: Centuries of Command at Sea

Researcher: Associate Professor Jack Sweetman

The object of this work is to survey the careers and, most especially, to examine the leadership style and skills of nineteen admirals--six British, four American, two Dutch, two Japanese, and one each Austrian, Danish, French, German, and Greek--who commanded in fleet engagements from the Battle of the Spanish Armada to the close of World War Two. Original essays are being prepared by an international team of academic, official, and private historians, and naval officers from Australia, Austria, Canada, Denmark, France, Greece, the Netherlands, the United Kingdom, and the United States. The work will be approximately 120,000 words in length. The projected completion date is winter 1989.

The Life of Joseph E. Johnston: Second Soldier of the Confederacy

Researcher: Professor Craig L. Symonds

This study is a full-length biography of Confederate General Joseph E. Johnson, who commanded rebel forces at the first Battle of Bull Run (Manassas), and in the eastern theatre until the Battle of Seven Pines, when he was replaced by Robert E. Lee. He then served as commander of the West in 1863 and 1864. After a long retreat in the face of William T. Sherman's superior army in north Georgia in 1864, Confederate President Jefferson Davis replaced him with John Bell Hood. Johnston was restored to command briefly in 1865 and was in command at the end of the war when he surrendered to Sherman in April 1865.

A History of the Third Reich

Researcher: Professor Larry V. Thompson

This research is intended to contribute to a book-length interpretive study (probably two volumes) of Germany under National Socialist rule. The work will synthesize the various theories and interpretations advanced by other specialists with the researcher's own research on the SS and eugenics policies in the Third Reich to produce an analytical study, arranged topically, of German life under Nazism. Chapters will deal with leisure, the family, institutions, elites, etc. The work is intended for other specialists, advanced level undergraduates, and graduate students. It is at least three years away from completion.

Mark Hanna's Election to the United States Senate

Researcher: Professor Philip W. Warken

This article is being prepared for submission to a professional journal. The research, conducted in secondary sources, newspapers, state archives, and manuscript collections, has been completed. The purpose is to examine the campaign issues and tactics in the Ohio legislative elections of 1897 and the maneuvering within and outside the legislature that resulted in the election of Mark Hanna to the United States Senate in 1898.

Research Course Projects

The U.S. Navy and the Cuban Missile Crisis, 1962

Researcher: Midshipman 2/C Robert M. Beer, USN
Adviser: Associate Professor Robert W. Love, Jr.

A survey of almost every book, article, and memoir on the Cuban Missile Crisis revealed important misunderstandings about the events which led up to October 1962 and included a number of flawed interpretations as to the Navy's role in resolving the issue. Recently-publicized revelations, incorporated in James G. Bright's and David A. Welch's *On the Brink*, do not begin to solve several of these existing riddles. Most accounts, for instance, fix the onset of U.S. concern over SS-4 Sandal MRBMs and SS-SIRBMs in Cuba in September, but a handful of less available sources (oral histories, interviews, archival collections) suggest that as early as December 1961, Navy leaders were aware that the Soviets intended to install SA-2 Guidelines at three sites in Cuba far from other military installations, weapons which could have no purpose other than to defend the construction of ballistic missile sites. How this intelligence was handled, why another nine months elapsed before Kennedy acted, and what the Navy did during the crisis--not only to enforce the blockade but also to drive Soviet submarines from the Atlantic--will form the basis of a Trident Scholar Project next year.

Agrarian Reform in Revolutionary Mexico: The Case of Morelos

Researcher: Midshipman 1/C Mario E. De La Ossa, Jr., USN
Adviser: Associate Professor Daniel M. Masterson

This study examines the process of agrarian reform in Mexico's south-central state of Morelos from the beginning of the Mexican Revolution in 1910 through the early 1980's. The paper's primary emphasis is on the changing role of the Mexican peasant in the agrarian sector throughout the past six decades. The researcher pays particular attention to the agrarian revolutionary movement of the Morelos peasant leader, Emiliano Zapata, and the major structural reforms of President Lazaro Cardenas during the 1930's. He concludes that Mexican agrarian reform programs have not kept pace with the rapid population increase in the countryside. Moreover, since the 1940's, the Mexican government has emphasized industrialization at the expense of agrarian reforms. This has led to growing frustration in the peasant sector, a renewed concentration of landholdings, and significant out-migration to Mexico City and the United States.

Military as Modernizer: The Provisional National Defence Council in Ghana

Researcher: Midshipman 1/C Charles L. Moore, Jr., USN
Adviser: Assistant Professor Samuel H. Nelson

Recent scholarship has postulated the institutionalization of the military coup in African politics. Such studies usually decry the brutal and despotic tendencies of many of these subsequently dictatorial regimes. The purpose of this essay, however, is to offer an example of a populist military regime acting as a modernizer of the African continent.

The last twenty years have been witness to over seventy coup attempts, and more than sixty successful coups and insurrections in thirty-one of the forty-nine African nations. Concurrently, following its early years of independence and hope-inspiring civilian governments, Africa has experienced a steady, negative rate of growth. It has been a continent in decline, regardless, with but precious few examples, of the type of government in power. As Flight Lieutenant Jerry Rawlings, leader of two coups in Ghana, has noted:

> At the end of 1981, Ghana was like a runaway train, rushing downhill towards a broken bridge. The economy and the moral fiber of the people appeared to have reached a point of no return (Novicki 1984a, 4).

Rawlings and Ghana certainly exemplify a number of the problems facing much of Africa: and, perhaps, some solutions, as well.

So far, Rawlings seems to be gambling wisely. However, the ability of other populist coups to be successful is highly speculative. When a military leader begins to call upon the civilian population for his support, he also must answer to their complaints. Charismatic leaders like Flight Lieutenant Rawlings are also quite rare. However, his regime is a highly viable example of military populism as a force for modernization.

Foreign Midshipmen at the Naval Academy, 1864-1980

Researcher: Midshipman 1/C Laurie J. Mundy, USN
Adviser: Associate Professor Jack Sweetman

This paper is a history of foreign nationals at the Naval Academy from 1864 to 1980. It entails more than a simple chronology of events. It is a history of both their lives at the Academy and the politics surrounding their entrance.

After a brief political history that explains the entrance of one French and about a dozen Japanese midshipmen, the paper turns to the more sociological aspects of the foreign national question. Statistics are compiled regarding the composition of foreign nationals over the years and their varying successes.

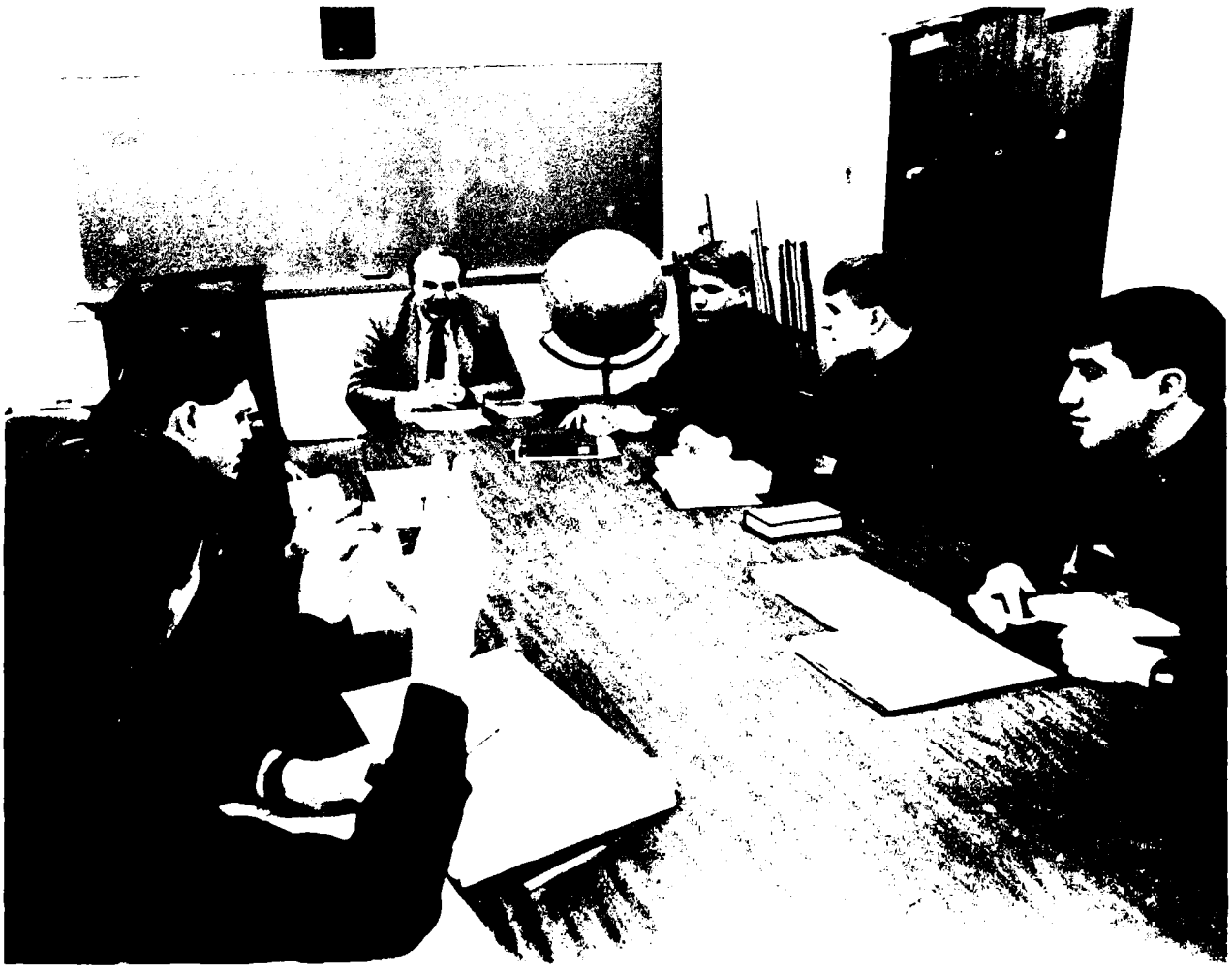
Finally, the paper looks at the responses of surveys by the foreign national graduates with an emphasis on their relative success in their home navies and the civilian sector. Questions are directed towards the effects their Naval Academy education has had on their careers and any biases that may have resulted. The paper includes almost entirely original research.

Readings in African Social History

Researcher: Midshipman 1/C Kristin A. Reynolds, USN
Adviser: Assistant Professor Samuel H. Nelson

This research project explored unique aspects of the African past through a broad reading of recent works in African social history where much of the best scholarly material on Africa is now being produced. Specific topics for research included a review of the evolution and methodology of social history, followed by specific works in African women's history, African medicine and therapeutic systems, national ideologies and consciousness, African religion and cosmology, African art and music, and African historical biographies.

Upon completion of the research, a thirty-page report was submitted which outlined the major methodological contributions of African social history. First, social history provides a means to challenge commonly accepted anthropological and historical models in which Africa is generally understood. By viewing a variety of social actions from a grass-roots perspective, general theories were tested against the daily experiences, behavior, and expressed values of ordinary people. This approach also provided a means to probe beneath surface events to achieve a more detailed explanation of social groups and cultural values than that afforded by an empirical approach alone. Finally, the focus on social history provided a way to investigate social groups and social phenomena too often neglected in traditional historical studies. In sum, the investigation into specific topics of social history yielded many new insights into the richness and complexity of African history.



Publications

BOGACZ, Theodore W., Associate Professor, "War Neurosis and Cultural Change in England, 1914-1922: The Work of the War Office Committee of Enquiry into `Shell-Shock,'" *Journal of Contemporary History* (London), **24** (April 1989), 227-256.

"Shell-Shock" in the First World War was a medical, legal, and moral half-way house in a society used to a clear distinction between the mad and the sane. This essay discusses the crisis of war neurosis in England in World War I and the postwar official investigation of this disturbing phenomenon. It analyzes the work and conclusions of the War Office Committee of Enquiry into "Shell-Shock" (1920-1922), and by extension how the crisis produced by a high incidence of war neurosis affected traditional English ideas regarding mental illness and morality. It begins with a brief discussion of the sharp medical and legal distinctions between the mad and the sane prevalent in pre-1914 England and describes how conditions on the Western Front helped blur these distinctions. It describes the reactions of the medical profession, the army, and the general public to the many mental casualties of that brutal war. The heart of this essay analyzes the conclusions of the "Shell-Shock" Committee, which reveal changing attitudes toward the origin and cure of mental illness, and especially Freudian psychoanalysis. It concludes with a discussion of a dramatic shift of attitudes toward cowardice in battle in light of a new understanding of war neurosis.

CULHAM, Phyllis, Associate Professor, "Pragmatic or Programmatic Augustus: The Case of the Italian Highways," *The Augustan Age*, **7** (1988), 5-21.

Recent, distinguished work on Augustus has emphasized his administrative style of *ad hoc*, non-ideological responses to perceived problems. There is no doubt that the Empire evolved and was not suddenly created at the time of the "restoration" in 27 B.C. Nonetheless, close examination of one facet of Augustus' administration, namely, his highway policy, demonstrates that republican motifs occur consistently in his apparently *ad hoc* actions. Augustus had, as early as 27 B.C., an internally consistent, highly developed idea of what he wanted in the way of a new state.

CULHAM, Phyllis, Associate Professor, "Archives and Alternatives in Republican Rome," *Classical Philology*, **84** (April 1989), 100-113.

Basic textbooks, encyclopedias, and dictionaries for the field of Roman history all report that the Romans deposited state documents at an archive on the Capitoline almost from the beginning of the Republic. Studies of Roman history and historiography all assume this well-known "fact." There was, nonetheless, no such archive and no tradition of making public documents available for consultation. Historians had to rely on manuscript documents in the hands of the great families. The effects on the Roman historiographic tradition were overwhelming.

DEJNOZKA, Jan, Lieutenant, USNR, "Russell's Robust Sense of Reality: A Reply to Butchvarov," *Grazer Philosophische Studien*, **32** (1988), 155-164.

Professor Tanayot Butchvarov argued in "Our Robust Sense of Reality," *Grazer Philosophische Studien*, (*GPS*)vol. 26, 1986, that (1) Russell has no criterion of existence, (2) Russell cannot have, since he holds that all objects exist, and (3) identifiability indefinitely many times is a genuine, i.e., classificatory, criterion of existence. This criterion is meinongian in that on it many objects do not exist. The author replies that (1) and (2) are false in that (3) states Russell's own structural position. Most notably in "The Philosophy of Logical Atomism," Russell uses "exists" in three interrelated senses. In sense (i) all objects exist. In sense (ii) lone particulars (sense-data) are unreal, and groups of correlated particulars are real things. In sense (iii) existence is a second-level property. It is sense (ii) which confounds Butchvarov. It effectively makes identifiability Russell's classificatory criterion of existence. Thus like Frege, but in a different way, Russell is a neglected major proponent of Quine's "no entity without identity" in the history of analytic philosophy.

DEJNOZKA, Jan, Lieutenant, USNR, "A Reply to Butchvarov's `Russell's Views on Reality´," *Grazer Philosophische Studien*, **32** (1988), 181-184.

This is a reply to Professor Tanayot Butchvarov's reply, *GPS* 32: 165-167 (1988), to the author's "Russell's Robust Sense of Reality: A Reply to Butchvarov," *GPS* 32: 155-164 (1988). All three replies were presented at the Russell Society Meeting at the Eastern Division American Philosophical Association Meeting on 28 December 1987 in New York City. The author clarifies Russell's 1903 characterization of being, and its relationship to what the author has called Russell's primary 1905-1919 sense of "exists." The author discusses the nature of concepts and of classificatory concepts. The author argues that not all concepts need be classificatory. The author shows that existence-identity connection theories are not limited to phenomenalist views. Last, the author distinguishes between the formal sense of "exists" in Russell's theory of descriptions and the sense of "exists" involved in determining the different truth values of different Russellian existential propositions.

DEJNOZKA, Jan, Lieutenant, USNR, "Reply to Umphrey's `The Meinongian-Antimeinongian Dispute Reviewed´," *Grazer Philosophische Studien*, **32** (1988), 185-186.

This is a reply to Professor Stewart Umphrey's reply, *GPA* 32: 169-179 (1988), to the author's "Russell's Robust Sense of Reality: A Reply to Butchvarov," *GPS* 32: 155-164, (1988). All three replies were presented at the Russell Society Meeting at the Eastern Division American Philosophical Association Meeting on 28 December 1987 in New York City. The author attempts to answer Umphrey's questions concerning what the author has called Russell's primary sense of "exists," i.e., not being nothing: (1) What is the content of this account? and (2) can the account be defended? (1) The author introduces quaternary being as a strategy to explain how we may speak of what is not and shows that Russell's definition of "C (nothing)" in "On Denoting" gives a thoroughly clear content to quaternary being. (2) The author then defends this account by appealing very briefly to Quine's common-sensical view that everything exists, and even more briefly to Parmenides.

DEJNOZKA, Jan, Lieutenant, USNR, "Zeno's Paradoxes and the Cosmological Argument," *International Journal for Philosophy of Religion*, **25** (1989), 65-81.

The author's aim is to show that the cosmological argument of Aquinas for the existence of God commits a rather trivial linquistic (or conceptual) fallacy, by showing that (1) some of Zeno's paradoxes commit a trivial linguistic (or conceptual) fallacy, and that (2) the cosmological argument is sufficiently similar to these paradoxes that it commits the same fallacy. This conclusion, of course, is far from being itself a trivial matter. Further, F.C. Copleston is adamant that "mention of the mathematical infinite series is irrelevant," to discussing *any* of Aquinas' arguments for God's existence. The author establishes secondly the fundamental incorrectness of Copleston's surprising view.

GOOD, Jane E., Associate Professor, and Captain Karl M. Klein Jr., USN, "Women in the Military Academies," *The Physician and Sportsmedicine*, **17** (February 1989), 99-106.

Women were admitted to the U.S. Naval Academy in 1976. To compensate for differences between men and women, some modifications were made in the physical training program, which originally had been designed for men. For example, the personal defense requirement includes judo, boxing, and wrestling for men and judo, hand-to-hand defense, and fencing for women. All of these activities are believed to develop poise, fortitude, and combat strategy. The article points out that athletic women have more success than non-athletes at the Academy, probably because athletes tend to possess the stamina, strength, and self-discipline required to survive the Academy's tough, uncompromising physical environment.

JOHNSON, David E., Professor, "Terror Tactics: A Conceptual Analysis," *Moral Obligation and the Military: Collected Essays*. Washington, DC: National Defense University Press, 1988, pp. 21-32.

Adoption of terrorist activities as a mode of warfare cannot be justified. Both the terrorists and the government that they are combating share a faulty conceptual framework--namely that violence to defend abstractions (liberty rather than free men) will produce beneficial change. The two questions which must be confronted are (a) what are the best means to bring about changes in people's lives, and (b) by whom will the future be built? In terms of the latter, we need to ask whether the opponents now share or can ever share a moral community. If dignity and self-respect are to be the outcomes of armed struggle for human freedom, the struggle cannot consist of terrorist attacks on children. Terrorism, defined as an attack on an individual to frighten and coerce a large number of others, is not justified because (a) it will probably not be successful; (b) it is internally inconsistent--the means do not morally promote the ends; (c) it cannot help to build the future; and (d) it is externally inconsistent--that is, it is inconsistent with democratic principles, especially regarding the enhancement of personal liberties.

SIMMS, Ronda R., Assistant Professor, "The Cult of the Thracian Goddess Bendis in Athens and Attica," *Ancient World*, **18, 3 & 4** (1988), 59-76.

The Thracian goddess Bendis was imported into Athens late in the fifth century B.C. Bendis became an official deity of the state--i.e., her cult was financed out of public funds and an elaborate festival was celebrated in her honor. The question is, why did the Athenians import this barbaric deity and bestow such honors on her? The evidence suggests that the Athenians were motivated more by political reasons than by religious ones. Bendis' entrance into Athens coincided with the early years of the Peloponnesian War--that long (431-403) and bitter struggle between Athens and Sparta. The honors received by Bendis were of a piece with other honors bestowed upon the Thracians at this time, the purpose of which was to ensure their continued military and diplomatic support (e.g., the mercenary soldiers who are mentioned by Thucydides and Aristophanes). Bendis remained popular in Athens through the third century, perhaps primarily because of her elaborate festival, but soon thereafter disappears from our records.

SIMMS, Ronda R., Assistant Professor, "Isis in Classical Athens," *The Classical Journal*, **84, 3** (February-March 1989), 216-221.

The Egyptian goddess Isis gained entrance into Athens sometime prior to 333/2 when her name appears in a decree dated to that year. The decree reveals that the Egyptians requested and received a permission to build a sanctuary to Isis, probably in the Piraeus. A careful analysis of the evidence suggests the following conclusions regarding the reasons for Isis' appearance in Athens and the nature of her worship: Egyptian merchants trading with Athens and Egyptian metics living in the Piraeus desired a sanctuary for their native goddess--to extend protection to them in this foreign land. The chief motivator behind the Athenian assent to this sanctuary was the statesman Lycurgus. His reasons were economic--i.e., the encouragment of trade. Trade was a necessary ingredient in his planned revival of Athens as the commercial and cultural center of Greece. The cult of Isis remained a private foreign cult with few citizen adherents during the classical period.

SWEETMAN, Jack, Associate Professor, "The Brown-Water Navy in Vietnam," *Acta of the XIV International Colloquium on Military History*. Ottawa, Canada: International Commission on Military History, 1989, pp. 626-636.

During the Vietnam confict the U.S. Navy developed a series of commands designed to prevent the enemy from infiltrating men and supplies into the South by its coasts and waterways and to break hostile control of the Mekong Delta and the Ca Mau peninsula. These commands were, in order of their appearance: Task Force (TF) 115, the Coastal Surveillance Force (Operation Market Time), established in March 1965; TF 116, the River Patrol Force (Operation Game Warden), established in December 1965; TF 117, the River Assault Force (the naval component of the Army-Navy Mobile Riverine Force), established in February 1967; and TF 194 (SEALORDS), established in October 1968. This paper surveys the origins, objectives, and operational procedures of these forces, evaluates their effectiveness, and describes the purpose-built small combatants they employed.

SWEETMAN, Jack, Associate Professor, "The Brown-Water Navy in Vietnam," Greek translation, *Nautike Epitheorese (Naval Review: Bimonthly Publication of the Navy General Staff)*, **129, 454** (January-February 1989), 71-83.

This is a Greek translation of the previous entry.

SWEETMAN, Jack, Associate Professor, Series Editor, "Classics of Naval Literature," Naval Institute Press.

This Naval Institute Press series is designed to provide useful new editions of classic works of naval history, biography, and fiction. In addition to the unabridged, original text, each work includes a substantial introduction and, when appropriate, notes by an expert in the field. Some editions also contain new illustrations and maps. The following works have appeared or are scheduled to do so during this reporting period:

Edward P. Stafford, *The Big E: The Story of the USS Enterprise*.
Introduction by Paul Stillwell.

Nicholas Monsarrat, *The Cruel Sea*.
Introduction by Edward L. Beach.

Arthur Sinclair, *Two Years on the Alabama*.
Introduction and notes by William N. Still, Jr.

James Fenimore Cooper, *Ned Myers; or, A Life before the Mast*.
Introduction and notes by William S. Dudley.

SWEETMAN, Jack, Associate Professor, "The U.S. Navy Enters the Age of Steam, 1814-1861," *Acta of the I. International Colloquium on Naval History.* Athens, Greece: International Commission on Military History, 1988, pp. 127-140.

At no time prior to the Civil War did the numerical strength of the U.S. Navy entitle it to be regarded as one of the world's great navies. Nevertheless, it played a pioneering role in the adoption of steam propulsion for naval vessels. The first steam warship commissioned in any navy was the USS FULTON--also known as the DEMOLOGOS--a twin-hulled vessel of 2,475 tons with a central paddlewheel. Designed by Robert Fulton, the ship was put under construction in 1814 for the purpose of defending New York harbor against an attack by the British fleet in the War of 1812. The first steamship to see combat also did so in the U.S. Navy. She was the SEA GULL, a small river steamer purchased in December 1822 by Commodore David Porter, the commander of the West India Squadron, for use in the campaign against pirates in the Caribbean. In 1843, the engineering genius of Swedish-born John Ericsson produced the revolutionary sloop-of-war PRINCETON, the world's first screw-propelled warship. The paper continues to trace the increasing employment of steam-powered vessels in the Navy to the eve of the Civil War.

Presentations

ARTIGIANI, P. Robert, Associate Professor, "On the Nature of Cognitive Maps," Planning Conference, University of Bologna, Bologna, Italy, 2 November 1988.

ARTIGIANI, P. Robert, Associate Professor, "A Nonequilibrium Thermodynamic Model of Civilization," General Evolution Research Group, Turku, Finland, 6 January 1989.

ARTIGIANI, P. Robert, Associate Professor, "Formalism for Understanding Nonequilibrium Thermodynamic Models of Social Structures," General Evolution Research Group Seminar, Turku, Finland, 19 January 1989.

ARTIGIANI, P. Robert, Associate Professor, "Societal Cognitive Maps," Conference Celebrating 900th Anniversary of University of Bologna on "Evolution Cognitive Maps," University of Bologna, Bologna, Italy, 15 May 1989.

ARTIGIANI, P. Robert, Associate Professor, "Evolution of Contemporary Science," Conference Celebrating 900th Anniversary of University of Bologna, University of Bologna, Bologna, Italy, 16 May 1989.

ARTIGIANI, P. Robert, Associate Professor, "Post-Modernism and the Semiotics of Science," Griffth Lecture, American University, Washington, DC, 28 April 1989.

BOGACZ, Theodore W., Associate Professor, "Tradition, Modernity, and the Great War in the Paintings of Stanley Spencer and the Music of Ralph Vaughan Williams," Western Conference of British Studies, New Orleans, Louisiana, 27 October 1988.

BOGACZ, Theodore W., Associate Professor, "Some Preliminary Comparisons of the Investigation and Treatment of War Neuroses in Austria, Germany, and England in the First World War," Seminar on Work in Progress on Combat Reactions, Departments of Psychiatry and Military Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland, 16 November 1988.

COGAR, William B., Assistant Professor, "The Naval Legacy of the Spanish Armada," conference on "La Felicissima Armada: Retrospective Views of the Fall of the Spanish Armada," California State University, Long Beach, California, 17 November 1988.

CULHAM, Phyllis, Associate Professor, "Chance, Control, and Command," The Military Conflict Institute, Carlisle Barracks, Carlisle, Pennsylvania, 12 October 1988.

CULHAM, Phyllis, Associate Professor, "Otherness as Ineffability: Female Mystics of Medieval Italy," Conference on The Outsider, Atlanta, Georgia, 31 October 1988. (read by another panelist in the absence of the author).

CULHAM, Phyllis, Associate Professor, "Recovering a Feminist Aesthetic by Reading a Reaction on the Left," Conference on Women, the Arts, and Society, Susquehanna University, Selinsgrove, Pennsylvania, 3 November 1988.

CULHAM, Phyllis, Associate Professor, "Democratic and Republican Imperialists: Athenians and Romans for Modern Americans," Fourth Annual McDonogh Conference (American Historical Association sponsored), McDonogh School, Baltimore, Maryland, 15 April 1989.

CULHAM, Phyllis, Associate Professor, "Women, Slaves, and Freedmen: Weber, Marx, and Concepts of Citizenship in Rome," Bicentennial Speakers Series, South Jersey Humanities Association, Stockton, New Jersey, 8 April 1989.

CUTLER, Thomas J., Lieutenant Commander, USN, "Welcome to Vietnam," Vietnam Veterans of America, Frederick, Maryland, 1 November 1988.

CUTLER, Thomas J., Lieutenant Commander, USN, "Welcome to Vietnam," Roundtable of American Military History, Baltimore, Maryland, 11 November 1988.

CUTLER, Thomas J., Lieutenant Commander, USN, "Technology in Vietnam," Armed Forces Communications and Electronics Association, Annapolis, Maryland, 15 December 1988.

CUTLER, Thomas J., Lieutenant Commander, USN, "Welcome to Vietnam," Broadneck Senior High School, Annapolis, Maryland, 30 May 1989.

DEJNOZKA, Jan, Lieutenant, USNR, "The Ontological Foundation of Russell's Theory of Modality," 1988 Russell Society Meeting at Eastern Division American Philosophical Association Meeting, Washington, DC, 28 December 1988.

ELLENBERGER, Nancy W., Associate Professor, "Trappings of Power: The Strange Political World of George Wyndham," North American Conference on British Studies, Philadelphia, Pennsylvania, 4 November 1988.

HAGAN, Kenneth J., Professor, "The U.S. Supercarrier: Strategic in Origin, Tactical in Use," Fourteenth International Military Colloquium on "Conflicts of High and Low Intensity Since the Second World War," sponsored by the Canadian Commission of Military History, Montreal, Quebec, Canada, 16 August 1988.

HAGAN, Kenneth J., Professor, "The Anglicization of the American Navy," History of the Armed Forces Symposium, United States Marine Corps Command and Staff College, Quantico, Virginia, 26 August 1988.

HAGAN, Kenneth J., Professor, "Perry in Perspective: The Expedition to Japan as Part of a Decade of Naval Expansionism," in session entitled, "The U.S. Navy and American Expansion in the Pacific during the Nineteenth Century," at the Twenty-second Annual Duquesne History Forum, Duquesne University, Pittsburgh, Pennsylvania, 28 October 1988.

HAGAN, Kenneth J., Professor, "The Influence of the Royal Navy on American Naval Strategy," Naval Reserve Intelligence Officers' CO and XO Course, Defense Intelligence College, Washington, DC, 1 March 1989.

HAGAN, Kenneth J., Professor, "Alfred Thayer Mahan: A Critical Evaluation of William E. Livezey, *On Mahan*, and A.T. Mahan, *The Influence of Sea Power Upon History, 1660-1783*," Military Classics Seminar, Officers' Club, Fort Myer, Virginia, 18 April 1989.

HAGAN, Kenneth J., Professor, "The English Influence on American Naval Strategy," Trident Society, Naval Reserve Officers Training Corps Unit, George Washington University, Washington, DC, 25 April 1989.

HAGAN, Kenneth J., Professor, "Dewey in Manila Bay: A False Example of the Capital Ship Theory at Work," North American Society for Oceanic History, San Francisco, California, 10 June 1989.

HUSTON, John W., Professor, "Air Ground Cooperation: Facts and Reflections," Symposium on D-Day, Royal Military Academy, Sandhurst, England, 22 March 1989.

ISENBERG, Michael T., Assistant Professor, "Irish Ethnicity and Acculturation in Nineteenth-Century America: The Case of John L. Sullivan," Gaelic League of America, Washington, DC, 19 February 1989.

KOLP, John G., Assistant Professor, "Elections and Evangelicalism: Anti-Establishment Religion and Local Politics in Eighteenth-Century Virginia," Missouri Valley History Conference, Omaha, Nebraska, 10 March 1989.

NELSON, Samuel H., Assistant Professor, "AIDS in Zaire: Beyond Epidemiology," African Studies Association Conference, Chicago, Illinois, 29 October 1988.

PEELER, David P., Associate Professor, "The Romance of Platonic Forms: Edward Weston and Ansel Adams," Annual Meeting of the American Historical Association, Cincinnati, Ohio, 30 December 1988.

QUARTARARO, Anne T., Associate Professor, "The Perils of Assimilation in Modern France: The Deaf Community and Social Change, 1815-1870," Gallaudet University, Washington, DC, 16 November 1988.

ROBERTS, William R., Associate Professor, "Choosing the First Army Chief of Staff: Lieutenant General S.B.M. Young," Twenty-Third Annual Northern Great Plains History Conference, Eveleth, Minnesota, 23 September 1988.

SIMMS, Ronda R., Assistant Professor, "Greek Family Religion: Religious Ritual as a Reflection of Social Structure," Duquesne History Forum, Pittsburgh, Pennsylvania, 26 October 1988.

SIMMS, Ronda R., Assistant Professor, "Comment on `Plutarch on Young Children,' by Valerie French," International Plutarch Society, American Philological Association Annual Meeting, Baltimore, Maryland, 6 January 1989.

SWEETMAN, Jack, Associate Professor, "The Brown-Water Navy in Vietnam," Fourteenth International Colloquium on Military History, Montreal, Canada, 16 August 1988.

SWEETMAN, Jack, Associate Professor, "History of the U.S. Naval Academy," Atlantic Alliance for Maritime Heritage Conservation, Annapolis, Maryland, 3 December 1988.

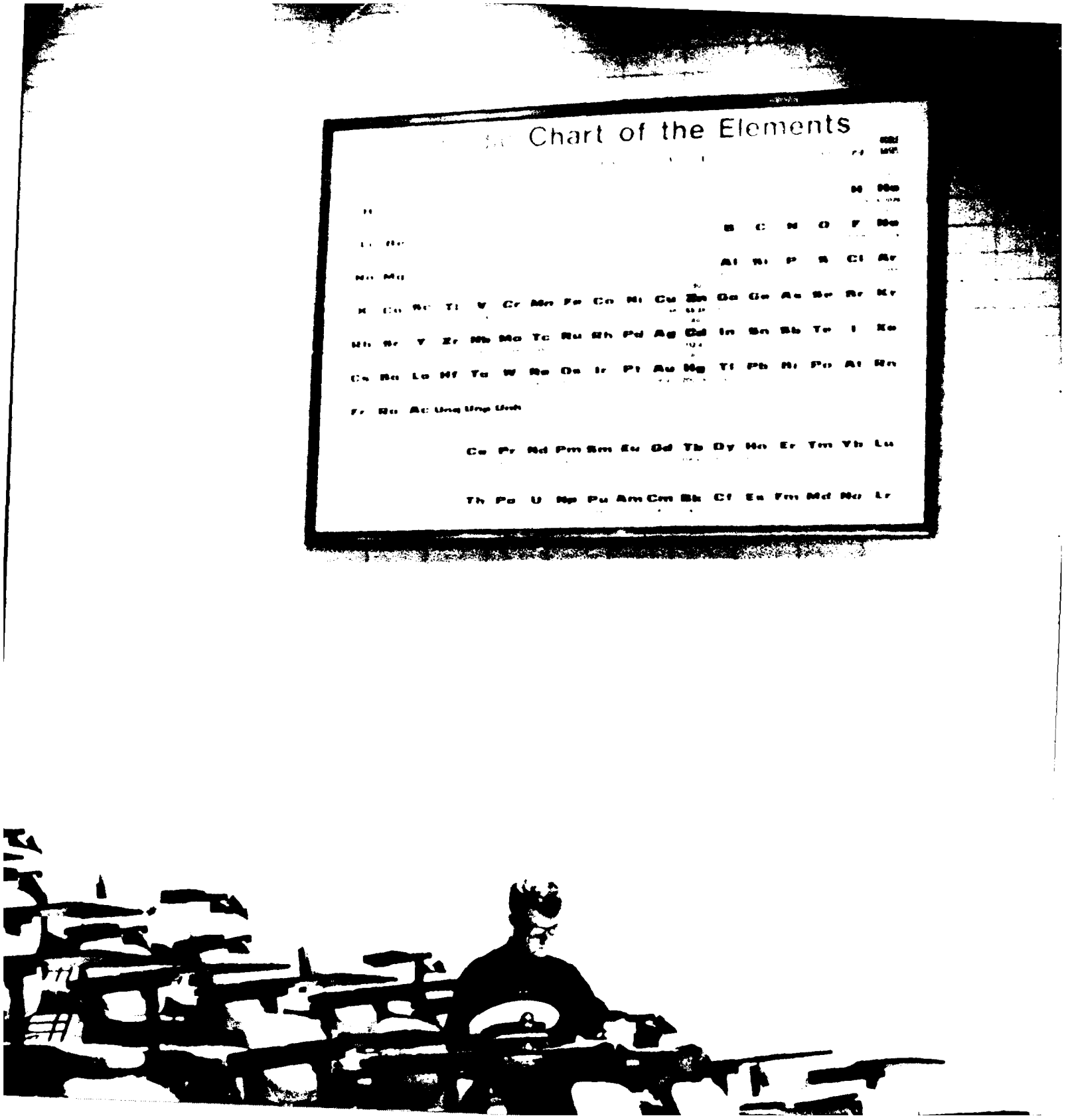


Chart of the Elements

Division of Mathematics and Science

DEPARTMENT OF

Chemistry

Commander John P. Christopher, USN
Chairman

The growth of new knowledge is the result of persistent effort on the part of researchers. This dedication carries with it a sense of excitement which illuminates the classroom as well. Publication in the open literature, presentations at scientific meetings, and collaboration with scientists, both in this country and abroad, are symptomatic of growing recognition and stature for the department. There is a healthy mix of practical Navy problems and more esoteric fundamental research. Student participation in research courses resulted in the completion of several projects. Some of the student findings were presented at the Forty-third Eastern Colleges Science Conference held at West Point. In addition, two students completed Trident Scholar projects dealing with the mathematical modeling of the immune reaction.

Sponsored Research

Electrochemical Studies of the Quartz Crystal Microbalance

Researcher: Associate Professor Graham T. Cheek
Sponsor: Naval Research Laboratory

Research involved the construction of a quartz crystal microbalance (QCMB) for use in investigating changes in electrode mass during electrochemical experiments. As currently implemented, the system monitors the frequency of a 5 MHz quartz crystal as the potential of a gold electrode, deposited on the crystal, is varied. The instrumentation, computer interface, and associated software for data acquisition have been completed, and it appears that measurements down to monolayer coverages are now feasible. Investigations of several systems are underway at this time.

Initial experiments involved measurement of mass changes accompanying the surface oxidation of gold electrodes. It was found that a frequency decrease (mass increase) corresponds to the onset of electrochemical oxidation of the gold surface in 1.0 M perchloric acid. Reduction of the oxide layer on the return potential sweep resulted in an increase in frequency (decrease in mass) back to the initial value. It is thought that the presence of chromium (from the underlayer) on the gold surface accounts for the lack of oxide formation on electrodes used some time (1-2 weeks) after preparation.

More recent work has focused on the adsorption of organic halide reduction products on gold and gold amalgam surfaces in nonaqueous media. Deposition of mercury from acetonitrile solution has been found to result in amalgam formation, there being no characteristic mercury oxidation at low positive potentials vs Ag/AgCl reference electrode. The extent of mercury deposition is very easily measured with the current QCMB system. A brief study of n-decyl iodide reduction has shown that a mass increase accompanies reduction of this compound, suggesting that adsorption of decyl radicals (or iodide anions) is occurring. Further work on this and other organic halide systems is in progress.

Crystal Structure Determinations of Energetic Materials

Researcher: Assistant Professor Douglas S. Dudis
Sponsor: Naval Research Laboratory

Precise molecular parameters, including the distances between individual atoms and the angles between the atoms, can be obtained from single crystal diffraction experiments. The picture of a molecule that results is valuable to the synthetic chemist in that it unambiguously determines the identity of a substance. For the theoretician such information provides accurate molecular experimental parameters against which theoretical calculations can be compared. Studies of biological materials often reveal details which indicate their mode of action (e.g., for enzymes). Of interest to this project, such data can be used to make structure-reactivity correlations which aid in the design of new materials with desired properties.

The crystal and molecular structures will be determined for a number of organic molecules. Most of the compounds examined will be high energy materials of interest such as explosives or propellants. Materials provided in suitable crystalline form will be studied promptly, whereas others will require recrystallization. The structures of these molecules may be of value for molecular and quantum mechanical studies. Many of the compounds may be crowded or strained, thus having unusual molecular structures.

Molecular Dynamics Simulation of Detonation

Researcher: Professor Mark L. Elert
Sponsor: Naval Research Laboratory

Previous work on the one-dimensional molecular dynamics simulation of detonation in nitric oxide is being extended to two dimensions and to other molecular systems. Extension to two dimensions is important in order to allow investigations of the effects of molecular orientation and crystal dislocations on the speed, reaction efficiency, and other parameters of the detonation. Since the LEPS potential surfaces employed in the previous studies could not be effectively extended to two-dimensional systems with an arbitrary number of interacting particles, a new many-body potential scheme based on the Tersoff potential was developed. Studies on a number of diatomic reactive model systems are progressing.

Studies of Reactive Molecular Fragments by Matrix-Isolation Spectroscopy

Researcher: Assistant Professor Robert F. Ferrante
Sponsor: Naval Research Laboratory

The purpose of this project is to prepare, identify, and spectroscopically characterize a number of highly reactive chemical intermediates in the class of nitrenes, using the matrix-isolation technique. These reactive fragments are frequently implicated as participants in well-known chemical reactions, but, in most cases, there is little *direct* evidence for their existence, due to their high reactivity. This part of the study has focused on the radical trimethylsilylnitrene, $(CH_3)_3SiN$. Traditional studies, utilizing photo- or thermal- degradation of the parent molecule trimethylsilylazide (or related compounds) have not generated this radical, but other products (mostly imines) resulting from rearrangements. However, some chemical evidence implies that the triplet nitrene intermediate should form. In addition, the results of many of these experiments differ when the silicon is substituted with carbon: t-butyl nitrene has been reported, and the rearrangement products are not the expected analogs. This research is directed at the production of the radical by a different means, and comparison with the carbon system where possible.

It has been shown that organic azides, when subjected to bombardment with metastable molecular nitrogen, undergo fragmentation with production of a triplet nitrene. These fragments can be trapped and studied in inert matrices at very low temperatures (10 K). Electron spin resonance (ESR) data obtained for this system suggests that the triplet trimethylsilylnitrene radical is produced and directly observed in such experiments. Samples so produced, when examined with a Fourier-Transform Infrared (IR) spectrometer, show numerous lines that behave on annealing or photolysis in the same manner as the ESR signal. This is good evidence that both the IR and ESR lines arise from the same molecule, trimethylsilylnitrene.

Experimental work on the trimethylsilylnitrene molecule is largely completed. The ESR results have been analyzed, and the IR results are under analysis in an attempt to determine the identity of the specific vibrational lines. Concurrent *ab initio* theoretical calculations with a minimal basis set are being performed as an aid in that identification, and also to provide data for a larger examination of a number of known nitrenes.

Thiolate Complexes of Ruthenium and Rhodium Porphyrins as Cytochrome P-450 Active Site Analogues

Researcher: Assistant Professor Jeffrey P. Fitzgerald
Sponsors: Petroleum Research Fund and
Naval Academy Research Council (ONR)

The purpose of this project is to understand the role of the unusual thiolate ligand, RS^-, found only in the Cytochrome P-450 enzyme family. Most other hemoproteins are ligated by nitrogen or oxygen atom donors. P-450 enzymes are also the only hemoproteins capable of using molecular oxygen directly to oxidize unactivated substrates. The connection between the thiolate ligand and the unusual catalytic properties of these enzymes remains unclear.

The mode of investigation will be to prepare and study heavy metal porphyrins which contain a sulfur donor in one of their axial coordination sites. The focus of these studies will be on the effect of the sulfur ligand on the electronic properties of the metal.

A two-step synthesis of RH(III) tetraphenylporphyrin ligated by t-butyl-thiolate has been discovered. This appears to be a general route to molecules of this type, and it is presently being used to synthesize sterically hindered derivatives. With the desired model compounds in hand, examination of the effects of thiolate ligation will begin.

Tetraazaporphyrins as Homogeneous Oxidation Catalysts

Researcher: Assistant Professor Jeffrey P. Fitzgerald
Sponsor: Naval Academy Research Council (ONR)

The objectives of this project are twofold; first, to prepare soluble metallotetraazaporphyrins, and second, to study their properties as homogeneous oxidation catalysts. The purpose is to compare the physical and catalytic properties of tetraazaporphyrins to the naturally occurring porphyrins. This may lead to greater understanding of bonding and catalysis in the natural system and to the development of more selective or more stable catalysts.

A short, high yield synthesis of soluble tetraazaporphyrins, containing iron or manganese, has been achieved. These substances show many interesting properties, including a deep blue-green color, metal redox potentials shifted several hundred millivolts positive of analogous porphyrin complexes, and high catalytic activity.

The iron tetraazaporphyrin has been examined as a catalyst for oxygen atom transfer reactions. Over 2000 turnovers of the catalyst at over 5 turnovers/second have been demonstrated.

More complete characterization of the catalyst, as well as examination of the catalytic reaction stereo- and regiochemistry, are needed.

Vacuum Flow Waste Disposal System for Naval Ships

Researcher: Associate Professor Frank J. Gomba
Sponsor: David Taylor Research Center, Annapolis Laboratory

A simulated vacuum flow waste disposal system for U.S. Naval ships was set up by others. Transducers set at various points in the system measured various parameters (temperature, water flow rates, air flow rates, pressures, volumes of air/water). Data collected was computer sorted using Lotus 1-2-3 to reduce the thousands of data points into useable mathematical and graphical form. "Macros" were written as required to manipulate the data more effectively. The graphical and mathematical data reduction was used to establish general empirical relationships to maximize the efficiency of the system when installed aboard ship.

Total Synthesis of Dolabelladiene

Researcher: Assistant Professor Debra K. Heckendorn
Sponsor: Naval Academy Research Council (ONR)

The total synthesis of the diterpene dolabelladiene is being undertaken. This compound, as well as related compounds with similar carbon skeletons, possesses biological activity. The type of degree of activity depends on the substitution pattern of the molecule. A synthetic strategy that will allow access to a wide variety of substitutions is being tested. Dolabelladiene represents not only a desirable synthetic target, but is also a key intermediate in preparation of related molecules.

The strategy being investigated involves a convergent approach wherein two small subunits are linked to produce the large complex dolabelladiene skeleton. This skeleton is composed of fused five- and eleven-membered rings. Studies on the preparation of the two requisite subunits are now underway. The eleven-membered ring contains two E-alkenes, and an eight carbon subunit containing these dienes is being prepared using a Wittig reaction as the key synthetic step. This subunit, once prepared, will then be joined to a fifteen carbon subunit containing a five-membered ring.

The cyclopentane subunit contains three contiguous chiral centers, and the strategy for its preparation focuses on simultaneous introduction of two of those centers through a novel ring-closure reaction. The acylic precursor needed for this cyclization reaction is being prepared at this time.

Total Synthesis of the Hapalindole Alkaloids

Researcher: Assistant Professor William T. Lavell
Sponsor: Naval Academy Research Council (ONR)

The synthesis of the hapalindole family of alkaloids is an interesting and challenging research area. A variety of literature reports have indicated that these compounds have interesting chemical and biological reactivity.

Interest in these compounds is in the development of a general synthetic route applicable to many members of the class; a key aspect of the current approach involves the development of a mild, selective, high-yield route to the indole nucleus via electrocyclization of an arene-metal complexed nitrene.

At this point, preliminary compounds are being prepared; the indolization reaction will be studied shortly.

Low Temperature Synthesis of Transition Metal Sulfides

Researcher: Assistant Professor Joseph F. Lomax
Sponsor: Naval Academy Research Council (ONR)

Metal sulfides are important as high energy density battery cathodes and as hydrodesulfurization catalysts. They are typically made by a high temperature (>700°C) combination of the elements. The researcher is attempting to develop a low temperature route to these important compounds by the reaction of metal alkoxides with hydrogen sulfide. In some cases the metal alkoxides are commercially available (e.g., titanium iso-propoxide). However, some of the starting alkoxides will need to be prepared according to known procedures. To do this, two high school students in the federally-sponsored SEAP(Science and Engineering Apprenticeship Program) will be trained in laboratory techniques during the summer. In developing this method, safety and high purity are of utmost importance. This is why a high vacuum synthesis line has been constructed by the investigator.

Electron Density Determination in Simple Inorganic Oxy-Anions

Researcher: Assistant Professor Wayne Pearson
Sponsor: Naval Academy Research Council (ONR)

This research project involves the determination of electron densities in simple oxy-anions by X-ray diffraction techniques. The interest in these compounds is in the degree to which d orbitals participate in the bonding density. This is important in calibrating the number of theoretical studies which have been performed on such systems over the years and have resulted in differing conclusions regarding d orbital participation. Crystals were grown for potassium permanganate and potassium dichromate. Data will be collected on these systems to provide additional information concerning the electron density around the central metal atoms. Previous work has been done on potassium manganate and potassium chromate. Data collection must be postponed, however, until the department acquires an X-ray diffractometer. The amount of data which needs to be collected prohibits using diffractometers in other laboratories. Data was obtained cn potassium tetrathionate from co-workers at the University of Missouri. Deformation density maps were developed containing all O-S-O, O-S-S, and S-S-S sections. The maps clearly show a deficiency of electron density in the bridging S-S bonds vs. the terminal S-S bonds. In fact, the bridging S-S bonds appear to have no deformation at all. Since there is clearly electron density in these bonds, this result points to a weakness in the modeling procedure. The more powerful approach of multipole modeling will be applied to this compound in an attempt to examine the bridging S-S electron density.

Photochemical Study of Cyano-Isocyanide-Phosphine Complexes of Iron

Researcher: Associate Professor Joyce E. Shade
Sponsor: Naval Academy Research Council (ONR)

The chemistry of carbonyl-cyano-phosphine complexes of iron has been studied extensively for the last ten years. In general, reflux or photolytic reaction conditions have been employed to initiate the loss of a carbonyl (CO) group from cyclopentadienyl-iron-carbonyl starting materials with a subsequent inclusion of a phosphine or phosphite ligand on the metal center. The resulting complexes obtained in these studies, however, all contain at least one carbonyl group. The purpose of this research was to prepare a series of anionic, neutral and cationic cyano, mono-and bisisocyanide complexes for reaction with phosphine or phosphite groups under photolytic conditions.

Photolysis of $(n_5\text{-}C_5H_5)$ Fe(Co)(CN)$(CNCH_3)$, the monoisocyanide complex, in the presence of a slight excess of triphenylphosphine at room temperature gave the desired product $[(C_5H_5)Fe(CN)\ (CNCH_5(PPh_3)]$ with loss of one equivalent of carbon monoxide. Two additional reaction products, $(n_5\text{-}C_5H_5)Fe(CNCH_3)_2(CN)$ and $(n_5\text{-}C_5H_5)Fe(CN)(PPh_3)_2$, have been obtained. Similar results were obtained with a variety of phosphine, phosphite, arsine, and antimony ligands. Several of the reaction products have been isolated from the fairly clean reaction mixtures, and a variety of spectral data have been obtained to verify their identity. Further purification and characterization of these compounds is continuing. In addition, trends of reaction product yields with bulk and basicity of ligand are being studied. Effect of ligand identity (both on the metal prior to photolysis and as an incoming group), wavelength of the photolysis lamp, and temperature of the reaction mixture are being studied as they affect the reaction products ob- tained. Anionic and cationic starting materials are being investigated under a variety of reaction conditions in order to analyze the system for any trend which might develop as a function of complex charge. A collaborative effort was established with Professor Antony Rest at The University of Southhampton in an effort to establish conclusively the identity of the reaction intermediate(s).

A Model of Oscillating Intracellular Calcium In B Cells

Researcher: Midshipman 1/C Joseph F. Lepage, USN
Adviser: Associate Professor Boyd A. Waite
Sponsor: Trident Scholar Program

Lymphocytes differ from one another not only in the specificity of their receptors but also in their functional properties. Two broad classes of lymphocytes are recognized: the B lymphocytes, which are precursors of antibody secreting cells, and the T lymphocytes. T lymphocytes consist of a series of subtypes, some of which mediate important regulatory functions, such as the ability to help or suppress the development of immune responses, including antibody production. The scope of this study will focus on the T lymphocyte responses only.

The most distinctive and heterogeneous products of B cells are antibodies which are also called immunoglobulins(Ig). B cell antigen receptor crosslinkage initiates the degradation of phosphatidylinositol-4, 5-biphosphate, with the resultant formation of two intracellular messengers, diacylglycerol and calcium-releasing inositol polyphosphates. The internal calcium ion concentration elevation activates a number of intracellular pathways which characterize the magnitude and duration of calcium signals engendered by antigen receptor crosslinkage.

The goal of this project is to propose a viable model which can account for the oscillations in intracellular calcium and the subsequent activation of B cells. Existing computer models for crosslinking are used in conjunction with mathematical models for enzyme-related oscillatory biochemical reactions.

Modeling the T-Cell Independent Response: Effect of Cross-Linking, Capping, Lymphokine Production, and Cell Number Density

Researcher: Midshipman 1/C Joel D. Stewart, USN
Adviser: Associate Professor Boyd A. Waite
Sponsor: Trident Scholar Program

Some of the questions that are still open to debate in the study of B-cell activation, independent of T-cells, are as follows: how to maximize the size and speed of a B-cell response to antigenic attack; whether experiments can actually ever be completely free of T-cell help due to contamination; what part B-cell derived lymphokines play; and the relevance of cross-linking in surface immunoglobulin(sIg) for stimulating lymphocytes.

The question of how B-cell sIg and antigenic linking contribute to lymphocyte activation is complicated by the fact that most mature B-cells have two sIg types, IgM and IgD. Another problem is that different B-cell subsets have different requirements for activation. Experiments have shown that sIg interactions can directly effect lymphocyte proliferation, but not Ig secretion, although it can help focus outside triggers for proliferation and Ig secretion.

The goal of this project is to develop a model which will demonstrate the relevance of the different B-cell activation systems, independent T-cells, to the generation of an antibody response to an antigenic challenge. The objective of the research is to develop a model involving intra-cellular cross-linking, inter-cellular cross-linking, and lymphokine diffusion which simulates the observed experimental dependence of the B-cell response on these factors.

Independent Research

Molten Salt Electrochemistry: Oxidation of p-Dimethoxybenzene

Researcher: Associate Professor Graham T. Cheek

Oxidation of the title compound in a room-temperature molten salt system produces a stable cation radical, as evidenced by an electrochemically reversible system at a scan rate of 100mV/s. This observation confirms the interesting ability of this medium to stabilize reactive intermediates. Upon addition of chloride to the melt, the cation radical reacts to form the chlorinated derivative of dimethoxybenzene.

Reduction of Fluorinated Aromatic Compounds

Researcher: Associate Professor Graham T. Cheek

Reduction of fluorinated aromatic compounds has been studied by the usual electrochemical techniques, as well as by ion chromatography, for measurement of any fluoride ion eliminated during reduction. In the reduction of decafluorobenzophenone, for example, approximately 10-15% of the process involves elimination of fluoride, indicating that this process plays some role in charge stabilization.

Plasmids in Xanthomonas

Researcher: Professor Reece R. Corey

The bacterial genus Xanthomonas consists of a group of plant pathogens, which are impossible to distinguish by the standard bacteriological tests. They appear to be identical in almost all of their characteristics except specificity for their host. The present project consists of surveying members of the genus for the presence of plasmids. Plasmids are small DNA particles found in the cytoplasm. The bacterial cells are lysed, and the DNA is extracted and separated by gel electrophoresis. The researcher seeks a pattern where the presence of different plasmids will correlate with host specificity.

New 1,1-Dithiolate and 1,2-Dithiolate Ligands and Their Metal Complexes

Researcher: Assistant Professor Douglas S. Dudis

The reactions of carbon disulfide with a variety of anions are being explored in an effort to prepare new ligands. The preparations of the ligands themselves are important in that they represent C-1 chemistry (i.e., building complicated molecules from simple starting materials). The metal complexes are of interest for a variety of reasons. Analogous compounds have spectroscopic properties, oxidation/reduction potentials, and reactivities that make them industrially important in applications ranging from catalysts to polarizers in sunglasses.

Progress is being made on two fronts. First, the researcher is exploring the reactions of simple halides with carbon disulfide in a variety of solvents. Though conceptually simple, the only published study of this reaction was published in 1984. Currently the researcher is trying to model these reactions with *ab initio* calculations.

The reaction of nitrite ion with carbon disulfide is also being examined extensively. It is clear that this reaction (which produces dinitrogen oxide, carbon dioxide, elemental sulfur, sulfide ions, and some as yet unidentified products) does not proceed as anticipated. From the collaborative work done at the University of Dayton, it is known that the stoichiometry is not 1:1 but rather 3 carbon disulfides to 4 nitrites. A great deal of spectroscopic data has also been obtained which suggest such species as dinitrogen trioxide as intermediates. Further spectroscopic studies (UV-visible, GL/MS) will be conducted shortly and help clarify the reaction further.

Nitrogen Oxides with Long N-N Bonds

Researcher: Assistant Professor Douglas S. Dudis

Nitrogen oxides of the formula N_xO_y are important components of air pollution. and some are used in rocket fuels, among many other applications. The compounds N_2O_2, N_2O_3, and N_2O_4 are formed from NO and NO_2, and a mixture of NO and NO_2 will have all five species present in equilibrium. The N-N bonds in N_2O_2, N_2O_3, and N_2O_4 are quite elongated (1.8 vs. 1.4 in most compounds having N-N bonds) and are thus quite weak. They thus provide a real test for ab initio methods in attempts to model all the molecular parameters. Simpler methods and basis sets which work well with other second row elements do not work well with these compounds.

In addition to obtaining high quality molecular orbital descriptions for these molecules, the researcher also seeks to model their formation from NO and/or NO_2. Finally there are papers reporting the existence of O=N-O=N which seem to be in error. The researcher believes the species studied were really adducts of O=N-N=O with Lewis acids. If reliable calculations for N_2O_2, N_2O_3, N_2O_4 can be obtained, the investigator should be able to test whether the reported formulation is plausible. Additionally, he seeks tensiometric titration data (in collaboration with Dr. H. Knachel, University of Dayton) for experimental proof of an adduct formulation.

Molecular Vibrations and Normal Modes for Simple Systems

Researcher: Assistant Professor Robert F. Ferrante

The purpose of this project is to develop computer software that will heighten understanding of the nature of molecular motion and its resolution into simple normal modes of vibration. The relative motions of atoms within molecules are quite complicated when viewed *in toto*, but can be resolved to a set of simpler vibrational motions called normal modes. These are the motions of interest when performing a full vibrational analysis of a molecule, or predicting the infrared and Raman spectrum of a molecule based on symmetry. Chemists often consider simpler representations of the normal modes when they discuss characteristic group frequencies of various moieties. It would be quite useful to the student to be able to visualize the normal modes of vibration for a number of simple molecular geometries, to consider their symmetry representations, and to relate these to the group frequencies and overall vibrational motion in the molecule.

The objective of this project is to create software that will provide this visual description for the student, using the methods of computer graphics. Geometries that may be treated (and some examples) include linear (H_2, HF, CO_2), angular, C_{2v}, (H_2O), pyramidal, C_{3v}, (NH_3), trigonal planar, D_{3h}, (BF_3), and tetrahedral, T_d, (CH_4). The overall motion, and the normal modes may be depicted, and observation of the image while consulting character tables should give the symmetries of the vibrations. It is also desirable to provide some latitude in construction of the examples, so that different isotopes or other elements can be substituted in simple cases. The student could then see the effect on the (scaled) vibrational frequency. In some cases, variable vibrational force constants could be treated similarly.

This project has just begun, and testing of image generation and motional representation in diatomics is underway.

Chemical Kinetics Simulations by the Monte Carlo Method

Researcher: Assistant Professor Robert F. Ferrante

The purpose of this project is to develop computer software that will heighten understanding of the kinetic behavior in a number of simple but important chemical systems. A secondary purpose is to introduce and demonstrate the application of the Monte Carlo method for simulations of physical processes. The guiding principle in this effort is that a graphical presentation permits most students to understand the kinetic behavior of a system much more readily than does the mathematical expression that the graph represents. The program is thus designed to allow students to vary the important parameters of initial concentrations and rate constants, and see the result of that variation in a plot of the temporal behavior of the concentrations of all chemical species in the system. Characteristic plots, when applicable, can also be presented. This is useful for simple first and second order kinetic systems, as usually taught in freshman chemistry classes. However, the main utility of the program is in the Physical Chemistry course. It is here that common complications such as consecutive reactions or reversibility are considered. For first order consecutive and/or reversible reactions, the mathematics is still tractable; indeed, these topics are presented in virtually every Physical Chemistry textbook. An analysis of the limiting cases of these expressions is then usually employed to lead into steady-state and equilibrium conditions. Repeated solution of these equations with various parameters to show the onset of the limiting conditions is so tedious that virtually no student would pursue that approach. However, this program will display a graphical presentation of the system with any realistic combination of parameters entered with a few keystrokes. The graph clearly shows when a given set of variables approaches the limiting conditions. This provides more time for discussion of the chemical features that lead to these conditions, rather than a strictly mathematical analysis.

The program utilized the Monte Carlo method to calculate, in real time, the concentration-time behavior of all components of the system. Each different kinetic system (first order, second order, first order consecutive, first order consecutive with reversibility) can be reached through menu entries, and additional commentary is provided for each system, as well as the Monte Carlo technique as a whole. Initial concentrations and relative rate constants within a wide range can be entered as data for the simulation in any kinetic system. This project is essentially complete.

A New Procedure for the Analysis of Dolomite in Quantitative Analysis

Researcher: Professor Edward Koubek

A new method was developed for the analysis of Dolomite which can be used in teaching Quantitative Analysis. As a result, the Thorn Smith Company is going to market unknowns of Dolomite for sale throughout the country.

Formation of Heterocyclic O-Xylylenes: Photoenolization of O-Alkylacylindoles

Researcher: Assistant Professor William T. Lavell

Research on this project, which was funded by the Naval Academy Research Council in the 1987-1988 fiscal year, continues.

At this stage, many of the substituted indoles required for photochemical study have been prepared; in particular, most of the 3-methylindoles series of compounds have been prepared, as have many of the N(1) unsubstituted compounds. The 2-acyl-3-alkyl-1-methylindoles, and the N(1) unsubstituted compounds, require a longer synthetic route, and their synthesis, although in progress, is not yet complete.

Photoenolization studies are also in progress; the deuterium exchange results are being evaluated by NMR and mass spectroscopy.

Should the deuterium exchange results show that photoenolization is occurring, the final stage of the project, elaboration of the indoles to members of the ellipticine alkaloid family, will be attempted.

Haptotropic Rearrangement of Fluorene Chromiumdicarbonyl Phosphine Compounds

Researcher: Associate Professor Joyce E. Shade

Organic compounds such as anthracene, phenanthrene, and a fluorenyl anion are multicarbon compounds consisting of fused carbon rings. There exist in these compounds two distinct aromatic centers through which a transition metal-containing substituent might be bound. In several systems, it has been determined that the metal can migrate from one aromatic center to the other, since this migration is known to have a small activation barrier. In chromiumtricarbonyl systems, for example, which are bound to fluorene, the metal is bound to the normal six-membered ring. Upon dehydrogenation of one of the methylene hydrogens, a fluorenyl anion is generated and there is the migration of the metal to the newly formed five-membered ring. A collaborative group headed by Professor Ceccon of Italy has investigated this fluorenyl system and other related compounds.

The research being investigated in this project is the effect on the metal migration between the two aromatic rings as the identity of the ligand substituents on the metal itself is varied. One method to measure such an effect easily is to introduce a phosphine or phosphite ligand onto the metal in place of a carbonyl group. Phosphorous containing ligands are known to affect directly the amount of electron density on the metal, which in turn affects the bonding preference of the metal for the different ring systems. To study this effect, a series of fluorenechromiumdicarbonylphosphine derivatives have been prepared by members of the research group at the Naval Academy. These compounds were sent to the Italian collaborators, where the haptotropic rearrangement studies were conducted. Spectral data were also collected by the Italian group on the compounds prior to the rearrangement studies, as well as during and after the studies.

Synthesis and Characterization of Organometallic Complexes Using Photochemical Techniques

Researcher: Associate Professor Joyce E. Shade

The chemistry of cationic (pentahaptocyclopentadienyl)(olefin) iron dicarbonyl complexes and their subsequent reaction with a variety of nucleophiles at the olefinic position to produce stable sigma-bonded alkyliron complexes has been studied extensively. Little work has been done, however, with the ruthenium analogues of this system. The purpose of this research was the synthesis and characterization of several ruthenium carbonylolefinisocyanide (CNR) complexes. A series of anionic, cationic, and neutral ruthenium complexes containing carbonyl (CO) groups, cyano (CN) groups, and isocyanide (CNR) groups has been synthesized. Photolytic decarbonylation of these complexes in the presence of ethylene gas at 5°C produced two complexes: $[(C_5H_5)Ru(CNCH_3)(ethylene)_2]PF_6$ and $(C_5H_5)Ru(CN)(ethylene)_2$. Both complexes have been separated from the reaction mixture, and spectral data have been obtained to confirm their identity. Additional reactions of ethylene gas, as well as propylene gas, with a variety of starting materials, is underway to compare reactivities of the gases toward the starting materials. In addition, temperature and solvent dependence studies are being conducted. Experiments for the reactions of the pi-bonded olefin compounds with a variety of nucleophiles are in the planning stages.

A First-Principles Explanation of the Acid Strengths of Water and Hydronium Ion

Researcher: Associate Professor Boyd A. Waite

Statements in general treatments of chemical principles are often inconsistent in describing the acid strengths of water and hydronium ion. A formally correct method (based on principles of thermodynamics) has been obtained in this study which provides a totally consistent description of the acid strengths of these simple but very significant species. By treating water or hydronium ion as a solute (i.e., by "labeling" a certain fraction of the water or hydronium ion), it is possible to calculate the thermodynamic equilibrium constants governing the acid reactions of the two species. Results indicate that the inconsistencies in general chemistry treatments arise mainly due to a loose management of standard state definitions. This treatment provides a clear resolution of this inconsistency.

Diet and Growth in the Crayfish, Procambarus Clarki

Researcher: Associate Professor D. Lawrence Weingartner

To study the ability of the swamp crayfish, *Procambarus Clarki*, to survive and grow on various food items, newly-hatched crayfish were placed in one of three dietary groups: (1) food consisting of various aquatic plants; (2) food consisting of various aquatic animals; and (3) food consisting of both plants and animals.

The results were that the best growth, especially in the younger stages, is achieved from a complete diet of both plant and animal material. Crayfish maintained on a strictly animal diet underwent slower growth initially, but eventually caught up with the crayfish on complete diets. The crayfish maintained on plant food grew very slowly during the first few months, then later ceased all growth and died before reaching sexual maturity. Crayfish maintained on either the animal or complete diet reached sexual maturity and females produced viable eggs.

Research Course Projects

The Synthesis of Dimesitylacetylene as an Intermediate for Octamesityltetraazaporphyrin, a Functional Model for Naturally Occurring Catalysts

Researcher: Midshipman 1/C Richard G. deGuzman, USN
Advisers: Assistant Professor Jeffrey P. Fitzgerald and
Lieutenant Keith A. Warner, USN

The three-step synthesis of dimesitylacetylene from mesitylaldehyde is described. Beginning with mesitylaldehyde, a modified McMurry reaction was used to dimerize the starting material, mesitylaldehyde, to produce dimesitylethene. This alkene was then brominated in CCl_4 to make 1,2-dibromo-1,2-dimesitylethene. The last step, a double dehydrohalogenation of the 1,2-dibromo-1,2-dimesitylethane to produce the desired dimesitylacetylene, was unsuccessful under several experimental conditions.

Synthesis of a Dolabelladiene Precursor

Researcher: Midshipman 1/C Marie Ann Demel, USN
Adviser: Assistant Professor Debra K. Heckendorn

The synthesis of organic compounds derived from biological sources is a very active area of research in organic chemistry and is important for two reasons. First, derivatives of compounds isolated from biological systems are the source of most commonly used pharmaceutical agents. The tailoring of antibiotics for specific activity by synthesis, as well as how to modify these compounds, can be determined in the laboratory by the synthesis of the naturally occurring compounds. Second, larger quantities than are available from natural sources may also be synthesized in the laboratory and used for biological testing. The syntheses of Dolabellane diterpenes are important to determine their biological activity. These compounds have only recently been isolated in small quantities from marine organisms. In order to perform chemical studies, larger quantities are needed. The synthesis of dolabelladiene requires that several small precursors be prepared. In this project, one of those precursors has been prepared. The overall process was completed in six steps. The final product, an alpha-beta unsaturated ester, was obtained after the successful completion of the scheme. Key steps in this reaction included the reduction of γ-valerolactone; the conversion of this product to a primary alcohol; oxidation of the alcohol to an aldehyde; and a Wittig coupling. Spectroscopic identification of all complexes was accomplished using Nuclear Magnetic Resonance and Infrared Spectroscopy with equipment available within the Chemistry Department. This project has been a significant contribution to the overall synthesis of dolabelladiene which is still ongoing.

2-Acetylquinoline Derivatives as Potential Antifilarial Agents

Researcher: Midshipman 1/C Florencio A. Dictado III, USN
Advisers: Professor Samuel P. Massie and
Assistant Professor Ronald E. Siatkowski

Filariae are slender, elongate, parasitic worms that infect the blood or tissues of mammals. Filariasis, a collective term describing the disease caused by any form of filariae, infect over 200 million people worldwide. Diethylcarbamazine is the only drug currently recommended for treatment. Though other antifilaria drugs exist, their effects are not as non-toxic. Due to the enormous human suffering inflicted by human filariae and development of possible resistance to the current drug of choice, it was decided to synthesize 2-acetylquinoline derivatives of thiosemicarbazone derived from a carbon dithioate and three secondary amines. These potential antifilarial compounds will be characterized by standard chemical analysis (melting point, NMR, IR, and elemental analysis) which will be followed by tests to ascertain both their toxicity and biological activity as antifilarial agents.

Synthesis of 1,2,4-Trioxanes: Analogs of Qinghaosu

Researcher: Midshipman 1/C Gregory B. Meyer, USN
Adviser: Assistant Professor William T. Lavell

The synthesis of 1,2,4-trioxanes, simple analogs of the novel antimalarial qinghaosu, was attempted from ascaridole and various aliphatic and aromatic aldehydes by an extension of methodology previously reported in the literature. The experiment focused on two areas of the reaction: (1) capture of the carbocation (formed from ascaridole and Lewis acid) with aldehydes was found to be independent of electronic effects, and, to a small degree, dependent on steric effects; (2) carbocation formation was dependent on the size of the alkyl substituents of the Lewis acid.

1,2,4-Trioxanes Qinghaosu Analogues: Potential for Antimalarial Activity

Researcher: Midshipman 1/C William S. Padgett, USN
Adviser: Assistant Professor William T. Lavell

1,2,4-Trioxanes were synthesized from the unsymmetrical peroxide ascaridole. Optimal conditions for the synthesis of ascaridole were found that resulted in large quantities of pure ascaridole in a short amount of time. In order to get a trioxane, it was determined that a very large excess of aldehyde had to be used to stop the ascaridole from polymerizing. Experimentation showed that the nucleophilic character of the aldehyde was not a variable in the reaction, and, thus, the aldehyde could be chosen to suit a specific purpose. Evidence for the possibility of steric control in determining isomer ratios was found in experimentation with three acids of different size.

2-Acetylpyrrole Derivatives as Potential Antifilarial Agents

Researcher: Midshipman 1/C Loren J. Smith, USN
Advisers: Professor Samuel P. Massie and
Assistant Professor Ronald E. Siatkowski

Filariasis is an infectious disease caused by parasitic worms transmitted to a mammalian host via an insect vector, usually a mosquito, and is common to many of the warmer climates in which our military finds itself. This study proposes the synthesis of 2-acetylpyrrole derivatives of thiosemicarbazone derived from a dithioate and three secondary amines as potential antifilarial agents. At the time of this writing, the three major moieties necessary for the synthesis of the proposed antifilarial agents have been synthesized, purified, and characterized. One of these intermediates, [methyl-3-(1-2-pyrrole)-ethylidene]-hydrazine carbodithioate, hereafter referred to as DS-I, is believed to be newly synthesized. An attempt was made to couple this intermediate, and additionally a 2-acetylquinaldine derivative, with simple ortho, para, and meta diamines to yield final products. NMR, IR, and melting points were used to chemically analyze these products. After thorough purification, these compounds will be turned over to Dr. Klayman's group at Walter Reed Army Institute of Research for the testing of biological activity as well as toxicity.

Publications

DUDIS, Douglas S., Assistant Professor, co-author, "The Formation of mu-Platinum by Oxidative-Addition and Other Reactions of Dinuclear Gold Complexes," *Proceedings* of The Legacy of Edward W. Morley: 100 years of Chemistry at Case Western Reserve University, Michelson Morley Centennial Celebration, 24-25 April 1987, pp. 35-37.

Oxidative-addition of small molecules such as $CH_{4-y}X_y$ (y = 1-4, X = Br, I) halogens, or pseudo-halogens, to dinuclear gold (I) complexes follows a reaction course very dependent upon the type of bridging ligands involved. When Y = Z = CH_2, as with dinuclear bridging ylide ligands, addition occurs readily to form gold (II) products. This occurs with CH_3Br, CH_3I, CCl_4, Cl_2, Br_2, I_2, benzoylperoxide, and a number of other oxidants. When Y = Z = S, as in dithiocarbamate derivatives, a few examples of oxidation are well established, e.g., with Br_2, but rearrangement of the product to gold (III) and gold (I) species occurs readily. When Y = Z = P, as in diphospho derivatives, no oxidative-addition is known, although bridging halide species can be formed.

ELERT, Mark L., Professor, co-author, "Conformation and Electronic Structure of Heterocyclic Ring Chain Polymers," *Synthetic Metals*, **25** (1988), 109-119.

A theoretical study is presented of the conformation and electronic properties of the polypyrrole, polythiophene, and polyfuran chain polymer systems. These results are compared with experimental results and other theoretical studies, including previous model studies indicating the importance of the heteroatom in the pi-bond structure of these systems.

ELERT, Mark L., Professor, co-author, "One-Dimensional Molecular-Dynamics Simulation of the Detonation of Nitric Oxide," *Physical Review B*, **39** (1989), 1453-1456.

A series of one-dimensional molecular-dynamics simulations was performed to model the shock-induced initiation of detonation in nitric oxide. Three-body potentials were used to reproduce accurately the energetics of the elementary reactions leading to the formation of the product species, molecular nitrogen and oxygen. The model produces a stable, self-propagating detonation front, without additional parametrization or the introduction of frictional forces. Initiation threshold, reaction-zone widths, product distributions, steady-state detonation-front velocities, and density and temperature profiles resulting from these simulations are presented.

GOMBA, Frank J., Associate Professor, co-author, "Invert Emulsion Fire-Resistant Hydraulic Fluid Summary Report II," *David Taylor Research Center/SME-87/89* (1989).

The risk of catastrophic fires that result from high-pressure leaks of petroleum-base fluid requires the consideration of fire-resistant fluid for high-pressure submarine hydraulic systems. The objective of this task is to determine the applicability of invert emulsion fluids to submarine internal systems. The first phase of the program, completed in Fiscal Year 1986, consisted of laboratory investigations designed to determine flammability characteristics, emulsion stability, toxicity, susceptibility to microbial growth, fluidborne noise characteristics, and physical and chemical properties. That study showed that invert emulsion fluids meet many submarine hydraulic system requirements; however, certain fluid limitations were identified which warranted the development of additional performance data.

The second phase of the project focused on determining the chemical compatibility of the invert emulsion fluids with materials found in and about the internal hydraulic system of the SEAWOLF Class of submarines. Fluid compatibility with metals, nonmetals, elastomers, paints, and filtration media was studied. Noise studies were continued also by evaluating the structureborne noise characteristics of an invert emulsion fluid. The results demonstrated that the invert emulsion fluids are compatible with nitrile and fluorocarbon elastomers and most paints used in submarine systems. There were some limitations concerning the compatibility of the emulsions with certain metals and filtration media. Structurebone noise tests revealed an increase in valve noise at frequencies higher than 10 kilohertz. These limitations warrant additional performance data. This project should continue to resolve these deficiencies and perform the dynamic testing required.

KOUBEK, Edward, Professor, "Absorption of UV Light by Ozone," *Journal of Chemical Education*, **66** (1989), 338.

An apparatus is described which can demonstrate the absorption of UV light by ozone gas. This demonstration enables a student to "see" the effect of the ozone depletion problem upon our environment.

LOMAX, Joseph F., Assistant Professor, co-author, "Nido-Carborane Building-Block Reagents. 1. Polycyclic Arene $RR'C_2B_4G_6$ Derivatives," *Inorganic Chemistry*, **27** (1988), 3069-3075.

The preparations of mono- and bis(C-indenylmethyl) and mono-and bis(C-fluorenylmethyl) derivatives of nido-2, 3, dicarbahexaborane (8)($C_2B_4H_8$) are described. These carboranes are multifunctional, presenting several aryl and carbonyl sites for metal g_5 or g_6-coordination, and are designed as structural modules for use in the construction of multi-unit metal sandwich complexes and proposed electron-delocalized solid-state arrays. The carborane syntheses were conducted involving the reaction of alkynes of B_5H_9 in the presence of $(C_2H_5)_3N$. However, these preparations require a priori the syntheses of 9-fluorenylmethylacetylene.

MCKELVEY, Timothy, Captain, USAF, co-author, "Structural Effects Controlling the Rate of the Retro-Diels-Alder Reaction in Anthracene Cycloadducts," *Journal of Organic Chemistry*, **54** (1989), 1018-1032.

The retro-Diels-Alder (rDA) reaction is a $\pi^2s+\sigma^2s+\sigma^2s$ electrocyclic process that, as the name implies, is the reverse of the familiar Diels-Alder cycloaddition reaction. While the factors that influence the rate of the cycloaddition reaction are rather well established, there remains little predictive ability in knowing at what temperature a cycloreversion will occur. Surprisingly, a survey of the substituent effect on the rDA reaction has not been reported; such information is essential to work on the design of cycloaddition/ cycloreversion-based catalysts. In addition, recent syntheses in which rDA reactions played a key role point to the need to understand how these reactions can be done at less than pyrolytic temperatures. Consequently, a fairly broad study of how the structure of an anthracene cycloadduct affects the rate of its cycloreversion reaction was undertaken. Some of these results have been published previously in abbreviated form.

SIATKOWSKI, Ronald E., Assistant Professor, co-author, "NMR Studies of a `D´ Phase Compound," *Physical Review A*, **38, 9** (1988), 4815-4821.

Proton NMR spectra and relaxation times (T_1s) at 60 MHz were obtained for the thermotropic compound 4'-n-hexadecyloxy-3'-nitro-biphenylcarboxylic acid, which, upon heating, has the sequence of phases: crystal→S_c→D (or smectic-D)→S_A→isotropic. The spectrum narrows over two orders of magnitude upon heating into the D phase, then broadens again in the S_A phase. The spectrum in the D phase is composed of a number of chemical shift peaks, the same as in the isotropic phase, except that the carboxylic acid peak is shifted further downfield in the D phase, evidence of intermolecular hydrogen bonding. In the smectic phases S_C and S_A the spectrum is super-Lorentzian with a width of around 2 kHz, considerably narrowed compared with the 36-kHz-wide spectrum of the solid. The relaxation times increase smoothly from 0.35 s at 124°C to 0.73 s at 194°C in the S_C and S_A phases. In the D phase, individual peaks have T_1s ranging from 0.18 to 1.1 s, with weighted averages agreeing with the trend of the data from the S_C and S_A phases. Measurements of spin echoes in the D phase without and with a field gradient gave values of about 50 ms for T_2 and $3x10^{-}m^2/s$ for the diffusion coefficient. The data indicate that, in the D phase, the molecules sample enough orientations on the time scale of the NMR experiments to average out the dipolar couplings left after the motional narrowing that takes place in the S_C and S^A phases. This is accomplished by diffusion of molecules through regions having different directors.

SIATKOWSKI, Ronald E., Assistant Professor, co-author, "The Chemical Elements of Logic," *Molecular Electronic Devices, Proceedings* of the Third International Symposium on Molecular Electronic Devices, eds. F. L. Carter, R. E. Siatkowski, and H. Wohltjen. Amsterdam, Netherlands: Elsevier Science, 1988, pp. 321-327.

The recent development of a calculus of logic by G. Spencer-Brown in "The Laws of Form" not only corresponds to an enhanced calculus of great power and simplicity, but also one that clarifies the innumerable ways that chemistry can and will function according to the rules of logic. G. Spencer-Brown and his brother D. J. Spencer-Brown (of four-color map fame) developed their calculus of logic based on two fundamental axioms which are analogous to the quantum mechanical projection and annihilation operations. This suggests that chemical systems which satisfy these axioms are candidates for logical operations at the molecular level (molecular computing). It is very easy to find such systems; these include soliton, optical, and reactive based phenomena. The application of this logic with respect to a general chemical system will be discussed.

SIATKOWSKI, Ronald E., Assistant Professor, co-author, "Molecular Electronic Devices," *Molecular Structure and Energetics, Vol. 11 - From Atoms to Polymers: Isoelectronic Analogies*, eds. J. F. Liebman and A. Greenberg. New York: Verlag Chemie, 1989, pp. 307-392.

The semiconductor VLSI (very large scale integration) logic chip is probably the most complex structure ever fabricated. However, it is but a pale forecast of what might be achieved if the switching elements of logic were reduced to the size of molecules (20-100 A). The remarkable complexity of the VLSI chip is, of course, a two-dimensional tribute to the most complex organization of material known, that is, human beings and their central nervous system. It is interesting to note that the logic elements in man are probably a factor of a hundred times larger (on average) that 20-100 A. This has important implications on what might be ultimately achieved. The central theme of this chapter is that as the switching elements of electronic circuitry approach molecular size in 20 to 30 years, the fabrication material of choice will no longer be silicon but will be materials whose switching functions will be an integral and logical consequence of their molecular structure. Two approaches therefore appear feasible, biological and non-biological. This chapter deals primarily with the latter. References to switching "molecules" or to "molecular level" are somewhat inappropriate except as a size reference. Free molecules are not involved, but switching moieties are, which need not be individually addressed. Usually, these groups will be addressed within arrays of molecules in mass and collectively known as a molecular electronic device (MED). The two most formidable barriers to even the conceptual development of a MED involve methods of communication with the individual switching moiety or group of choice, and methods of device fabrication. Both problem areas are considered in this chapter.

SIATKOWSKI, Ronald E., Assistant Professor, co-editor, *Molecular Electronic Devices, Proceedings* of the Third International Symposium on Molecular Electronic Devices. Amsterdam: Elsevier Science, 1988.

The field of molecular electronics is increasingly being recognized by the international scientific community as the next logical step in the quest for information gathering/ processing machines that are ever smaller, ever faster, and less expensive than their predecessors. This book offers a broad view of the emerging concepts, methods, and techniques in this rapidly growing field. Molecular Electronic Devices is the compilation of papers presented at the Third Symposium On Molecular Electronic Devices, (MED III), held in Arlington, Virginia on 6-8 October 1986. Earlier symposia, MED I and MED II, focused on conceptual and theoretical aspects of molecular electronic devices. In contrast to these symposia, the aim of MED III was to highlight experimental progress in the synthesis of nanocomposite structures, as well as the generation, transport, and control of signals in such structures. The fine work documented in this volume provides ample evidence of the steady progress being made toward the realization of practical molecular electronic devices.

WAITE, Boyd A., Associate Professor, "Antibody Multivalency Effects in the Direct Binding Model for Vesicle Immunolysis Assays," *Journal of Immunological Methods*, **115** (December 1988), 227-238.

An extension of a previous model of liposome-based immunoassays is presented which incorporates the effects of antibody multivalency in the binding process. Equations based on the distribution of vesicles having both mono- and divalently bound species show the qualitative relationships of the experimental parameters, including vesicle concentration, antigen density on vesicle surfaces, antibody concentration, and antibody affinity (both for the initial binding step and for the subsequent cross-linking step). It is found that in the case of low antibody concentration, the multivalent model can be cast in the form of the previously described monovalent model, replacing the association equilibrium constant with an effective equilibrium constant which is found to depend linearly on the lateral antigen density and on the valency of the binding antibody. Comparisons to certain experiments are made using this more realistic model of complement-mediated vesicle immunoassay. For the case of IgM binding, it is estimated that as few as 1000 antibody molecules can be detected in a typical lytic assay, representing a significant increase in sensitivity over previous predictions.

WYMAN, John F., Lieutenant Commander, USN, co-author, "Isolated Rat Liver Perfusion Studies With Cyclic Heptapeptide Toxins of Microcystis and Oscillatoria (Freshwater Cyano Bacteria)," *Toxicon*, **26** (1988), 827-837.

Isolated perfused rat livers were used to study the dose-dependent effects of three cyclic heptapeptide toxins isolated from Norwegian fresh-water bloom samples containing Microcystis aeruginosa, Oscillatoria agardhii var., and Oscillatoria agardhii var. isothrix. The high pressure liquid chromatography (HPLC) purified toxins had an i.p.LD_{50} in the rat and mouse of approximately 50,500 and $1000_{\mu g/kg}$, respectively. Hepatic insult of the toxins at concentrations of 0.5-4.0 times the rat i.p. lethal dose were assessed by monitoring bile flow, accumulation of total protein in the perfusate, release of intracellular enzymes, and histopathologic examination of perfused liver tissue. One hundred micrograms of Microcystis toxin produced cessation of bile flow during a 1-hour perfusion period, while the two Oscillatoria toxins required 1000 and $2000_{\mu g}$ of toxin, consistent with their lower LD_{50} values. Hepatic cell membranes remained intact during the perfusion since release of enzymes and proteins into the perfusate was similar for toxin treated and control livers, and histopathologic examination of Trypan Blue infused livers revealed exclusion of the dye from the intracellular compartment of the parenchyma. Histopathologic findings for all three toxins showed hepatocellular disassociation that increased with toxin concentration. At the ultrastructural level, all three toxins caused dose-dependent vesiculation of rough endoplasmic reticulum, formation of concentric whorls composed of rough-ER, mitochondrial swelling, large cytoplasmic vacuoles, and altered bile canaliculi. These changes were similar to those found for previous in vivo studies using Microcystis cyclic heptapeptides from Scotland and Australia. The Oscillatoria toxins required five to ten times more toxin to produce similar effects as the Microcystis toxin. At the higher concentrations, the Oscillatoria toxins also caused a proliferation of smooth-ER. The isolated perfused rat liver was found to be a good model for studying the hepatocellular effects of different cyclic peptide toxins from cyanobacteria.

Presentations

CHEEK, Graham T., Associate Professor, "Electrochemical Behavior of Fluorinated Aromatic Compounds," Southeastern Regional Meeting of the American Chemical Society, Atlanta, Georgia, 9-11 November 1988.

CHEEK, Graham T., Associate Professor, "Electrochemistry of Fluorinated Aromatic Compounds," 1989 Gordon Conference on Electrochemistry, Ventura, California, 16-20 January 1989.

CHEEK, Graham T., Associate Professor, "Electrochemical Reduction of Organic Compounds at the Quartz Crystal Microbalance," Spring 1989 Meeting of the Electrochemical Society, Los Angeles, California, 7-10 May 1989.

DUTTERA, Michael R., Assistant Professor, "Grading Macro for Quattro," United States Naval Academy Software Fair, Annapolis, Maryland, 1-2 March 1989.

FERRANTE, Robert F., Assistant Professor, "Production of Triplet Trimethylsilylnitrene by Decomposition of the Parent Azide," Forty-fourth Symposium on Molecular Spectroscopy, Columbus, Ohio, 12-16 June 1989.

FERRANTE, Robert F., Assistant Professor, "Chemical Kinetics Simulations by the Monte Carlo Method," United States Naval Academy Software Fair, Annapolis, Maryland, 1-2 March 1989.

KOUBEK, Edward, Professor, "The Use of Shadowgraphs to Demonstrate Chemical Properties in Upper Level Chemistry Courses," Tenth Biennial Conference on Chemical Education, Purdue University, West Lafayette, Indiana, 31 July-4 August 1988.

LAVELL, William T., Assistant Professor, "Reactions of Trialkylsilyl Triflates: Regioselective Carbocation Formation," Forty-third Eastern Colleges Science Conference, United States Military Academy, West Point, New York, 21-22 April 1989.

LOMAX, Joseph F., Assistant Professor, "Conductivity and Chemistry in Two Dimensions: The Layered Transition Metal Dichalcogenide," Ohio Northern University, Ada, Ohio, 19 April 1989.

MASSIE, Samuel P., Professor, "A Survey of the History of Blacks in Science," Keynote Address, SMART Conference, Howard University, Washington DC, 24 February 1989.

MASSIE, Samuel P., Professor, "The Young Scholars Program of the National Science Foundation Symposium," White House Initiative on Science in HBCU Institutions Conference, Washington, DC, 25-26 September 1988.

SIATKOWSKI, Ronald E., Assistant Professor, "Molecular Devices: Present Status and Future Applications," Department of Materials Science and Engineering, Johns Hopkins University, Baltimore, Maryland, 10 April 1989.

SIATKOWSKI, Ronald E., Assistant Professor, "NMR Studies of a 'D' Phase Compound," Twelfth International Liquid Crystal Conference, University of Freiburg, Freiburg, Federal Republic of Germany, 15-19 August 1988.

WYMAN, John F., Lieutenant Commander, USN, "Combustion Toxicity of an Aircraft Lubricant," Twenty-Eighth Annual Meeting of the Society of Toxicology, Atlanta, Georgia, 27 February-3 March 1989.

DEPARTMENT OF

Computer Science

Commander Frank S. Calcaterra, USN
Chairman

Computer Science Department research activity increased significantly this year. New members of the faculty have contributed their research skills, while working with established professors to bring new projects to the department. Additionally, equipment purchased and installed over the past two years is beginning to enhance the productivity of each faculty member and the range of projects the department can support. This situation increases our ability to bring new concepts to the classroom, which in turn improves the overall program and promotes the reputation of the Naval Academy.

Research endeavors within the Computer Science Department are coordinated by the Department Research Committee. The committee is composed of both military and civilian faculty members. Faculty research was funded by the Defense Advanced Research Project Agency (DARPA), David Taylor Research Center, Defense Mapping Agency, U.S. Navy Supply Systems Command, Naval Research Laboratory, and the Air Force Office for Scientific Research. The Computer Science Department encourages its entire faculty to engage in research, because it believes that both faculty and students benefit. Research will continue to hold a high priority within this department.

Sponsored Research

Derivation from First Principles of Belief Valves Generated in Networks by Message Passing

Researchers: Assistant Professor Wayne Amsbury and
Professor Patrick R. Harrison
Sponsor: Naval Academy Research Council (ONR)

Some basic assumptions about the propagation of belief in the normal mode operation of system components in an arithmetic network are identified. They lead naturally to a message passing paradigm that propagates local computations throughout the system, and they are applicable to the quantification of reasoning in the presence of uncertainty in other contexts.

Graphical Representations of Channel Flows

Researcher: Professor Frank L. K. Chi
Sponsor: David Taylor Research Center, Annapolis Laboratory

Traditionally, numerical results of scientific research are presented in tables or plotted in curves. The meaning of these tables and curves are not obvious, and their interpretations are not easy. The researcher seeks ways best to present the numerical results in computer graphics for easy interpretation, illustration, and presentation. As a specific example, the velocity field of the turbulent fluid flow in a channel of irregular shape is presented in a series of screen displays. Each display shows the vortices around the obstacle at different times. Different colors are used to show the magnitude of the velocity field. The results will be extended to channels of more complex geometry in future studies.

Toward A Raster Image-Based Electronic Chart Prototype

Researcher: Assistant Professor Clayton A. Dane
Sponsor: Defense Mapping Agency

Progress in the development of an electronic chart prototype sponsored by the Defense Mapping Agency is described. A system design using a database of raster images was selected for implementation. Design decisions and their justifications for a PC-based system are elaborated. Possible application of these observations to other electronic chart systems is discussed.

Database Integration Aspects for a Ship Design and Analysis System

Researchers: Assistant Professor Nikolaos Glinos,
Professor Bruce Johnson, and Associate
Professor Gregory J. White (Naval Systems Engineering)
Sponsor: Defense Advanced Research Project Agency

The U.S. Naval Academy is to test and evaluate ship design codes which Science Applications International Corporation (SAIC) is currently implementing. This has required that a complete system for ship Design and Analysis be developed at the Academy. The central part of this system is a database which the ship design and analysis tools can query for information and data. The research evolves around the design of the above database. Ideally, this database should be able to use as many open architecture tools as possible, so that the exchange of data between systems based on different hardware and between different organizations is both possible and efficient. Such a database should contain information on the hull form geometries and the corresponding numerical and experimental results from previous ship designs, so that performance comparisons can be made. The ORACLE database system has already been chosen for the implementation of the database. A prototype is expected to be operational during the summer of 1989.

Self-Reflective Symbolic Interpreters

Researcher: Professor Patrick R. Harrison
Sponsor: Naval Research Laboratory

The research develops LISP interpreters that have continuation passing rather than evaluation as their fundamental semantic. Reflective interpreters can modify themselves during execution by looking up and down the chain of continuations that represent their ongoing computations. Such an engine is being explored as a better abstraction and kernel for specifying and developing programs that learn.

Software Concepts in Lisp

Researcher: Professor Patrick R. Harrison
Sponsor: Naval Research Laboratory

This is a program of research that has developed software engineering concepts and programming techniques for symbolic programming. Common Lisp implements a universal symbol system and should, therefore, be able to express theories of mind that can be subjected to immediate testing. In fact, this is the way the Lisp language should be viewed. With this in mind, the researcher has been exploring how these theories should be expressed. Along the way, the program has developed new approaches to abstraction, program decomposition, and the organization and layering of abstractions to express concepts in machine learning and expert system design.

Ship Design for Survivability: The Fire Problem

Researcher: Professor Patrick R. Harrison
Sponsor: David Taylor Research Center, Annapolis Laboratory

The purpose of this research project is to design and implement an expert system that snythesizes the fire problem into the survivability models that are part of ship design for damage tolerance. DDG-51 will provide an initial platform for prototyping. The expert system design will integrate numerical and symbolic computing models.

Data Communications Analysis of the Ship's Configuration and Logistic Support Information System

Researcher: Lieutenant Jeremiah X. McEnerney, USN, SC
Sponsor: Naval Supply Systems Command

The Ship's Configuration and Logistic Support Information System is the Navy's architecture for configuration and logistic accounting in support of fleet units. This study establishes the data communications capabilities of each activity in LSIS and recommends some changes to improve configuration data processing.

Parallel Processing on the Connection Machine

Researcher: Assistant Professor Eun K. Park
Sponsor: Naval Research Laboratory

This research explores software engineering concepts as they apply to parallel processing on the Connection Machine. Highly experimental languages such as Parallel Lisp will be used in this research.

Parallel Algorithms for Constrained Nonlinear Global Optimization

Researcher: Assistant Professor Andrew T. Phillips
Sponsor: Air Force Office for Scientific Research

This project is a two-year research program on designing parallel algorithms for large-scale constrained nonlinear global optimization programs. The overall objective of this work is to design and implement new algorithms which, by taking full advantage of parallel computing capabilities, will efficiently solve large-scale constrained nonlinear global optimization problems on the shared-memory CRAY 2, CRAY X-MP, and CRAY Y-MP supercomputers.

Constrained global optimization problems arise in many important areas of science and technology and include scheduling and allocation problems with non-convex objective functions and a variety of computer-aided-design and computational geometry applications. These kinds of optimization problems may possess many constrained local optima, but an acceptable solution to the problem requires that a global optimum, or a good approximation to it, be obtained. Because of the inherent difficulty of computing the global optimum, the emphasis of this research is on the design and implementation of efficient algorithms which obtain in a reasonable amount of time an approximate solution to these problems on parallel computers. Typically these algorithms will find both an approximate solution and guaranteed grounds on this solution, with the accuracy of the approximate solution and the tightness of the bounds depending on the amount of computation performed. In view of this approach, primary interest is placed on the average rather than on the worst case behavior of these algorithms. The performance analysis of this behavior will require a combination of both theoretical investigation and extensive computational testing.

Parallel Algorithms for Constrained Nonlinear Global Optimization

Researcher: Assistant Professor Andrew T. Phillips
Sponsor: Naval Research Laboratory

This research applies parallel algorithms for constrained nonlinear global optimization problems to problems in neural networks. The overall objective of this work is to design and implement new algorithms which will efficiently solve the constrained nonlinear global optimization subproblems required by many neural network applications.

Independent Research

Computing Topological Series With A Computer Algebra System

Researchers: Assistant Professors Nikoloas Glinos and
Assistant Professor George Nakos (Mathematics Department)

A p-series in Topology is defined as $f(x)=\sum_{i=1}^{\infty} m_i x^{p^i}$ where m_i are constants. Topologists are interested in finding the reverse series $g(x)=\sum_{i=1}^{\infty} a_i x^i$ where $f(g(x))=x$. Beyond this there is great interest in computing the series $g(p^k f(x))$. The computation of such power series is very expensive in terms of time and space. Since the m_i are unknown constants, the computations are in the most part symbolic. The numerical coefficients tend to be very large. Symbolic computation systems can be used to perform the calculations, provided an efficient algorithm is used. The researchers have been able to compute for some of the series, coefficients that have not yet published, to the best of their knowledge. A paper on this subject describing their method and results is in preparation. A computer Algebra system like MACSYMA can be used also to verify some conjuc-tures about the algebraic structures where the above coefficients belong.

Multiple Fault Diagnosis

Researcher: Professor Patrick R. Harrison

This is an ongoing program of research concerned with model-based, non-backtracking, non-monotonic reasoning systems for diagnosing multiple faults. The current application is mixed analog/digital systems. The generic shell uses cliches and macro operators to codify quick responses by the expert and an entropy model to control the propagating of test results throughout the system. The current focus of this research is on the feasibility of using a bayesian belief network to control the computation and propagation of good and bad test results, and the use of concepts from qualitative physics for designing test sets for analog devices.

Question-Answering Interface System

Researcher: Assistant Professor Eun K. Park

A query expressed in an English sentence can always be translated into an equivalent logical form. This research answers the queries to Database by finding the corresponding set of logical forms. The researcher accepts a subset of natural language that describes Wh-questions and yes/no questions arising from a stored database. The researcher translates the queries into their logical forms by the time they are taken and matched with the stored database. The researcher uses an ATN to monitor the queries that the question-answering system can take. The translations and the match of logical forms are done by the Interface System.

Research Course Project

Prometheus

Researcher: Midshipman 1/C Adrienne Hegman, USN
Adviser: Lieutenant Commander William G. Borries, USN

The central control program for the technical reflex area of the testbed-van at hand has been coded in FORTRAN and is executed in real-time on a conventional IBM-AT. To increase the system's capabilities, a switch to a multi-processor system had to be made. The researcher used a four-transputer system programmed in OCCAM, recoded the algorithms given, and validated the parallel OCCAM version against the sequential FORTRAN version. The results achieved were demonstrated during live testcourse-runs with the van and were documented on video including a written documentation of the OCCAM implementation.

Publications

AMSBURY, Wayne P., Associate Professor, and Patrick R. HARRISON, Professor, "Derivation from First Principles of Belief Valves Generated in Networks by Message Passing," *Proceedings* of Association of Computing Machinery National Conference, St. Louis, Missouri, 1989, pp. 131-137.

Some basic assumptions about the propagation of belief in the normal mode operation of system components in an arithmetic network are identified. They lead naturally to a message passing paradigm that propagates local computations throughout the system, and they are applicable to the quantification of reasoning in the presence of uncertainty in other contexts.

DANE, Clayton A., Assistant Professor, "The Use of Ada as a Primary Language in a Computer Science Curriculum," *The Journal of Computing in Small Colleges*, **4, 2** (October 1988), 207-210.

How one builds a house depends on both the available tools, as well as the available construction materials. In computer science, a programming language is a tool. The selected language of illustration for basic principles is very important. It affects how one expresses solutions to problems and hence how one thinks about problems. The traditional curriculum was developed in conjunction with the language Pascal. Changing to Ada must affect the curriculum, because the two languages are different in philosophy. One can attempt to anticipate curriculum changes, but there is no substitute for actual teaching experience. Experiences gained teaching a CS1 curriculum with Ada twice are documented and shared here.

DANE, Clayton A., Assistant Professor, "Toward a Raster Image-Based Electronic Chart Prototype," *Computer Science Technical Report 89-1.* United States Naval Academy, 1989.

Progress in the development of an electronic chart prototype sponsored by the Defense Mapping Agency is described. A system design using a database of raster images was selected for implementation. Design decisions and their justifications for a PC-based system are elaborated. Possible application of these observations to other electronic chart systems is discussed.

HARRISON, Patrick R., Professor, "Testing and Evaluation of Knowledge-based Systems,"*Structuring Expert Systems: Domain, Design and Development*, eds. Liebowitz and DeSalvo. New York: Yourdon Press, 1989, pp. 303-329.

The purpose of this chapter is to bring together from a widely scattered and fragmented literature some of the major issues concerning the evaluation of knowledge-based or expert systems (KBS). First, a definition of evaluation and a definition of the basic method underlying the behavior of most current knowledge-based systems are used to bring a perspective to the discussion and to limit the generic classes of KBS operations discussed. The concept of generic operation is introduced as a language for abstracting and classifying evaluation strategies. Next, a model of development is proposed that brings together rapid prototyping and more traditional life-cycle development approaches. The development model provides a structure and perspective for viewing the central issues of evaluation. The relationship between knowledge base specification, evaluation, and representation and overall performmance evaluation is explored within the framework of the model of development. Important issues are described, and approaches to their solution are discussed.

HARRISON, Patrick R., Professor, "The Evaluation of Knowledge-Based Systems," *Proceedings*, AFCEA Space Symposium, Annapolis, Maryland, May 1988, pp. 38-51.

Two aspects of software evaluation are commonly used in Computer Science. Optimization focuses attention on measurements of utility, efficiency, robustness, cost, maintainability, and so on. The second aspect focuses attention on the reliability, validity, and certifiability of the software. This paper focuses on the second aspect. Evaluation is defined as the analysis of a Knowledge-Based System (KBS) in terms of internal consistency, validity, and certifiability. In common parlance, the question is, "Does it do what it is supposed to do the same way every time?" Consistency addresses the question of whether it does whatever it does the same way every time. Validity addresses the question of whether it does what it is supposed to do. Certifiability can be thought of a validity in context and will be viewed as part of the validation process. It is possible to have a very consistent system that does the wrong thing in the same way every time; or, to have a system that does the right thing in the same way every time but in the wrong context.

PARK, Eun K., Assistant Professor, "Software Fault-Tolerance in Real-Time Embedded Systems," *Proceedings* of Association of Computing Machinery 89, Computer Science Conference, Lexington, Kentucky, February 1989, p. 431.

This research is primarily concerned with the development of effective techniques for achieving fault-tolerance in the large-scale embedded applications providing users with continued services in real-time operation in spite of the occurrence of partial malfunction of the systems. An error classification technique, an error detection technique, and an error recovery technique are discussed for the Software Fault-Tolerance in Real- time Systems.

PARK, Eun K., Assistant Professor, "A Graph Model for Understanding Linear Recursive Queries in Deductive Databases," *Proceedings* of World Conference on Information Processing and Communication, Seoul, Korea, 13 June 1989, pp. 2-10.

In this paper, the author presents a powerful graph for classifying and compiling linear recursive formulas in deductive databases. The graph model consists of two kinds of graph: I-graphs and Resolution Graphs. Users of the model can extract essential properties of a recursive formula from its I-graph and can easily figure out the compiled formula and the query evaluation plan of the recursive formula from its resolution graph. In his previous work (HH88), the researcher applied the graph model to only a subset of linear recursive queries, namely simple recursive queries. In this paper, he applies the graph model to the full class of linear recursive formulas, including linear recursive formulas having repeated variables.

PHILLIPS, Andrew T., Assistant Professor, co-author, "A Parallel Algorithm for Partially Separable Non-Convex Global Minimization," *Technical Report UMSI* 88/137, University of Minnesota Supercomputer Institute, December 1988.

The global minimization of large-scale partially separable nonconvex problems over a bounded polyhedral set using a parallel branch and bound approach is considered. The objective function consists of a separable concave part, an unseparated convex part, and a strictly linear part, which are all coupled by the linear constraints. These large-scale problems are characterized by having the number of linear variables much greater than the number of nonlinear variables. An important special class of problems which can be reduced to this form are the synomial global minimization problems. Such problems often arise in engineering design, and previous computational methods for such problems have been limited to the convex polynomial case. In the current work, a convex underestimating function to the objective function is easily constructed and minimized over the feasible domain to get both upper and lower bounds on the global minimum function value. At each minor iteration of the algorithm, the feasible domain is divided into subregions and convex underestimating problems over each subregion are solved in parallel. Branch and bound techniques can then be used to eliminate parts of the feasible domain from consideration and improve the upper and lower bounds. It is shown that the algorithm guarantees that a solution is obtained to within any specified tolerance in a finite number of steps.

PHILLIPS, Andrew T., Assistant Professor, co-author, "A Global Optimization Approach for Solving the Maximum Clique Problem," Computer Science *Technical Report CS 89-3*, United States Naval Academy, March 1989.

The problem of finding a maximum clique of an undirected graph is formulated and solved as a linearly constrained indefinite quadratic global optimization problem. Theoretical upper and lower bounds on the size k of the maximum clique are derived from the global optimization formulation, and a relationship between the set of distinct global maxima of the optimization problem and the set of distinct maximum cliques of the graph is discussed. In addition, some preliminary computational results are also presented.

Presentations

AMSBURY, Wayne P., Associate Professor, and Patrick R. HARRISON, Professor, "Derivation from First Principles of Belief Valves Generated in Networks by Message Passing," Computer Science Conference '89, Association for Computing Machinery, Louisville, Kentucky, 21 February 1989.

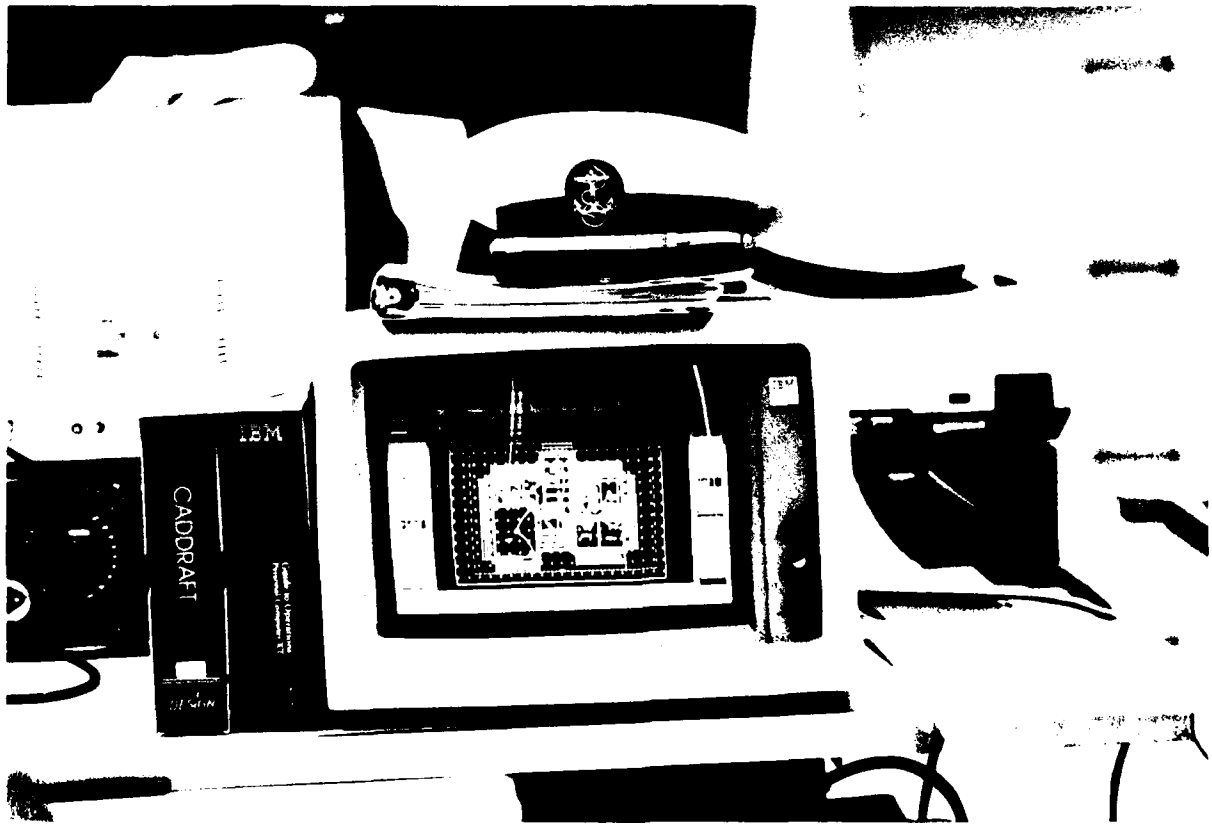
GLINOS, Nikoloas, Assistant Professor, and Bruce JOHNSON, Professor, (Naval Systems Engineering) "DataBase Aspects for a Computer-Aided Ship Design and Analysis System," Marine Design and Artificial Intelligence Workshop, Rutgers University, New Brunswick, New Jersey, 10-11 January 1989.

PARK, Eun K., Assistant Professor, "Use of Software Artifacts in Software Engineering Education," Software Engineering Institute Faculty Development Workshop, Scottsdale, Arizona, 6 January 1989.

PARK, Eun K., Assistant Professor, "Software Fault-Tolerance in Real-Time Embedded Systems," Seventeenth Computer Science Conference Association for Computer Machinery, Louisville, Kentucky, 22 February 1989.

PARK, Eun K., Assistant Professor, "Computer Virus and Reliabililty," KSEA Washington Annual Seminar, University of Maryland, College Park, Maryland, 19 November 1988.

PHILLIPS, Andrew T., Assistant Professor, co-author, "Guaranteed Approximate Solution for Large-Scale Global Minimizing," TIMS/ORSA Joint National Conference, Vancouver, British Columbia, 8 May 1989.



DEPARTMENT OF

Mathematics

Professor James M. D'Archangelo
Chairman

The Mathematics Department has had another very productive year. Approximately thirty research articles appeared this past year in refereed journals published throughout the United States and abroad. Another thirty articles have been accepted for publication and will appear shortly. The topics covered in these articles are as varied as mathematics is itself. They range from the "applied" areas of partial differential equations, numerical analysis, and robotics to the "pure" areas of number theory, algebraic geometry, and topology.

Of over forty-five ongoing research projects, approximately fifteen were undertaken independently, while the other thirty represent sponsored research. Sponsors of the department research included the Office of Naval Research, the National Science Foundation, the Johns Hopkins Applied Physics Laboratory, the David Taylor Research Center, the Naval Academy Research Council, the Naval Academy Instructional Development Advisory Committee, NASA Goddard Space Flight Center Robotics Laboratory, and the Office of the Chief of Naval Operations.

Mathematics Department members presented their work on approximately seventy different occasions at professional mathematical meetings and colloquia in the United States and abroad. This activity, along with publication, enhances the academic stature of the Naval Academy and promotes the professional growth and reputation of those individuals involved. Research activity by the faculty adds to teaching effectiveness and provides material for investigation by midshipmen in advanced courses.

Mathematics provides a logical framework and a language indispensable to understanding the world in which we live. The following pages summarize the contributions of members of this department to this field of study. They reveal the great scope and diversity of the subject and offer glimpses of its intellectual beauty and excitement.

Sponsored Research

Tactics for US SSBN Fleet

Researcher: Professor Pierre P. Andre
Sponsor: Johns Hopkins Applied Physics Laboratory

This project examined options for a submarine commander in the SSBN fleet The purpose of the project was to help the SSBN commander maintain the covert status of his ballistic missile submarine. The project involved analyzing various threats to the security of the SSBN fleet and designing useful tactics to improve that security.

The Use of Computers in the Core Calculus Courses

Researchers: Associate Professor Craig K. Bailey and Professor Howard L. Penn
Sponsor: Naval Academy Instructional Development Advisory Committee

The purpose of this project is to investigate the ways computers can be used in the teaching of Calculus in order to improve that instruction. Software is used to enhance the understanding of concepts, emphasize the numerical methods in calculus, to allow the study of more complex and interesting applications, to emphasize the connection between the analytic and geometric understanding and to increase interest in the material. Site licenses have been obtained for Calc Pad and Microcalc. The program (Midshipman Plotting Package) has been developed. Copies of these programs were given to every midshipman in the Class of 1992. Additionally, a large collection of computer assignments has been developed; these assignments have been incorporated into the lesson assignments for the standard track of Calculus, and used by the majority of instructors in the standard track of Calculus, as well as by many instructors of the lower track. Students have shown increased understanding of some of the topics. Several talks have been given at regional and national meetings. Application has been made to the National Science Foundation for funding of this project. The program has been submitted to the EDUCOM/NCRIPTAL awards competition and will be reviewed in a future issue of the *College Mathematics Journal.*

Positive Polynomials and Time Dependent Integer-Valued Random Variables

Researcher: Associate Professor B. Mitchell Baker
Sponsor: Naval Academy Research Council (ONR)

The purpose of this project was to investigate the asymptotic behavior of products of Laurent polynomials with no negative coefficients. This may be viewed as the study of time-dependent random walks on an integer lattice. The objective was to obtain information on the shape of the coefficient distribution as time goes to infinity; particularly, the "flatness" properties in this limit. There was additional motivation: namely, the answers to these questions gave information on the theory of Operator Algebras. The methods were of two types: (1) "hard" analysis techniques and (2) order theoretic techniques from the Ko-Theory of Operator Algebras. The results were detailed theorems giving necessary and sufficient conditions for asymptotic flatness of several large classes of time-dependent random walks. As a by-product, information on equivalence classes of automorphisms on AF algebras and isomorphism classes of the algebras themselves was obtained. These results are recorded in a preprint (same title as above) which is to be submitted for publication in June 1989.

A Teaching Package for Numerical Methods and Analysis

Researchers: Associate Professors James L. Buchanan and Peter R. Turner
Sponsor: Naval Academy Instructional Development Advisory Committee

There is at present no suitable published course material for the advanced numerical analysis courses (SM425 and SM426) which is appropriate for the Turbo PASCAL computing environment. The main aim of this proposal is to produce course materials: notes, numerical algorithm code, and graphics support. A secondary purpose would be to identify those areas of numerical mathematics which would be most appropriate for a practical treatment in introductory courses in scientific computation for presentation to science and engineering majors.

Over the last several years the methods of computer solution of the mathematical problems arising from modelling of physical situations have been steadily growing in importance. The range of problems which uses scientific computation in their solution has grown along with the availability of computing power. However, the mathematical texts for the teaching of this material in undergraduate courses have remained firmly fixed in the use of FORTRAN as the primary programming language. The widespread--and, importantly, the local--use of Turbo PASCAL has been largely ignored thus far. It is the researchers' intention to rectify this situation.

SM426, Numerical Differential Equations, has posed a particular difficulty, in that approximating differential equations numerically can involve root finding and solving of linear systems, neither of which can be covered well within the course if students must program the methods themselves. If libraries were available which could be linked into student programs, only a brief discussion of such methods would be necessary. Moreover, a greater number of methods of approximation could be discussed and compared.

Text, software, and support materials tailored to the needs of students will be developed from the material currently covered in the courses and the supplementary notes already used. The programs will be written to take advantage of the new facilities offered by Turbo PASCAL Version 5, such as the ability to pass functions into and through procedures. It is the lack of this ability which has meant that even the existing good software such as the Turbo PASCAL Numerical Methods Toolbox is of little assistance since it does not allow large realistic problems requiring the use of more than one of these procedures to be solved. It is also the case that this Toolbox consists of "finished programs" and so its use does not give any real idea of the considerations which go into the development of scientific software.

The programs will include some similarly polished work but will also include sample programs to help the midshipmen in their understanding of the development and construction of such. The final versions would be sufficiently well-organized to be used as procedures within more extensive programs. By the end of the two courses students would have a good and realistic understanding of the broad aspects of the subject, together with useful experience in building complex programs to solve real-life problems using these programs as significant building blocks.

Self-Help Tutorials in Probability and Statistics

Researcher: Professor Michael W. Chamberlain
Sponsor: Naval Academy Instructional Development Advisory Committee

The primary goal of this IDP is to produce standalone computer lessons for midshipmen to use as supplements to course work in probability and statistics. The lessons cover basic notions of elemenary probability theory. Each lesson is intended to emphasize a certain aspect of this theory and to give the student a better feeling for what randomness is, and how mathematics attempts to model nondeterministic phenomena. In particular, elementary simulations are used to show how well the theory predicts reality.

Almost Proper Line Colorings and Near Chromatic Polynomials

Researcher: Associate Professor Carol G. Crawford
Sponsor: Naval Academy Research Council (OMN)

Near Chromatic Polynomials were created and first introduced by this investigator and Dr. Ruth Bari as an invited address at the First CHINA-USA International Conference on Graph Theory in Jinan, China. The investigators have continued this research effort in developing further properties, applications, and algorithms associated with Near Chromatic Polynomials. These results will be presented as another invited address at the Second CHINA-USA Graph Theory Conference, July 1989, in San Francisco.

Communicating Mathematics

Researcher: Associate Professor Carol G. Crawford
Sponsor: Naval Academy Instructional Development Advisory Committee

This project is a continuation of the work done by Professor Charles Hanna and Instructor Patricia Sine to develop a series of modules to help midshipmen understand, communicate, and apply the formal language of mathematics. Project materials will be designed for the new SM291-292 math major sequence.

Statistical Computing in Applied Statistics Courses

Researcher: Associate Professor Gary O. Fowler
Sponsor: Naval Academy Instructional Development Advisory Committee

Statistical training of the midshipmen can be improved by providing a computing package that allows them to perform statistical calculations at a level that is both easy and illustrative. A collection of computer procedures will be written that will allow statistical analysis that neither requires programming details that do not illustrate the statistical methodology, nor hides the statistical methodology by undue automation of the analysis. This computer package, along with exercises and real world data sets, will be used in the two semesters of applied statistics taught by the Mathematics Department.

The collection of procedures will allow the midshipmen to compute descriptive statistics such as means, medians, and standard deviations; to perform statistical tests of distribution parameters; to perform analysis of variance; and to perform regression analysis. The interface will also allow the midshipmen to combine these procedures into new procedures. These new procedures will be used in two ways. First, simple statistical methods will be constructed by the midshipmen as a learning exercise. Later, more complicated statistical methods will be developed as a collection of simpler methods already constructed by the midshipmen and the instructor. By building statistical procedures a better understanding of statistical methodology will be achieved.

Moving Mesh Based on a Mixed Element Method and Implementation

Researcher: Assistant Professor Sonia M. F. Garcia
Sponsor: Naval Academy Research Council (ONR)

The mixed finite element method (MFEM) is a simple but useful modification of the finite element method. The idea is to replace the governing differential equation by a system of lower-order equations in order to obtain a more accurate approximation of one of the equations (usually the gradient of the solution) or to avoid the necessity of the use of C^1-elements to trial functions.

This project concerns the study of equations of motions of fluids in porous media such as those describing the displacement of one fluid by another: $\phi u_t + \nu \cdot \nabla u - \nabla \bullet D \nabla u = 0$ where $u(x,t)$ is the concentration of the displacing fluid, $\phi = \phi(x)$ is the porosity, ∇ is the gradient with respect to the spatial variables, $\nu = \nu(x,t)$ is an underlying flow field, and D is a diffusivity matrix. This equation is the simplest example of the many types of models that are used in petroleum engineering.

Communicating Mathematics

Researchers: Associate Professor Charles C. Hanna and Instructor Patricia Sine
Sponsor: Naval Academy Instructional Development Advisory Committee

To understand mathematics, a student must first understand the formal language in which mathematics is communicated. The purpose of this project is to develop a series of instructional modules and exercise sets which will help midshipmen develop facility with the basic vocabulary and techniques of argument used in advanced mathematics courses. The first phase of the project involved literature searches and discussions with colleagues. It has resulted in a comprehensive outline for the modules, preliminary versions of a large number of modules and exercise sets, and presentations to a sectional meeting of the Mathematical Association of America and the Penn State Rhetoric Conference. The researchers have explored some of the relationships between classical rhetoric and mathematical rhetoric. They also discussed which techniques for improving students' reading and writing skills can be useful in a mathematics classroom, and have applied these techniques in SM292, Fundamentals of Mathematics, a new course in the 1989 academic year. The project is being continued in 1989 under the direction of Associate Professor Carol Crawford of the Mathematics Department.

Infinitesimal Modeling for Midshipmen II

Researcher: Professor Robert A. Herrmann
Sponsor: Naval Academy Instructional Development Advisory Committee

In this project a series of teaching modules is being developed and supplied to all science and engineering faculty, as well as to selected midshipmen. These modules will present the highly sufficient and newly discovered fixed methods that correct and rigorously yield what previously were intuitively infinitesimal processes. These procedures are the basic methods that yield integral, differential, and analytical models that characterize much natural system behavior. This will make available to midshipmen, for the first time, one fixed set of rules that are mathematically consistent and lead directly from their intuitive laboratory experiences to the appropriate analytic expressions that mirror natural system processes. New applicable infinitesimal modeling concepts will also be developed and reported upon.

The 200-page basic manual is essentially complete. It presents significant new rigorous processes and rules for both integral and differential equation modeling. The modeling includes integral generalizations through the gauge and Lebesgue integrals, where it is shown that all such integrals are intuitively similar. Numerous examples illustrate the correct application of these rules to physical and geometric problems. Three levels of modeling are investigated, with the major emphasis being rigorously defined physical and geometric elements. All the methods and propositions utilized for such infinitesimal modeling are established within an extensive appendix.

Abstract for Base Change for PSL(2)

Researcher: Assistant Professor W. David Joyner
Sponsor: Naval Academy Research Council (ONR)

In 1979 Labesse and Langlands initiated the theory of the stable trace formula by stabilizing the trace formula for SL(2). The application here is simply to apply the stable metaplectic trace formula to obtain a "Shimura correspondence" between automorphic representations of PSL(2,**A**) and of SL(2, **A**), where SL(2,**A**) is the 2-fold metaplectic cover of SL(2,**A**). Here $\mathbf{A} = \mathbf{A}_K$ denotes the ring of adeles of a totally imaginary number field K containing $\sqrt{-1}$. (The assumption $\sqrt{-1} \in K$ is important for various technical reasons.) The reason that PSL(2) occurs here (rather than SL(2)) is due to the fact that the image of the "Shimura correspondence" from SL(2) to SL(2) consists only of "even" representations, i.e., those living on PSL(2).

In an announcement of results, Labesse conjectured the multiplicity one "theorem" for SL(2,**A**). As a consequence of the metaplectic analog of the theory of Labesse and Langlands and the metaplectic multiplicity one theorem of Waldspurger, the researcher proves the multiplicity one theorem for the (non-metaplectic) group PSL(2,**A**).

The steps that are followed to achieve this are as follows: First comes recall of some local background on the metaplectic group, including a refinement of Flicker's vanishing lemma, the classification of the admissible genuine representations of the two-fold metaplectic cover of SL(2,F), the (case-by-case) definition of a metaplectic L-packet, some character identities, and the formulation of the local correspondence. Then the researcher provides a proof of a local metaplectic "fundamental lemma"-type character relation, one needed to stabilize the metaplectic trace formula and to compare terms of the stable trace formulas of SL(2) and SL(2). Next, in preparation for the stabilization of the metaplectic trace formula, the researcher must present more simple-minded computations: the "stable trace" of principal series representations in terms of the Fourier transform of an orbital integral, along with a weighted analog, and some basic results on unipotent orbital integrals and germ expansions. Using a well-known procedure, the metaplectic trace formula is derived. For this, some basic results on normalized metaplectic intertwining operators are recalled. Using all these results, the researcher finally derives the stable trace formula, when n = 2. Then special attention must be given to the hyperbolic terms as they must be rearranged, in contrast with the GL(2) case, before they can be compared with their non-metaplectic analogs.

Given the stable trace formula, the researcher can and does prove the global "Shimura" correspondence of L-packets and applies it to proving the multiplicity one theorem for PSL(2,**A**). In particular, the researcher obtains (a special case of) the "Waldspurger correspondence" from SL(2,**A**) to PGL(2,**A**) via the trace formula.

Classification of the Finite Extensions of a Multidimensional Bernoulli Shift

Researcher: Assistant Professor Janet W. Kammeyer
Sponsor: National Science Foundation

A multidimensional Bernoulli shift is an independent process given by a commutative Z^n-action on a Lebesgue probability space. A finite (k-point) extension of this base process is a skew product of the Bernoulli shift with the actions of S_k, the symmetric group on k symbols. What may such an extension look like? In particular, when is such an extension itself a Bernoulli process?

This researcher plans to investigate the possible structure of these finite extensions. The hypothesis is that if such an extension is weakly mixing, then it must be a Z^n-Bernoulli shift. If the extension is not weakly mixing, then it must be one of a specific finite list of processes, classified according to the algebraic structure of the symmetric group S_k. These results should extend easily to the finite extensions of R^n-Bernoulli flows and Z^n-Bernoulli processes of infinite entropy.

The method to be used in this investigation is known as a "nesting procedure," which was used by D. Rudolph to prove this theorem for Z-Bernoulli processes, and was used by this researcher to prove this result for two-point extensions. The method amounts to showing that certain distributions of names in the extension process are close in the d-metric, via a method of successive d-matching. Those extension processes which permit such a "nesting procedure" to be carried out successfully are exactly those which are Bernoulli.

Much research in ergodic theory has focused on the study of one dimensional systems. This proposed work is significant, in that it is a study of multidimensional dynamical systems. The one-dimensional version of this theorem, set forth by D. Rudolph, has been shown to characterize the frame flow along a manifold of negative curvature. It is hoped that this higher dimensional study could realize similar such applications.

It is clear that the methods outlined above will also apply to the classification of more general compact extensions, in which the symmetric group S_k is replaced by some group of isometries on a compact metric space. This will be but one direction taken in the generalization of these results.

Physical Processes in Spacetimes with Mild Singularities

Researcher: Assistant Professor Deborah A. Konkowski
Sponsor: Naval Academy Research Council (ONR)

This project is a study of the behavior of particles and fields in spacetimes which contain mild singularities. Theorems in general relativity predict singularities in large classes of spacetimes, but the nature of these singularities is mostly unknown. If mathematical tests prove a singularity is present in a spacetime, then it can be classified as one of three types depending on its strength: quasiregular, nonscalar curvature, and scalar curvature. The first two types are mild. One interesting object which is modelled by a mild singularity is a cosmic string. Recently, the search for cosmic strings has been discussed in the press.

The researcher is studying physical processes in spacetimes with quasiregular and nonscalar curvature singularities. Even though these singularities are mild, they have unusual effects on particles and fields. For example, a cosmic string can act as a gravitational lens and produce more than one image of a single galaxy. These effects are being examined.

Three papers have been submitted to journals based on this research.

Applications of Algebraic Image Operators to Robot Vision

Researcher: Associate Professor Bao-Ting Lerner
Sponsor: National Aeronautics and Space Administration/
Goddard Space Flight Center Robotics Laboratory

The aim of this research project is to develop a comprehensive mathematical model for the representation, interpretation, and manipulation of grey-level and binary images for robotic vision applications. All grey-level images are represented by a polynomial architecture which can be easily manipulated, and this algebraic approach provides a significant foundation for practical applications. Some specific goals will be to: develop algebraic operators to determine object features in grey-level and binary images, formulate faster image operators based on irreducible polynomials, and extend the polynomial architecture to 3-D for solid modeling.

Utilizing this algebraic structure, an innovative efficient edge detection scheme has been formulated to develop a robust method for linear feature extraction. The major advantage of this feature extractor is its general, object-independent nature. Target attributes, such as line segment lengths, intersections, and endpoints will be derived by the feature extraction algorithm and employed during model matching.

The Attenuation of Fan Noise

Researcher: Associate Professor Thomas J. Mahar
Sponsor: David Taylor Research Center, Annapolis Laboratory

Two models of fan noise in duct flow are under study. The first deals with the installation of a resonator along the duct, while the second is concerned with the use of acoustic lining along the duct. Of particular interest is the design of treatments which reduce noise within a specified frequency range. The equations for acoustic pressure are decoupled from the velocity equations by use of a dynamic boundary condition for impedance interactions. The resulting initial-boundary value problem is solved numerically. Various methods are used on a mathematically equivalent Schwedinger equation (analogous to the parabolic equations approach used for underwater acoustics).

Some Unstable Solutions in Plasticity Theory

Researcher: Associate Professor Reza Malek-Madani
Sponsor: Office of Naval Research

The main purpose of this research is to study the equations of thermo-visco-elasticity in the context of formation of singularities known as shear bands. It has been observed experimentally that materials undergoing high strain rate deformations do not conduct heat uniformly in the medium, and often, heat seems to localize in small bands. Such concentration of heat could result in melting and fracture. In this work the researcher seeks this phenomenon of localization in a rigorous fashion for a variety of mathematical models proposed for these materials.

Several results have been proved. First, for materials with exponentially decaying temperature dependence, it is shown that there are two steady state solutions to the system of nonlinear partial differential equations that govern the dynamics of temperature and velocity. The two steady state solutions are inhomogeneous and shear-band-like. Moreover, the solution with the smaller amplitude is stable as the equilibrium solution of the full system of partial differential equations (cf. *Quarterly of Applied Mathematics*, Vol. 47, 1989, pp. 247-262).

Second, the same result as above is proved for the power-law and the Arrhenius law; i.e., when the temperature dependence is decaying with a rational power of temperature and when the temperature dependence is exp(1/T), respectively. These problems are no longer self-adjoint, and an energy method is used to arrive at the result. This result is not as sharp in the domain of the parameters involved as is the result of the first paper (paper submitted to the *Journal of Mathematics and Mechanics*).

Representation and Structure of Harmonic Functions in Several Real Variables with Applications to Partial Differential Equations

Researcher: Professor Peter A. McCoy
Sponsor: Naval Academy Research Council (ONR)

The objective was to develop integral representations of harmonic functions on R^4 and use those to characterize the singularities. The paper "Representation of Harmonic Functions in R^4" has been accepted for publication in the *Journal of Mathematical Analysis and Applications*. One finds reciprocal integrals so that {H,h} constitutes a dual transform pair where H is a harmonic function in R^4 and h the associated analytic function in C^3. Necessary and sufficient conditions for the harmonic continuation to encounter singularities are linked to properties of the analytic continuation and conversely. Thus, Gabor Szego's classical theorem regarding Bond harmonic series and analytic functions in C^1 has a function theoretic extension to several variables. Current work focuses on the LaPlacian in various coordinate systems.

On the Brown-Peterson Homology of Finite Abelian P-Groups

Researcher: Assistant Professor George Nakos
Sponsor: Naval Academy Research Council (ONR)

This project involves computing the Brown-Peterson homology of finite Abelian p-groups in Algebraic Topology. The method of computation is the Adams spectral sequence, modified by the Cartan-Eilenberg change of rings spectral sequence. This problem has to do with the geometric problem of group actions of manifolds.

Some Topological Series by Computer Algebra Methods

Researchers: Assistant Professors George Nakos and
Nikolaos Glinos (Computer Science)
Sponsor: Naval Academy Research Council (ONR)

Computer algebra methods are used to compute (and confirm some conjectures about) the important topological series $[P^n]x =$

$\sum_{i=0}^{\infty} a_{n,\,i}\, x^{i+1}$ defined combinatorially as follows:

Let $\underline{\log x} = \sum_{i\geq 0} m_i\, x^{p^i}$ (p any prime). Then if

$\underline{\exp} = \underline{\log}^{-1}$ then $[P^n]x = \underline{\exp}(p^n \underline{\log x})$. The m_i's are polynomial algebra generators in certain degrees.

On the Coefficients of [Pn]x

Researcher: Assistant Professor George Nakos
Sponsor: Naval Academy Research Council (ONR)

In this project the researcher generalizes Johnson's theorem on [p]x to [pn]x.

Alterations in the Pattern of Buckling of a Cylindrical Rod Under Compression Subject to Symmetry-breaking Loads

Researcher: Visiting Assistant Professor John F. Pierce
Sponsor: Office of Naval Research

The project investigates how the pattern of equilibria for a nonlinearly elastic, isotropic, cylindrical rod under axial compression alters when the researcher applies additional loads which break the axial symmetry of the mechanical system. Because the system has a continuous group of symmetries, attempts to analyze the problem using the symmetric bifurcation theory have been thwarted. In this work the researcher refines the tools of the bifurcation theory using an extension to the Malgrange Preparation Theorem developed by J. Damon. The researcher then uses the refined theory to analyze the symmetry-breaking problem.

Semigroups of Endomorphisms

Researcher: Associate Professor Geoffrey L. Price
Sponsor: Naval Academy Research Council (ONR)

A linear operator δ defined on a uniformly dense *-subalgebra $D(\delta)$ of a C*-algebra B is called a *-derivation if it satisfies the Leibniz identity $\delta(x^*y) = (\delta x)^*y + x(\delta y)$, for all x and y in $D(\delta)$. The researcher indicates that δ is a generator of a C*-dynamical system if there is a strongly continuous semigroup $\{\alpha_t : t \in R^+\}$ of endomorphisms, such that δ is the infinitesimal generator (loosely speaking, the derivative with respect to t) of $\{\alpha t\}$.

Recently both R. T. Powers and W. B. Arveson have developed independently an index theory for semigroups of endomorphisms of the particular algebra B(H), the bounded operators on a Hilbert space H . This index takes on the values $0,1,2,\ldots,\infty$, and has some of the characteristics of the Fredholm index for operators in B(H). In his theory, Powers counts the multiplicity of a certain representative of $D(\delta)$, where δ is the infinitesimal generator of the semigroup. On the other hand, Arveson obtains an index by counting, in a sense, the dimension of the space of intertwining semigroups of $\{\alpha t\}$. An intertwining semigroup $\{U_t : t \in R^+\}$ of $\{\alpha t\}$ is a strongly continuous semigroup of operators in B(H) which satisfy $U_t A = \alpha t(A) U_t$ for all t in R^+ and all A in B(H) . In joint work with R. T. Powers, the researcher has shown that the Arveson index is actually identical to the Powers index. This work will appear in the *Transactions of the American Mathematical Society.*

C*-Algebras Generated by Pairs of Semigroups of Isometries

Researcher: Associate Professor Geoffrey L. Price
Sponsor: Naval Academy Research Council (ONR)

The notion of an intertwining semigroup plays a primary role in W. B. Arveson's version of an index for semigroups of *-endomorphisms of B(H). An elementary observation, which is crucial to showing the equivalence of the Powers and Arveson index theories, concerns the relationship of any two intertwining semigroups. If $U = \{U_t : t \in R^+\}$ and $V = \{V_t : t \in R^+\}$ form such a pair, then there is a number g such that $U_t^* V_t = \exp(-\gamma t) I$ for all t in R^+ . This observation has led to an interesting problem of classifying the C*-subalgebras of B(H) generated by U and V . More generally, one may ask about the structure of the C*-algebras A_Γ generated by semigroups $V_\Gamma = \{V\gamma : \gamma \in \Gamma\}$ and $U_\Gamma = \{U_\gamma : \gamma \in \Gamma\}$ where Γ is a sub-semigroup of R^+ .

This problem has led to a synthesis of two disparate areas of the field of Operator Algebras. Using tools from both the Coburn-Douglas theory of C*-algebras generated by single semigroups of isometries, and the more recent theory of Cuntz algebras, the researcher has shown that $A\gamma$ is a simple C*-algebra if and only if Γ is a dense semigroup of R^+ . This work has been accepted for publication by the *Pacific Journal of Mathematics.*

A New Approach to Index Theory for Quasi-Free Derivations

Researcher: Associate Professor Geoffrey L. Price
Sponsor: Naval Academy Research Council (ONR)

Given an unbounded *-derivation δ acting on a C*-algebra A, it is usually a difficult problem to determine whether δ is the infinitesimal generator of a one-parameter group $\{\alpha_t : t \in R\}$ of automorphisms of A. A related problem is to try to determine whether δ has a derivation extension which is a generator. For many years a number of authors has attempted to resolve this question in the case where δ is a quasi-free derivation on the CAR (canonical anticommutation relations) algebra. In this instance the domain of definition of δ is linked with the domain of a symmetric operator S on a Hilbert space. A conjecture of longstanding is that any generator extensions of δ must correspond to a generator extension of S. This conjecture, due to Powers, has been verified in only a few cases (by P. E. T. Jorgensen, Powers, and Price), and is the stimulus behind the Arveson and Powers index theory for semigroups of endomorphisms.

Along with Jorgensen, Price has developed an index theory which generalizes the Arveson-Powers index theory for semigroups of endomorphisms, and which gives supportive, if not conclusive, evidence that the Powers conjecture for quasi-free derivations is true. This work is still being developed. Some preliminary results have been written in the form of an announcement and will soon be submitted for publication.

Compact Lie Group Actions on Manifolds

Researcher: Assistant Professor Aaron I. Stucker
Sponsor: Naval Academy Research Council (ONR)

In this project the researcher studied the geometric properties of smooth spaces called manifolds. Much of this geometric information can be understood by investigating the group of symmetries of the space, which are called "transformation groups." This area of topology is currently the subject of much interest and activity. The author has developed an algebraic theory for defining equivariant Whitehead torsion for compact Lie groups. The researcher has shown that the algebraic construction agrees with the already existing geometric one. The author plans to investigate applications of this algebraic theory. One such application is a definition of Reidemeister torsion for compact Lie group actions on manifolds. Unlike Whitehead torsion, which are elements of an abstract group, the Reidemeister invariant will be an actual real number.

Project Nould

Researcher: Associate Professor John C. Turner
Sponsor: David Taylor Research Center, Annapolis Laboratory

This project is classified research for Magnetic Signature Groups at David Taylor Research Center, Annapolis, Code 2751, and it involves data analysis, math modeling, and prediction models. Trial Nould involved SSN-10 HMS Spectre for data collection. The methodology was proved and good predictions obtained. Further analysis of this data will take place this summer. Additional trials are planned for fall 1989 and fall 1990.

Implementation and Applications of Level-Index Arithmetic

Researcher: Associate Professor Peter R. Turner
Sponsor: Naval Academy Research Council (ONR)

The research continues the development of possible schemes for the eventual hardware implementation of li (level-index) arithmetic and the analysis of the algorithms used, while at the same time gaining more computational experience and evidence of the potential practical value of the system via applications using software implementations of the level-index, li and sli systems which were developed to overcome the difficulties created by overflow and underflow. Additionally, the li and sli systems have the virtue of using a consistent and appropriate measure of precision throughout their range. The advantages are offset by the fact that arithmetic within the computer will be slowed down. However, the fact that the software designer would be freed from worries about potential overflow will in many cases more than balance this loss.

The principal objectives were to investigate further the implementation and application of li and sli arithmetic and the comparison of these with other proposed new computer arithmetics. Specifically, this was to entail the completion of the root-squaring work in collaboration with Professor Clenshaw at the University of Lancaster, United Kingdom, and the development of software implementations of li and sli arithmetic.

The principal output of this research has been in the form of research papers and the development of ideas for further developments and publications. The new ideas include work on potentially fast, new (hardware) schemes for squaring numbers and for determining the signs of "double numbers."

Target Location and Tracking

Researcher: Visiting Professor James K. Tyson
Sponsor: Office of the Chief of Naval Operations

The researcher prepared a review of the methods for determining accuracy of target location and track, especially when off board sensors are employed. The objective is to provide a self-contained reference document which will be useful for instruction and in the development and evaluation of tactics for employing over-the-horizon systems. The approach is analytical, employing standard methods of classical and Baysean statistical inference.

Solutions to bearing fix problems have been examined at higher orders of approximation to establish conditions when bias errors may be important. The problem of determining target position and speed vector from bearings only data is now being addressed. The project is continuing; completion is scheduled for August 1989.

Weight-Balanced Measures and the Conjugacy Problem for One-Dimensional Maps

Researcher: Associate Professor W. Douglas Withers
Sponsor: Office of Naval Research

The researcher has applied weight-balanced measures to the study of the conjugacy problem for one-dimensional maps. One-dimensional maps provide simple and yet flexible models for the evolution of a variety of dynamical systems. Two maps are said to be conjugate if one can be converted to the other by a coordinate change. The problem of determining conjugacy of one-dimensional maps has been of great interest in recent years and has been much studied using the concept of a kneading sequence. A new approach to the conjugacy problem via weight-balanced measures leads to quite explicit results on conjugacy under much weaker hypotheses than previous work. The researcher is also studying the relationship between weight-balanced measures and other invariant measures in the theory of dynamical systems, such as maximal-entropy measures and Gibbs states.

Independent Research

Hypermembrane Shells

Researcher: Associate Professor James L. Buchanan

A hypermembrane shell is a generalization of the classical notion of a membrane shell which permits greater latitude in the specification of boundary and surface stresses and displacements. Generalized analytic function theory has been found to be an effective tool for investigating membrane shells. The researcher and a co-worker are currently exploring the use of generalized hyperanalytic function theory in studying hypermembrane shells. To date they have succeeded in establishing a Cauchy integral representation for solutions to the stress moment problem for surfaces of positive curvature, and have demonstrated the solvability of the Riemann-Hilbert problem for the stress moment equation. Current work focuses on finding a set of constitutive equations for hypermembrane shells.

Dipole Scattering and Background Mobility

Researcher: Professor James M. D'Archangelo

In some of the earlier literature, it was suggested that the lowest-order dipole mode of an elastic sphere immersed in a fluid and excited by an incident acoustic wave corresponds to a rigid-body oscillatory motion of the sphere as a whole. The present investigation verifies and corroborates these statements in a quantitative fashion. The results appear in a paper co-authored with Professors Michael Werby and Herbert Uberall, which has been submitted to the *Journal of the Acoustical Society of America*.

Estimating Parameters in a Mixture of Discrete and Continuous Distributions

Researcher: Associate Professor Gary O. Fowler

When auditors attempt to estimate the total dollar value of cheating in government programs, they frequently find that only a portion of the population is cheating. In this case the usual statistical techniques of making estimates are still valid, but have less precision than the results would have, if only cheaters were sampled. Since the cheaters will not be known in advance, other techniques for improving the precision of the estimates are desired. This research models this problem as a mixture of two distributions. One distribution models the portion of the population that is not cheating and the other models the cheaters. Maximum likelihood estimates of the mixing proportion and the distribution parameters have been computed. It still remains to find efficient methods for computing confidence intervals for the estimates and sampling plans.

Conjectures of Tarski in Group Theory

Researcher: Professor Anthony M. Gaglione

Let L_o be the language of group theory and L be obtained from L_o by adjoining two new constant symbols a and b to be interpreted as a_1 and a_2 respectively as the free generators of the free group $F_2 = \langle a_1,a_2 \rangle$. Also consider the chain of free groups $\langle a_1,a_2 \rangle \subseteq \langle a_1,a_2,a_3 \rangle \subseteq \langle a_1,a_2,a_3,a_4 \rangle \subseteq$ ... Now Tarski conjectured that all the members of this chain were elementarily equivalent. It is not hard to see that this is equivalent to the condition that the set $T_o = \{\alpha \in L_o | \langle a_1,...,a_r \rangle | = \alpha$ for all $r \geq 2\}$ is a complete theory. Tarski also conjectured that T_o is decidable. The researcher considered the slightly stronger conjecture of Tarski with T_o replaced by

$$T = \{\alpha \in L | \langle a_1,...,a_r \rangle | = \alpha \text{ for all } r \geq 2\} .$$

Tarski also conjectured the existence of an infinite group all of whose proper subgroups are cyclic of the same prime order. The researcher continues to investigate all of these conjectures.

Classic Tests of "Super" Theories

Researcher: Assistant Professor Deborah A. Konkowski

Experimental gravity strongly supports general relativity. Any "super" theories (e.g., n = 1 supergravity, superstrings,...) which may wish to supersede general relativity must also be in agreement with these tests. Many of these theories involve long-range scalar fields, the so-called dilation fields. In the research, a "super" theory with a dilation field was considered and compared to general relativity. When certain parameters in the theory were small enough, the researcher found that the theory agrees with general relativity and the classic tests.

A paper on this research was entered in the Gravity Research Foundation Essay contest.

Conjugacy Problem and Graph Product

Researcher: Assistant Professor Jody M. Lockhart

It is known that it is possible for an HNN-extension and free product with amalgamation to have unsolvable conjugacy problems even if the base groups have solvable conjugacy problem. The question of what restrictions placed on the extensions would guarantee the solvability of the conjugacy problem has been studied by others. In particular, the restriction of the associated subgroups being cyclic has received attention. In the researcher's paper, "An HNN-extension with Cyclic Associated Subgroups and with Unsolvable Conjugacy Problem" (to appear in the *Transactions of the AMS*), the researcher showed that it is possible for such extensions with cyclic associated subgroups to have unsolvable conjugacy problem. The researcher's example is of a recursively presented group, and so the question remains open for finitely presented groups.

Since graph products are a generalization of free products with amalgamation and HNN-extensions, the researcher has been studying the analogous question for finitely presented graph products. K. J. Horadam showed that with further restrictions--including that each associated subgroup be a finite cyclic subgroup contained in the center of the base group--the graph product must have solvable conjugacy problem. Horadam conjectured the similar result when the associated subgroups are infinite cyclic. This was proved by the researcher.

The researcher is now investigating what happens in the case of finitely presented graph products where the associated subgroups are finite cyclic but are not required to be in the center of the base groups.

Solutions in Cones for Certain Evaluation Equations

Researcher: Assistant Professor Robert Lockhart

In many problems in differential geometry, one is interested in finding a positive solution to a non-linear elliptic equation. For example, in scalar curvature problems one wants a positive solution to the equation $\Delta u + f(a) + c(x) = 0$. An approach to such problems is to change this into an evolution equation $\frac{\partial u}{\partial t} = \Delta u + f(a) + c(x)$ and look for a steady state solution.

This year the researcher has been looking at an iteration scheme for equations of the form $\frac{\partial u}{\partial t} = q(t,x) + G(t,x,a)u$ where q and G satisfy certain exponential positivity properties. In the cases the researcher has looked at, the scheme gives alternately global upper and lower approximate solutions, i.e., $u_{2n}(t,x) \leq u(t,x) \leq u_{2n+1}(t,x)$ for all $(t,x) \in R^+ x M$, which is a good sign.

However, much work on the properties of semi-groups in Frechet spaces, i.e., $C^\infty(R^+ x M)$ still has to be done. In this regard, the works of Hille, Yoshida, Kato, and Simen are important. The researcher has spent much time this year reading them.

Fractals

Researcher: Professor Mark M. Meyerson

"Fractals" is a mathematical term coined by Mandelbrot for sets with certain striking properties. Usually it is taken to mean either a set of fractional, non-integer, dimension (hence the name), or a set with certain properties of self-similarity. Drawings of these sets can be strikingly beautiful. They have applications in the field of dynamical systems.

Of special interest are certain topological and geometric questions about fractals. Topological questions include: Is a given fractal set connected? Simply connected? A simple closed curve? Geometric questions include: What is the (fractional) dimension? What self-similarities are there?

Base Change for SL_2

Researchers: Associate Professor Courtney Moen and
Assistant Professor W. David Joyner

This project is concerned with the problem of lifting automorphic terms on the reductive group $SL_2(A_F)$, where A_F is the adele ring of a number field F, to automorphic forms on the group $SL_2(A_E)$, where E is a finite cyclic extension of F. The primary tool is the Selberg trace formula.

Fractals and Geometric Function Theory

Researcher: Associate Professor Edward J. Moulis, Jr.

Much of today's investigation into the relatively new fields of fractals and chaos involves maps of real numbers R^1 and the real plane R^2 into R^2. Geometric function theory for the past eighty years has studied the isomorphically equivalent problem of maps from the unit disk $|z| < 1$ onto the complex plane. Being prepared to shed the restrictions of univalency and analyticity, the researcher attempts to analyze fractal objects (such as the Mandelbrot and Julia sets) from the viewpoint of classical geometric function theory.

The Global Structure of Buckled States of Compressible Columns

Researcher: Visiting Assistant Professor John F. Pierce

Singularity Theory and Global Bifurcation Theory are used to determine the qualitative properties of non-bifurcating buckled states of a compressible nonlinearly elastic rod. The work complements existing descriptions of those buckled states which arise by bifurcation from known equilibrium configations for such rods.

Moments of Quadratic Mappings

Researcher: Associate Professor JoAnn S. Turisco

The researcher is studying deformations of quadratic mappings using the methods of Professor T. Ono at the Johns Hopkins University. His methods are briefly as follows: Let W be an open set of R^n containing the unit sphere S^{n-1} and f: $W \to R^m$ be a smooth map. Denote the inner product $\langle x,y\rangle = \Sigma X_i Y_i$ and let dw_{n-1} be the volume element of S^{n-1} such that S^{n-1} gets volume 1. For every integer $\nu > 0$, we associate a form $f\nu$ of degree ν on R^m: $f\nu(\zeta) = \int_{S^{n-1}} \langle \zeta, f(x)\rangle^{\nu} dw_{n-1}$ for ζ in R^m. The mean value $\sigma_\nu(f)$ of $f\nu$ on S^{m-1} is $\sigma_\nu(f) = \int_{S^{m-1}} f\nu(\zeta) dw_{m-1}$ and we have the generating function $\sigma(f;t) = \sum_{\nu=0}^{\infty} \sigma_\nu(f) \frac{t\nu}{\nu!}$. The number $\sigma_\nu(f)$ depends on the "norm" $N_k(f) = \int_{S^{n-1}} |f(x)|^{2k} dw_{n-1}$, $\nu = 2k$.

Since $N_k(f) = 1$ whenever $f: S^{n-1} \to S^{m-1}$, these numbers measure a deviation of f from being "spherical." If $f: S^{2n-1} \to S^n$ is a classical Hopf fibration, and f_p is a certain deformation, T. Ono showed that $\sigma_{2k}(f_p)$ is a hypergeometric polynomial. The researcher is studying more general Hopf maps, and showing that, in certain instances, $\sigma_{2k}(f_p)$ is a multiple hypergeometric polynomial. The researcher computes explicit formulas for $\sigma_{2k}(f_p)$ for general types of Hopf maps f.

Finding the Smallest Matrix of Period N

Researcher: Associate Professor William P. Wardlaw

A nonsingular matrix A has period n, denoted $p(A) = n$, if $A^n = I$ but $A^k = I$ for $0 < k < n$. An s x s matrix A has size s, denoted $s(A) = s$. The goal of this research is to find the smallest size $r_K(n) = \{\min s(A) : p(A) = n$ and A over K$\}$ of any matrix over the field K having period n. The researcher has evaluated $r_K(n)$ in terms of certain structural constants $\theta_K(n)$ of the field K, and has completely determined the latter constants over all finite fields and over the fields Q, R, and C.

Euler's Theorem for Polynomials and an Extended Euler's Theorem

Researcher: Associate Professor William P. Wardlaw

The researcher has proved the following two theorems and is submitting them for publication:

Theorem. Let B be an n x n matrix over a field K. Then there is a matrix A over K such that B = adj(A) if and only if (i) det(B) has a nonzero (n - 1)st root in K, (ii) B has rank 1 or (iii) B is the zero matrix.

Extended Euler's Theorem. Let a and m be positive integers. Then there is a positive integer $\nu(m)$ depending only on m such that $a^{r+s} \equiv a^s$ whenever $\varphi(m) \mid r$ and $s \geq \nu(m)$.

The paper will also include several applications and refinements of the above theorem.

Fractal Tiles

Researcher: Associate Professor W. Douglas Withers

The researcher is investigating several topics related to fractal tiles, nonperiodic tilings, and seeking a formula for the area of a fractal generated by an iterated function system. The project has so far yielded a partial classification of fractal tiles which yield periodic tilings.

The Multiplex Method of Linear Programming

Researcher: Associate Professor Carvel S. Wolfe

Tests of an improved method of linear programming using a combination of primal and dual techniques show a significant reduction in the number of necessary iterations. This method essentially cuts through the feasible region of the problem instead of traversing the surface. Preliminary tests on problems with a Simplex Matrix of 100 by 150 indicate a reduction in iterations by a total of 10 to 50.

Research Course Projects

Harpoon Targeting

Researcher: Midshipman 1/C Sean P. O'Malley, USN
Adviser: Lieutenant Commander Steven C. Rowland, USN

This project consisted of developing an analytical model of Harpoon in order to investigate probabilities of lock-on. The effects of localization errors, target movement, time-late, sea-state, wind, target size, and aspect were included. Scenarios investigated included single ship target by itself, target vessel in same area as non-target vessels (merchants, etc.), high value target being escorted by other enemy combatants, and target vessel in vicinity of land. The conclusions drawn provide rules-of-thumb for methods of employment of Harpoon in a variety of situations.

The Effect of Different Flight Paths on Harpoon Missile Performance

Researcher: Midshipman 1/C Edward F. Toppi, USN
Adviser: Professor Thomas J. Sanders

This is an SA412 course project. A probabilistic model of an N on 1 engagement between N cruise missiles and a Soviet surface platform was developed. The model was then used to study the effects of different flight profiles (altitude) on the survivability of the missiles.

Publications

BAILEY, Craig K., Associate Professor, co-author, "Regular Steinhaus Graphs," *Congressus Numerantium*, **66** (1988), 45-48.

A Steinhaus graph is a graph generated from a symmetric 0-1 matrix A whose first row is a string of 0's and 1's with a leading 0. The rest of the entries in the upper triangle are defined by $a_{i,i} = 0$ for all i and for $1 < i < j_1$ $a_{ij} = a_{i-1,j-1} \oplus a_{i-1,j}$ where $\oplus$ is addition mod 2. The researchers investigate the existence of regular Steinhaus graphs; that is, Steinhaus graphs for which each point is connected to the same number of other points. The only known examples are an infinite family that are regular of degree 2(n-1)/3 on n points. Several necessary conditions are derived that a regular Steinhaus graph of odd degree must satisfy. The investigators believe that the necessary conditions will eventually be strong enough to guarantee that there are no regular Steinhaus graphs of odd degree existing.

BAILEY, Craig K., Associate Professor, co-author, "Sum Zero (mod n), Size n Subsets of Integers," *The American Mathematical Monthly*, **96** (1989), 240-242.

A theorem of Chevalley is used to prove that among any 2n-1 integers there is a subset of exactly n of them whose sum is divisible by n.

GAGLIONE, Anthony M., Associate Professor, co-author, "A Theorem in the Commutator Calculus," *Proceedings* of the 1987 Singapore Group Theory Conference, (1989), pp. 367-371.

The purpose of this paper is to establish a group theoretical identity which involves basic commutators. The basic commutators derived from the generators of a free group a finite rank, r, $F = <c_1, c_2,...,c_r>$ are implicit in the work of Philip Hall, as they are precisely the commutators which arise in his "collection process." The basic commutators of a given weight n do form a basis for the free Abelian group $\gamma_n(F)/\gamma_{n+1}(F)$, where $\gamma_n(F)$ denotes the nth term of the lower central series of F. The commutator identity established here generalizes a previous result of the authors. It arose as the result of research on the lower central series of free products of cyclic groups. This identity is very important for the authors' work on such free products. Moreover, this identity should be of interest in itself, as it may be very valuable for use in solving many group theoretical problems.

GOTAY, Mark J., Associate Professor, "A Multisymplectic Approach to the KdV Equation," *Differential Geometric Methods in Mathematical Physics*, ed. K. Bleuler and M. Werner, NATO Advanced Science Institute Series C: Mathematical and Physical Sciences, **250** (Kluwer, 1988), 295-305.

A canonical multisymplectic formulation of the KdV equation is presented which, when space + time decomposed, gives rise to the usual symplectic description of dynamics on the appropriate space of Cauchy data. In addition to allowing one to treat the KdV equation covariantly, this formalism enables one to derive the Gardner symplectic structure for the KdV system in a completely systematic way.

GOTAY, Mark J., Associate Professor, "Zero Levels of Momentum Mappings for Cotangent Actions," *Nuclear Physics B Proceedings Supplement*, **6** (1989), 384-389.

The researchers show that zero level sets of momentum mappings for cotangent actions are coisotropic, even when the momentum mapping is singular. The proof applies to both the finite- and infinite-dimensional cases. We use this result to show that vacuum Yang-Mills theory is indeed first class in the sense of Dirac.

GOTAY, Mark J., Associate Professor, "Compact Parallelizable Four Dimensional Complex and Symplectic Manifolds," *Proceedings* of the American Mathematical Society, **103** (1988), 1209-1212.

Examples of compact symplectic manifolds with no complex and/or Kahler structures are presented.

HERRMANN, Robert A., Professor, "Fractals and Ultrasmooth Microeffects," *Journal of Mathematics Physics*, **30** (April 1989), 805-808.

In the application of nonstandard analysis to the behavior of a natural system, when a characterizing mathematical entity is infinitely close to an internal nonstandard entity, then the microeffects characterized by the nonstandard entity are conceived of as one of the basic causes for standard behavior. One of the major results in this paper is as follows: Theorem. Let $K \subset R^n$ be compact. If $f: {}^*K \to {}^*R^m$ is internal, micro-continuous, and $f[{}^*K] \subset L^m$, then there exists an internal mapping $G: {}^*R^n \to {}^*R^m$ such that (i) G is *-continuously *-differentiable on $^*R^n$, (ii) if $n = 1$, then G is *-continuously *-differentiable on $^*R^n$ for any order $k \in {}^*N$, (iii) with respect to *K, $f,G|{}^*K$ preserve nearness, (iv) internal $G|{}^*K$ is microcontinuous and uniformly S-continuous on *K, (v) $f,G|{}^*K$ are infinitely close on *K, (vi) if for some standard g, $f = {}^*g$, then $g = st(G|{}^*K)$. To apply this result to fractals, simply observe that if fractal behavior is characterized by a continuous function f defined on a compact $K \subset R^n$ into R^m, then the function *f satisfies the hypotheses. Since G is internal, then this result can be characterized by stating that some fractal behavior may be produced by the microeffects of an ultrasmooth ultranatural process within the nonstandard physical world.

HUTSON, H. Leroy, Visiting Assistant Professor, "On Zero-dimensional Rings of Quotients and the Geometry of Minimal Primes," *Journal of Algebra*, **112** (1988), 1-14.

This paper is an examination of how the topology of the minimal spectrum of a commutative ring A is reflected on the various maximal rings of fractions of A. Earlier results with A assumed reduced are here extended to rings with nilpotent elements--a situation which introduces several technical difficulties. A key device consists of examining the images of these rings of fractions in the ring of global sections of the restriction to MIN(A) of the structure sheaf of A. Several examples display the exotic diversity of the behavior of these rings.

JOYNER, W. David, Assistant Professor, "On the Metaplectic Analog of Kazhdan's `Endoscopic' Lifting," *Israel Journal of Mathematics*, **61** (1988), 115-154.

A simple "twisted" form of the Selberg trace formula, due to Kazhdan, is used to prove a metaplectic analog of Kazhdan's lifting of gressen-charackters of a cyclic extension of degree r to automorphic representations of GL(r). The author also proves the metaplectic analog of Kazhdan's "fundamental lemma."

KONKOWSKI, Deborah A., Assistant Professor, "The Importance of Symmetries in Spacetimes with Quasiregular Singularities," *Nuclear Physics B* (Proceedings Supplement) **6** (1989), 408-410.

The process by which elementary quasiregular singularities are constructed by cutting and pasting a regular spacetime after identifying points under some discrete group of isometries is reviewed. There is also a description of how the addition of perturbing test-fields which retain the symmetry of the spacetime retains the quasiregular singularity while those which destroy the symmetry lead to stronger singularities.

LERNER, Bao-Ting, Associate Professor, "On Fuzzy Right-Topological Semigroups," *Journal of Mathematical Analysis and Applications*, **134** (September 1988), 306-311.

Zadeh's classical paper of 1965 introduced the concepts of fuzzy sets and fuzzy set operations. Foster combined the structure of a fuzzy topological space with that of a fuzzy group (introduced by Rosenfeld) to formulate the elements of a theory of fuzzy topological groups. Some of Foster's results on homomorphic images and inverse images to fuzzy right-topological semigroups are extended.

LERNER, Bao-Ting, Associate Professor, "Grey-level Images--An Algebraic Approach Through Compact Polynomials," *Proceedings* of the 1988 IEEE Systems Man and Cybernetics Conference, August 1988, pp. 761-766.

This paper describes an algebraic approach to the representation of grey-level images which can be viewed as commutative monoids under appropriately defined addition and multiplication operations. A polynomial architecture in two variables can be formed. Specific polynomial operators are examined and examples given for contour description.

LERNER, Bao-Ting, Associate Professor, "A Fuzzy Set Approach to Grey-Level Image Representation," *Proceedings* of the 1988 North American Fuzzy Information Processing Society Conference, June 1988, pp. 152-156.

This paper describes a fuzzy set approach to the algebraic representation of grey-level imagery for machine vision. These images can be expressed, and manipulated as compact polynomials in two variables. Conventional image manipulation techniques typically produce values which exceed the range of the display system. The author's polynomial architecture offers a bounded solution range, as well as algebraic operations which are otherwise difficult or inefficient. Specific polynomial operators are examined for contour enhancement and edge detection.

LERNER, Bao-Ting, Associate Professor, co-author, "Applications of Algebraic Image Operators to Model-Based Vision," *Proceedings* of SPIE 1989 Technical Symposium on Optics, Electro-Optics and Sensors--Applications of Artificial Intelligence, **1048** (March 1989), 37-48.

This paper extends the author's previous research on a highly structured and compact algebraic representation of grey-level images. Addition and multiplication are defined for the set of all grey-level images, which can then be described as polynomials of two variables.

Utilizing this new algebraic structure, the researchers have devised an innovative, efficient edge detection scheme. A robust method for linear feature extraction by combining the techniques of a Hough transform and a line follower with this new edge detection scheme has been developed. The major advantage of this feature extractor is its general, object-independent nature. Target attributes, such as line segment lengths, intersections, angles of intersection, and endpoints are derived by the feature extraction algorithm and employed during model matching.

The feature extractor and model matcher are being incorporated into a distributed robot control system. Model matching is accomplished using both top-down and bottom-up processing: a priori sensor and world model information are used to constrain the search of the image space for features, while extracted image information is used to update the model.

MALEK-MADANI, Reza, Associate Professor, co-author, "The Effect of Boundary Data and Diffusion on Shear Localization," *Proceedings* of the International Symposium in Plasticity, 1989, pp. 1-4.

In this paper the authors present some new analytical and numerical results for the equations governing the simple shearing motion of a plate composed of thermally conducting visco-plastic material. The stability and bifurcation of steady-state solutions of these equations and their connection to shear localization are discussed.

MALEK-MADANI, Reza, Associate Professor, "Travelling Waves in Nonlinearly Viscoelastic Media and Shock Structure in Elastic Media," *Quarterly of Applied Mathematics*, **1** (March 1988), 77-93.

This paper presents study of a class of travelling shear waves in incompressible nonlinearly viscoelastic media with three goals: (1) to present exact solutions for a family of properly invariant equations of nonlinear viscoelasticity; (2) to study the roles of nonlinear elastic response and nonlinear viscous response in determining the qualitative behavior of solutions; and (3) to study the behavior of solutions in the limit as the viscous dissipation approaches zero in order to illuminate the shock structure of the system of hyperbolic conservation laws that result from this limit process.

MALEK-MADANI, Reza, Associate Professor, co-author, "Lipschitz Continuity of Local Minimizers of a Nonconvex Functional," *Applicable Analysis*, **28** (1988), 223-230.

Lipschitz continuity of local minimizers of the energy function of an isotropic compressible hyperelastic material is studied. The functional is a nonconvex function of the deformation gradient. By using a blowup technique the co-authors show that all local minimizers are Lipschitz continuous everywhere.

MALEK-MADANI, Reza, Associate Professor, co-author, "An Asymptotic Stability Condition for Inhomogeneous Simple Shear," *Quarterly of Applied Mathematics*, **47** (1989), 247-262.

Analytic steady solutions of inhomogeneous simple shear with isothermal and stress boundary conditions are found. The material is assumed to be thermoviscous; inertia and heat conduction effects are included. The basic inhomogeneous solution is spatially dependent, but time independent. Bifurcation of this solution, as the parameters vary, is analyzed. It is shown that there is a critical value of the parameter, corresponding to thermal softening, below which two steady state solutions exist for specified values of other parameters. A linear perturbation method, which gives rise to a linear set of partial differential equations (with spatially dependent coefficients), is used to distinguish the stable branch of the bifurcation diagram. After separation of variables, the existence of eigenvalues and eigenfunctions of the resulting fourth order system is demonstrated. An asymptotic solution to the eigenvalue problem, for the case when an appropriate parameter is set equal to zero, is obtained explicitly. An integral method is then used in the general case to obtain a sufficient condition for stability.

MCCOY, Peter A., Professor, "Near-Best Approximate Solutions for a Class of Elliptic Partial Differential Equations," *Journal of Approximation Theory*, **55**, 3 (1988), 248-263.

A variety of steady state physical phenomena linked with boundary value problems for the diffusion equation, the wave equation in separated form, or those which arise after transforming the time dependence in an initial value problem, are associated with a certain class of second order elliptic PDE's in the plane. A pair of integral transforms is developed that allows the concepts of optimal and near-best approximation for analytic functions on a disk to be transformed to corresponding properties for solutions to certain boundary value problems.

MCCOY, Peter A., Professor, "Transmutation of Analytic and Harmonic Functions," *Differential Equations and Math Physics*, **1285** (1987), 314-319.

Reciprocal transforms are constructed that link analytic functions in complex 3-space with harmonic functions whose angles are expressed as the spherical Euler Variables. The representations are well suited to problems with multiple symmetry patterns with axes skewed relative to the standard system. Special cases include the Bergman-Whittaker and Gilbert reciprocal integral transforms.

MOEN, Courtney, Associate Professor, "Kirillov Models for Distinguished Representations of GL_2," *Nagoya Journal of Mathematics*, **116** (1989), 1-22.

This article gives a detailed analysis of the Kirillov models of the distinguished principal series representations of the 2- and 3-sheeted covering groups of SL_2 over a p-adic field. The operator corresponding to the non-trivial Weyl group element is the one of interest. For the 2-sheeted covers this operator takes on a very simple form, but for the 3-sheeted covers, the analogous simplification does not take place. This suggests that there is no analogue of the Weil representation for 3-sheeted covers.

PRICE, Geoffrey L., Associate Professor, "Shifts of Integer Index on the Hyperfinite II_1 Factor," *Pacific Journal of Mathematics*, **132** (1988), 379-390.

This paper generalizes some of the author's earlier work on shifts of index 2 on the hyperfinite II_1, algebra. A shift σ on a C^*-algebra with identity is a *-endomorphism with the property that the intersection of the ranges of its powers σ^n is the subalgebra of scalar operators. Using a construction which is analogous to the construction of the Clifford algebra, necessary and sufficient conditions are given for a certain class of commutative relations on unitary operators to yield a hyperfinite II_1, factor. A shift on these unitary operators induces a shift on the factor. Necessary and sufficient conditions are given for two shifts to be conjugate.

TURNER, Peter R., Associate Professor, *Guide to Numerical Analysis*. London: MacMillan, 1989.

Guide to Numerical Analysis covers in a straightforward and readable way the problems, methods, and mathematical background required by most introductory courses in the subject. Full and rigorous mathematical justifications of the numerical methods are supplied where these are accessible to first-year students, but where these would require an advanced knowledge of linear algebra or analysis, a less formal approach is adopted. The author takes care to explain fully all the necessary algebraic manipulation, and to provide plenty of examples and exercises which illustrate when and how each method can be applied.

TURNER, Peter R., Associate Professor, co-author, "Level-index Arithmetic," *Numerical Analysis*, Lancaster, England, (1987), pp. 107-180.

This set of seven lectures form a unified introduction to the subject of Level-Index Arithmetic. The first two lectures prepare the way for their successors by demonstrating the motivation for seeking arithmetic systems other than floating-point, and by describing some of the early responses to the need. The next four describe the level-index system and its most important properties, show how it can be implemented and how it performs on some numerical examples. The final lecture points to the future by showing ways in which the implementation may be made more efficient.

TURNER, Peter R., Associate Professor, "Errors in Numerical Processes," *International Journal of Mathematics Education Science Technology*, **20** (1989), 29-36.

As the impact of computers and computational mathematics on school syllabi grows, it becomes increasingly desirable to say something about the errors which arise in the process of a piece of mathematical computing. Within this note some of the familiar ideas of rounding and truncation error are discussed, as well as some of the less-frequently mentioned aspects related directly to the floating-point arithmetic used within a computer.

TURNER, Peter R., Associate Professor, co-author, "The Symmetric Level-Index System," *IMA Journal of Numerical Analysis*, **8** (1988), 517-526.

The purpose of this paper is to present the details of an arithmetic system which virtually abolishes the phenomena of computer overflow and underflow in a logically symmetric manner. A generalized exponential function is used in such a way as to enable very large numbers to be represented with a uniform precision, and very small numbers by reciprocation.

WARDLAW, William P., Associate Professor, "Problem Q736 and Solution A736," *Mathematics Magazine*, **61** (1988), 261 and 265.

Q736. Let p be a fixed prime and n a fixed positive integer. What is the probability that an $n \times n$ matrix A with randomly chosen integer entries has determinant divisible by p ?

A736. The probability that p divides $\det(A)$ is

$$\Pr(p \text{ divides } \det(A)) = 1 - \prod_{k=1}^{n}(1 - p^{-k}),$$

if we assume that the integer entries are chosen so that each residue modulo p is equally likely. To see this, let A^- be the matrix obtained by reducing each entry of A to its least nonnegative residue modulo p. Then $\det(A)$ is divisible by p if and only if A^- is singular as a matrix over the field Z_p of integers modulo p. There are $(p^n-1)(p^n-p)\ldots(p^n-p^{n-1})$ invertible matrices among the p^{n^2} equally likely $n \times n$ matrices over Z_p, so the probability that p divides $\det(A)$ is

$$1 - \frac{(p^n-1)(p^n-p)\ldots(p^n-p^{n-1})}{p^{n^2}} .$$

WARDLAW, Willliam P., Associate Professor, "Problem 405," *The College Mathematics Journal*, **20** (1989), 257.

405. For each vector $x = (x_1,x_2,\ldots,x_n)$ in R^n and each permutation π in S_n, define $\pi x = (x_{\pi 1},x_{\pi 2},\ldots,x_{\pi n})$. Prove or disprove: if $a = (a_1,a_2,\ldots,a_n)$ and $b = (b_1,b_2,\ldots,b_n)$ with $0 \le a_1 < a_2 < \ldots < a_n$ and $0 \le b_1 \le b_2 \le \ldots \le b_n$, then $a \bullet b \ge a \bullet \pi b$ with equality if and only if $\pi b = b$.

WARDLAW, William P., Associate Professor, co-author, "Solution to Problem 344," *The College Mathematics Journal*, **20** (1989), 167-168.

This publication is a composite of the independent solutions of Pei Yuan Wu, National Chiao Tung University, Hsinchu, Taiwan, and the author to the following problem: Let the k-subsets of the n-set $\{1, 2, \ldots, n\}$ be listed in lexicographic order.

a. In which position is the set $\{a_1, a_2, \ldots, a_k\}$?
b. Which set is in position r ?

WARDLAW, William P., Associate Professor, co-author, "Solution to Problem 353," *The College Mathematics Journal*, **20** (1989), 261-262.

This publication is a composite of the independent solutions of the author and three others to the following problem: Prove that the interior of a triangle contains a point that lies on three congruent circles, each tangent to two different sides of the triangle.

WITHERS, W. Douglas, Associate Professor, "Newton's Method for Fractal Approximation," *Constructive Approximation*, **5** (1989), 151-170.

The problem of fitting a given function in the L^q norm with a function generated by an iterated function system can be rapidly solved by applying Newton's method on the parameter space of the iterated function system. The key to this is a method for calculating the derivatives of a potential function with respect to the parameters.

Presentations

BAILEY, Craig K., Associate Professor, "Teaching Calculus with an HP-28," Joint Service Academies Computer Conference in Mathematics, U.S. Military Academy, West Point, New York, 1-2 June 1989.

BAKER, B. Mitchell, Associate Professor, "Random Walks and the K_0-Theory of AF Algebras," Durham, New Hampshire, 24 July 1988.

BUCHANAN, James L., Associate Professor, "Software for Differential Equations," Mathematical Association of America Meeting, Washington, DC, 12 November 1988.

BUCHANAN, James L., Associate Professor, "Midshipman Differential Equations Program," Faculty Software Fair, U.S. Naval Academy, Annapolis, Maryland, 2 March 1988.

BUCHANAN, James L., Associate Professor, and Howard L. PENN, Professor, "MPP, Software for the Teaching of Calculus," Minicourse presented at Meeting of the Maryland, District of Columbia, Virginia Section of the Mathematical Association of America, Virginia Beach, Virginia, 21-22 April 1989.

BUCHANAN, James L., Associate Professor, and Howard L. Penn, Professor, "MDEP, Software for the Teaching of Differential Equations, Minicourse presented at Meeting of the Maryland, District of Columbia, Virginia Section of the Mathematical Assocation of America, Virginia Beach, Virginia, 21-22 April 1989.

BUCHANAN, James L., Associate Professor, "Software for Differential Equations," Joint Service Academy Conference on Computers in Mathematics, U.S. Military Academy, West Point, New York, 2 June 1989.

CHAMBERLAIN, Michael W., Professor, Mathematics Department,"Probability and Statistics Tutorials," Mathematical Association of America Section Meeting, American University, Washington, DC, 12 November 1988.

CHAMBERLAIN, Michael W., Professor, Mathematics Department, "How to Win at Chuck-a-Luck," Western Maryland College, Westminster, Maryland, 16 November 1988.

CRAWFORD, Carol G., Associate Professor, "Near Chromatic Polynomials," Georgetown University Mathematics Department Colloquium, Washington, DC, 14 April 1989.

CRAWFORD, Carol G., Associate Professor, "Almost Proper Line Colorings and Near Chromatic Polynomials," U.S. Naval Academy Mathematics Department Colloquium, U.S. Naval Academy, Annapolis, Maryland, 12 April 1989.

GAGLIONE, Anthony M., Associate Professor, "The Commutator Calculus," University of South Florida Meeting, Tampa, Florida, 12-20 July 1988.

GAGLIONE, Anthony M., Associate Professor, "The Probability that Two Group Elements Commute," Fairfield University, Fairfield, Connecticut, 2 November 1988.

GAGLIONE, Anthony M., Associate Professor, "What Witt Did Not Tell Us," Mathematics Department Colloquium, U.S. Naval Academy, Annapolis, Maryland, 11 January 1989; University of Waterloo, Waterloo, Canada, 9 March 1989.

GARCIA, Sonia M. F., Assistant Professor, "Improved Estimates for Parabolic Problems Using Mixed Finite Element Methods," Conference on Domain Decomposition Methods, Houston, Texas, 20 March 1989.

HANNA, Charles C., Associate Professor, "Communicating Mathematics: Teaching Mathematics Majors to Write," Maryland-District of Columbia-Virginia Sectional Meeting, Mathematical Association of America, Washington, DC, 12 November 1988.

JOYNER, W. David, Assistant Professor, "Base Change for PSL(2)," University of South Carolina, Columbia South Carolina, 2 February 1989; University of Maryland, College Park, Maryland, 7 March 1989.

KAMMEYER, Janet W., Assistant Professor, "The Isomorphism Theorem for Relatively Finitely Determined Zn-Actions," University of Maryland Graduate Dynamics Seminar, College Park, Maryland, 16 March 1989.

KAMMEYER, Janet W., Assistant Professor, "Did You Ever Hear the One About Dye's Theorem?" University of Maryland Student-Faculty Colloquium, College Park, Maryland, 10 April 1989.

KAPLAN, Harold M., Professor, "How to Evade the Bahadur-Savage Theorem," Mid-Atlantic Regional Probability and Statistics Day, The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland, 22 October 1988.

KONKOWSKI, Deborah A., Assistant Professor, "Spacetime Surrounding a Superconducting Cosmic String," Fourteenth Texas Symposium on Relativistic Astrophysics, Dallas, Texas, 11-16 December 1988.

LERNER, Bao-Ting, Associate Professor, "A Fuzzy Set Approach to Grey-level Image Representation," North American Fuzzy Information Processing Society Conference, San Francisco, California, 8 June 1988.

LERNER, Bao-Ting, Associate Professor, "Applications of Algebraic Image Operators to Model-Based Vision," SPIE 1989 Technical Symposium on Optics, Electro-Optics and Sensors, Seventh Artificial Intelligence Conference, Orlando, Florida, 28 March 1989.

MALEK-MADANI, Reza, Associate Professor, "Unstable Solutions in Nonlinear Elasticity," Viscoelasticity Seminar, Virginia Polytechnic Institute, Blacksburg, Virginia, 16 November 1988.

MALEK-MADANI, Reza, Associate Professor, "Bifurcation and Stability of Solutions in Thermo-elasticity," SIAM National Meeting, San Diego, California, 17 July 1989.

MARUSZEWSKI, Richard F., Associate Professor, "WORD," Mathematics Department Computer Seminar, U.S. Naval Academy, Annapolis, Maryland, 12 September 1988.

MARUSZEWSKI, Richard F., Associate Professor, "Disk Operating Systems," Mathematics Department Computer Seminar, U.S. Naval Academy, Annapolis, Maryland, 12 September 1988.

MARUSZEWSKI, Richard F., Associate Professor, "Radical Theory," Mathematics Department Colloquium, U.S. Naval Academy, Annapolis, Maryland, 28 September 1988.

MARUSZEWSKI, Richard F., Associate Professor, "Spreadsheets," Mathematics Department Computer Seminar, U.S. Naval Academy, Annapolis, Maryland, 13 February 1989.

MARUSZEWSKI, Richard F., Associate Professor, "Tech Word, A Technical Word Processor," Mathematics Department Computer Seminar, U.S. Naval Academy, Annapolis, Maryland 17 October 1989.

MCCOY, Peter A., Professor, "Transporting Function Theory," Mathematics Department Colloquium, U.S. Naval Academy, Annapolis, Maryland, 7 December 1988.

MCCOY, Peter A., Professor, "Singularities of Harmonic Functions in Several Real Variables," Mathematics Department Colloquium, U.S. Naval Academy, Annapolis, Maryland, 6 April 1989.

MCCOY, Peter A., Professor, "Solving Some PDE's for Time Dependent Processes," Applied Mathematics Seminar, U.S. Naval Academy, Annapolis, Maryland, 26 April 1989.

MYLANDER, W. Charles, Professor, "Solving Large Lp Problems on Microcomputers," Process Industry Modeling Systems Conference, Miami, Florida, 26 October 1988.

MYLANDER, W. Charles, Professor, "The OR Curriculum at the USNA," Milltoy Operators Research Society Education Colloquium, U.S. Naval Academy, Annapolis, Maryland, 7 March 1989.

NAKOS, George, Assistant Professor, "The Bernoulli Numbers," Number Theory Seminar, U.S. Naval Academy, Annapolis, Maryland, 14 April-19 May 1988.

PENN, Howard L., Professor and Jerry MORZINSKI, Lieutenant Commander, USN, "Computer Graphics for the Learning of Calculus," Engineering and Science Seminar, U.S. Naval Academy, Annapolis, Maryland, 2 June 1988.

PENN, Howard L., Professor and Craig K. BAILEY, Associate Professor, "MPP, Software for the Teaching of Calculus," Mathematics Department Computer Seminar, U.S. Naval Academy, Annapolis, Maryland, 31 August 1988.

PENN, Howard L., Professor and Craig K. BAILEY, Associate Professor, "Computers in the Core Calculus Courses," Software Fair, U.S. Naval Academy, Annapolis, Maryland, 1-2 March 1989.

PENN, Howard L., Professor and James L. BUCHANAN, Associate Professor, "MPP Software for the Teaching of Calculus," Minicourse presented at Meeting of the Maryland, District of Columbia, Virginia Section of the Mathematical Association of America, Virginia Beach, Virginia, 21 April 1989.

PENN, Howard L., Professor and James L. BUCHANAN, Associate Professor, "MDEP, Software for the Teaching of Differential Equations," Minicourse presented at Meeting of the Maryland, District of Columbia, Virginia Section of the Mathematical Association of America, Virginia Beach, Virginia, 22 April 1989.

PENN, Howard L., Professor, "MPP, Software for the Teaching of Calculus," Joint Service Academy Meeting, U.S. Military Academy, West Point, New York, 1-2 June 1989.

PENN, Howard L., Professor, "Software Available for the Teaching of Mathematics," Joint Service Academy Meeting, U.S. Military Academy, West Point, New York, 1-2 June 1989.

PIERCE, John F., Assistant Professor, "Bifurcation Theory, Rod Theory, and Symmetry-Breaking Loads," MSI Workshop on Symmetry and Groups in Continuum Mechanics, Cornell University, Ithaca, New York, 21 June 1988.

PIERCE, John F., Assistant Professor, "Lectures on Symmetric Bifurcation Theory in Continuum Mechanics," Institut fur Mechanik, Technischen Universitat Wien, Vienna, Austria, 1-14 July 1988.

PIERCE, John F., Assistant Professor, "Symmetry and Groups in Bifurcation Theory," Applied Mathematics Seminar, Mathematics Department, U.S. Naval Academy, Annapolis, Maryland, 12 September 1988.

PRICE, Geoffrey L., Associate Professor, "Semigroups of Isometries," Colloquium Address, Indiana University, Purdue University at Indianapolis, Indiana, 12 October 1988; Colloquium Address, University of Cincinnati, Cincinnati, Ohio, 13 October 1988; Colloquium Address, Wright State University, Dayton, Ohio, 14 October 1988.

PRICE, Geoffrey L., Associate Professor, "The C*-Algebras Generated by Pairs of Semigroups of Isometries," American Mathematical Society Regional Meeting, Worcester, Massachusetts, 15 April 1989.

PRICE, Geoffrey L., Associate Professor, "Semigroups of Endomorphisms of B(H)," Dartmouth College, Dartmouth, New Hampshire, 17 April 1989.

TURISCO, JoAnn S., Associate Professor, "Composition of Sums of Squares: Topological, Algebraic, and Analytic Techniques," Number Theory Colloquium, University of South Carolina, Columbia, South Carolina, 3 February 1989.

TURNER, Peter R., Associate Professor, "A Teaching Package for Numerical Analysis," Joint Service Academies Conference on Computers in Mathematics, U.S. Military Academy, West Point, New York, 1-2 June 1989.

TURNER, Peter R., Associate Professor, "Alternatives to Floating-Point: The Need," Applied Mathematics Working Seminar, University of Arizona, Tucson, Arizona, 3 March 1989.

TURNER, Peter R., Associate Professor, "Alternatives to Floating-Point: The Candidates," Computational Mathematics Pro-Seminar and Mathematics Department Colloquium, Arizona State University, Tempe, Arizona, 3 March 1989; Mathematics Department, U.S. Naval Academy, Annapolis, Maryland, 23 September 1988.

TURNER, Peter R., Associate Professor, "The Distribution of LSD and its Implications for Computer Design," Mathematics Department Colloquium, Northern Arizona University, Flagstaff, Arizona, 4 March 1989.

TURNER, Peter R., Associate Professor, "How Does Your Calculator Work?" Mathematical Association of America Regional Meeting, Washington, DC, 12 November 1988.

TURNER, Peter R., Associate Professor, "Algorithms for the Elementary Functions in Level-Index Arithmetic," Conference on Algorithms for Approximation at RMCS, Shrivenham, England, 10 July 1988.

TURNER, Peter R., Associate Professor, "Numerical Analysis at USNA," Joint Service Academies Conference on Computers in Mathematics, U.S. Naval Academy, Annapolis, Maryland, 6 June 1988.

TYSON, James K., Visiting Professor, "On the Job Training in Naval Operations Research," Operations Research Education Colloquium, Military Operations Research Society, U.S. Naval Academy, Annapolis, Maryland, 7 March 1989.

WARDLAW, William P., "Matrices of the form AB-BA," Maryland, District of Columbia, Virginia Section of the Mathematical Association of America Fall Meeting, American University, Washington, DC, 12 November 1988.

WARDLAW, William P., "A Characterization of the Adjoint," Western Maryland College, Westminster, Maryland, 10 March 1989.

WARDLAW, William P., "Euler's Theorem for Polynomials," Maryland, District of Columbia, Virginia Section of the Mathematical Association of America Spring Meeting, Virginia Beach, Virginia, 22 April 1989.

WITHERS, W. Douglas, Associate Professor, "Folding Polynomials," George Washington University Mathematics Colloquium, Washington, DC, 16 October 1988.

WITHERS, W. Douglas, Associate Professor, "Introduction to Fractals and Chaos," Anne Arundel County Board of Education, Annapolis, Maryland, 11 November 1988; Anne Arundel County Spring into Mathematics Conference, Old Mill Senior High School, Glen Burnie, Maryland, 23 March 1989; and Virginia Council of Teachers of Mathematics, Harrisonburg, Virginia, 1 April 1989.

WITHERS, W. Douglas, Associate Professor, "Fractals Generated by Markov Processes," National Institute of Standards and Technology, Gaithersburg, Maryland, 2 December 1988.

WITHERS, W. Douglas, Associate Professor, "The Potential Function of the Mandelbrot Set," National Institute of Standards and Technology, Gaithersburg, Maryland, 2 December 1988.

WITHERS, W. Douglas, Associate Professor, "Fractals Generated by Markov Processes," Symposium on the Interface: Computing Science and Statistics, Orlando, Florida, 12 April 1989.

DEPARTMENT OF

Oceanography

Commander Michael P. Cavanaugh, USN
Chairman

During the 1988-1989 academic year, civilian faculty members conducted sponsored research in a broad range of oceanographic and atmospheric areas. This research provided opportunities for the faculty to keep abreast of current work, and it served as the basis for qualified midshipmen to undertake related research projects.

Funding was secured from the Defense Mapping Agency, the Johns Hopkins University Applied Physics Laboratory, the National Science Foundation, the Office of Naval Research, and the Commander, Naval Oceanography Command.

Specific areas of research activity within the department included acoustics; ocean optics; latent heat in extratropical cyclone development; polar phenomena, including polynya formation and ice movement; and a variety of meteorological and oceanographic phenomena studied by means of remote sensing using the department's Digital Image Processing System.

Sponsored Research

Gray Whale Hydrodynamics

Researcher: Professor John W. Foerster
Sponsor: NAV OP21 through Johns Hopkins University
Applied Physics Laboratory

This project, in its initial stages, involves computer modeling of a swimming gray whale. The researcher is developing interactive, animated analysis.

Wind-driven Polynya and Lead Formation Thresholds with the Arctic Pack and Along the Continental Shelves Bordering the Arctic Ocean

Researcher: Visiting Professor Thomas L. Kozo
Sponsor: Office of Naval Research

It is proposed that Arctic Ocean Buoy Program (AOBP) data, on-ice buoy positions and surface atmospheric pressure, be merged with concomitant satellite imagery (National Oceanic and Atmospheric Administration, NOAA-7, predominantly) for the 1979-1988 period (approximately 10 years). These data would be examined for: (1) clear sequential images of polynya or lead formation; (2) proximity of AOBP buoys to these areas of ice divergence; and (3) proximity of permanent land meteorology stations to the areas of ice divergence and the AOBP buoys. Combinations of three pressure recording stations surrounding the incipient leads or polynyi would be used to compute the geostrophic wind from the network measured pressure gradient. Conversion of these geostrophic winds (10 m level) or wind stresses will be undergone after a useful data set has been built.

The scientific objectives for this project are: (1) a more quantitative examination of the mechanisms for differential ice floe movement and fracture within the polar pack; (2) determination of polynya and lead creation thresholds on continental shelves and in the ice pack; (3) determination of the causes of recurring lead and polynya loci; (4) relation of the divergence areas to deep water renewal sources; (5) relation of horizontal wind stress computed via the mesonetwork and loci of high ambient noise; and (6) development of an all-weather polynya or lead prediction scheme for future naval applications.

Atmospheric Science Education Program for Teachers (Grades 7-12)

Researcher: Assistant Professor David R. Smith
Sponsor: National Science Foundation

The primary objective of this project is to assist science teachers in middle and high schools with the implementation of weather-related topics in their science curricula. Over the past two summers, 51 teachers from Indiana and Chicago, Illinois, have participated in summer workshops to enhance their atmospheric science background. These workshops have a strong "hands-on" emphasis in teaching meteorology, including laboratories in weather observations, weather analysis and forecasting, physical meteorology, and computer applications.

In addition to the summer workshops, this project has developed a series of videotapes entitled *The Active Atmosphere*, which are currently being distributed by a national educational resource firm (Focus Media, Inc). Furthermore, the project includes an accompanying set of activity books to demonstrate various applications of the topics presented in the videotape series.

Currently, the project is developing a videotape series to emphasize career applications of meteorology in a variety of occupational fields (agriculture, aviation, engineering, law, retailing, etc.). In addition, a computer-based weather data access system is being developed to provide teachers and students with near-real-time weather information in the classroom.

Independent Research

At-sea Measurements of Underwater Cavity Resonance Using a Towed Catamaran Platform

Researcher: Lieutenant Commander Leynox G. Baker, USN

Earlier investigations in the USNA High Speed Tow Tank, using a 4.5-foot towed model, have shown that large amplitude resonant oscillations can be produced by flow over a wall cavity immersed in water. For this case, it was found that critical speed is predictable from a Strouhal number formula derived for resonant cavity oscillations in air. Currently, the researcher is attempting to measure radiation from an underwater resonating cavity using the same towed model. Since "wave guide" cutoff of the tow tank is above oscillation frequency, it has been necessary to perform the measurements in deeper water. For this purpose, a 17-foot catamaran has been adapted for use as a towing platform to make it possible to take measurements in the Chesapeake Bay. A YP class vessel equipped for oceanographic research is used for towing and for recording data. For speeds up to 10 knots, f_{11} and f_{12} models have been detected at the expected speeds. Current results for amplitude and radiation will be described.

Geologic Map of the Indian Springs, Nevada, 1:100,000 Quadrangle

Researcher: Assistant Professor Peter L. Guth

A bedrock geologic map of the Indian Springs, Nevada, 1:100,000 quadrangle is being completed. This project is part of a larger effort to understand the regional geology surrounding the Nevada test site and the proposed high level nuclear waste repository at Yucca Mountain. The preliminary version of the map will be published as an open file, black-and-white map by the Geological Survey; the final version will be the first published color map in a new series by the Nevada Bureau of Mines. The map has undergone its first review. A manuscript describing the work has been submitted for a Memoir of the Geological Society of America. This work will be featured during a field trip in July for the International Geological Congress.

Microcomputer Applications of Digital Data Sets

Researcher: Assistant Professor Peter L. Guth

A computer program to manipulate digital elevation models has been expanded to use other data such as gridded athymetric and gravity data. A paper was published on the use of this data for working on geologic cross sections. A paper was presented at a conference sponsored by the Defense Mapping Agency, and another will be presented this summer at the International Geological Congress.

Relationship of Various Optical Parameters in the Chesapeake Bay

Researcher: Professor Jerome Williams

From 1980-1985, optical data were collected in Chesapeake Bay under the sponsorship of the Defense Mapping Agency. These parameters included particle size analysis, beam attenuation, diffuse light attenuation, and Secchi Disc readings. During the past year, these data have been analyzed for pertinent relationships. Results so far indicate a poor relationship between suspended particle size distribution and any of the other optical parameters. There also appears to be a poor relationship between beam attenuation and diffuse light attenuation. However, as predicted by previously developed theory, there is a good relation between beam attenuation and Secchi Disc readings.

Research Course Projects

East Coast Upwelling During the 1988 Summer

Researcher: Midshipman 1/C Timothy C. Gallaudet, USN
Adviser: Visiting Professor Alan E. Strong

The National Oceanic and Atmospheric Administration-Advanced Very High Resolution Radiometer (NOAA-AVHRR) data, together with Landsat Thematic Mapper (TM), have been compared with a coastal buoy off New Jersey to depict and study the unusually persistent 1988 upwelling that involved much of the coast of the United States from Delaware to Cape Cod. Buoy data from June through August have been analyzed and reveal unusually proficient offshore winds that rarely allowed surface waters to warm and accumulate. AVHRR data showed extensive and frequent values at or below 20°C all summer long.

The Mysterious Die-off of Sea Urchins in the Caribbean in 1983

Researcher: Midshipman 2/C Richard C. McCormack, USN
Adviser: Visiting Professor Alan E. Strong

Coastal Zone Color Scanner (CZCS) data have been analyzed in 1982, 1983, and 1984 over the entire central Caribbean basin for changing levels of pigment (chlorophyll) concentrations. A comparison of early 1982 values with those in early 1983 shows that average pigment levels decrease nearly an order of magnitude. Although 1984 data coverage is not entirely satisfactory at this time, according to CZCS indications in the northern Caribbean, levels recovered slightly in 1984.

Lower chlorophyll (consequently productivity) levels show significantly less food was available to support the algae-eating sea urchin populations. Such a notable decline in chlorophyll may have led to the catastrophic demise of the sea urchin. Concurrent effects from changing SST's are being examined for further clues.

These lower pigment levels have been attributed to dramatic extinction of incoming solar radiation owing to large concentrations of volcanic aerosol in the stratosphere over the Caribbean during the last eight months of 1982.

Offshore Explosive Cyclogenesis along the East Coast of the United States

Researcher: Midshipman 2/C Russell S. McCormack, USN
Adviser: Assistant Professor David R. Smith

The primary objective of this project is to investigate explosive cyclogenesis along the east coast of the United States. Explosive cyclogenesis is the rapid development (at the rate of 24 mb/24 hours or more) and intensification of the circulation associated with a low pressure system. This is a somewhat frequent (5-10 times per year) event that occurs over the Gulfstream ocean current off Cape Hatteras, North Carolina, bringing strong winds and heavy precipitation (often in the form of snow or freezing rain) to the Atlantic seaboard.

In this investigation, the researcher examined both conventional meteorological information and remotely-sensed data to determine possible signatures in the data fields preceding the rapid development of these storms at sea. Identification of such features will greatly enhance the ability of operational forecasters to predict this hazardous meteorological phenomenon, a most important weather producer for the east coast and just offshore.

The Future Prospects for OTEC

Researcher: Midshipman 1/C Michael D. Michel, USN
Adviser: Professor Jerome Williams

This is a rather detailed look at Ocean Thermal Energy Conversion in terms of what is involved physically and the expected environmental effects. An assessment is made of the future possibility of OTEC becoming commercially viable.

Global Trends in Sea Surface Temperatures

Researcher: Midshipman 2/C Arthur J. Reiss, USN
Adviser: Visiting Professor Alan E. Strong

Monthly mean Sea Surface Temperatures (SST's) from satellites have been analyzed from 1982 to the present for regional, hemispheric, global, and seasonal trends. Over the past seven years, all major ocean basins, with the exception of the Indian Ocean, show increasing levels from 0.08°C/yr to as much as 0.13°C/yr, in the Southern Hemisphere and North Atlantic, respectively. Although considerable SST cooling took place during 1988 to reduce the record warm of the global oceans in 1987, global (and especially Southern Hemisphere) SST's are resuming their upward trends in 1989.

An oral presentation on these results was made at the Fall Meeting of the American Geophysical Union (AGU), and an update is scheduled for the Spring AGU Meeting. New areas of research focus on latitudinal and seasonal sensitivities.

A Proposed Model for the Existence of a West Coast Tertiary Estuarine System and Subsequent Coastline Emergence and Migration

Researcher: Midshipman 1/C John E. Ries, USN
Adviser: Professor Douglas W. Edsall

Current theories postulate that the west coast of Washington, Oregon, and Northern California was much farther inland during the Eocene and Oligocene epochs, creating a large embayment west of what are now the Cascade Mountains (Dott, 1966). It is proposed that this model is totally inaccurate, failing to account for significant bio-stratigraphic data. Instead, preliminary field work and laboratory analysis by this author indicate that the paleogeography resembled that of a submergent coastline estuarine system similar to the modern Chesapeake Bay. This paper describes several newly discovered floral assemblages and their paleoclimatic implications.

The implications of a West Coast Tertiary Estuarine System are extraordinary. Because the system was almost certainly a tectonically controlled basin, it would be the first detailed facies model of this type, forming a depositional model intermediate between a sandy fluvial and a river dominated shelf system. Thus, the data provided would be unique as an integrated basis for hydrodynamic interpretation, a framework for future observations, and as an acceptable model in the geological community. Comparison with modern type systems, such as the Brazos River, Texas, and the Chesapeake Bay, is necessary.

The goals of this project include: to prove conclusively the existence of a West Coast Tertiary Estuarine System stretching through Washington, Oregon, and Northern California; to reconstruct a theoretical model of the paleography of the surrounding shore; to reconstruct the Eocene environment based on fossil flora and fauna; and to determine the significance of this data in relation to modern estuarine dynamics. If gradational transition can be recognized and the extent of bioturbation identified, new computer modelling techniques can be applied to generate a stratigraphic model.

Analysis of Sea Ice Drift in a Coastal Ice Zone

Researcher: Midshipman 1/C Piper A. Smith, USN
Adviser: Visiting Professor Thomas L. Kozo

From March to July 1982, a satellite transmitting weather station was deployed in the coastal ice zone (CIZ) 150 km north of Alaska. Sea ice in this area may be influenced by synoptic scale winds, mesoscale winds (created by Brooks Range mountain barrier effects), ocean currents, and coastal shearing and compaction transmitted through internal ice stresses. These influences complicate ice movement predictions in the CIZ; however, the use of mesoscale network computed winds, rather than synoptic scale winds, accounts for many of the influences and simplifies the prediction process. Data were collected to compute mesoscale pressure network winds, surface (3m) winds, and ice velocity. Speed ratios and turning angles between computed network geostrophic winds, surface winds, and ice drift were compared. A plotting algorithm was implemented to superimpose mesoscale wind vectors on the buoy's track. Also, in late April, a large lead developed along the Canadian Archipelago, which resulted in an apparent rotation of the entire ice sheet in the Beaufort Sea and an increase in ice velocity in the study area.

Publications

ANDERSON, Alan D., Commander, NOAA, Visiting Professor/Instructor, "The Changing Face of Hydrographic Surveying," *Professional Surveyor*, **9**, 3 (May/June 1989), 4-9.

Rapid changes are taking place in hydrographic surveying technology. Modern and future technologies are presented in a historical context. Modern equipment includes dual beam sounders, side scan sonars, multibeam (SWATH) sounding systems, and laser systems. Future systems discussed are the satellite global positioning system (GPS) and shallow water interpermetric sound systems which combine the functions of a side scan sonar and a multibeam system.

FOERSTER, John W., Professor, "Shelf Break Upwelling in Denmark Strait," *Port and Ocean Engineering Under Arctic Conditions*, **1** (1988), 227-238.

Investigations of historical oceanographic records and recent infrared satellite scans in the area between longitude 24° west to 32° west and latitude 62° north to 66° north led to the discovery of a zone of apparent unstable water. This zone was between the 200-m and 1,000-m bathymetric contours west of Iceland in the Denmark Strait. The study area continues to be very active in biological production and has provided the majority of the catch for the Icelandic whale fishery. A survey expedition investigated this area in June 1981. Calculations from the survey data revealed that water was transported to the northwest at 2.3 x $10^3 m^3$/sec with an average Ekman layer depth of 74 m. An anomaly in the vertical Sigma-t distribution indicated water movement towards the surface. This physical information, results of distribution of the biota and the infrared satellite scans, led to the conclusion that upwelling conditions exist during the polar summer in this area of the Denmark Strait. This upwelling is believed to be a function of the particular air-sea interaction that exists at this time of year. The result of this interaction has been the development of a 40,000 km^2 area of high biological productivity.

GUTH, Peter L., Assistant Professor, "Microcomputer-assisted Drawing of Geologic Cross Sections," *Mathematical Geology*, **20** (1988), 991-1000.

A digital elevation model (DEM) uses an array of numbers to record surface elevation. DEM's usually consist of a regular grid of elevations with x-y coordinates implicit in the data structure. Specific geologic applications include using the DEM to solve three point problems, calculate thicknesses based on map outcrop patterns, or trace the path of a plane (fault or formation contact) across topography. These applications involve repetitive, simple mathematical operations, but in the case of contact tracing, the volume of calculations realistically precludes manual operation. Because of the ease of computer operation, many calculations can be performed rapidly and results compared. DEM use for cross section generation lets the computer draw topographic profiles and assist drawing by keeping track of many details.

GUTH, Peter L., Assistant Professor, "Day 4. Tertiary Extension in the Sheep Range Area, Northwestern Clark County, Nevada," *Extensional Tectonics in the Basin and Range Province between the Southern Sierra Nevada and the Colorado Plateau: Field Trip Guidebook T138*. American Geophysical Union, 1989, pp. 33-39.

This portion of the transect will consist of three stops, two on the west side of the Sheep Range to look at the breakaway zone for a major detachment system, and an overview stop at Angel Peak in the Spring Mountains to look at extension along the Las Vegas Valley shear zone. These exposures lie within the central topographic high of the southern Great Basin. The author concentrates on Cenozoic extension of the Paleozoic miogeoclinal section. Except for the overview at Angel Peak, the observed rocks belong to the upper plate of a single Mesozoic thrust (Gass Peak-Wheeler Pass); thrust belt deformation was not examined. The geology on the west side of the Sheep Range has previously been described and is summarized here.

KELLEY, Richard G., Lieutenant Commander, USN, co-author, "Ship Trail/Cloud Dynamic Effects from Apollo/Soyuz Photograph 16 July 1975," *Proceedings* of the Sixth Joint Conference on Applications of Air Pollution Meteorology, 30 January to 3 February 1989, Anaheim, California, pp. 37-39.

A preliminary analysis of a ship trail photograph is described. The photograph was taken from an altitude of 174 km by the Apollo-Soyuz crew. The photograph shows detail of the ship trails and the cloud free bands generated by the trails. These trails are initiated by initial energy release of ship power plants and latent heat release from the aerosol nucleation process. The paper describes numerical modeling efforts to simulate ship trails using energy release from the ship as a technique to give an indication of how much more energy may be required from the nucleation process.

KOZO, Thomas L., Visiting Professor, co-author, "The Role of Alternating Cyclones and Anticyclones in Triggering Sea Ice Fracture in the Canadian Arctic Basin," *Proceedings* of the Ninth International Symposium on Ice, August 1988, Sapporo, Japan. eds., H. Saeki and K. Hirayama. International Association for Hydraulic Research, Committee on Ice Problems, Vol. I, 1988, pp. 633-642.

Satellite imagery obtained over the Canadian Basin has been meshed with Arctic Ocean Buoy Program (National Science Foundation and the Office of Naval Research) meteorological data for the months of April-May 1982. Atmospheric pressure data from six satellite transmitting buoys drifting on the Bering Sea ice allowed for better definition of synoptic weather patterns. The April imagery showed a major fracture in the sea ice canopy (over 1000 km long) just west of the Canadian Archipelago. This fracture grew from a lead to a polynya with a maximum width of 80 km from 27 April to 3 May and signaled the onset of major sea ice movement along the Alaskan Beaufort Sea coast to the south. Prefracture drift was 8 km/day for 7 ms^{-1} surface winds from the east. Post fracture drift was 16 km/day from 7 ms^{-1} surface winds from the east, which compares to summer ice drift under usually unconsolidated conditions.

Reasons for this extensive fracture in this coastal ice zone are thought to be storm tide cracking and barometric effects, increase in ice divergence due to superposition of the synoptic low over the Beaufort Gyre, and the 180° alternation of wind stress application.

SMITH, David R., Assistant Professor, and Eric J. Coolbaugh, Lieutenant, USN, "Developing a Computerized Meteorology Laboratory for Undergradate Instruction at the United States Naval Academy," *Preprint Volume* of the Fifth International Conference on Interactive Information and Processing for Meteorology, Oceanography, and Hydrology, American Meteorological Society, 1989, pp. 265-270.

The Oceanography Department at the U.S. Naval Academy is currently configuring a computerized meteorological laboratory based upon 12 Hewlett-Packard HP 350 computers and a software system developed by Northwest Digital Research Corporation. This project focuses on creating and defining the proper computerized learning environment for students at the undergraduate level. Instructional systems must differ significantly from those designed for operational or research purposes in order to satisfy the desired learning objectives. Defining the objectives that can be met with a computerized system and configuring the hardware and software to meet these objectives is the initial goal of this investigation. Further work is also underway, focusing on lesson plan development which capitalizes on the proposed system configuration.

SMITH, David R., Assistant Professor, co-author, "The Role of Latent Heat Release in the Evolution of a Weak Extratropical Cyclone," *Monthly Weather Review*, **117**, **5** (May 1989), pp. 1039-1057.

A study of the sensitivity of a weak winter extratropical cyclone to latent heat release (LHR) is presented using 48 h simulations of the cyclone's evolution derived from three versions of the LFM model: a MOIST simulation in which full model physics was employed, a DRY simulation in which all latent heating was removed, and a DOUBLE MOIST simulation in which the effect of latent heating on the temperature field was doubled. Results indicate that a deepening cyclone occurs in the DOUBLE MOIST simulation, a near steady-state cyclone in the MOIST simulation, and a filling cyclone in the DRY simulation. Thus, for this case the presence and intensity of LHR is of critical importance to this cyclone's intensification. In addition, using height tendency diagnoses, it is concluded that in the lower troposphere the dominant LHR influence is direct, through the explicit diabatic heating forcing in the height tendency equation. In contrast, in the middle and upper troposphere, this direct LHR role is no longer dominant, but rather shares its importance with the indirect effect, represented by the influence of LHR on the dynamical forcing mechanisms.

STRONG, Alan E., Visiting Professor, "Greater Global Warming Revealed by Satellite-derived Sea Surface Temperature Trends," *Nature*, **4** (20 April 1989), 642-645.

Investigating the response of global climate to changes in external forcing is essential to our understanding of climate change. An analysis of satellite-derived sea surface temperatures for the period 1982-1988 is presented. It can be seen from this analysis that the global ocean is undergoing a gradual but significant warming of approximately 0.1°C per year, whereas the trend obtained for the same period from conventional data sources (ships and buoys) is about half that magnitude. Satellite global coverage, however, is far greater and, although lacking a long time series of satellite data (as opposed to conventional data), it is possible to observe short-term trends, as shown here, that may not be discerned using the coarser-resolution conventional data.

Presentations

EDSALL, Douglas W., Professor, co-author, "Potential Pre-Tertiary Hydrocarbon Accumulations Beneath NOSR No. 2," Seventy-fourth Annual Convention of the American Association of Petroleum Geologists, San Antonio, Texas, 25 April 1989.

GUTH, Peter L., Assistant Professor, "MICRODEM+: Comparing Digital Elevation Models on a Personal Computer," Defense Mapping Agency Systems Center Symposium 89, Herndon, Virginia, 17 May 1989.

KOZO, Thomas L., Visiting Professor, co-author, "The Orientation of Wind-generated Polynyi along the South Coasts of Eastern Bering Sea Islands," American Geophysical Union, Fall Meeting, San Francisco, California, December 1988, and Tenth International Conference on Port and Ocean Engineering Under Arctic Conditions, Lulea, Sweden, 14 June 1989.

KOZO, Thomas L., Visiting Professor, co-author, "The Role of Alternating Cyclones and Anticyclones in Triggering Sea Ice Fracture in the Canadian Arctic Basin," Ninth International Symposium on Ice, Sapporo, Japan, 23 August 1988.

SMITH, David R., Assistant Professor, "The Atmospheric Science Education Program - Summer Workshop for Teachers (1988)," Annual Meeting of the American Meteorological Society, Board on School and Popular Meteorological and Oceanographic Education, Anaheim, California, 1 February 1989.

SMITH, David R., Assistant Professor, "Status of *The Active Atmosphere* Videotape Series," Annual Meeting of the American Meteorological Society, Board on School and Popular Meteorological and Oceanographic Education, Anaheim, California, 1 February 1989.

SMITH, David R., Assistant Professor, "Developing a Computerized Meteorology Laboratory for Undergraduate Instruction at the United States Naval Academy," Fifth International Conference on Interactive Information and Processing for Meteorology, Oceanography, and Hydrology, American Meteorological Society, Anaheim, California, 4 February 1989.

SMITH, David R., Assistant Professor, "Tackling the Twister: Current Research on Tornadoes," USNA and DTRC Chapter of Sigma Xi Luncheon Meeting, Annapolis, Maryland, 15 March 1989.

SMITH, David R., Assistant Professor, "Weather or Not? - Meteorology in the General Science Curriculum," National Convention of the National Science Teachers Association, Seattle, Washington, 8 April 1989.

STRONG, Alan E., Visiting Professor, "Increasing Sea Surface Temperature Trends During the 1980's," American Geophysical Union Fall Conference, San Francisco, California, 5-9 December 1988.

STRONG, Alan E., Visiting Professor, and Arthur J. REISS, Midshipman 2/C, USN, "Global Sea Surface Temperature Trends Derived from Satellite Monthly Mean MCSST's," American Geophysical Union Spring Conference, Baltimore, Maryland, 8-12 May 1989.

STRONG, Alan E., Visiting Professor, and Timothy C. Gallaudet, Midshipman 1/C, USN, "East Coast Upwelling During the Summer of 1988 as seen using AVHRR and Landsat TM Data," American Geophysical Union Spring Conference, Baltimore, Maryland, 8-12 May 1989.

WATERS, Marshall P., III, Captain, USNR, "NOAA's Space Station Polar Platform," Naval Observatory, Washington, DC, 20 December 1988.

WILLIAMS, Jerome, Professor, "Introduction to Estuarine Dynamics," Conference on Scientific Education, U.S. Naval Academy, Annapolis, Maryland, 14 May 1988.

WILLIAMS, Jerome, Professor, "Estuarine Science in Europe," Atlantic Estuarine Research Society Fall Meeting, Solomons, Maryland, 28 October 1988.

WILLIAMS, Jerome, Professor, "An American Looks at European Science," Sigma Xi, U.S. Naval Academy, 18 January 1989.

WILLIAMS, Jerome, Professor, "Oceanography in Europe," Marine Technology Society, Washington, DC, 16 March 1989.

WILLIAMS, Jerome, Professor, "Just What do Secchi Disc Readings Mean?" Atlantic Estuarine Research Society, Beaufort, North Carolina, 7 April 1989.

DEPARTMENT OF

Physics

Professor Graham D. Gutsche
Chairman

The past year has been another productive year for research activity in physics. The areas of research activity include non-linear acoustics, acoustic signatures of ships, submarine magnetics, galactic astronomy, atomic physics, nuclear physics, condensed matter physics, optics and lasers, and theoretical studies. The installation of a new "Pelletron"™ accelerator at the end of the academic year will enhance in-house research activities in atomic and nuclear physics in the future. The research undertaken was about an even mix of basic and applied research. A great deal of unfunded research and development work on computer interfacing and software development has accompanied all of these projects as part of our overall laboratory development. The vitality of the program is evidenced by its productivity, resulting in 17 published papers in research journals, 23 presentations at professional meetings and one patent disclosure. During the year Professor Larry L. Tankersley received the Alan Berman Research Publication Award as a co-author of the outstanding research publication from the Naval Research Laboratory during 1988.

During the first semester, Dr. Shigeru Yoshikawa was a Visiting Research Professor in Physics. Dr. Yoshikawa comes from the Technical Research and Development Institute of the Japan Defense Agency. He worked in collaboration with Professor Samuel A. Elder in acoustics research.

Midshipman involvement was evidenced by the completion of nine midshipman research projects. Two research publications, involving four midshipmen as co-authors, resulted. Other midshipman research participation is evidenced by eight physics majors going to Los Alamos National Laboratory,

one to Oak Ridge National Laboratory, and one to Johns Hopkins Applied Physics Laboratory for their elective summer training. Additionally, two physics majors went to Los Alamos National Laboratory for temporary assigned duty following graduation.

Funding for physics research has come from department funds, Naval Academy Research Council grants, the Office of Naval Research, the Naval Research Laboratory, and the David Taylor Research Center.

Sponsored Research

Electroviscous Study

Researcher: Professor Donald W. Brill
Sponsor: David Taylor Research Center, Annapolis Laboratory

An investigation was made of the electroviscous absorber designed and currently being tested by the David Taylor Research Center engineer, Ron Reitz. An effort was made to model the energy absorption mechanism which accounts for the observed loss. This was done by attempting to model the absorber as an analog circuit with lumped circuit parameters.

Computer Modeling of Laser Systems

Researcher: Professor Gerald P. Calame
Sponsor: Naval Research Laboratory, Code 6540

A program, DERAMAAN2, has been written to numerically integrate two coupled differential equations of phonon excitation, just Stokes scattering, and Pump depletion. The program has been used to model the Naval Research Laboratory experiments on Raman Scattering trains of short pulses, with fair agreement. The program is now being used to explore the problem of generating a Stokes seed pulse, and is being extended in order to study the build-up of the second stokes line.

Ion-Beam Mixing of Molybdenum in Aluminum

Researcher: Associate Professor Francis D. Correll
Sponsor: Naval Research Laboratory, Code 4671

This work was part of a continuing search for practical ways to improve the corrosion resistance of aluminum metal. In ion-beam mixing (IBM), an energetic beam of ions is used to mix intimately together several elements in the near-surface region of a material. The potential of IBM for producing tough, thick, corrosion-resistant surface alloys of Mo and Al on Al metal was evaluated in this project.

The general approach was to make several different types of layered Mo/Al samples, mix them with Xe ions, and use Rutherford Backscattering Spectroscopy to detect changes of the Mo/Al interfaces. Two kinds of samples were used: one with a vacuum-deposited layer of Mo produced by ion bulk Al, and the other with a sub-surface layer of Mo produced by ion implanation into bulk Al. Mixing was done at room temperature with Xe ions of two different energies and doses from 1×10^{15} to 4×10^{17} ions/cm^2.

Mixing with 1.8-MeV Xe produced a nearly uniform damage profile at the Mo/Al interface, and caused mixing in both kinds of samples (but with different results for the different kinds). Mixing the evaporated samples produced a smoothly-graded interface that was well fit by an error function (diffusion-like) concentration profile. The amount of mixing was found to increase almost linearly with the dose of mixing ions after a threshold dose of about 1×10^{16} ions/cm^2. By contrast, mixing the implanted samples produced several distinct Mo/Al phases rather than diffusion of Mo into Al. In this case, it is more difficult to quantify the dependence of mixing efficiency on dose.

Mixing with 250-keV Xe produced a much steeper damage gradient at the Mo/Al interface, but the mixing was qualitatively similar to that obtained with the higher-energy ions.

A Propagator Study of Resonance Phenomena

Researcher: Assistant Professor John P. Ertel,
Sponsor: David Taylor Research Center, Annapolis Laboratory, Code 2704.1

The current studies involve the development of the Propagator Solution to several acoustics problems of interest to the Navy and the numerical evaluation of certain significant measurable parameters. Of the parameters evaluated, the "partial radiation efficiency" has proved most interesting, in that it predicts that damping does not always reduce radiated power. In fact, it has been shown that the radiated power may well be significantly enhanced at certain frequencies when damping is arbitrarily applied.

Scattering of Sound Pulses from an Elastic Body

Researchers: Assistant Professor John P. Ertel and
Professor Donald W. Brill
Sponsor: Naval Surface Weapons Center,
White Oak Laboratory (R-43)

In the current studies, an elastic body ensonified by acoustic pulses of arbitrary shape and finite duration scatters the incoming acoustical energy. A convolution of the Fourier integral representation of the incident pulse and the resonance (Resonance Scattering Theory, RST) representation of the scattered pressure field is analyzed in both the frequency and the time domains and compared to the available experimental data to yield signatures which are characteristic of the scattering structure.

Analysis of Layered Structures by Rutherford Backscattering

Researcher: Assistant Professor James R. Huddle
Sponsor: Naval Research Laboratory, Code 4670

High resolution Rutherford Backscattering Spectrometry (RBS) has been used to measure the thickness of individual layers in multilayer structures. Two MeV He^{2+}ions were directed into a multilayer target. Ions scattered at 135° to the beam were energy analyzed with a 2-meter double focussing magnetic spectrometer which afforded resolution better than 5 keV at ion energies of about 2 MeV. The resulting spectrum was analyzed with the Rutherford Backscattering Spectrometry analysis program RUMP. The resolution was high enough to determine the real density of individual layers of thickness in the multilayer target. At present, the main limitation to precision derives from accelerator terminal voltage fluctuations and inaccurate stopping power data.

Modification of Surface Mechanical Properties by Ion Implantation

Researcher: Assistant Professor James R. Huddle
Sponsor: Naval Research Laboratory, Code 4670

The objective of this work is to investigate surface chemical and tribomechanical properties of ceramics modified by ion implanation using advanced surface analytical techniques (RBSS, XPS, Auger, and/or SIMS analysis) in order to gain an understanding of the mechanisms by which the strength, hardness, corrosion resistance, and tribomechanical properties of ceramics can be improved.

Nonlinear Sound Scattering of Crossed Focussed Beams in the Presence of Turbulence

Researchers: Associate Professor Murray S. Korman and
Ensign Steven C. Rife, USN
Sponsor: Naval Academy Research Council (ONR)

Experiments are performed involving the interaction of mutually perpendicular crossed, continuous wave, ultrasonic beams overlapping (at a common focal point) and interacting in the presence of turbulence in water. A profile of radiated sum frequency pressure is measured by scanning across a width of turbulence produced by a submerged circular water jet ($Re = 8.5x10^5$). In scanning, the receiver transducer unit (located outside the interaction region) moves fixed relative to the senders. The two primary focussed beams (of frequencies $f_1 = 2.05MHz$ and $f_2 = 1.9MHz$, respectively) are generated by individual spherically concave transducer elements with 15.2 cm focal lengths. The receiving unit is a circular plane array. All transducer surface scattered sum frequency components (of frequency $f_+ = 4.0$ MHz) are detected outside the interaction region. In the absence of turbulence, no sum frequency can be detected. Pressure scans of the radiated sum frequency component compare well with known values of the radial turbulent velocity profile.

Photorefractive Effects on BSKNN and SBN

Researcher: Assistant Professor Steven R. Montgomery
Sponsor: Naval Academy Research Council (ONR)

The object of the research is to examine the photorefractive effects in solids, mainly strontium barium niobate (SBN) and barium strontium potassium sodium niobate (BSKNN). The investigations so far have centered on extending the photofractive activity of these criptals into the infrared with the appropriate dopont (cerium) and, more recently, explaining the appearance of regular ringlike structures in the photorefractive scattered light that emerges from these crystals for certain polarizations and incident angles.

This project is being carried out in B-10 Michelson and in cooperation with the U.S. Army's Night Vision Laboratory in Fort Belvoir, Virginia, where the crystals were obtained.

Study of III-V Semiconductor Properties

Researcher: Professor Robert N. Shelby
Sponsor: Naval Research Laboratory, Code 6870

This is a continuing project that studies all aspects of electronic defect states in III-V semiconductors. The research group uses primarly C-V, I-V, and Deep Level Transient Spectroscopic Techniques to determine the nature, location, and concentration of electronic defects in GaAs, AlGaAs, and other III-V semiconductors of importance to the Navy. Current investigation includes work on high electron mobility FET's and ion-implanted GaAs.

Transient Raman Studies

Researcher: Professor Lawrence L. Tankersley
Sponsor: Naval Research Laboratory, Code 6540

The current study of transient Raman amplification is being continued and extended. Planned work includes: (1) Amplification of phase modulated pulse trains; (2) Phase front preservation; (3) Statistical fluctuations and the threshold for amplifier locking; (4) Higher order Stokes; (5) Beam combing; (6) Numerical modelling of phase pulling; (7) UV Faraday isolators; and (8) Unstable resonator physics.

NMR of $Al_xGa_{1-x}As$

Researcher: Professor Donald J. Treacy
Sponsor: Naval Research Laboratory, Code 6870

The purpose of this program of research is to determine how closely the lattices of GaAs and AlAs match mechanically. The reason for this set of experiments is the Navy's desire to determine how well the mixed semiconductor $Al_xGa_{1-x}As$ will function.

Many devices are being fabricated from the mixed semiconductor $Al_xGa_{1-x}As$. These devices are fabricated using the films of $Al_xGa_{1-x}As$, because it is difficult to make high quality $Al_xGa_{1-x}As$ in bulk form, and microelectronics offer space and weight advantages. Since this is an alloy, there is a question as to how well the lattice can incorporate the different bond lengths required by the separate species. Nuclear Magnetic Resonance (NMR) is a very sensitive probe of the strain in the lattice in a mixed system.

In the III-V compounds, all the elements have quadruple moments (with the exception of P) which can be used to document the strain in their lattices via Nuclear Magnetic Resonance. The satellite lines found with nuclei which have quadruple moments are split from the central Nuclear Magnetic Resonance transition, and their splitting can be used to determine the strain in the lattice by relating it to the electric field gradient at the site of a particular nucleus.

This system presents unique problems both in obtaining samples and in obtaining sufficient quantities to measure. Samples for two values of x have been measured (x = 0.3 and 0.7). The results are being evaluated and prepared for publication.

Further work is planned on a sample having an x of 0.5. Additional work is being planned on samples prepared using different growth technique.

Independent Research

Interstellar Gas in the Galactic Halo

Researcher: Associate Professor C. Elise Albert

The aim of this program, which is being carried out in collaboration with Dr. D. C. Morton, Director, Herborg Institute of Astrophysics, and Dr. J. C. Blades, Space Telescope Science Institute, is to conduct a high resolution spectroscope study of interstellar gas in the galactic halo by observing the absorption lines of CaII, TiII, and NaI superimposed in the spectra of high latitude stars. Spectra of more than 60 stars have now been obtained at CaII, and 40 have been observed at TiII in three observing runs with the 3.6 meter Canada-France-Hawaii Telescope. Complementary spectra of neutral hydrogen emission were obtained with the 140-foot telescope of the National Radio Astronomy Observatory in Green Bank, West Virginia. Preliminary results indicate that material above the galactic plane increases significantly in both amounts and absorption velocity range out to but not beyond a distance of 500-1000 parsecs.

Radiation from Underwater Cavity Resonator, Using Towed Catamaran Platform

Researchers: Professor Samuel A. Elder,
Visiting Professor Shigeru Yoshikawa, and
Lieutenant Commander L. Gene Baker, USN (Oceanography)

Earlier investigations in the United States Naval Academy High Speed Tow Tank, using a 4.5 foot towed model, have shown that large amplitude resonant oscillations can be produced by flow over a wall gravity immersed in water. For this case, it is found that critical speed is predictable from a Strouhal number formula derived for resonant cavity oscillations in air. Currently, the researchers are attempting to measure radiation from an underwater resonating cavity, using the same towed model. Since "wave guide" cutoff of the tow tank is above the oscillation frequency, it has been necessary to perform the measurements in the Chesapeake Bay. A YP-class vessel, equipped for oceanographic research, is used for towing and for recording data. Early tests indicate that modes are occurring at the expected speeds. Meanwhile, by means of a modal analysis investigation of the model, it has been possible to correlate the principal acoustical mode with breathing-mode vibrations of the cavity walls. A paper reporting current results was given in Syracuse, New York, on 24 May 1989, before the Acoustical Society of America.

Magnetospheric Physics

Researcher: Associate Professor Irene M. Engle

The researcher pursued several projects intermittently, as other activities allowed. Those projects are as follows:

(1) Adapting a set of orthogonal functions for three-dimensional representation of magnetospheres for earth and other planets with intrinsic planetary magnetic fields;

(2) Formulating a theory to explain satisfactorily the existence of a "sudden" physically-extensive cometary ion tail in Kohoutek, as imaged by the Naval Research Laboratory UV camera;

(3) Representing a semi-inflated state of the Jovian magnetosphere which is consistent with the Voyager flyby observations; and

(4) A new look at the Mercury magnetospheric field, in response to a recently published review on Mercury which contains some conclusions which are not supported by this investigator's experience.

The Phenomenological Fitting Processor

Researcher: Assistant Professor John P. Ertel

Development in this area has proceeded steadily for several years awaiting the state-of-the-art to catch up and provide an adequate and acceptably priced computational and display environment. A real-time interactive process has been developed for use in fitting multi-variate functions to experimental observations. The "fit" is generated real-time on any computer linked to any graphics display device, either in color or on multiple (two or more) memory planes. First, the graph frame (coordinate axes, tick marks, and axis labeling) is drawn, followed by the data and appropriate error bars. These are frozen in one color or memory plane. Next, the proposed algorithm or model is evaluated over the range of the data to produce a curve in another color or memory plane, which may be dynamically varied according to the current values of the fit parameters. These two plots, one fixed and one changing, are superimposed on the user's display. Using joysticks or other input devices, the application user then "flys" the resulting curve to match the data giving "the most optically pleasing" fit while monitoring the reduced-χ^2.

A Study of Robust Numerical Integration

Researchers: Assistant Professors John P. Ertel and
Patricia E. Burt (Electrical Engineering)

A suite of techniques has been developed providing for the "intelligent integration" of a function which is immune to most of the pathologies limiting the resolution of typical numerical methods. By avoiding the pitfalls of "blind integration," which is insensitive to the slope and therefore nonadaptive to the curvature of the problem at hand, and the intrinsic inefficiencies of "fixed Riemann cell width," these procedures form a shell under which any of the standard methods for approximating area, Trapezoidal Rule, Simpson's Rule, Gaussian Quadrature, etc., may be more reliably used. While not intrinsically fast, this process nevertheless provides for a potential improvement in the speed with which a numerical integral may be obtained and yields consistently robust results.

A Search for a Robust Automated Digitizing Processor

Researcher: Assistant Professor John P. Ertel

Current state-of-the-art digitizing tablets fall into two basic categories, depending whether they sense position ultrasonically or through inductive coupling. The final intrinsic resolution of these devices, after interpolation, typically varies from about 0.05 to about 0.005 of an inch, depending on the model and price range. While any of these devices can be a tremendous aid in obtaining numerical information from a 2-D (two-dimensional) source, they all suffer from three distinct problems which are not likely either to be cured or alleviated by any redesign These problems are: (1) difficulty in alignment of the 2-D article to be digitized to the "natural axes" of the tablet; (2) possible, if not probable, astigmatic distortions of the source article due to photographic or xerographic reproduction; and (3) possible non-orthogonality of the coordinate axes of the source article.

A two-step method has been developed addressing these problems through software processing of the output of the digitizer in which fiduciary marks, chosen by the operator, are digitized. This information is sufficient to calculate up to quadratic tensor corrections to adjust for astigmatism and lack of internal orthogonality. Additionally, a coordinate rotation is effected, yielding proper x-y data pairs for the digitized object. A third step is added to scale the output within the x and y ranges specified by the operator.

The software for the above transformations has been written in PASCAL, FORTRAN, and BASIC, and may be easily translated to any other high level language. Pseudo-macro versions of this software have recently been developed to allow a similar translation into the typical assembler. Handlers for several digitizer/micro-computer configurations have also been developed.

Computer-Automated Data and Analysis System for the new Tandem Accelerator Laboratory

Researchers: Assistant Professor James R. Huddle and
Associate Professor Francis D. Correll

The United States Naval Academy Physics Department has purchased a new Tandem Electrostatic Accelerator as part of an upgrade of the present accelerator laboratory. The new lab will support four Physics courses (SP301, SP324, SP425 and SP434), training about 250 midshipmen per year in modern, atomic, and nuclear physics. In addition, the lab will support midshipman and faculty research projects in materials science, atomic, nuclear, and solid-state physics.

The need for a computer-automated data acquisition and analysis system has arisen in order to perform sophisticated experiments in multi-parameter atomic and nuclear physics. The researchers have evaluated a number of such systems, and have prepared description, specification, justification, and requisition documents for the "sole manufacturer" purchase of a microVax CAMAC-based data acquisition and analysis system, which will meet department requirements. This purchase involves eight different vendors and will total over $120K. Delivery of the system is expected in August 1989.

New Laboratory Experiments for SP324-425

Researcher: Assistant Professor James R. Huddle

A package of spectroscopy experiments for the Physics of the Atom sequence of courses for physics majors (SP324-425) is under development. The package will include experiments performed in the visible portion of the electromagnetic spectrum, using a variety of spectrometers ranging from a rudimentary spectrometer assembled from "spare parts" to a research quality high-resolution two-meter Czerny-Turner type instrument. Under development are experiments dealing with a variety of phenomena, including the Lande interval rule, the normal and anomalous Zeeman effects, and fine structure and hyperfine structure in hydrogen. "First revision" experiments dealing with the hydrogen hyperfine structure and the Zeeman effect have already been incorporated into the course.

Also under development is an experiment in which the Physics Department's new accelerator will be used to perform proton-induced x-ray emission analysis of various materials.

Radiated Noise Increase of a Submerged Turbulent Jet Flow Due to Bubble Entrainment

Researcher: Associate Professor Murray S. Korman

Experiments are performed in an open tank (L = 1m, W = 0.75 m, H = 0.6 m) to study the effects of entrained air bubbles on the noise radiation produced by a turbulent shear flow created by a submerged water jet (nozzle diameter D = 4 mm, located 27 cm from the bottom). Using a small hydrophone, measurements of the average frequency spectrum level between 1.9 and 20 KHz are compared for case (1) no bubble entrainment and case (2) bubble entrainment, under the same experimental conditions of the turbulence. A 2.54-cm column of bubbles (with radii between 1/4 mm and 1 1/2 mm) is generated below the cavitation threshold of the jet [$\sigma = 2(P_{amb} - P_{vap})/\rho u^2$ and $\sigma > 0.4$]. Results indicate an increase of over 10 dB in the radiated noise level measured between 6 and 10 KHz and over 20 dB between 110 and 20 KHz for studies where $0.42 < \sigma < 1.47$. It is hypothesized that bubble breakup may be one cause of this increase.

Study of Magnetic Suspension System for Water Tunnels

Researcher: Associate Professor Bruce H. Morgan

Dr. David Coder, David Taylor Research Center, Carderock, suggested the topic of this study. Most the the work to date has been library research, and some correspondence. The work on this project has been almost entirely in abeyance during the academic year; however, the researcher became focussed on the problem of magnetic shielding for building habitability before classes started, and expects to continue on that subtopic during the intersession.

Variational Principles with Two Internal Parameters

Researcher: Major Billy R. Smith, Jr., USAF

The researcher is investigating a maximum proper-time formulation of the equations of motion of an isolated particle in four-dimensional space-time while assuming that the particle has two internal parameters: proper time and another parameter related to electric charge. If one assumes that electric charge is the partial derivative of that second internal parameter with respect to coordinate time, then perhaps the geodesic equation of the two-surface scanned by the internal parameters will reduce to the Lorentz Force Law when transformed to four-dimension space-time. If so, then a charged particle will follow a path of maximum interval under the constraint that the path lies on a given surface. The method involves theoretical analysis and mathematical derivation.

Research Course Projects

Upgrade of the United States Naval Academy Accelerator Laboratory

Researcher: Midshipman 1/C William D. Billingslea, USN
Advisers: Associate Professor Francis D. Correll and
Assistant Professor James R. Huddle

The United States Naval Academy has purchased a new Tandem Electrostatic Accelerator as part of an upgrade of the present accelerator laboratory. The new lab will support four Physics courses (SP301, SP324, SP425 and SP434), training about 250 midshipmen per year in modern, atomic, and nuclear physics. In addition, the lab will support midshipman and faculty research projects in materials science, atomic, nuclear, and solid-state physics.

The accelerator is expected to be delivered in May 1989. The investigators are presently preparing the laboratory space and facilities to receive the new instrument.

NMR of GaAs:In

Researchers: Midshipmen 1/C Frank A. Boylan, USN, and
Charles A. Messenger, USN
Adviser: Professor Donald J. Treacy

The purpose of this program of research is to determine how isovalent impurities are incorporated into the GaAs lattice. The driving force behind this particular set of experiments is the Navy's interest in GaAs and methods of improving its speed as a semiconductor.

The immediate objective of the set of experiments is to determine how isovalent impurities distort the GaAs lattice. This objective is best accomplished using Nuclear Magnetic Resonance (NMR), which is a sensitive probe of the local environment of the lattice atoms via the interaction of the quadruple moment of the host atoms and the electric field gradient caused by the impurities. Isovalent impurities were chosen because charged impurities mask the effects of lattice distortion with charge effects. The isovalent impurity In was chosen because it has a severe lattice mismatch with GaAs and would produce the largest and most easily interpreted results. The final motivation for doing the research at the United States Naval Academy is the presence of a very stable magnet which will allow the experiments to be run over a sufficient period of time to signal average and enhance the results.

This is an ongoing project and could be investigated at greater length by midshipmen of subsequent classes. The results obtained to date indicate that previous work on lightly doped samples was substantially correct, but the resolution which can be obtained with this experimental setup is better than that of previous experiments and should lead to useful conclusions with more heavily doped material.

Acoustics of the Trombone

Researcher: Midshipman 1/C Paul W. Cook, USN
Adviser: Professor Samuel. A. Elder

The purpose of this project is to investigate the acoustics of a musical instrument, in this case a trombone. The particular aspect under investigation is the driving mechanism at the embouchure. A new technique, devised by Dr. Shigeru Yoshikawa (research scientist in residence at the United States Naval Academy during the fall of 1988), employs a strain gauge mounted in the mouth of the musician to measure lip movement, and the correlation of this with the sound pressure measured in the mouth end of the instrument. Currently, a bridge-amplifier has been fabricated, and tests are being made to test the response of the strain gauge under artifical excitation.

Cosmic Strings

Researcher: Midshipman 2/C Eyo E. Ita, USN
Adviser: Assistant Professor Deborah A. Konkowski (Mathematics)

This project is a study of cosmic strings and their application to cosmology.

Optimization of a Total Integrated Scatter Scatterometer

Researcher: Midshipman 1/C Todd A. Kiefer, USN
Adviser: Associate Professor Francis D. Correll

The purpose of this project was to test and improve the design of a total integrated scatter (TIS) instrument (an optical device used to measure the surface roughness of reflecting materials) which was constructed last year as part of the Trident research project of Midshipman Charles D. Ferguson, II.

As originally built, the Total Integrated Scatter instrument was difficult to align, and seemed incapable of measuring mean roughness less than about 2nm (even for samples which were believed to be much smoother). In addition, the effect on measured roughness of possible differences in sensitivity of its two light sensors and variations in its laser output were not sufficiently well understood. Finally, the instrument was physically large, a disadvantage for some applications.

In this work, the sensitivities of the two light sensors were measured as functions of incident light intensity, angle, and positions. They were found to be equal within 2%, contributing only about 4% to the uncertainty in measured roughness under typical operating conditions. In addition, while the laser output power was found to vary by 5% even after a long warm-up period, it was shown that the measured roughness was essentially insensitive to such variations because of the timing and sequence of intensity measurements. More significantly, the sample stage and several mirrors were redesigned to position better the sample and one detector and to reduce scattered light. The results were a much simplified alignment procedure and a demonstrated ability to measure roughness as low as 0.6 nm.

As a result of this work, the Total Integrated Scatter instrument is more sensitive, easier to align and use, and generally better understood than before. In addition, its present design is better suited to planned miniaturization, which may make it more versatile.

Holographic Interferometry

Researcher: Midshipman 1/C Paul M. Parashak III, USN
Adviser: Assistant Professor Steven R. Montgomery

The objective in this project is to use holographic techniques to measure very small displacements. By multiply exposing the hologram of an object that is changing its shape, the displacements of the object's surfaces can be measured by counting the interference fringes produced on the hologram. This technique is appropriate to measure the growth of a plant over a short time or to find the modal surfaces on a vibrating object such as a musical instruument.

The researcher began by making ordinary transmission holograms and moved on to holographic interferometry thereafter.

Electric Modulus Studies of Ion-Conducting Polymers

Researcher: Midshipman 1/C John J. Wilson, USN
Advisers: Professor John J. Fontanella and
Associate Professor Mary C. Wintersgill

Two methods of data analysis have been developed and applied to ion-conducting polymers. First, the data have been transformed to the reciprocal of the complex dielectric constant, which is called the electric modulus. Peaks in a plot of the imaginary part of the electric modulus vs. applied frequency for all of the materials studied have been found. The second phase of the work has been to fit various types of theoretical expressions to the data, including those based on Cole-Davidson, Havriliak-Negami, and stretched exponential (Williams-Watts) distribution functions. The stretched exponential expression has been found to be most useful, and trends in the fitting parameters with the various types of ion have been identified.

Publications

CORRELL, Francis. D., Associate Professor, co-author, "Study of the Reaction H(polarized d, 2p)n at 16 MeV around Collinear Configurations," *Nuclear Physics*, **A475** (1987), 407-421.

The cross section and the analyzing powers A_y, A_{xx}, A, and A for the reaction H(d,2p)n are studied by kinematically overdetermined measurements at an incident energy of 16 MeV at collinear and somewhat off-collinear kinematic conditions. A three-body Faddeev model using two realistic separable potentials that have different short-range parts gives a good fit to the data. Uncertainties in Coulomb corrections make it difficult to draw definitive conclusions about possible three-nucleon force effects at collinearity conditions.

ELDER, Samuel A., Professor, co-author, *Fluid Physics for Oceanographics and Physicists*. Oxford: Pergamon Press, 1989.

This book is designed as a textbook for a course such as SP328, Fluid Physics, which is taught as a service course for the Oceanography Department. It consists of a clear and consise introduction to the physics of low speed flow mechanics, emphasizing fundamental concepts and methods. Particularly suited to a one semester course, the book provides a sound foundation in continuum mechanics. The choice and treatment of topics covered provide a fresh approach aimed at ensuring that the abstruse aspects of the subject are more physically comprehensible and teachable. Mathematical difficulty gradually progresses over the course of the book, requiring at the outset only a knowledge of elementary differential equations, with optional advanced treatments provided where appropriate. Illustrations and worked examples are provided to clarify each new concept; carefully chosen exercises are included at the end of each chapter to test the student's understanding of the material, and to assist in developing problem-solving skills. SI units are used throughout.

ELDER, Samuel A., Professor, "Special Project: MODAL ANALYSIS," *USNA Report SE-8A-88*, August 1988.

This booklet is designed as a handout for the Modal Analysis experiment in the Acoustics Laboratory. The Modal Analysis system used in the Acoustics Laboratory is based on the B&K Model 2032 Analyzer. An IBM PS/2 Model 50 computer runs SMS Star System software, using the B&K as a front end for analog inputs. An instrumented force transducer is used to apply a measured impact to the object under study, with a single-axis accelerometer mounted at the driving point DOF. The brief but comprehensive booklet enables the student quickly to get into making measurements with the system. The aim is to shorten the "learning curve" for students desiring to perform a useful experiment on a rather complex apparatus in one or two lab encounters. The booklet gives a quick overview of the system of 69 keys involved in operating the B&K analyzer, together with simplified instructions for the IBM computer, and then leads the student step-by-step through the maze of operating procedures in order to accomplish a particular measurement.

ELDER, Samuel A., Professor, "Tutorial to Accompany MODAL ANALYSIS Report," *USNA-ERC Video Tape Tutorial #142161SOCC890380*, January 1989.

This 30-minute video instructional tape, or "turbo-manual," is designed to accompany the tutorial booklet. It shows the student what it looks like when the experiment is done right. Segmented into modules of 3 to 5 minutes length according to subtopic, the tape can be viewed as a whole, for general orientation, or used to give particular instruction about specific problem areas during the running of the experiment. The combination of the tape and hardcopy booklet make it possible for students to perform the experiment with minimum direct assistance from the instructor, an important factor for labs assigned for out-of-class projects.

ELDER, Samuel A., Professor, "Special Project: RAYPLOT Program," *USNA IDAC Report SE-8B-88*, August 1988.

This program is designed to be used as a homework assignment or out-of-class project. The Handout is self-explanatory. In its present form it is written to be used on Apple IIe or Apple IIGS computers, available in the Physics Lab area of Michelson Hall. However, it could be easily adapted to be used on Zenith computers.

Based on simultaneous numerical integration of the equations:

$$dx/dt = c \cos \theta$$
$$dy/dt = c \sin \theta$$
$$dq/dt = g \cos \theta$$

where x and y are the coordinates of the sonar beam wave front, θ is the angle the beam makes with the horizontal, and g is the vertical velocity gradient, the path of the beam is continuously determined by dead reckoning. A fourth-order Runge- Kutta procedure is used for enhanced accuracy and speed.

When used with the Grappler interface, a screen dump of the plotted curves may be obtained simply by issuing the correct printer command. However, when used with a serial interface (in conjunction with the Imagewriter printer, for example) a machine language subroutine is necessary. This was supplied by Professor Nordling and occupies lines 900-960 in the Image- writer version. The machine language program itself must be stored in memory above HIMEM (line 6).

In addition to the program listing, the writeup gives typical printouts of several calculated rayplots. The entire experiment is designed to be carried out in a time of one normal lab period or less.

ERTEL, John P., Assistant Professor, "The Phenomenological Fitting Procedure and the Fast Microcomputer," *Advances in Computer Science*, **II** (1988), 538-539.

Techniques are described which allow the user to "fly" a model dependent curve into the "best fit" for the available data. While originally developed for small microcomputers to enable them to produce real-time animation with a smooth (non-jerky) display for video games, these methods are easily adapted to the requirements of this real time "fitting" procedure. This procedure does not necessarily replace the more standard Linear Least Squares and Non-Linear Regression fitting methods. Rather, it provides a user friendly way to obtain "good seeds" for possible later regression analysis of available data. While this "fit" has no obvious statistical merit, "fits" that look good are almost always statistically better than those that don't look as good. Use of this method gives the user a feeling for the sensitivity of the model to changes in a particular parameter and for the possible "interaction" of two or moreof the model parameters. Also, at a very low computational cost, users can obtain "good seeds" which lie within physically meaning-ful limits for a regression to the available data. The user can look for and therefore avoid possible "traps" (parameter values which are not physically meaningful but may yield pathologically lower values of χ^2_{red}).

ERTEL, John P., Assistant Professor, "An Automated Digitizing Processor," *Proceedings* of the Nineteenth Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, Pennsylvania, **19** (1987), 2083.

A digitizing processor is introduced which allows (1) automated alignment and calibration of any digitizing tablet; (2) "repair" of graphical reproductions with either linear or quadratic astigmatic distortions; and (3) "repair" of graphical reproductions with non-orthogonal axes.

Current state-of-the-art digitizing tablets fall into two basic categories, depending whether they measure/sense position ultrasonically or through inductive coupling. The ultimate intrinsic resolution of these devices, after interpolation, typically varies from about 0.05 to about 0.005 of an inch, depending on the model and price range. While any of these devices can be a tremendous aid in obtaining numerical information from a 2-D (two-dimensional) source, they all suffer from three distinct problems which are not likely to be either cured or alleviated by any redesign. These problems are: (1) difficulty in alignment of the 2-D graphic to be digitized to the "natural axes" of the tablet; (2) possible, if not probable, astigmatic distortions of the source article due to photographic or xerographic reproduction; and (3) possible nonorthogonality of the coordinate axes of the source article.

FONTANELLA, John J., Professor, and Mary C. WINTERSGILL, Associate Professor, "TSDC and DR Studies on PEO Complexed with Inorganic Salts," *Solid State Ionics*, **28-30** (1988), 1023-1028.

TSDC studies have been carried out on PEO complexed with inorganic salts. The results clarify the structure of the DR spectra observed previously for these materials. In the case of the Y relaxation region, which is associated with the amorphous phase, several new relaxations are observed in PEO complexed with the various salts. Changes in the strength of these peaks give rise to the differences observed previously in the DR spectra for these materials, not only between different salts but between different concentrations of the same salt. The results show that in the amorphous phase below the glass transition, at least, the ions occupy very well defined positions vis a vis the polymer chains. Models for the relaxation are discussed along with the influence of the ions.

HUDDLE, James R., Assistant Professor, "Multilayer Analysis by High Resolution RBS," *Nuclear Instruments and Methods in Physics Research*, **B40**, **41** (1989), 773-775.

High resolution Rutherford Backscattering Spectrometry (RBS) has been used to measure the thickness of individual layers in multilayer structures. Two MeV He2+ ions were directed onto a multilayer target. Ions scattered at 135° to the beam were energy analyzed with a 2-meter double focussing magnetic spectrometer which afforded resolution better than 5 Ke V at ion energies of about 2 MeV. The resulting spectrum was analyzed with the RBS analysis program RUMP. The resolution was high enough to determine the real density of individual layers of thickness ~20 Å in the multilayer target. At present, the main limitation to precision is due to accelerator terminal voltage fluctuations and inaccurate stopping power data.

KORMAN, Murray S., Associate Professor, coauthor, "Nonlinear Scattering of Crossed Ultrasonic Beams in the Presence of Turbulence in Water, II: Theory," *Journal of the Acoustical Society of America*, **85** (February 1989), 611-620.

A theoretical investigation is reported on the scattered (and radiated) sum frequency signals, generated nonlinearly from two finite-amplitude, mutually perpendicular ultrasonic beams intersecting (and interacting) in the presence of turbulence. This article forms a complement to experimental study of such interactions, previously published and referred to as Part I [M. S. Korman and R. T. Beyer, *Journal of the Acoustical Society of America*, 84 (1989), 339-349]. An investigation of the scattering to lowest order is from the cubic quadrupole source term in the Lighthill wave question (the Reynolds stress tensor $\rho u_i u_j$). This theory, combined with results by Kraichnan [*Journal of the Acoustical Society of America*, 25 (1953), 1096-1104] and Ishimaru [*Wave Propagation and Scattering in Random Medium* (Academic: New York, 1978), Vol. 2, Chap. 16], explains much of the experimental scattering phenomenon discussed in Part I.

MONTGOMERY, Steven R., Assistant Professor, co-author, "Self-Pumped Phase Conjugation on the Red in Photorefractive BaSrKNaNb5O15 and SrBaNb2O6 with Cerrum on 9-fold Coordinated Sites," *Journal of the Optical Society of America B* (August 1980), 1775-1782.

This paper reports observations on self-pumped phase conjugation on two crystals. The objective was to see if the self-pumping in the red could be enhanced by doping the crystals with cerrum. As there are no phase conjugating solids on the infrared at present, this project showed a method for enhancing photorefraction on the infrared for known photorefractive materials.

WINTERSGILL, Mary C., Associate Professor, and John J. FONTANELLA, Professor, "DSC, Electrical Conductivity, and NMR Studies of Salt Precipitation Effects in PPO Complexes," *British Polymer Journal*, **20** (1988), 195-198.

Differential scanning calorimetry (d.s.c.) and electrical conductivity measurements of poly(propylene oxide), PPO, complexed with the salts NaI and KSCN are reported. In addition, 23Na N.M.R. measurements on PPO-NaI(x=8), both at ambient and elevated pressure (2 k bar), have been performed. The d.s.c. data clearly indicate that the salt precipitates out of the complexes at about 85ºC for NaI and 60ºC for KSCN. These effects are manifested by a dramatic departure of the conductivity from Vogel-Tammann-Fulcher (VTF) behavior, and a relatively sharp drop in mobile Na+ concentration, as deduced from n.m.r. measurements, above about 80ºC. High pressure n.m.r. linewidth measurements are consistent with a pressure-induced increase in glass transition temperature.

WINTERSGILL, Mary C., Associate Professor, John J. FONTANELLA, Professor, and David A. BEAM, Lieutenant, USN, "Amorphous Phase Separation, Salt Precipitation, and High Pressure Electrical Effects in PPO Containing NaI," *Electro-Ceramics and Solid State Ionics*, eds. H. L. Tuller and D. M. Smith, The Electrochemical Society Proceedings, **88-3**, Pennington, New Jersey, pp.211-218.

Audio frequency dielectric constant and electrical conductivity, 23Na NMR, and differential scanning calorimetry studies have been carried out on poly (propylene oxide) (PAREL elastomer) containing various concentrations of NaI. Both the NMR and the electrical conductivity measurements were performed at high pressures. The low temperature DSC results show the existence of two amorphous phases, one very dilute and one with a concentration of approximately 8 monomer units per sodium. All techniques applied indicate that the more concentrated phase is the ion-conducting phase. At high temperatures, however, the conductivity decreases as temperature increases. The decrease coincides with anendotherm in the DSC studies, which is associated with salt precipitation. Further, the DSC studies show that the salt precipitation temperature decreases as the concentration increases. An explanation for the salt precipitation phenomenon is suggested in that it is found that the dielectric constant of the host polymer decreases as temperature increases. The NMR measurements reveal the presence of both bound and mobile sodium species, where the bound phase probably corresponds to small salt clusters. All high pressure results suggest an increase in the glass transition temperature with applied pressure.

WINTERSGILL, Mary C., Associate Professor, and John J. FONTANELLA, Professor, "NMR, DSC, Electrical Conductivity Studies of MEEP Complexed with Sodium Triflate," *Solid State Ionics*, **28-30** (1988), 1042-1046.

^{23}Na NMR, electrical conductivity, and DSC studies have been carried out on MEEP complexed with $NaCF_3SO_3$. All results are similar to those for other amorphous ion-conducting polymers. Specifically, the NMR spectrum associated with mobile Na+ ions exhibits motional narrowing above the glass transition temperature, and activation energies deduced from both T1 and linewidth measurements reflect localized motion of the cations. The electrical conductivity exhibits the usual non-Arrhenius behavior. However, using previous data for PDMS-EO complexes, it is shown that the VTF or WLF equations are only approximate, as the parameters depend upon the temperature range. This sheds light on several discrepancies in the literature.

WINTERSGILL, Mary C., Associate Professor, and John J. FONTANELLA, Professor, "NMR Studies of Na+-Acion Association Effects in Polymer Electrolytes," *Solid State Ionics*, **31** (1988), 241-245.

^{23}Na nuclear magnetic resonance (NMR) measurements on poly(propylene oxide) (PPO) and silozane-based polymer electrolytes containing various sodium salts at a single nominal concentration are reported. In addition, differential scanning calorimetry (DSC) and electrical conductivity studies were carried outon the PPO materials. The NMR-determined mobile Na+ concentrations and DSC results provide evidence for ionic aggregation effects which, for some samples, result in salt precipitation at elevated temperatures. ^{23}Na chemical shifts observed in solid state NMR due to mobile Na+ ions are obtainable without the use of high resolution techniques, and exhibit strong dependences on anion and temperature. These results indicate that Na+-anion interactions influence ionic transport as well as the number of available carriers.

WINTERSGILL, Mary C., Associate Professor, John J. FONTANELLA, Professor, and David A. BEAM, Lieutenant, USN, "High Pressure Conductivity and NMR Investigation of Silozane-Based Polymer Electrolytes," *Molecular Crystals and Liquid Crystals*, **160** (1988), 347-357.

Variable temperature and pressure conductivity and ^{23}Na nuclear magnetic resonance (NMR) measurements of several silozane-based polymers complexed with $NaCF_3SO_3$ are reported. The conductivity exhibits V.T.F. behavior of the type commonly observed in amorphous polymer electrolytes, and activation volumes (29.9 cm3/mol at 313K for one sample) typical of these materials. The NMR linewidths associated mobile Na+ ions exhibit motional narrowing above Tg in a manner similar to other Na-polymer electrolytes. The pressure dependence of the ^{23}Na linewidth is consistent with a 10-15 K/kbar increase in Tg.

Presentations

ALBERT, C. Elise, Associate Professor, "Preliminary Results from New High Resolution Optical Observations of the Galactic Halo," Workshop on Halo Gas, Space Telescope Science Institute, Baltimore, Maryland, 23-24 February 1989.

ALBERT, C. Elise, Associate Professor, "Preliminary Results from New High Resolution Optical Observations of the Galactic Halo," I.A.U. Colloquimn #120, Structure and Dynamics of the Interstellar Medium, Granada, Spain, 17-21 April 1989.

ALBERT, C. Elise, Associate Professor, "The USNA 7 3/4" Alvan Clark Telescope," Meeting of United States Naval Academy Class of 1941, Annapolis, Maryland, 23 June 1989.

ANTHONY, John M., Assistant Professor, "Evidence for Constructive Interference between RTE and NTE for C4+ on H3 & H2," Southeastern Section of the American Physical Society, Raleigh, North Carolina, 10 November 1988.

ANTHONY, John M., Assistant Professor, "The Role of Inelastic Collisions with Target Electrons in Forming the Carbon K-Auger Spectrum for MeV Collisions of C2+ Ions with Gas Targets," Tenth International Conference on the Application of Accelerators in Research and Industry, Denton, Texas, 17 November 1988.

ELDER, Samuel A., Professor, "Labs That Need No Instructor," Southeastern Section of the American Physical Society, Raleigh, North Carolina, 12 November 1988.

ELDER, Samuel A., Professor, Shigeru YOSHIKAWA, Visiting Professor, and Lieutenant Commander L. Gene BAKER, USN (Oceanography), "At Sea Measurements of Underwater Cavity Resonance Using a Towed Catamaran," Meeting of the Acoustical Society of America, Syracuse, New York, 24 May 1989.

ERTEL, John P., Assistant Professor, and Patricia E. BURT, Assistant Professor (Electrical Engineering), "A Robust Integral Processor," Fourth International Conference on Systems Research, Informantics, and Cybernetics, Baden-Baden, West Germany, 15-21 August 1988.

FONTANELLA, John J., Professor, and Mary C. WINTERSGILL, Associate Professor, "Disorder in Rare Earth Doped Beta," Aluminas; X-Ray Absorption and Dielectric Measurements, 1989 March Meeting of the American Physical Society, St. Louis, Missouri, 20-24 March 1989.

FONTANELLA, John J., Professor, and Mary C. WINTERSGILL, Associate Professor, "Dielectric Loss in Berlinite," International Conference on Defects in Insulating Crystals, Parma, Italy, 29 August-2 September 1988.

HUDDLE, James R., Assistant Professor, "Analysis of Multilayered Structures by High Resolution Rutherford Backscattering Spectrometry," Tenth Conference on the Application of Accelerators in Research and Industry, Denton, Texas, 7-9 November 1988.

KORMAN, Murray S., Associate Professor, Radiated Noise Increase of a Submerged Turbulent Jet Flow Due to Bubble Entrainment," Second Joint Meeting of Acoustical Societies of American and Japan, Honolulu, Hawaii, 14-18 November 1988.

KORMAN, Murray S., Associate Professor, "Education in Acoustics I: Demonstrations of Experiments in Acoustics and Undergraduate Posters," (Lecture and Poster Session); co-chairman of session TT, 117th Meeting of the Acoustical Society of America, Syracuse, New York, 25 May 1989.

NORDLING, David A., Associate Professor, "Five Years of Using Microcomputers in Basic Physics Laboratories at the U.S. Naval Academy," Conference on Computers in Physics Instruction, Raleigh, North Carolina, 1-5 August 1988.

TANKERSLEY, Larry L., Professor, and Gerald P. CALAME, Professor, "Stimulated Raman Scattering with Pulse Trains of Alternating Signs," Optical Society of America Annual Meeting, Rochester, New York, 18-23 October 1987.

TANKERSLEY, Larry L., Professor, and Gerald P. CALAME, Professor, "Multiple Pulse Effects in Transient Raman Amplification," International Society for Optical Engineering 1988 Symposium (SPIE OS LASE 88), Los Angeles, California, 11-15 January 1988.

TANKERSLEY, Larry L., Professor, and Gerald P. CALAME, Professor, "Stimulated Raman Amplification with Pulse Trains Having Alternating Signs," Conference on Laser and Electro-Optics, Anaheim, California, 25-29 April 1988.

TANKERSLEY, Larry L., Professor, co-author, "Narrow Linewidth Unstable Resonator," Conference on Laser and Electro-Optics, Anaheim, California, 25-29 April 1988.

TANKERSLEY, Larry L., Professor, and Gerald P. CALAME, Professor, "Spatial-Mode Control of a Transient Raman Amplifier," Conference on Laser & Electro-Optics, Anaheim, California, 25-29 April 1988.

TUCHOLSKI, Edward J., Lieutenant, USN, "Three-Dimensional Surface Representations of Linear Elastic Anisotropy in Cubic Single Crystals," Third International Symposium on Nondestructive Materials Characterization, Saarbrucken, West Germany, 3-6 October 1988.

WINTERSGILL, Mary C., Associate Professor, and John J. FONTANELLA, Professor, "Electrical Relaxation in Sodium Beta" Alumina and Beta" Alumina Containing Rare Earth Ions," International Conference on Defects in Insulating Crystals, Parma, Italy, 29 August-2 September 1988.

WINTERSGILL, Mary C., Associate Professor, and John J. FONTANELLA, Professor, "Electrical Conductivity, Dielectric Relaxation, DSC, and NMR Studies in Amorphous Poly(ethylene oxide) Complexed with Alkali Metal Salts," Specialty Polymers '88, Cambridge, England, 13-15 September.

ZUREY, Edward C., Lieutenant Commander, USN, and Murray S. KORMAN, Associate Professor, "Demonstrations on the Scattering of Ultrasound by Turbulence in Water," Annual Meeting of the Acoustical Society of America, Syracuse University, Syracuse, New York, 25 May 1989.

Division of Professional Development

DEPARTMENT OF

Leadership and Law

Commander Peter A. Scala, USN
Chairman

Research by members of the Department of Leadership and Law during the 1988-1989 Academic Year focused on issues relevant to the Naval Academy and the Brigade of Midshipmen. Dr. Leanne Atwater's study of transformational leadership, student research projects which predicted plebe professional performance and discovered a correlation between psychosocial factors and midshipmen illnesses, Dr. Eric Bowman's work concerning supervisory effectiveness, and the value of exercise programs in alleviating depression all provide significant insight into improving the performance and well-being of midshipmen.

Independent Research

A Study in Transformation Leadership among Midshipmen at the United States Naval Academy

Researcher: Assistant Professor Leanne E. Atwater

This project is a study of transformational leadership among midshipmen plebe summer squad leaders. Results were similar to those found among naval officers in the fleet, i.e., a rather high degree of transforming (charismatic, inspiring) leadership existed, which was related to some indicators of effective performance.

However, transforming leadership was not related to Naval Academy selection measures used by the Admissions Board nor to performance grades given by company officers.

Also as part of this project, each midshipman leader involved in the study received individual feedback about his/her leadership performance during plebe summer. The feedback was well received and considered helpful by the midshipmen. Work to publish results of this study is in progress.

Research Course Projects

Predicting Performance in Plebe Professional Courses

Researcher: Midshipman 1/C Michael R. LeFlore, USN
Adviser: Lieutenant Blake T. Bush, USN

The aim of this project was to develop a means for predicting the performance of fourth class midshipmen in the plebe professional curriculum, based on a number of variables. The project entailed developing a computer program to run in the Pascal programming language on the Naval Academy mainframe computer. The program examines the correlation between plebe performance in professional courses and the Professional Competency Review with the following variables: company, battalion, regiment, academic major, ethnic code, and sex.

The program remains in place as a mechanism for studying the results of the performance of future plebe classes.

The Effects of Psychosocial Factors on Midshipmen Illnesses

Researcher: Midshipman 2/C Eric R. Pihl, USN
Adviser: Associate Professor Eric D. Bowman

Recent data from animal studies on stress suggest that stress can impair immunological competence, rendering the host more vulnerable to infection. Although many studies have methodological weaknesses, the bulk of evidence suggests that psychosocial variables may play a role in modulating the human immune response. This project was a correlational study examining illness, defined as the number of sick-in-room days over a three-year period, and psychosocial factors, defined from the 16 personality factors test. The personality factors of the first and last quartiles of the subject pool were compared to determine what personality characteristics tend to cause a breakdown in the immune system. Information from this study will enable predictions to be made regarding immunological resistance. The project is still in the data analysis status.

Publications

ATWATER, Leanne E., Assistant Professor, "The Relative Importance of Situational and Individual Variables in Predicting Leader Behavior: The Surprising Impact of Subordinate Trust," *Group and Organizational Studies*, **13**, 3 (1988), 290-310.

The study assessed the relative influence on leader behavior of such factors as personality traits of leaders, job characteristics, expectations of both superiors and subordinates, and trust and loyalty. Results indicated that subordinates' levels of trust and loyalty toward their leaders were most predictive of supportive leader behavior, whereas personality traits of the leader were most predictive of demanding leader behavior. The findings are discussed in terms of new avenues to pursue in attempts to understand more fully the complicated dynamics of leader behavior.

BOWMAN, Eric D., Associate Professor, co-author, "Definitely Not a Breeze: Extending an Operant Model of Effective Supervision to Teams," *Journal of Applied Psychology*, **74**, 3 (1989), 522-529.

To identify what leaders ought to do to orchestrate optimal team performance, an expanded model of effective supervision was tested in a setting combining realism, control, and clear-cut outcomes. The components of the empirically-based operant model-monitoring and consequences were extended to tasks requiring the integration of team efforts. A sailboat regatta was arranged, with series standings as the primary measure of supervisory effectiveness. Using the Operant Supervisory Team Taxonomy and Index, trained observers recorded skippers' actions. As predicted, racing success correlated significantly with monitors and consequences during the actual races. The relationship between the model's two critical behaviors and an unfiltered measure of effectiveness has implications for the group and leadership literatures as well as for management practices.

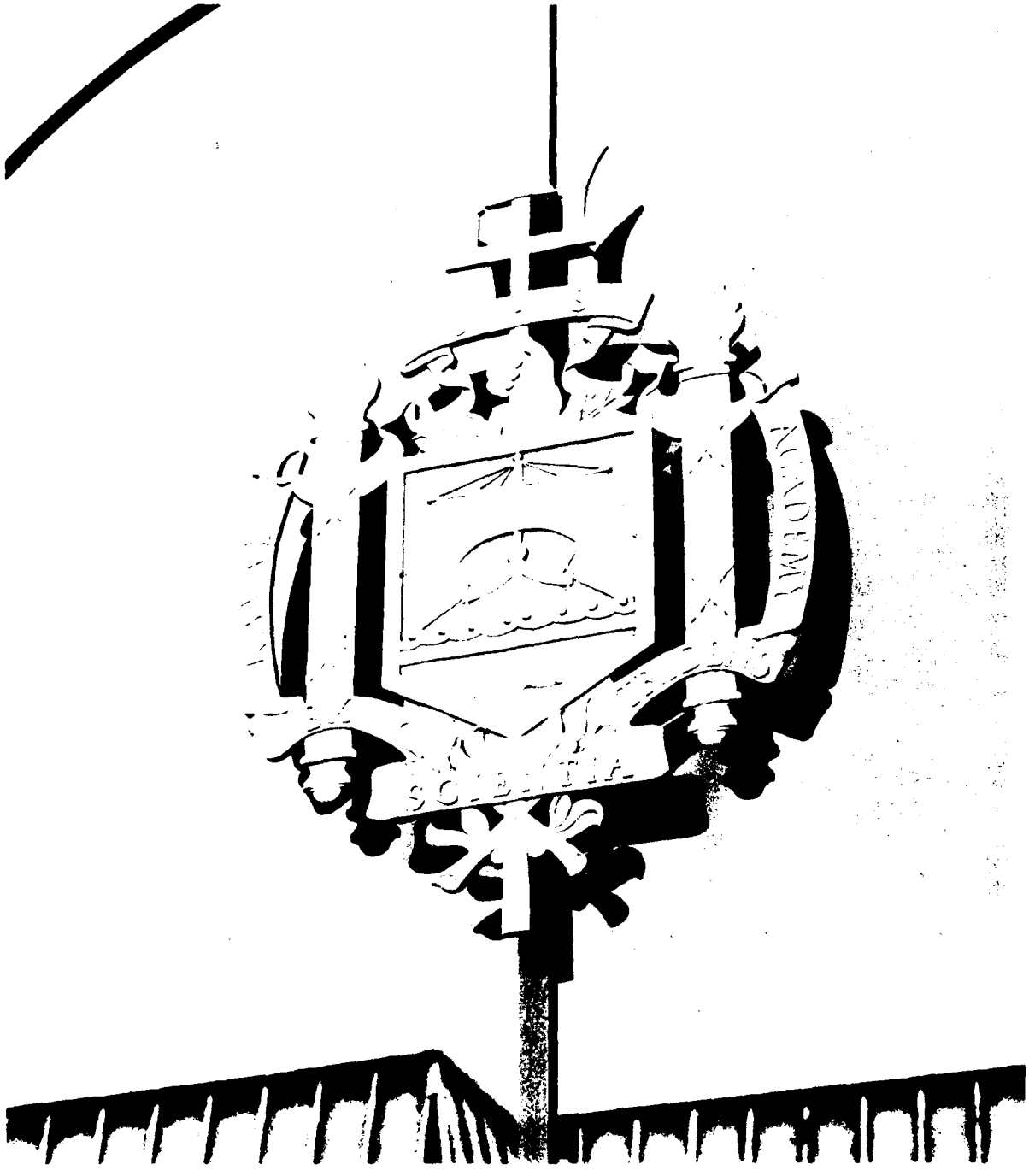
BOWMAN, Eric D., Associate Professor, co-author, "Effects of Running or Weight Lifting on Self-Concept in Clinically Depressed Women," *Journal of Consulting and Clinical Psychology*, **57**, 1 (1989), 158-161.

Forty clinically depressed women were randomized to a running, weight lifting, or delayed treatment condition. Self-concept was assessed at baseline pre-, mid-, and posttreatment for all subjects and at 1, 7, and 12 months for exercise groups. Significant improvements in self-concepts were found for the exercise groups relative to the control groups. No significant differences between exercise groups were found, and improvements were reasonably well-maintained over time. Differential changes on dimensions of self concept were not demonstrated. These results suggest that both running and weight lifting exercise programs improve self-concept for clinically depressed women.

Presentations

ATWATER, Leanne E., Assistant Professor, "What is This Thing Called Charisma?," Military Testing Association Meeting, Washington, DC, 1 December 1988.

BOWMAN, Eric D., Associate Professor, "Going for the Gold: Psychology for the Athlete," Annual Conference of the Maryland Psychological Association, College Park, Maryland, 9 June 1988.



Division of U.S. and International Studies

DEPARTMENT OF

Economics

Professor J. Eric Fredland
Chairman

Research activity in the Economics Department encompassed a broad range of topics during the past academic year, and the faculty was active in presenting results of this work in a variety of forums. All but one of the civilian faculty are represented in the report below. Three distinguished visiting professors contributed to the research efforts. Dr. Robert F. Lockman of the Center for Naval Analyses was appointed to the Manpower, Personnel and Training Research Chair, sponsored by the Deputy Chief of Naval Operations (Manpower, Personnel and Training). The Naval Supply Systems Command sponsored Acquisition, Supply and Logistics Chair was occupied by Associate Professor Jeffrey B. Miller of the University of Delaware. Both these visiting professors worked on research projects for their sponsoring agencies, as well as pursuing individual research efforts. The department was also enriched by the presence of Martin Binkin, a senior fellow in the Foreign Policy Studies Program at the Brookings Institution, who served as a Secretary of the Navy Fellow at the Naval Academy in 1988-1989. Professor Binkin published a book on reserve forces in the past year. Among the permanent faculty, Professor F. Reed Johnson's work on risk analysis, which resulted in five publications and several presentations, is particularly noteworthy. Associate Professor William R. Bowman also had a productive year. His work focused on effects of worker retraining programs, displaced workers, and unemployment insurance.

The second year of the Economics honors program resulted in one recipient of honors, Midshipman 1/C Charles W. Mills, whose senior paper is abstracted briefly below.

Sponsored Research

Modelling Naval Academy Retention and Success: Phase I

Researcher: Associate Professor William R. Bowman
Sponsor: Naval Academy Research Council (OMN)

In the first phase of the project, a complete database of both applicants and entering class plebes for the graduating classes 1987 and 1988 has been completed. Data collected for applicants include: verbal and math SAT scores, high school QPA, class rank, and recommendation scores from English and mathematics teachers, and science and engineering interest scores. In addition, personal data coded include: military background of parents, race, sex, and athletic and non-athletic activities.

For the accepted applicants from these classes, data collected include: average grade in courses grouped as engineering, mathematics and science, and humanities and social sciences in addition to the overall QPA score. Military performance and leadership and law grades are also recorded.

Both databases have been merged and prepared for statistical analyses that will be performed during the second phase of the study. The major objectives of the two-step statistical analysis will be to determine valid predictors of retention and success of midshipmen, given the choice to be selected and to accept nomination for appointment to the Academy.

Direct Foreign Investment as a Deterrent to Trade Barriers

Researcher: Assistant Professor John B. Buck
Sponsor: Naval Academy Research Council (OMN)

In recent years, the United States has seen a considerable increase in the level of direct foreign investment in the U.S., particularly by the Japanese. An obvious example is the investment in the United States by Japanese automobile manufacturers. Every major Japanese automobile producer either has built an assembly plant in the U.S. or has plans to do so in the near future.

Economic theory suggests that a typical motive for direct foreign investment is to avoid tariffs or quantity restrictions that have been imposed on imported goods by the importing country. Yet in practice, direct investment occurs between countries without such trade restrictions. Recent evidence indicates that direct investment might not be a response to any trade restrictions already in place, but instead may be an attempt to influence trade policy in the importing country. By providing benefits to the host country such as job creation and tax revenues, direct foreign investment may reduce the likelihood of trade barrier imposition. Thus, direct foreign investment may serve as a deterrent to trade barriers.

This research examined this "new" motive for direct foreign investment using the theory of games. Game theory attempts to explain the behavior of "players" or "opponents" in a situation in which strategic decision making occurs. Decisions on direct foreign investment and trade policy have many strategic elements. Analysis of their relationship using game theory may help to understand the motives for investment decisions and thus aid policy makers in their decisions aimed at achieving economic objectives.

The theoretical model suggests that it is possible for direct investment to influence trade policy. Direct foreign investment may make a host country's trade policies more liberal than they would be in the absence of the investment. Thus, a nontraditional motive for direct foreign investment may be to deter trade barriers in the host country.

The theoretical model has been developed and solved for the specific case of one home country firm and one host country firm. Current research examines whether the results of this model are influenced by increases in the number of firms in the two countries.

Implicit Contracts, Specific Human Capital, and Macroeconomic Fluctuations

Researcher: Assistant Professor Hareesh M. Dhawale
Sponsor: Naval Academy Research Council (OMN)

Fluctuations in output over the business cycle are associated with greater variability in employment and smaller variability in the real wage than predictions of a conventional model of the labor market organized on an auction basis suggest. Recent research basis suggest. Recent research has tried to explain these findings by viewing labor markets as organized on a contractual basis rather than on an auction basis, where an implicit, unwritten agreement between workers and firms determines the response of wages and employment to changes in demand conditions. In much of the contract literature, such implicit agreements are viewed as providing workers with a stable income stream in the face of unstable product demand conditions. The risk-based contract model is able to account for the greater variability in employment during either a recessionary period or during a boom, depending on the underlying assumptions that are made. It is unable, however, to explain the greater variability in employment over the whole course of a business cycle.

The purpose of this project is to synthesize two alternative approaches to the risk-based contract models--the job search model and the specific human capital model--and to investigate the ability of the resulting contract model to account for the greater observed variability in employment over the entire business cycle.

In the job search contract model, new entrants in the labor market are unable to find a job immediately and have to incur job search costs. Furthermore, firms are uncertain about product demand conditions at the time hiring decisions need to be made. Under these circumstances, firms and workers find it beneficial to enter into implicit contracts that govern the response of wages and employment levels to changes in product demand conditions which are currently unknown. Implicit contracts in the job search model provide the necessary inducement for workers to undertake a costly job search and provide firms with an adequate supply of labor.

In the specific human capital approach, workers attached to a particular firm possess skills and knowledge specific to that firm, and hence are economically more valuable to that firm than to any other. New workers hired by the firm undergo firm-specific training before becoming productive. Under these conditions, worker-firm separation imposes costs on both parties. Implicit contracts in this approach specify the response of wages and employment to changes in current and future demand conditions and are beneficial to both parties, since they ensure that worker-firm separations are optimally set.

A two-period contract model incorporating job search and specific human capital considerations was developed. The model appears to account for the greater employment variation observed over the course of the business cycle than that predicted by a conventional labor market organized on an auction basis. A paper for journal submission is being prepared.

Social Accounting Matrix Modeling

Researcher: Associate Professor Arthur Gibb, Jr.
Sponsor: Naval Academy Research Council (OMN)

Agriculture-based growth is probably the key to development in the poorest of the developing nations in the 1990's. Analysis of the available policy alternatives in such contexts has typically been hindered by the inability to isolate the agricultural regions as distinct economic units within such nations. In addition, there is a severe index number problem in attempting to evaluate rural-urban linkages using monetary values. A part of the solution to these problems is to analyze agricultural growth at the regional level using social accounting matrices (SAM's). Such matrices also are well-suited for classroom use to illustrate comprehensively the characteristics of a regional economy.

The use of regional input-output models as tools for economic research and policy analysis has increased in recent years, but the dichotomy between very expensive survey-based tables and non-survey (synthetic) tables has persisted. Hybrid, or partial survey, input-output tables appear to hold promise. Another promising area of research involves extending the emphasis of the modeling beyond the inter-industry matrix to include more detailed information on income generation, the final demand and payments sectors, inter-regional trade flows, and employment linkages.

The project involved a literature review, consultation with colleagues in international aid agencies in Washington who are using SAM's, and the development of a simplified model, suitable primarily for classroom use. The model is representative of a small African nation with a dominant export sector and a lagging rural economy. Evolved largely from data from Zambia in the 1970's, it uses a modified input-output accounting system which allows protection and income generation to be disaggregated by "region" and employment generation to be explicitly derived.

Subsequent steps in the sabbatical research to follow notably include efforts to enable a SAM to forecast the structure of the urbanization which agriculture-based growth produces.

Learning Curve Estimation in Automated Clearing House Services

Researchers: Professor Rae Jean B. Goodman
and Associate Professor Thomas A. Zak
Sponsor: Naval Academy Research Council (OMN)

Automation in the check clearing and clearinghouse operations began in 1972 at the Federal Reserve. Learning curves represent the increase in production as a result of learning, as opposed to an increase in output due to increased inputs, change in plant size, or technological change. Accumulated production knowledge is an advantage of established firms over new entrants, and the learning-by-doing phenomenon may provide an explanation for the lack of competition to the Federal Reserve in its provision of payments services.

The purpose of the research was to extend previous research, also sponsored by the Naval Academy Research Council, by (1) extending the data set to include the 1970's and incorporating improved measures of input prices; (2) reformulating the functional form of the cost function; and (3) estimating automated clearing house, check clearing, and other Federal Reserve services as joint products

Data for the period 1972-1976 were collected from the Federal Reserve's *Functional Expense Report*. The data represent direct expenses only and differ substantially from the data previously collected from the *Planning and Control System Expense Report*. The data for the automated clearinghouse function were inadequate for statistical analysis due to the slow growth in the ACH market and incorporation of the computerization at Federal Reserve Banks. Analysis of the data for check clearing indicates that (1) initially there are diseconomies of scale [the coefficient on the log of output is greater than one]; (2) economies of scale appear in the years 1973-1976; and (3) the "learning by doing" phenomenon, as evidenced by significant coefficient on the sum of output, was not statistically significant.

Military Veterans and Their Voting On Defense Issues in the 98th and 99th Congresses (1983-1986)

Researchers: Professor Roger D. Little and
Lieutenant Commander Raymond F. Turner, USN
Sponsor: Naval Academy Research Council (OMN)

As congressmen who served in World War II or the Korean Conflict leave the Congress, they are not being replaced by younger veterans. Their departure reflects the fact that young men of the World War II era stood a much greater chance of serving in the military than young men of any era since. If veteran status makes a difference in voting behavior, then fewer veterans in Congress suggests that support for pro-defense positions may diminish over the rest of the century.

Under sponsorship of the Naval Academy Research Council in 1987, the researchers compiled personal data and compared profiles of veteran and nonveteran members of the 98th Congress to determine whether veterans vote differently than nonveterans on defense and defense-related issues, and to make quantitative estimates as to whether veteran status is a statistically significant variable with respect to voting behavior on defense issues. The first objective of the present research was to add the 99th Congress to the database and to enhance the databases for both congresses by adding various measures of defense presence by state. The second objective was to perform more sophisticated multivariate statistical analysis on the whole database.

With respect to the first objective, databases now exist for the Senate and House which contain Department of Defense presence by state, and the voting records and personal characteristics, including veteran status and liberal/ conservative ratings, for two congresses.

Univariate results for the 99th Congress tended to match the findings from the 98th Congress. Substantial differences in voting behavior on defense and defense-related issues between veteran and nonveteran members again were observed.

Detailed analysis of equations which properly accomplish the second objective is ongoing. The general form of the basic equations--logistic regression for single votes and a weighted logic technique for considering all votes simultaneously--is now in place. Different specifications of the defense presence variables by state continue to be tried. No firm conclusions can yet be drawn.

Evaluation of Navy General Detail (GENDET) Programs

Researcher: Visiting Professor Robert F. Lockman
Sponsor: Chief of Naval Research (OP-01)

The purpose of this research is to analyze GENDET success dimensions, including first-term survival, conduct, advancement, and retention, in order to assist OP-01 in enlisted strength planning. To facilitate the analyses, data for 3-year obligor (YO) and 4YO GENDETS and for 3YO and 4YO direct inputs to class A schools were obtained. The first step was to compare the two GENDET groups. Among the conclusions is that while 4YO's are of higher quality as measured by mental category, 3YO's have higher survival rates. Subsequently, a statistical comparison was made between the A-school and GENDET populations to provide a broader context for 3- and 4-year obligor program evaluation and management. Research is ongoing.

Advanced Shipping Cost-Effectiveness Study

Researcher: Visiting Professor Jeffrey B. Miller
Sponsor: Naval Supply Systems Command

This report analyzes the cost effectiveness of the Advanced Shipping Project. Advanced Shipping was implemented to improve the accountability for repairable items that are shipped between hubs and repair facilities. The items are first sent to hubs where they are identified. They are then sent to Naval Supply Centers (NSC) where they are stored until repair facilities are prepared to repair them.

This study was done while a prototype was being implemented between NSC, San Diego, and NSC, Jacksonville. The focus of the analysis was the impact that Advanced Shipping, once implemented, will have on continuing OMN funding. It was concluded that Advanced Shipping on the scale of the prototype would require increased OMN funding. There are, however, important economies-of-scale in implementing Advanced Shipping system-wide. The researcher projected that on balance system-wide implementation of Advanced Shipping, in its present form, should cause only a modest increase in OMN funding. If anticipated improvements are made, some savings could result.

PUR Budgeting with EWP and PGS

Researcher: Visiting Professor Jeffrey B. Miller
Sponsor: Naval Supply Systems Command

This report analyzes the Productive Unit Resourcing (PUR) budgeting system in physical distribution and the impact that Engineering the Work Place (EWP) and Productivity Gain Sharing (PGS) may have on the way it functions. The perspective taken is that information demands are a crucial factor in determining the viability of a budget system. EWP and PGS could change the environment in which budget negotiations take place by changing the information which is available to budget officers.

The change to the PUR budgeting system reduced information requirements in several important ways. As budget responsibility was shifted to the Naval Supply Centers (NSC's), and the level of monitoring was reduced, the importance of incentives increased. Since PUR funds the NSC's on the basis of movement units, the PUR rate is important. Presently the PUR rate is higher than marginal cost. This causes a number of problems. It is argued that lowering the PUR rate or establishing a two rate system with higher PUR rates for reductions in output and lower PUR rates for expansions would reduce these problems.

EWP is generating additional information which could be used in the budget process. This would change the informational requirements of the budgeting system in many important ways and would constitute a return to a system similar to what PUR replaced and recreate old problems. The researcher therefore advised against it. PGS, on the other hand, provides incentives to generate less biased information than is presently obtained through budget negotiations. With PGS, headquarters will have a more accurate picture of what the NSC's can accomplish and the budgeting process should improve.

Stovepipe

Researcher: Visiting Professor Jeffrey B. Miller
Sponsor: Naval Supply Systems Command

Naval Supply Center (NSC), Jacksonville, has been reorganized along the lines of a Stovepipe. Since the adoption of Stovepiping, this and other productivity improvement programs have led to a reduction in work force involved in physical distribution of about 40%.

Stovepiping changed the organizational structure so that now there are small vertical teams. Each team is accountable for many activities. Individuals in the teams are responsible for learning more than one job, and they are moved up steps based on mastery of numerous job skills. People in the stovepipe train one another. The objective is to have many people who can do any particular task. If an assignment requires more than the normal number of people with a special skill, there are many people available who can help. Furthermore, since people learn many skills and are rewarded for this, they do not have to change jobs to advance.

This project is an analysis and evaluation of Stovepiping. This will be a case study of the Jacksonville experience.

Interindustry Economics

Researcher: Associate Professor A. Royall Whitaker
Sponsor: Naval Academy Instructional Development Advisory Committee

Interindustry economic analysis falls between macroeconomic analysis and microeconomic analysis. It is the study of relationships among intermediate producing and using sectors and final using sectors for the purpose of tracing all the direct and indirect effects of changes (price, quantity, or technology) in any one sector. It can be approached either as the aggregation of many small microeconomic sectors or as the disaggregation of a few large macroeconomic sectors, and can therefore naturally be taught in either macro theory or micro theory courses.

The chief obstacle to teaching interindustry economics is that it involves the use of simultaneous equations to analyze input-output tables, and this in turn normally involves the study of matrix algebra.

Personal computer spreadsheets present an easy alternative to learning matrix algebra. A student who already knows the personal computer, even if he or she has never used spreadsheets, can learn to use their circular arithmetic capability to solve a useful variety of input-output problems. Moreover, the problem is even smaller now that Supercalc4 is routinely issued.

The output of the project is written instructions on using Supercalc4. The first assignments show how to solve simultaneous equations generally by iteration, with some consideration of when a particular program will converge and when it will diverge. The convergence problem does not have to receive much attention, though, because as it happens, input-output tables always converge (all the coefficients are less than 1).

The assignments developed so far have been used in two sections of FE210 to illustrate the direct and indirect consequences for all sectors of a change in consumer demands on two of the sectors, and to illustrate the direct and indirect consequences in all sectors of changes in labor costs in one sector.

The ultimate objective is a free-standing manual with one introductory assignment on circular arithmetic generally, a second common assignment on the simplest basic input-output problem, followed by a series of free-standing assignments which can then be assigned independently in several courses.

Independent Research

Finishing Up with Pride: A Case Study in Early Intervention Assistance for Dislocated Workers

Researcher: Associate Professor William R. Bowman

An on-site survey of copper miners employed at Tennessee Chemical Company in eastern Tennessee is developed to evaluate the participation choice of those who enroll in job search, upgrading, and retraining programs funded under JTPA Title III and Trade Readjustment Assistance for dislocated workers. The program began full-scale operation one year prior to permanent mass layoffs. In addition, a follow-up survey is used to determine the extent participant post-training earnings are affected by program participation.

Findings of the study suggest participation in preclosing assistance programs is significantly related to personal financial situation, prior enrollment in apprenticeship programs, and union leadership support. Post-training earnings are positively related to earlier program participation and completion of early intervention assistance. The type of assistance undertaken has little, if any, significant difference on post-training earnings, which suggests less expensive job search assistance should be offered as a primary support service for dislocated workers along with more costly retraining assistance.

Net Impact Analysis of Utah JTPA Title III: PY1984-1985

Researcher: Associate Professor William R. Bowman

The development of a two-and-one-half year longitudinal database of quarterly earnings and employment for over 95 percent of all workers in the state of Utah is developed for the purpose of estimating the returns to the Job Training Partnership Act, Title III program for dislocated workers.

Although pre- to post-training earnings of participants fell on average, the multivariate regression models of earnings and employment indicate a short-lived, but positive return to government subsidized retraining programs on a state-wide basis. The difference between the observed fall in average earnings and the estimated positive effect training has on earnings is attributable to the inherent self-selection bias common to employment and training programs. For the group of enrollees studied, it appears those who are more highly motivated and able to find reemployment do so without going through government subsidized job search and retraining programs. Those left who utilize such services, do so after longer periods of job search which have proven ineffective in identifying acceptable full-time employment.

The statistical methodology used in the study to estimate returns to employment and training programs utilizes the Heckman self-selection correction factor, as opposed to typical government evaluation studies that fail to model the selection decision of program participants.

Partial Unemployment Insurance Benefit Options for Maryland

Researcher: Associate Professor William R. Bowman

The study was done for the Office of the Governor for the state of Maryland following earlier legislation that urged a report be done to indicate alternative policy options to the current partial unemployment benefit formula used in Maryland.

The study was completed for the Unemployment Insurance Advisory Board and suggests a new interpretation of Maryland's current benefit formula be immediately instituted, with alternative benefit formulae to be considered under a full-scale evaluation study of the regular and partial unemployment benefit system in Maryland.

Effects of Hazardous Waste Risks on Property Transfers: Legal Liability vs. Direct Regulation

Researcher: Professor F. Reed Johnson

The primary national mechanism for remediating commercial and industrial sites contaminated with hazardous wastes is the so-called Superfund program. The Superfund legislation relies on the use of strict liability of current and previous owners of a property to recover the costs of cleanup. The state of New Jersey has added direct regulatory requirements under its Environmental Cleanup and Responsibility Act. This paper describes each of these regulatory responses to hazardous waste risks and suggests a benefit-cost framework for comparing the net social benefits of these programs.

Financial Accounting Standards Board Cash Flow Statement

Researcher: Associate Professor A. Royall Whitaker

The Financial Accounting Standards Board (FASB) has recently issued a new standard for the cash flow statement, which is one of the three major financial statements. Although the Navy is not legally subject to FASB requirements, the Comptroller does in fact require conformance to its requirements for Morale, Welfare, and Recreation activities. The purpose of this research is to examine the relevance and adaptability of the new standard to Navy activities. This involves detailed study of Navy requirements, FASB's general requirements, and the new standard itself. The conclusion is that the standard is both relevant to Navy operations and adaptable to Navy needs, but could be improved for such purposes in two ways. A paper is being revised for publication, following comments from a journal editor.

Research Course Projects

Non-Pay Factors and Navy Officer Retention

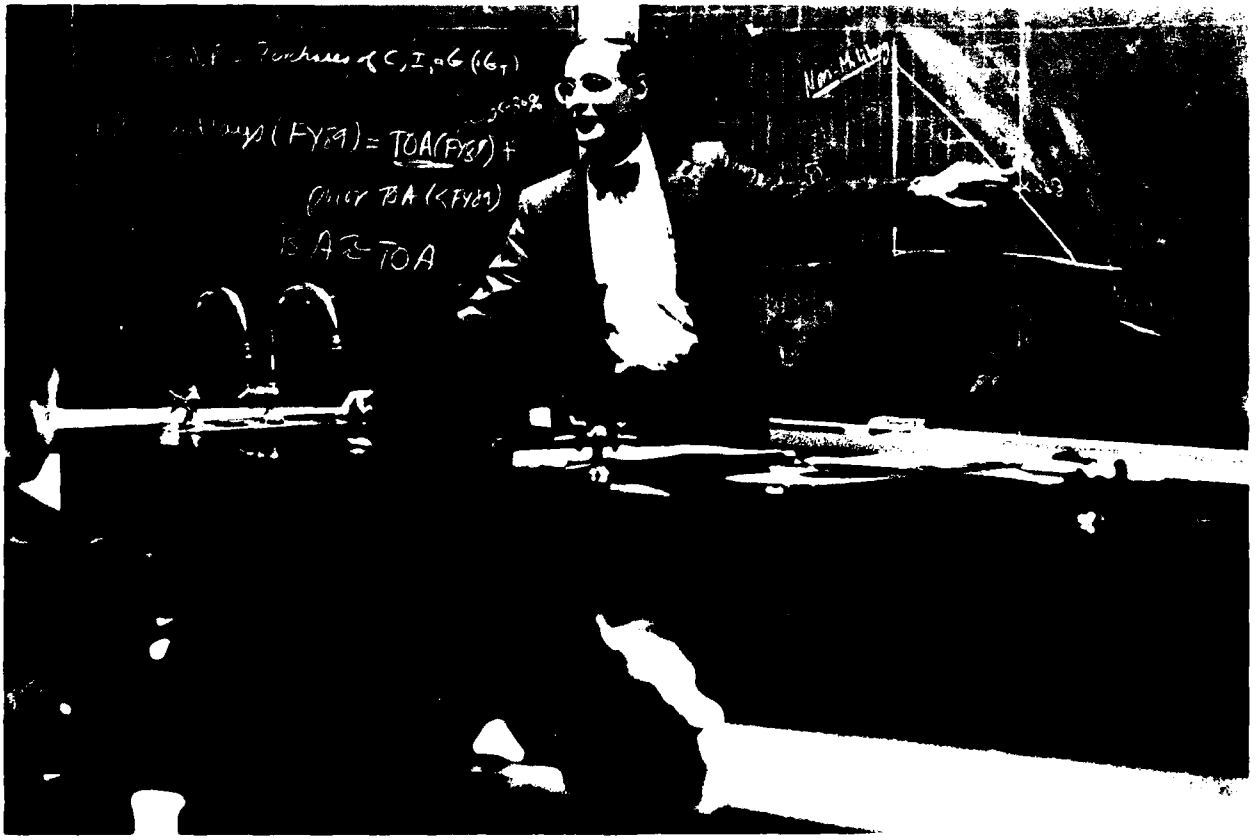
Researcher: Midshipman 1/C Charles W. Mills, USN
Adviser: Associate Professor William R. Bowman

The project utilizes survey data for Navy officers from separate retention and exit questionnaires for fiscal years 1985-1988. The objective is to determine the relative ranking of observed factors related to staying and leaving using a multivariate regression model of retention with combined records from the two data files. In addition to fifteen common questions related to the stay-leave decision, the model controls for an individual's rank, designator, years of service, and other personal characteristics.

The study shows that the current Department of Navy practice of ranking reasons for leaving and staying separately is biased. By combining both data files into a common file and regressing the dichotomous retention variable (1=yes;0=no) on related factors, the study is able to rank the relative importance of factors related to retention according to the size of estimated slope coefficients on the questionnaire variables.

The results indicate many factors which receive a low relative ranking on the separate questionnaires are more important when the two questionnaires are combined. For example, the importance of obtaining a graduate degree is highly related to the retention decision in the statistical model, but weakly related to retention for those officers who decided to stay. Similarly, military pay now ranks relatively low on the leaver questionnaire survey, but is highly related to retention using the combined data sets for the statistical model.

It is advised that OP-136, Office of Navy Officer Retention, develop a new survey instrument that can be used for both stayers and leavers. This instrument can be analyzed to yield improved estimates of the relative importance of pay and non-pay factors related to officer retention.



Publications

BINKIN, Martin, Visiting Professor, co-author, *U.S. Army Guard & Reserve Rhetoric, Realities, Risks*. Washington, DC: The Brookings Institution, 1989.

In the nearly two decades since the Nixon administration decided to withdraw U.S. armed forces from Vietnam and to end their dependence on conscription, America's military institution has undergone substantial changes. One of the most pronounced has been the increased reliance on Army reserve components, which today shoulder unprecedented responsibilities for protecting the nation's security.

Of special importance have been the growing expectations about the capabilities and readiness of the Army National Guard and the Army Reserve. Reserve components would now be among the first to be used in a range of possible conflicts--from limited contingencies involving rapid deployment forces to a major confrontation in Central Europe between NATO and the Warsaw Pact. This shift has been instituted with little public fanfare or debate, yet the consequences could be dramatic and far-reaching. This book, written with co-author William W. Kaufmann, raises the central question: How has greater reliance on Army reserves affected the nation's ability to protect its security interests?

BOWMAN, William R., Associate Professor, "The Role of Experimental Designs in Estimating the Effectiveness of Dislocated Worker Programs," *JTPA Impact*, **1**, 1 (Washington State Employment Security), 1-4.

The study summarizes and contrasts the major findings and statistical methodologies used in three major federally funded and supported random assignment programs for Job Training Partnership Act (JTPA) Title III dislocated worker programs. The major findings in the study support the feasibility of random assignment of personnel to designed work search and retraining programs in large scale worker lay-off cases. In addition, the findings support the cost effectiveness of job search assistance only as compared with more costly classroom and on-the-job retraining programs.

JOHNSON, F. Reed, Professor, co-author, "Learning about Radon's Risk," *Journal of Risk and Uncertainty*, **1, 2** (June 1988), 233-258.

This article reports the results of an evaluation of the effectiveness of different types of information materials in communicating the risk from exposure to radon, a naturally-occuring indoor air pollutant. The study involved a panel of 2300 homeowners who actually experienced risks from radon, and the information program used to explain these risks. The analysis considered information transfer and performance of specific tasks requiring information on the risk from radon to measure learning. The results suggest a systematic learning process, but indicate that the process can be influenced by how risk information is presented.

JOHNSON, F. Reed, Professor, "Indoor Radon Pollution," Timothy Wirth and John Heinz, eds., *Harnessing Market Forces to Protect Our Environment: Initiatives for the New President*. Washington, DC: The Environmental Policy Institute, 1989, pp. 189-198.

This volume was produced to influence the Bush administration's environmental agenda. It was cited in the president's recent announcement of his proposals for amending the Clean Air Act. The chapter on radon outlines the national extent of the problem and the difficulties of reducing radon risks under existing legislation. Policy recommendations include requiring radon testing with other inspections at time of real estate sales and improving dissemination of information about radon risks, alternatives, and mitigation costs. The current EPA action guidelines are questioned, because the public regards them as safety thresholds rather than (now obsolete) technology-based guidelines.

JOHNSON, F. Reed, Professor, co-author, "Conventional Wisdom on Risk Communication and Evidence from a Field Experiment," *Proceedings* of the 1987 Annual Meetings of the Society for Risk Analysis, Houston, Texas: Society for Risk Analysis, 1988, pp. 253-259.

Psychologists who are experts in risk communication have cited a number of "principles" of effective risk communication. This conventional wisdom is sometimes based on limited clinical evidence, but more commonly based on impressions and intuition of practitioners. Some of these principles contradict other principles. This article discusses seven propositions drawn from the literature on risk communication in light of an extensive field experiment in communicating radon risks to 2300 homeowners in New York. The empirical evidence confirms some of the propositions, but contradicts others.

JOHNSON, F. Reed, Professor, "Disclosure, Consent, and Environmental Risk Regulation," Jason Shogren, ed., *The Political Economy of Government Regulation*. Norwell, Massachusetts: Kluwer Academic Publishers, 1989, pp. 191-208.

The regulatory apparatus for controlling environmental risks is designed primarily to identify safe exposure thresholds and to enforce controls based on that standard. Unfortunately, this system is ill-suited to deal with several categories of risk. One category includes hazards for which the public's concern seems disproportionately large relative to the actual risks. Another category includes hazards for which the public's concern seems disproportionately small relative to the actual risks involved. A third category consists of hazards beyond the reach of conventional regulatory enforcement, such as indoor air quality in private residences. This paper discusses some practical and ethical dilemmas facing government agencies charged with protecting the public health and safety from such hazards. The analysis focuses on the role of government as an information provider in light of discrepancies between public health objectives and public attitudes about health risks. The paper explores the economic welfare implications of these different regulatory perspectives by modeling preferences under alternative disclosure frames.

JOHNSON, F. Reed, Professor, "Blind Men and Elephants: Prospects for Integrating Methods in Natural Resource Valuation," George L. Peterson, ed., *Amenity Resource Valuation*. State College, Pennsylvania: Venture Publishing, Inc., 1988, pp. 221-224.

This paper evaluates the alternative methods of valuing natural amenities from the point of view of natural resource program managers, academic economists, and academics from other disciplines. Discrepancies between empirical estimates of willingness to pay and willingness to accept compensation for environmental changes have different significance for each of these groups. Opportunities for improved interaction among natural resource professionals are suggested.

LITTLE, Roger D., Professor, co-author, "Screening for Moral Delinquency," *Economics of Defense Manpower Conference*. Colorado Springs, Colorado: Dean of the Faculty, U.S. Air Force Academy, June 1988, pp. 165-188.

Better screening devices to identify individuals whose previous behavior makes them unacceptable for induction into the military or whose expected behavior makes them a high risk either in terms of early attrition or inferior performance, surely offer opportunities for substantial cost avoidance. Preliminary evidence on the determinants of delinquency suggests at least two potentially fruitful areas for further research. First, the authors present evidence that drug use, stealing, and damaging property can be predicted based on information that a recruiter could elicit from the applicant. Second, a seemingly important finding of this research is the significance of the "ever suspended" variable in the equations. Means has suggested that repeated minor misdemeanors may establish a behavior pattern that increases the probability of attrition among those granted moral waivers. School suspension, which usually occurs only after several instances of unacceptable behavior and associated warnings, may provide important evidence bearing on the form of behavior that Means finds to be associated with military attrition.

Presentations

BINKIN, Martin, Visiting Professor, "The 1990 Defense Budget:Problems and Prospects," Chesapeake Economic Association Meetings, Western Maryland College, Westminster, Maryland, April 1989.

BOWMAN, William R., Associate Professor, co-author, "Statistical Methodologies For Evaluation of State Training Programs," U.S. Department of Labor, Labor-Management Cooperation Administration Conference on Dislocated Workers, Park City, Utah, 2 December 1988.

BOWMAN, William R., Associate Professor, "Why States Should Develop Longitudinal Earnings and Employment Data Bases," Maryland Department of Economic and Employment Development, Baltimore, Maryland, 15 February 1989.

BUCK, John B., Associate Professor, "Direct Foreign Investment as a Deterrent to Trade Barriers," Eastern Economic Association Meetings, Baltimore, Maryland, 3 March 1989.

GIBB, Arthur, Jr., Associate Professor, "Our Global Economy and Its Impact on Financial Markets," Scarborough, Ames & Associates Investment Seminar, Annapolis, Maryland, 8 November 1988.

GOODMAN, Rae Jean B., Professor, and Thomas A. ZAK, Associate Professor, "A Methodological Note on Production Efficiency and Distributional Consequences in Economic Education," American Economic Association Meetings, New York, New York, 29 December 1988.

JOHNSON, F. Reed, Professor, "Effects of Hazardous Waste Risks on Property Transfers: Legal Liability vs Direct Regulation," American Economic Association Meetings, New York, New York, 29 December 1988.

JOHNSON, F. Reed, Associate Professor, "Effective Risk Communication and Problem Solving," Workshop on Evaluation and Effective Risk Communication, Washington, DC, 3 June 1988.

JOHNSON, F. Reed, Professor, "Radon Risk Communication as a Regulatory Strategy: Evidence from Field Experiments," American College of Toxicology Workshop on Indoor Radon, Baltimore, Maryland, 2 November 1988, and Conference on Management of Genotoxic Substances in the Environment, Stockholm, Sweden, 4 October 1988.

MILLER, Jeffrey B., Professor, "Customs and Norms in Economics," Eastern Economics Association Meetings, Baltimore, Maryland, 3 March 1989.

MORRIS, Clair E., Professor, and Steven G. ROEHRICH, Lieutenant Commander, USN, "Methodological Approaches to the Study of Labor Valuation in the Public Sector: An Assessment of Marginal Productivity Analysis," Eastern Economic Association Meetings, Baltimore, Maryland, 3 March 1989.


G. SIMONIAN

DEPARTMENT OF

Language Studies

Professor Michael C. Halbig
Chariman

The past academic year has been one of exceptional teaching and research productivity by the faculty: members of the department had two book-length projects and ten articles accepted for publication. They also presented thirty-seven papers at conferences world-wide. Work in progress suggests that next year will be at least as productive. In addition to individual work, the department's efforts in exploring interactive video technology for the foreign language classroom continued to draw national and international attention.

Sponsored Research

Annapolis Interactive Video Project

Researchers: Associate Professor William H. Fletcher, project director, Assistant Professor Christopher D. Buck, Associate Professor Sharon G. Dahlgren, Professor John A. Hutchins, Assistant Professor Enrique Márquez, Assistant Professor María Moux, Assistant Professor Ludmila A. Pruner, Associate Professor Helen E. Purkitt, Professor Guy J. Riccio, Associate Professor Gladys M. Rivera-La Scala, and Professor John Yarbro
Sponsor: Department of Defense, National Security Agency

Since its inception in 1985, this project has expanded into a team of professors who author interactive video (IAV) lessons for Spanish, French, and Russian. Project members have developed delivery and authoring software for a standard approach to composing lessons and have produced extensive documentation to guide authors through the process: authors combine selections from a set of some twenty presentation and exercise template types into a lesson structure and provide lesson content in text, graphic, and "control" files produced with USNA-developed authoring tools and commercial graphic software. The project team regularly shares its software and its IAV expertise with other Naval Academy departments and with the Department of the Navy and other government agencies.

In the past year five team members have produced a total of 20 new IAV lessons for Intermediate Spanish and have revised the 24 existing lessons from Beginning Spanish. Work has continued on the project's longitudinal evaluation of language acquisition via computerized IAV, which has attracted widespread interest as the first study of its kind. Through the development of Cyrillic screen fonts the door has been opened for lessons in all European languages taught at USNA, including Russian. The Academy's new 12-meter satellite dish receives broadcast-quality video from more countries and sources than its 6-meter companion dish; 5 new videodiscs were compiled in Spanish and Russian.

The Annapolis Interactive Video Project continues to expand the scope of its internationally recognized pioneering work. A video-mediated, computerized adaptive test is being developed in collaboration with the Educational Testing Service, which will permit rapid individualized assessment of listening proficiency with stimuli taken from authentic video; a pilot test will be operational by spring 1990.

Basque Popular Theater in the Twentieth Century

Researcher: Assistant Professor Audrey Gaquin
Sponsor: Naval Academy Research Council (OMN)

The long-range objective of this project is to contribute to the study of the twentieth-century Basque **pastorale**. The Basque **pastorale**, a type of rural theatrical production, has existed, without interruption, as a Basque tradition, since the late fifteenth century. The earliest extant **pastorales**, which are related to the French mystery plays of the late Middle Ages, are still performed today, providing a unique example of continuity in popular theater in western Europe. New **pastorales** continue to be written and performed. Theater productions of the **pastorale** include dramatizations of Old Testament stories, lives of saints, exploits of medieval heroes, intrigues from Greek tragedy, and episodes from Basque, French, Spanish, and world history. The only complete study of Basque popular theater is the highly respected work of Georges Hérelle, which was completed between 1923 and 1928, and which therefore does not include the considerable theatrical production of the twentieth century.

The short-term objective of the project was to complete a first-year course in the Basque language and, if possible, to begin reading in the language. Because of scheduling conflicts, the researcher was unable to attend any of the Basque summer language programs in Spain, and therefore completed the first year of Basque at the Naval Academy, using the text and tapes of the method *Euzkera Itzketan Zelan Ikasi* by Professor J. Eiguren of Boise State University, Boise, Idaho. All thirty lessons of the text were completed, and the researcher is continuing study of the language using materials recommended by the Basque-American Foundation.

The Correspondence of Luis Alberto Sánchez

Researcher: Assistant Professor Elsa M. Gilmore
Sponsor: Naval Academy Research Council (OMN)

The purpose of this ongoing project is to produce an edition of the literary correspondence of Luis Alberto Sánchez. Dr. Sánchez is a well known writer and scholar, and one of the founders of Peru's APRA Party. He currently occupies the office of Vice President of Peru.

At present, transcription of those letters in Dr. Sánchez's archives which were authored by well-known literary figures, or which concern primarily literary topics is nearly complete. It is expected that final proofreading and approval by Dr. Sánchez will occur over the summer months.

Narrative Elements in Spain, Take This Cup from Me
Elementos narrativos en España, aparta de mí este cáliz

Researcher: Assistant Professor Elsa M. Gilmore
Sponsor: Naval Academy Research Council (OMN)

César Vallejo (1892-1938) is generally regarded as one of the best lyric poets of Latin America. His last book, *España, aparta de mí este cáliz* (*Spain, Take This Cup from Me*), was written entirely during the late fall and winter of 1937 and the early spring of 1938. In its poems, Vallejo gave an impassioned account of the unfolding Spanish Civil War and glorified the Republican cause. The texts show a departure from Vallejo's earlier lyrical mode and exhibit elements characteristic of the epic genre.

This author dedicated the last chapter of her doctoral dissertation to *Spain, Take This Cup from Me*, looking specifically at the language of time and at time sequences. (The study was grounded on the theory of time in narrative language put forth by Gérard Genette in his book *Narrative Discourse*.) The author proposes to review the arguments and conclusions put forth in her thesis in the light of more recent work done by others, and to attempt to relate the conclusions of the study to earlier Vallejo work. The research should result in a publishable article.

Conciliation and Refutation in Fidel Castro's Speeches on China (1962-1968)

Researcher: Assistant Professor Enrique Márquez
Sponsor: Naval Academy Research Council (OMN)

The focus of this research is Fidel Castro's rhetoric. Its purpose is to study some of its characteristics as they appear in his foreign affairs speeches concerning his dual ideological alignment vis-á-vis the USSR and China. Specifically, the corpus consists of two public speeches made during the period 1962-1968. Chronologically, this is the stage in Castro's rhetoric which might be described as one of promulgation and polarization. It seems to produce an ambiguous rhetoric, more vital and with greater diversity of viewpoints than is evident later, when the Cuban Revolution consolidates its gains, and the diversity of viewpoints is reduced through coalescence around major positions on key issues such as the New Constitution and the Party platform. The speeches seem to foster dual goals as to the Cuban alignment. Yet, they emphasize confidence, assertiveness, and a somewhat ambivalent attitude towards the present.

Since different conflicts produce different rhetoric, the main concern is whether these speeches embody conciliatory and/or confrontative perspectives, and how these perspectives are revealed. By *conciliation* is meant the use of argumentation leading to placatory and compromising conclusions, instead of unyielding ones. The basis of *confrontation* is a sense of division or disruption from the status quo, appearing in negative propositions or refutations.

The study relies on the argumentation theories of Austin and O. Ducrot, as well as drawing from Aristotle's theory of *topoi*.

Study of the Cinematic Image in Andrei Tarkovsky's Ivan's Childhood

Researcher: Assistant Professor Ludmila A. Pruner
Sponsor: Naval Academy Research Council (OMN)

The purpose of this research was to analyze Andrei Tarkovsky's treatment of cinematic image in the 1962 film production of *Ivan's Childhood*. Tarkovsky (1932-1986), a Soviet-born film-maker, believed that the cinema is able to incarnate reality directly and by its own means. He formulated and put in practice his concept of "the logic of poetry in cinema," based on the poetic links of images in non-linear cinematic narrative. Ingmar Bergman referred to Tarkovsky as "the greatest" film maker of our time, "the one who invented a new language, true to the nature of film." The researcher analyzed Tarkovsky's work by comparing the function of an image in developing a cinematic plot through film montage and the function of literary image in a linear plot structure of Bogomolov's novel *Ivan*, on which the film was originally based. The study of intrinsic characteristics of images and links between them in the cinematic narrative leads to the understanding of the grammar of Tarkovsky's cinematography.

During the research, the researcher participated in a workshop on "Contemporary Issues of Soviet Cinema" sponsored by the Russian and East European Center at the University of Illinois in Urbana-Champaign in July 1988, where the work of Tarkovsky was discussed. In November 1988 the researcher presented a paper at the Twentieth American Association for the Advancement of Slavic Studies National Convention in Honolulu, Hawaii, and was invited to contribute a paper on Tarkovsky at the Fourth World Congress for Soviet and East European Studies in Harrogate, United Kingdom, 21-26 July 1990. At present, she is finishing an article on Tarkovsky's cinematic language, which she expects to submit for publication in July 1989.

Viewing Comprehension and the Function of Speech: a Study of the Evolution of the Theory of Listening Comprehension and the Use of Interactive Video in the Teaching of Foreign Languages, with a Focus on Russian

Researcher: Assistant Professor Ludmila A. Pruner
Sponsor: Naval Academy Research Council (OMN)

The purpose of this research is to establish criteria required for viewing comprehension and to analyze its role in the function of speech. "Viewing" or "watching" comprehension as a term refers to the information conveyed through the non-verbal means of communication essential for the completion of a verbal message. This research analyzes the difference between listening and viewing comprehension and their roles in the development of communicative skills. The criteria of viewing comprehension will bring new understanding of the theory of listening comprehension and its correlation with the function of speech.

Since August 1988, the researcher has participated in conferences devoted to listening and viewing or 'watching' comprehension, organized and chaired a panel at the 1988 AATSEEL National Convention in December on the Use of IAV in the teaching of foreign languages, delivered two papers on the development of listening skills, and submitted an article which will appear in the American Council of Teachers of Russian journal in June 1989.

Furthermore, Professor John Hutchins and the researcher have just finished all the necessary work for the production of two sixty-minute videodiscs which will be used to develop new IAV lessons for listening in Russian. The researcher will continue with this research topic through the summer of 1989.

Annapolis Interactive Video Project: Satellite Telecasts and Computer-Assisted Language Acquisition

Researchers: Associate Professors Sharon G. Dahlgren and
William H. Fletcher
Sponsor: Naval Academy Institutional Development Advisory Committee

For Summer 1988 the Annapolis Interactive Video Project (AIAVP) had two principal objectives: (a) to revise and refine existing IAV lessons for first-year Spanish, FS101-102; (b) to produce new IAV lessons for second-year Spanish, FS201-202. These tasks were performed by a team of investigators, including three other colleagues with other sources of funding.

In addition to lesson revision and production, there was a complete redesigning of the approach to lesson presentation and writing. Specifications and documentation for the reprogramming were developed and discussed with production team members to enable them to encode revisions and new lessons in accordance with this next generation of control files.

Revisions of FS101 lessons accomplished by Associate Professor Sharon G. Dahlgren included three lessons now in use in the course: (1) Paso C: "La familia" and "La escuela"; (2) Paso D: "¿De dónde es usted?" and "Los estudiantes"; and (3) Capítulo 4: "Academia de policía. For FS201-202, this investigator completed two lessons each consisting of two distinct parts with different video segments. The first relates to Hispanic family life and tradition: "Las bodas" from Mexican television, and "Casarse vestida de blanco," from Chile. The differences in pronunciation of Spanish provide students with a realistic linguistic text and an appreciation for the diversity of the language and culture. The second lesson combines nautical terminology and family relationships: "Cuauhtémoc en Acapulco," detailing the arrival of the Mexican training ship to its home port, and "El Día del Niño," Children's Day in Mexico, with two different video segments, an announcement of public interest and a news report on pediatricians and child rearing in Mexico. Students are then presented with material on real situations regarding the family, marriage, and children from the perspective of another culture as they refine their skills in listening comprehension.

As Project Director, Associate Professor William H. Fletcher performed various production-related tasks in addition to project administrative duties and revision and production of lessons. He evaluated and helped revise existing lessons and assisted team members with routine tasks in implementing new lessons. He worked with the IAV programmer to develop specifications for revisions and additions to IAV lesson software, evaluated the resulting programs, and wrote the documentation for the new approach. This investigator authored various programs, such as ones to help convert parts of the existing courseware to the new format and to permit editing foreign fonts (a Cyrillic font and a Russian demonstration lesson have been implemented) and displaying them in IAV lessons. He regularly advised other team members on approaches to revising and authoring their lessons and edited the resulting lessons. In support of the evaluation side of the project, he produced booklets for Tests I and III, "rehabilitated" booklets for Test II, and organized the recording session for Test III. As a production team member, this investigator revised many FS101-102 lessons: « Las Profesiones », « Te veo si hace buen tiempo » , « Las vacaciones y los deportes », « Horario de cierre » and « Comer en Aladino's », « Condominios », « Tiempos mejores», « Calesero I & II », « La Comida », « Los Restaurantes », « Montevideo ». He also authored a new lesson for FS201, « Cruzando la frontera », which dramatizes the issue of illegal immigration from Mexico from the point of view of the "undocumented" worker.

Interactive Computer-Video and On-Screen Computer Lessons in French

Researcher: Professor John D. Yarbro
Sponsor: Naval Academy Instructional Development Advisory Committee

The overall aim of the project has been to design and create computer and computer-video lessons in French to serve as learning aids for midshipmen. A complementary aim has been to integrate these lesson elements into course programs for FF301 and FF302, Advanced French with Civilization readings.

Authentic native-French video materials were collected using the USNA earth satellite receiving station to record Canadian or Parisian (rebroadcast) programs from Canada, as well as Parisian programs rebroadcast by the SCOLA network from Creighton University. The monthly France-TV Magazine was also recorded. The segments on each videocassette were catalogued and evaluated, and suitable segments were selected for use as video or interactive computer-video lessons. Plans were drawn up for the adaptation of TV segments into video or computer-video lessons, using available computer authoring systems, or preparing study scripts and guides. At the same time, exercises that parallel and reinforce homework assignments were created for on-screen computer lessons using CALIS. At present, segments of videocassettes are being selected for inclusion in a new French videodisc, as a basis for additional interactive computer-video lessons.

Extensive experience with authentic foreign video programs greatly increases the opportunity for students to comprehend another language as it is actually spoken, by natives, in their home environments and in situations that reveal the culture and character of the country. The lessons oblige the students to react to scenes, dialogues, narratives--and allow them to replay a segment as often as necessary. This is a life-like way of learning to comprehend many kinds of speech. The use of video in language instruction also stimulates interest, lifts motivation, increases comprehension, and conveys a wide range of information about other cultures and areas.

Interactive computer-video lessons are now being created for FF301-302 for the academic year 1989-1990, based on video segments selected in the course of this project. The CALIS exercises produced through this project to accompany audio segments were already used during 1988-1989 and have brought about a dramatic improvement in midshipmen's written work.

Also during the academic year 1988-1989, seven MS/DOS diskettes with CALIS lessons were produced for home assignments supporting textbook and cassette materials used in FF301-302. These materials proved to be very effective in strengthening the performance of midshipmen on written work, and received very positive responses from the midshipmen themselves.

Independent Research

Confrontations with Gyorgy Lukacs

Researcher: Associate Professor Eva L. Corredor

After publication of the researcher's first book, entitled *Gyorgy Lukacs and the Literary Pretext* (January 1988) and a chapter in *Tracing Literary Theory* (July 1987), this project is a consideration of Lukacs' work in the broader context of contemporary critical theory. The manuscript consists presently of twelve essays (papers presented at conferences or articles previously published in literary journals) in which the researcher confronts Lukacs's views with those of other critics. Completion of the project involves rethinking and reshaping these essays, and providing them with a proper introduction, critical bibliography, and index before releasing them for publication.

Theoretical Fictions

Researcher: Associate Professor Eva L. Corredor

This researcher is embarking on an entirely new project which combines her interest in contemporary literary theory, the fiction of "exiled" authors, and the conceptualization of her own experience with the languages and cultures of countries in which she has sought to create her home. The purpose of this research is to identify and study the fiction of "displaced" francophone writers who have been marked by a cultural and linguistic predicament in relation to their own ethnicity. Their fiction may have been affected by the lack or loss of an authentic "mother" tongue, or the impossibility of achieving oneness with the culture in which they exist. It could also have been influenced by lingering colonial experiences as was the case of Maghreb (North African) writers such as Rajid Boudjedra and Mourad Bourboun who chose French, not their ethnic Arabic, as the language of their fiction.

Further research will be conducted at the British Museum in London, the Bibliothèque Nationale in Paris, and the Library of the University of Heidelberg in Germany this July. Preliminary conclusions will be reported at two conferences: the Congress of the American Association of Teachers of French, 13 July, in Paris, in a presentation tentatively entitled "Théorie révolutionnaire et lyrisme solitaire du roman naghrébin," and at the Conference of the Modern Language Association in Washington, DC, in December of 1989.

This project will be funded by the Naval Academy Research Council for summer 1989.

Adjuvancy and Opposition: A Study of Supporting Roles in Pedro Calderón de la Barca. (1600-1681)

Researcher: Associate Professor Sharon P. Dahlgren

This book-length study combines the methodology of the semiotics of theater with historical archival research on Pedro Calderón's secular and religious drama of seventeenth-century Spain. While supporting roles are often overlooked as components of dramatic structure, they nevertheless provide keys for interpreting the text, since they complement the actions of the main characters. These secondary roles involve adjuvancy of or opposition to the quests of the principals. In an attempt to establish a typology of dramatic functional roles in Calderón, the researcher has limited the corpus of dramatic works to his high drama. Comedies offer alternate kinds of supporting roles, usually involving love pursuits, in which the relationship of primary to secondary personnages remains one of equal social status.

Adjuvancy and opposition, terms from Algirdas J. Greimas's actantial semiotic model, imply unequal social rank. In viewing drama from the perspective of the underlings, the researcher seeks to provide a clearer understanding of the relationships between plot and character, between ranking aristocrats and their assistants, and between kings and subjects, in an attempt to show that Calderón, in his support of the absolute monarchism of his time, was not uncritical of it.

A Different France: Documents from the Minority Cultures of France

Researcher: Assistant Professor Audrey Gaquin

A Different France is an anthology of documents from the seven regions of France whose languages and cultures are different from those of mainstream France: Basque country, Brittany, Alsace, Corsica, Occitania, North Catalonia, and Flanders. Recent laws passed by the French government to allow a measure of regional autonomy in France have had a significant impact on minority cultures in these regions, encouraging the revival of the minority languages, literatures, and art forms. Small but vocal autonomist and separatist groups in most of the minority regions have greatly influenced policy makers in the French government. The regionalist policies of post-Franco Spain have had some effect on the demands of Basques, Catalans, and Corsicans, and the approaching abolitions of economic barriers in the European Economic Community in 1992 is also an important factor in the way the minorities perceive their relation to the central government of France.

The regionalist movement in France and its consequences for the minorities have received little attention outside of France. *A Different France* makes available to students, teachers, and scholars primary source materials relating to the regional cultures of France. One section of the anthology is devoted to each minority, and each section includes a historical introduction, an interview with minority leaders, articles on the political and economic issues concerning the region in question, sample lessons in the minority language, brief literary selections in the minority language with translations into French, and information about customs, traditions, and folk art of the region.

This project was funded by the Naval Academy Research Council in summer 1987. Three of the seven sections have now been completed and the anthology has been accepted for publication by the University Press of America.

Elements of Theoretical Linguistics in Priscian's Institutiones

Researcher: Assistant Professor Audrey Gaquin

Twentieth-century linguistics, judging from a strictly modern point of view, dismisses Priscian's work as unscientific, lacking in method, and irrelevant to the progress of modern linguistics. Yet Priscian's place at the end of the long tradition of classical grammar, building on the work of his many predecessors and functioning as a principal source of information for medieval grammarians, points up his importance for the western grammatical tradition.

An examination of Priscian's *Institutiones* shows that this work made available to Priscian's successors certain fundamental theories on the nature of language, as well as doctrines about specific grammatical points. The presentation of the different levels of language and definitions of the noun and verb represent the most extensive theoretical discussions in Priscian's work. These discussions stress the role of the communication situation in governing language production, analogies between language and the physical universe, and the definitive importance of the semantic component of language. These discussions also suggest the importance of the derivation process.

This project, which involves revising and updating the researcher's doctoral dissertation, will be funded by the Naval Academy Research Council for summer 1989, and should be completed by the end of the summer.

G.W.F. Hegels Ästhetik: Ein Künstlerisches System Angewandter Anthroposophie

Researcher: Assistant Professor Sylvain Guarda

This essay explores the breadth of Hegel's compendious aesthetics from its mythological to its socio-political dimension. Through careful analysis of Hegel's statements on aesthetics, ethics, and religion, it charts the author's attempts to define the realm of man's freedom in an estranged world and to formulate a form of art that would reconcile the individual with the divine, aesthetics with religion. Grown out of Theosophie and centering on man as mirror image of God, Hegel's lectures are then defined as an artistic system of applied anthroposophy and, more importantly, as a political document, inasmuch as Hegel threads his artistic views into a coherent whole, that is, a concept of community.

Writing about Armageddon: The German Poets and the Thirty Years' War

Researcher: Professor Michael C. Halbig

In this book-length study, the researcher will review how the German writers who experienced Germany's worst war wrote about it. Although the war was clearly the single most important experience of these writers' lives, there is no study to date which discusses this theme within their writings. This study, when completed, will be a major contribution to the understanding of the German seventeenth century. It will also reveal how one society reacted to a war of horrific proportions, in which Germany's population was reduced by two-thirds.

During a four-month sabbatical in fall 1988, the researcher established a comprehensive bibliography of secondary literature and a working list of authors and works which will be the basis for the study, read seminal studies about the period, and drew up a preliminary chapter organization: wars and warriors; victims; sanctuaries; and the inverted world.

Spanish Golden Age Poetry and Drama

Researcher: Assistant Professor Rita P. Landers

The researcher is continuing the research on intertextual relationship between primary and secondary literary texts as they relate to specific topics; that is, the relation of Spanish poets with respect to their classic and Italian sources. The study is still two-fold. On one hand, it continues exploration of the Spanish Golden Age poet, Barahona de Soto, expanding the investigation of another aspect of his lyric: the poems that Barahona "translated" from Ovid. On the other hand, it is directed at expanding the researcher's study of Golden Age Spanish theater, in particular, the works of Lope de Vega, exploring another of Lope's early plays where he incorporated themes and characters from Ariosto's and his own epic poems. The latter was the topic of a presentation at the El Paso Symposium on Golden Age Drama in March 1989.

Automated Biographic Analysis of the Chinese Military Leadership

Researcher: Professor Daniel T.Y. Lee

This is a continuing long-range research project to study biographic characteristics and career patterns of significant military leaders in the People's Republic of China. It employs English-text summaries prepared according to strict syntactical rules with embedded computer flags permitting the computer to search biographies and develop summaries by characteristics, or to link logically different leaders as they progress through their careers. As data accumulate, it is expected that hierarchical clustering techniques will establish patterns of ascendancy.

The total number of biographies included now stands slightly over 1,000, and about 500 previous entries have been updated.

Analogía y ekphrasis, anestoresia e historia: formas de tiempo clásico en la polis de José Lezama Lima

Researcher: Assistant Professor Enrique Márquez

This brief presentation attempts to explain how this major Cuban writer, who became internationally known simultaneously with the Cuban Revolution, embraces and adapts elements found in the classical tradition of Greek art and political philosophy.

With classical (Aristotelian) analogy and **ekphrasis** (from the early Greek pictorial arts), this author embarks on a profound examination of what effects mimesis, or the copy of nature, seems to have on a given society or culture, and how language's main role is to discover and manage the contradictions imposed in the ordering both of individual consciousness and social and political ordering.

By studying and adapting both Aristotelian analogy and classical **ekphrasis**, or the deliberate imitation of spatial order through imiatative models as defended by Socrates in Plato's *Meno*, Lezama Lima not only builds an essential link in his **sistema poético del mundo** as it concerns how reality is constructed in speech, but proceeds to articulate a historical image or consciousness that goes back to a pre-modern, "non-revolutionary" (in the post-enlightment, modern sense) model inspired by Giambattista Vico and Nicholas of Cusa. How can a society shaken by abrupt change move from a stagnated, ahistorical situation of **anestoresia**, or irrationality, to a triumphant image of itself, of the city, and of man, without falling into the extremes of modernity?

This research will be presented in a paper at the American Association of Teachers of Spanish and Portuguese conference in 1989.

The Poetry of Severo Sarduy

Researcher: Assistant Professor Enrique Márquez

This project is an introductory paper on the Cuban-born French writer, who is known primarily for his post-modernistic fiction and his close links with the *Tel Quel* group in Paris during the 1960's and 1970's, with Roger Caillois, and with critic Roland Barthes. Sarduy is less well known in this country as a poet of note, art critic, and scientific commentator; this critical volume tries to fill that void and offer a more general framework from which to appreciate better the contributions of this writer.

Specifically, this essay presents both biographical and critical data: his early, formative years in a Cuban province during the pre-revolutionary years, early symbolist poems, his conversion to *lezamismo*, a post-modern school of poetry and fiction spearheaded by his compatriot José Lezama Lima in the 1960's, his embrace of Lacanian epistemology in the 1970's in Paris, and the impact of the *new biology* on his literary thinking. While his fiction has grown increasingly cosmopolitan in breadth and scope, his poetry remains intensely intimate and rich with allusions and references to his Cuban adolescent years.

Guy Davenport's Poems, from Eclogues, Apples and Pears, and Thasis and Ohio

Researcher: Assistant Professor Enrique Márquez

George Steiner of *The New Yorker* has appropriately singled out Mr. Davenport as among "the truly autonomous voices now audible in American letters." His oeuvre includes distinguished fiction (*Tatlin!*), essays (*The Geography of the Imagination*, nominated for the National Book Award, nonfiction), outstanding classical translations of Archilocus, and a few select volumes of poetry.

The researcher has undertaken to translate into Spanish a selection of poems by Mr. Davenport, mostly known in the Hispanic world of letters by his novel *Tatlin!* (Barcelona, 1982), and selections of essays published by Peruvian critic Julio Ortega in Mexico's *Vuelta*. Coming out of the American modernistic tradition of Ezra Pound and Wallace Stevens, Mr. Davenport's poetry combines the raw force and spontaneous grace of early, primitive Greek poetry with his own personal wit, creativity, and encyclopaedic mind.

Upon completion, a selection of ten poems will be submitted for publication to Octavio Paz's review *Vuelta*, where most of Mr. Davenport's works have been initially published in Spanish. Later on, a total of fifteen poems will be sent with an introductory study of Mr. Davenport's poetry to Anagrama Publishers in Madrid.

Juan de Mena's Laberinto de Fortuna: A Critical Transcription and Concordance of ESP.MS 229 of the Bibliothèque Nationale, Paris.

Researchers: Assistant Professor María Moux and
Associate Professor Gladys Rivera-La Scala

For this project the researchers have contacted Professor John Nitti for guidance as to transcription requirements. This project will be published by the Hispanic Seminary of Medieval Studies, University of Wisconsin-Madison, and the lexicon from the concordance will be included in the first *Dictionary of Old Spanish*, the first volumes of which are scheduled for dissemination in the early 1990's. This thirty-year project, begun in the late 1950's by Professor Lloyd Kasten, has enjoyed annual support from the National Endowment for the Humanities for over 10 years and the expertise and work of at least two generations of scholars from the national and international communities.

The transcription is in machine readable form and will be published in microfiche.

Juan de Mena's Coplas de los siete pecados mortales: Second and Third Continuations: A Critical Edition and Study

Researcher: Associate Professor Gladys Rivera-La Scala

This book includes the first critical edition of the Second and Third Continuations of the *Coplas de los Siete Pecados Mortales*, left unfinished at Juan de Mena's death, and an intertextual analysis of the main poem and its three continuations. The first chapter contains a comparative study of the four works based on themes, imagery, meter, and rhyme. In the second chapter the author gives detailed, firsthand descriptions of the manuscripts and sixteenth-century printings used in establishing the base text; she also discusses the interrelationships that exist among the many versions of the works. A corrected version of the continuations in modern script follows. Editorial, literary, and linguistic notes appear in the next section, which ends with a glossary of medieval Spanish terms and one of proper names. Included in this volume is an extensive bibliography of primary and secondary source materials on Spanish and European fifteenth-century didactic poetry.

This researcher began working on this project on a NARC grant in 1982-1983 and has now completed the research and four of the seven chapters of the book. It has been accepted for publication by *Scripta Humanistica*.

Publications

DAHLGREN, Sharon G., Associate Professor, "Teaching *El gran teatro del mundo*: A Semiotic Approach to Allegorical Drama," *Approaches to Teaching Spanish Golden Age Drama*, ed. Everett Hesse. York, South Carolina: Spanish Literature Publications 1989, pp.70-91.

This article centers on the use of semiotics as a teaching methodology for seventeenth-century allegorical drama. Calderón's *theatricum mundi* play, *El gran teatro del mundo*, or "The Great Stage of the World," is particularly well suited to undergraduate instruction, since it includes a carefully-crafted interplay between recognizable social types, such as the Rich Man and the Poor Man, and the more complex allegorical figures, such as God as Impresario of the life play and the World as Stage Manager. The author proposes a practical means of analyzing sign systems operative in allegory with three basic levels: (1) the typology of signs as an analysis of the kinds of signs in the work, (2) semiotic models indicative of the ways in which signs combine to promote dramatic action, and (3) visual performance codes and gestural codes gleaned from the text as indicators of the actors' stage movements. The author concludes that semiotics is a useful approach, since it serves as a mediator between the written text and the dramatic performance. The theory of signs includes both the verbal and non-verbal codes in dramatic art.

FLETCHER, William H., Associate Professor, "Authentic Video in the Foreign Language Curriculum: The Annapolis Interactive Video Project," *Interactive Media: The Human Issues*, ed. Richard N. Tucker. London: Kogan Page Ltd., 1989, pp. 180-187.

This article is based on a conference presentation describing and demonstrating approaches to interactive video (IAV) foreign language lessons developed at the United States Naval Academy and based on commercial television from abroad received by a satellite earth station. The initial pedagogical aim of the project is to teach students to understand authentic native-speed materials via a medium with a directness and realism the classroom cannot match, and to stimulate student interest in foreign languages and cultures in the process. The USNA IAV team has pioneered an impressive array of techniques, which have proved highly successful in enhancing student comprehension of native-speed language and in helping them develop listening strategies. These techniques are discussed in detail from both a practical and a theoretical viewpoint.

Of even greater potential interest to educators and courseware developers is the project's goal of evaluating the contribution of interactive video to elementary and intermediate-level language learning by college students. This independent evaluation is studying the achievements of two two-year cycles of students learning Spanish who complete a weekly interactive video homework assignment by comparing their performance on standardized listening and speaking tests with that of a control group which has comparable assignments with audio tapes instead. This article also reports on the goals and preliminary evidence provided by this evaluation.

FLETCHER, William H., Associate Professor, co-author, *Repaso e integración*. New York: McGraw-Hill, 1989.

Targeted for third- and fourth-year high school learners of Spanish, this supplementary textbook's mature approach also makes it suitable for advanced college students. While it arose from the need for preparation for the Educational Testing Service's Achievement and Advanced Placement Tests in Spanish, this book is much broader in scope and content than typical examination practice books. It seeks to review and integrate what students have learned in elementary and intermediate Spanish courses both by building familiarity with essential vocabulary and structures and by practicing effective context-based listening and reading strategies with authentic texts. The combination of bottom-up and top-down approaches in complementary exercises ensures that students with different learning styles can work with some familiar techniques while developing alternative learning and comprehension strategies. Finally, this book gives learners hints on how to take tests, so that their scores will reflect their language skills as accurately as possible.

The book consists of three types of chapters: practice tests, reading comprehension strategies, and listening comprehension strategies. Seven practice tests help the student pinpoint weaknesses in command of vocabulary and grammar and in reading skills. Three reading comprehension chapters explore reading strategies and practice approaches to reading which build on linguistic and real-world knowledge and exploit contextual cues in authentic passages of about 2000 words. Three listening comprehension chapters start out with vocabulary exercises and proceed via brief conversations to a practice test on a listening passage of about 10 minutes' duration. Extensive notes on each chapter review the principles underlying the items and explain possible sources of confusion.

GILMORE, Elsa M., Assistant Professor, "El mito y su subversión en *La noche de los asesinos*," *En busca de una imagen: el teatro de Griselda Gambaro y de José Triana*, ed. Diana Taylor. Ottawa: Girol, 1989, pp. 4-14.

This article provides an overview of earlier criticism of *La noche de los asesinos* and seeks to explain sharply divergent interpretations of the drama as complementary views which arise out of the text's mythical character. At the same time, the article proposes that although mythical signs and codes structure the play, the referential system has been subverted by the dramatist. The article bases its discussion of mythical structure on the anthropological studies of Claude Lévi-Straus (*The Raw and the Cooked*) and of the literary application of those studies put forth by critic Algirdas Greimas (*Of Meaning*).

GILMORE, Elsa M., Assistant Professor, "Technology and Foreign Language Instruction at the USNA: a Personal View," *Pennsylvania Modern Language Association Bulletin*, **66, 2** (Spring 1988), 9-17.

This article opens with a discussion of current language acquisition theory as put forth by Stephen D. Krashen and others. The paper then describes pedagogic applications of audiovisual technologies which are based on Krashen's hypotheses, and which presumably foster listening comprehension (and acquisition).

The article refers to specific details of the classroom activities which can be developed in connection with the presentation of authentic (audiovisual) texts. The author discusses particular skimming, scanning, cloze, and gisting exercises based on commercially-available language videotapes and on foreign television commercials.

The author also presents a general overview of the Annapolis Interactive Video Project. This section describes the project's methodological premises, traces its history, describes its software and hardware specifications, and closes with preliminary conclusions regarding its effects on student motivation.

GUARDA, Sylvain, Assistant Professor, *Theodor Fontane und das "Schau-Spiel": Die Künstlergestalten als Bedeutungsträger seines Romanwerks*. New York, Frankfurt am Main, Bern: Peter Lang Verlag, 1989.

This study examines the function and significance of the artist figures in the novels of Theodor Fontane (1818-1898). It offers unexpected glimpses into the deceptiveness of Fontane's humor and points to a recurrent structural pattern underlying five major novels. The identification of this mythical pattern, a key to the inherent dialectics of the author's political aspirations and artistic freedom, leads the critic to reassess Fontane's "modernity." He claims that Fontane's "narrative plays" are to be viewed as overtures to German and Austrian fin-de-siècle *Festspiele* and a *plaidoyer* for the fusion of life and the arts as well.

MARQUEZ, Enrique, Assistant Professor, *Diccionario Bio-bibliográfico de Poetas Cubanos Contemporáneos*. ed. P. Le Riverend. New Jersey: Ed. Q-21, 1989, pp. 128-129.

This critical compilation received the Cintas Award (New York, 1988). It offers biographical as well as critical appraisals of Cuban writers living outside Cuba since the Cuban Revolution, and includes poets of three distinct generations. It describes the different professional and intellectual activities that the writers have pursued in sixteen different countries, and reviews literature written in Spanish and other languages but dealing with the experience of Cuban exiles and the crisis of consciousness brought about by the Revolution.

The entry on Professor Márquez centers on what tenets sustain his personal vision and the reasons behind the three volumes he has published since 1971 through 1985. The key topic addressed is the "usefulness" of poetry in the politically disoriented, skeptical, materialistic, and scientifically-minded world of today.

MOUX, María, Assistant Professor, "El hipérbaton en el *Laberinto de Fortuna* de Juan de Mena: Estudio cuantitativo," *Campo Abierto* **2, 2** (June 1989), 10-15.

This article is a statistical study of the syntactic structure of Juan de Mena's *Laberinto de Fortuna* which classifies hyperbatic constructions and contrasts data found with examples of regular word order in another poem written by Mena, *La Coronación*. The comparison of relative frequency of phenomena seems to point out differences of style between the two works examined, supporting María Rosa Lida's assertion that Juan de Mena's poetical style is not uniform throughout his poetical works.

PRUNER, Ludmila, Assistant Professor, "The Use of Interactive Video in Proficiency-Oriented Teaching: Developing Listening and Speaking with Authentic Material," Front-Page Dialogue: Issues Germane to Teaching Listening or Watching Comprehension, *ACTR LETTER*, **4** (1989), 1-4.

The acquisition of a proficiency level in listening and speaking directs the foreign language instructor's interest toward the use of authentic material, e.g., foreign television broadcasts. The article discusses the need for introducing authentic video at very early stages of the teaching-learning process and ways of integrating foreign television broadcasts into the proficiency-oriented curriculum.

The traditional way of teaching a foreign language demonstrates strong preference of grammar over any other skill. The contemporary practice of developing speaking rests upon a gradual advancement from a word, to its form, to the grammar structure. A significant amount of time elapses before students attempt to use the learned vocabulary to express their thoughts on their own.

Yet, theories of cognitive development tell us that "communication can be achieved *only* in a roundabout way: ... from the motive which engenders a thought to the shaping of the thought, first in inner speech, then in meanings of words, and finally in words." Thus, the word represents the "final product" in the functioning of speech. The gradual development of a thought in speech does not necessarily presume the divided learning of the lexical means of communication on the one hand and the mechanism of speech on the other. The IAV is regarded as a 'motive' that promotes and encourages the students to speak. The incorporation of the authentic video at the early stages of the teaching-learning process benefits the development of listening and speaking skills, and contributes to the students' cultural understanding.

Presentations

BLEDSOE, Penelope M., Assistant Professor, "Constraints on the Ordering of Constituents of the Relative Clause in Spanish," The Louisiana Conference on Spanish and Portuguese, Tulane University, New Orleans, Louisiana, 17 February 1989.

CORREDOR, Eva L., Associate Professor, Panelist, Special Session of MLA Committee on Professional Ethics, Modern Language Association Conference, New Orleans, Louisiana, 27-30 December 1988.

CORREDOR, Eva L., Associate Professor, "The Idea of Revolution and the Reality of War in the Critical Theory of the Young Lukacs," Lecture at Columbia University, New York, New York, 6 March 1989.

CORREDOR, Eva L., Associate Professor, Chair, "Rationalities after Croce and Gramsci," Fourteenth Annual Meeting of the International Association of Philosophy and Literature, "Dialectic and Narrative," Emory University, Atlanta, Georgia, 4-7 May 1989.

DAHLGREN, Sharon G., Associate Professor, "*La imagen de la hermosura*: Describing Feminine Beauty in the Spanish Pastoral Novel of the Sixteenth Century," Midwest Modern Language Association, St. Louis, Missouri, 3 November 1988.

DAHLGREN, Sharon G., Associate Professor, "Teaching Listening Comprehension with Computers at Beginning Levels," Association of Teachers of Slavic and Eastern European Languages, Washington, DC, 28 December 1988.

DAHLGREN, Sharon G. Associate Professor, "The Feminine Opposant and Calderonian Plot Dynamics: The Case of Anne Boleyn," Golden Age Spanish Drama Symposium, University of Texas at El Paso, El Paso, Texas, 15 March 1989.

FLETCHER, William H., Associate Professor, "Annapolis Interactive Video Project: Project Background, Lesson Design and Learner Outcomes," Conference on "Learning to See/Seeing to Learn: Video and Interactive Video for the Foreign Languages," University of Massachusetts, Amherst, Massachusetts, 1-3 June 1989.

FLETCHER, William H., Associate Professor, "Opportunities for Interactive Video in the High School," Workshop on "Interactive Videodiscs in Foreign Language Instruction," Center for Applied Linguistics, Washington, DC, 15 April 1989.

FLETCHER, William H., Associate Professor, "Interactive Video Lesson Production Techniques at the United States Naval Academy," Session on "Consumer's Guide to Interactive Video Authoring Systems," Computer-Assisted Language Learning and Instructional Consortium (CALICO), Colorado Springs, Colorado, 28 March-1 April 1989.

FLETCHER, William H., Associate Professor, "Interactive Video Authoring Templates Developed at the United States Naval Academy," Session on "Federal Agencies Review," CALICO, Colorado Springs, Colorado, 28 March-1 April 1989.

FLETCHER, William H., Associate Professor, Workshop on "Getting Started in Interactive Video," CALICO, Colorado Springs, Colorado, 28 Mar 89.

FLETCHER, William H., Associate Professor, "Techniques and Tools Developed at the United States Naval Academy for Interactive Video with Authentic Materials," Interagency Language Roundtable, Pre-Georgetown University Roundtable in Linguistics Session, Washington, DC, 8 March 1989.

FLETCHER, William H., Associate Professor, "Interactive Video for Building Listening Comprehension," Conference on "The Impact of Technology in Foreign Language Instruction," Loyola College, Baltimore, Maryland, 4 March 1989.

FLETCHER, William H, Associate Professor, "Authentic Video in the Foreign Language Curriculum at the United States Naval Academy," SCOLA Conference, Annapolis, Maryland, 9-10 January 1989.

FLETCHER, William H., Associate Professor, "Interactive Video for Teaching Foreign Languages," American Association of Teachers of Slavic and East European Languages (AATSEEL), Washington, DC, 28-30 December 1988.

FLETCHER, William H., Associate Professor, "Interactive Video for Teaching Spanish at the United States Naval Academy," University of California at Davis, Davis, California, 21 November 1988.

FLETCHER, William H., Associate Professor, "Authentic Video for Building Listening Comprehension: the Annapolis Interactive Video Project," American Council on the Teaching of Foreign Languages (ACTFL), Monterey, California, 17-20 November 1988.

FLETCHER, William H., Associate Professor, "Authentic Video in the Foreign Language Curriculum: the Annapolis Interactive Video Project," Interactivity 1983, The Hague, Netherlands, 5-7 October 1988.

FLETCHER, William H., Associate Professor, "De Verenigde Staten en Nederland: Raakvlakken en verschilpunten in de volksaard" (The United States and the Netherlands: Commonality and Contrast in the National Character), Symposium "Common Values: a Bilateral Discussion," Roosevelt Study Center, Middleburg, Netherlands, 27 September 1988.

FLETCHER, William H., Associate Professor, "IAV Techniques for Integrating Authentic Video in the Foreign Language Curriculum: Implementation and Evaluation," Nebraska Videodisc Symposium, Lincoln, Nebraska, 12-15 September 1988.

GILMORE, Elsa M., Assistant Professor, "Vallejo y Neruda: cartas de 1937," Louisiana Conference on Languages and Literatures, New Orleans, Louisiana, 16-18 February 1989.

LANDERS, Rita P., Assistant Professor, "El pretexto como pretexto: *El Premio de la Hermosura* de Lope de Vega," Golden Age Spanish Drama Symposium, The University of Texas at El Paso, El Paso, Texas, 17 March 1989.

MARQUEZ, Enrique, Assistant Professor, "Luis Martín Santos or the Texts to Come," Louisiana Conference on Hispanic Languages and Literatures, Tulane University, New Orleans, Louisiana, 17 February 1989.

MARQUEZ, Enrique, Assistant Professor, "Vico and Lezama Lima: The Natural, the Historic, or the Problem of Skepticism," Tenth Congress of the International Association of Hispanists, University of Barcelona, Barcelona, Spain, 22 August 1989.

MOUX, María, Assistant Professor, "Astrología y política en el *Laberinto de Fortuna*," Conference on Fifteenth-Century Castilian Poetry, Pittsburgh, Pennsylvania, 15-17 September 1988.

MOUX, María, Assistant Professor, "Cultural Objectives in the Preparation of IAV Lessons," Conference on Pedagogical Objectives of Interactive Video Lessons, Monterey, California, 17-21 November 1988.

MOUX, María, Assistant Professor, "El hipérbaton en el *Laberinto de Fortuna* de Juan de Mena: Estudio cuantitativo," Conference on Literary Style of a Fifteenth Century Spanish Poet, New Orleans, Louisiana, 17-19 February 1989.

MOUX, María, Assistant Professor, "Tres invocaciones demoníacas en « El Trato de Argel », « El cerco de Numancia » y el *Laberinto de Fortuna*: Juan de Mena en Cervantes," Conference on Literary Influences, El Paso, Texas, 16-19 March 1989.

MOUX, María, Assistant Professor, "The Theory of Communication and the Preparation of Interactive Video Lessons at USNA," Conference on technology in Education, Amherst, Massachusetts, 2 June 1989.

PRUNER, Ludmila, Assistant Professor, "Selecting Materials for the Interactive Video in Russian"--Principles and Analysis of New Selection of Video Segments for a Video Disc Production, Inter-agency Consortium on Russian Development Conference (ICORD), Foreign Service Institute, Arlington, Virginia, 4 August 1988.

PRUNER, Ludmila, Assistant Professor, "Contemporary Issues in Soviet Cinema: More Than `Repentance,' Kira Muratova's Contribution to Soviet Cinema during Perestroika," 1988 Convention of American Association for the Advancement Slavic Studies, Honolulu, Hawaii, 18-21 November 1988.

PRUNER, Ludmila, Assistant Professor, "Interactive Video: Present and Prospective Methodology," Chair of panel, 1988 Convention of American Association of Teachers of Slavic and East European Languages, Washington, DC, 28-30 December 1988.

PRUNER, Ludmila, Assistant Professor, "Interactive Video Strategies for Intermediate and Advanced Russian," 1988 Convention of American Association of Teachers of Slavic and East European Languages, Washington, DC, 28-30 December 1988.

PRUNER, Ludmila, Assistant Professor, "Current Status on the New Russian Video Disc Project," Inter-agency Consortium on Russian Development Conference, USNA, Annapolis, Maryland, 26 January 1989.

PRUNER, Ludmila, Assistant Professor, "Interactive Video and the Development of Listening Comprehension," Third Soviet-American Conference on the Russian Language and the Methodology of its Teaching as a Second Language, Washington, DC, 18 February 1989.

TOLSTOY, Vladimir, Associate Professor, "The Soviet Press in 1989", American University Slavic Honor Society, Washington, DC, 15 May 1989.

DEPARTMENT OF

Political Science

Professor Charles L. Cochran
Chairman

The 1988-1989 academic year saw another significant increase in research and publication within the Department of Political Science. The department received more competitively awarded grants based upon research design, relevance, and the likelihood of successfully completing the proposed research project than in any previous year. Professor Stephen Frantzich published a book entitled *Political Parties in the Technological Age*, and Professor Pope Atkins published a revised edition of his work entitled *Latin America in the International Political System*. At least two other book-length manuscripts will be published during the next year. Professor Arthur Rachwald received a study grant to attend the International Summer Course on International Security, Institute of Political Science, Christian-Albrechts University, Kiel, Germany.

There were other areas of research that resulted in department recognition. Professor Frantzich was recognized for his research and writing efforts on "how to teach" using Cable Satellite Public Affairs Network (C-SPAN) and in the creation of simulations to be used in the teaching of political science that are being used by The American Political Science Association as the flagship simulation models to be distributed to political science departments throughout the country.

Seven funded research projects during the year and fourteen unfunded projects resulted in two books published, two pending publication, seven chapters in books, four articles in scholarly journals, and nine ongoing research projects. There were thirty-one papers presented at scholarly meetings.

Faculty/midshipmen research project activity continued to increase, with twenty-eight faculty supervised projects completed by midshipmen. Midshipmen also attended conferences at West Point, Colorado Springs, and Washington, DC.

Sponsored Research

The Comparative Analysis of Latin American Foreign Policies

Researcher: Professor G. Pope Atkins
Sponsor: Naval Academy Research Council (OMN)

The past decade and a half has seen a heightened and more sustained scholarly interest in Latin America's role in world affairs. A large number of studies, inevitably of widely varying purposes and quality, have addressed a range of general and specific aspects of Latin American international relations. Nevertheless, a systematic scholarly approach to the comparative analysis of the foreign policy environments and decisional processes of the Latin American states themselves has lagged behind the literature, which tends to focus on the interests and roles of outsiders who interact with Latin America. The purpose of this project is to develop a comprehensive theoretical framework for Latin American foreign policy analysis that subsequently will be applied to a series of country case studies. The goal is to formulate an inclusive comparative description and explanation of foreign policy structures and processes in the Latin American states. A further purpose is to contribute, to some degree, to the larger body of international relations literature having to do with foreign policy analysis.

Nuclear Waste Policy: Congress and the Search for a High-Level Waste Repository

Researcher: Assistant Professor Robert L. Beckman
Sponsor: Naval Academy Research Council (OMN)

Congress passed the Nuclear Waste Policy Act in December 1982 to provide for a scientifically, technically, and politically acceptable system for managing high-level military and civilian nuclear waste and spent nuclear reactor fuel. Since then, the Department of Energy and the U.S. Congress have not been able to reach agreement about the development and implementation of disposal plans.

This project will examine political and technical obstacles to agreement about the best ways to proceed to ensure that, in accordance with the law, one geologic repository is constructed by 1998. The research will involve comparisons of U.S. approaches with other governments, an analysis of the major disagreements standing in the way of a unified policy, and the implications of failure to reach an acceptable compromise.

The methodology employed includes analysis of materials already compiled, such as Department of Energy studies, Congressional reports, independent analyses of nuclear waste storage, international findings, and scientific studies. Interviews with federal, state, and local participants, to include military and civilian employees, is a very important part of the research.

It is no understatement to say that until the nuclear waste repository question is resolved--either in the form of a short-term and temporary monitored retrievable storage facility, or in the form of permanent deep geologic sites--there will be a continuing public perception of malfeasance on the part of the government.

As a prime beneficiary and user of nuclear power, the U.S. Navy is an active participant in discussions on the best ways to cope with nuclear wastes. With the controversies swirling around the subject of high-level nuclear waste, public opinion and Congressional scrutiny are of major concern to policymakers within the Department of Defense.

Delinquency, Race, and School Suspension

Researcher: Professor John A. Fitzgerald
Sponsor: Naval Academy Research Council (OMN)

Previous research in the area of race, delinquency, and school suspension had suggested that the disproportionally high black suspension rate (four times that of white students) was a function of factors other than disruptive behavior. Personal characteristics, especially lower verbal ability, rather than overt behavior such as assault, tended to be more highly correlated with black suspendees in this earlier work. Were these findings reliable? And if reliable, were the analytical techniques yielding as much information as they might? The primary statistical tool employed in this study, in addition to various nonparametric measures of association, was regression analysis. It was decided that since the data did not exhibit a normal distribution but rather were characterized by a "0/1" pattern ("Have you or have you not been suspended during the past school year?"), a more sophisticated and powerful approach would be to employ the relatively new logit/probit analytical technique. This new technique confirmed earlier findings, using a technique in which the researcher could have the highest possible level of confidence.

For students in general, suspension correlated with such expected factors as an unemployed and/or absent father, family being on welfare, and father's lack of education. The positive correlation noted in earlier work between assaultive behavior and suspension remained. Moreover, there is some indication that black delinquent behavior is more likely to result in their suspension. Equally important, although likelihood of suspension correlated with various demographic factors (e.g., parents' income, etc.) and with personal behavior attributes (e.g., number of times fought), none of these variables explained the higher black disciplinary rates. The researcher did find, however, that logit/probit analysis confirmed that suspension rates correlated highly with verbal scores. Specifically, for all students, for each one percent decrease in verbal score, the probability of suspension increased by 1.3 percent. Thus, the tendency to score lower on the verbal variable, rather than specific disruptive behaviors, would seem to offer a more fruitful explanation for disproportionate black suspension rates.

Bringing Microcomputers to the Classroom: Decision-Making Simulations in Political Science

Researcher: Professor Stephen E. Frantzich
Sponsor: Naval Academy Instructional Development Advisory Committee

Microcomputer simulations have the potential for providing students with realistic "hands on" experience in analyzing political processes. During the last five years a number of simulations have been developed with two underlying goals in mind: exposing students to a body of substantive material and making them aware of information as a scarce resource in political decisions. Three simulations were completed under this year's Instructional Development Program (IDP) grant. The "Judicial Process" simulation allows the student to make a number of decisions designed to defend themselves from charges of drug possession. Students are given varying amounts of resources based on their assigned social position and must skillfully utilize the resources available. In the "Public Opinion Polling" simulation students are introduced to the underlying principles of polling and then given the opportunity to use their knowledge to bias a poll they must carry out. By showing how easy it is to bias a poll, the simulation is designed to make students more sophisticated poll consumers. The "Presidential Popularity" simulation introduces the student to empirical data analysis. Students are made familiar with the process of crosstabulation and then encouraged to test a series of hypotheses using data on the causes and consequences of presidential popularity. Each of the simulations has been successfully used in Naval Academy courses; revised versions are being distributed by the American Political Science Association.

Victims of the State: Genocides, Politicides, and Group Repression Since 1945

Researcher: Assistant Professor Barbara Harff
Sponsor: Naval Academy Research Council (OMN)

This research is concerned with the collective victimization of ethnic, religious, national, and political groups by the state. It analyzes information on more than 60 communal and political groups which have been victimized in genocides and politicides since 1945 and about 75 communal and regional groups which in the mid-1980's were the subjects of systematic political repression or discrimination. The prospects that the latter groups will be the victims of future geno/politicide are assessed. The uses of these datasets for future research on the causes of geno/politicide are assessed in the conclusion.

U.S. Bases in Europe: An Anachronism or a Continuing Necessity?

Researcher: Associate Professor Gale A. Mattox
Sponsor: Naval Academy Research Council (OMN)

The purpose of the project was to begin research on the issue of U.S. bases in Europe and the American commitment to European defense. While the U.S. presence in Europe has been vital to U.S. as well as European national security interests since World War II, it is also clear that the terms under which the troops have been stationed on the continent are changing. The research reviewed the development of U.S. conventional and nuclear strategy in Europe and focused there on the current debate in the U.S. and Europe over the concept of extended deterrence and the requisite forces and weapons systems necessary for alliance security.

The Role of Cognition, Information, and Cultural Variables in Expert Predictions of Future Political Trends in South Africa

Researcher: Associate Professor Helen E. Purkitt
Sponsor: Naval Academy Research Council (OMN)

The renewed cycle of violence in South Africa during 1984-1986 was accompanied by a number of often contradictory expert-generated scenarios of future political trends in South Africa. In fact, the number of widely varying predictions about future political trends in South Africa seemed to have reached an all-time high in the Unites States by 1987. Past research suggests that people are "limited information processors" who can use only a few analytical factors systematically to understand and to make subjective judgments about complex problems. It may be possible to model the cognitive process of political experts using artificial intelligence text processing routines. However, the critical variables to be included in an Artificial Intelligence (A.I.) model of expert political problem-solving must first be identified. In order to investigate the importance of the cultural background of substantive experts, the researcher conducted systematic interviews with a variety of U.S. and South African experts currently working in policy-making or research positions. The results of this first wave of interviews indicated that cultural differences between U.S. and South African experts were a major determinant of variance in the subjective estimates of future political trends in South Africa. This first stage of research also provided support for the utility of using an information processing theoretical perspective to model the subjective judgments of experts. The next stage of this research program is to conduct a second set of interviews with the same experts in both the United States and South Africa during 1989. A second wave of interviews is necessary in order to assess the relative importance of cognitive, information, and cultural factors as determinants of experts' intuitive predictions about one ongoing international crisis over time. Moreover, additional protocol data are needed to develop a prototype open-ended A.I. text processing system which is capable of automatically updating and analyzing the subjective judgments of political experts.

Evaluation of USNA's Language Department's Interactive Audio Video Project

Researcher: Associate Professor Helen E. Purkitt
Sponsor: National Security Agency

This is a four-year field experiment designed to assess the effectiveness of interactive audio video lessons to increase listening comprehension in Spanish at the U.S. Naval Academy. Data for the first two years have been completed. The longitudinal nature of this study is designed to compare the relative effectiveness of Interactive Audio Video (IAV) with more traditional teaching techniques (e.g., audio cassette tapes) during the first two years of foreign language instruction.

Independent Research

An Information Processing Perspective of Political Decision-Making: Comparison of Results from Experimental and Real World Settings

Researcher: Associate Professor Helen E. Purkitt

This project seeks to compare the results of how a small group of political choosers make decisions with the processes observed in the "real world." To date, a preliminary case study of the decision processes in the initial meetings of the Executive Committee Group deliberations during the Cuban Missile Crisis has been completed. The results of this study were presented at the International Studies Association (ISA) Annual Conference in London in March 1989. This paper is currently being revised for possible publication. A second case study of recent U.S. foreign policy decision-making is currently being researched. The results of this second case were presented at the biannual meeting of the Society for the Study of Subjective Probability, Utility, and Decision-Making (SPUDM) in Moscow in August 1989.

Research Course Projects

The Cuban-Soviet Alliance

Researcher: Midshipman 2/C Donald R. Bourassa, USN
Adviser: Professor G. Pope Atkins

The alliance between the Soviet Union and Fidel Castro's Cuba has been an especially significant relationship between a superpower and a lesser-developed country. The Moscow-Havana axis has helped define several international political agendas, from the relationship between the United States and the Soviet Union to regional affairs in Latin America, Africa, and the Middle East. A number of views of the Soviet-Cuban relationship tend to simplify the symbiosis between the two states to the point of seriously distorting the ability to analyze and predict trends in the alliance. One extremity of perspective sees the alliance purely in terms of advantage for the Soviet Union. In this view the Soviets are able to accomplish significant geopolitical goals through the use of the Cuban "proxy," spreading the Cubans thin in regions and operations that would otherwise be of little Cuban interest. The other extreme perceives the Cubans as dragging the Soviets into a highly expensive subsidization of their domestic economy with the effect of curtailing the amount of Soviet resources available for other foreign policy initiatives. The reality of the relationship is that the ruling elites in both Moscow and Havana have been able to pursue their individual interests in the context of a relationship that has combined mutuality of purpose with tension and disagreement. The close Soviet-Cuban relationship has been maintained over the years, but it has not been a simple one and has encountered difficulties in coordinating aspirations, purposes, interests, tactics, and instrumentalities.

NOTE: This paper won the Captain Roy C. Smith III, USN, Retired, Essay Contest Prize, Naval Academy Foreign Affairs Conference (NAFAC), presented on 20 April 1989.

A Campaign Comparison: The Role of the State Department in International Organization Elections

Researcher: Midshipman 1/C Devon M. Burr, USN
Adviser: Professor Charles L. Cochran

This paper compares the strategies of two United States campaigns to put an American in an elected position in an international organization. In 1987, Dean Burch was elected to the Directorship of the International Telecommunications Satellite Organization. Today, Richard Kirby is involved in the race to be Director of the Consultative Committee on Radio of the International Telecommunications Union, which will be decided at the Union's Plenipotentiary Conference in June 1989. Extended campaigning by Mr. Burch was a major factor in his successful upset of four opponents, while it appears that Mr. Kirby's incumbency will have been a substantial help in his campaign. The State Department played a major role in both campaigns, sending extensive demarches through American embassies abroad and directing the politicking. Statistical information through May 12 was encouraging but inconclusive about Mr. Kirby's chances of success.

Trends in the ITU: Implications for United States Interests

Researcher: Midshipman 1/C Devon M. Burr, USN
Adviser: Professor Charles L. Cochran

The Unites States has been losing influence in the International Telecommunications Union (ITU) since the 1960's. There are indications that a European-Third World coalition in the ITU is one cause. Similarities in telecommunications industry management and the influence of the developing nations point toward such a coalition. However, the ongoing liberalization process in the European Economic Community (EEC) telecommunications industry and the great economic differential between the First and Third Worlds indicate that the EEC will continue to side with the United States in the ITU. Statistical analysis proved inconclusive.

This study recommends that the United States halt its decline of influence in the ITU by supporting the EEC's market liberalization efforts.

Evolution of the National Security Council from Truman to Reagan: Lessons Learned and Future Recommendations

Researcher: Midshipman 1/C John T. Buthod, USN
Adviser: Lieutenant Commander Kevin J. Latham, USN

The function of the National Security Council, at its creation, was to "advise the President...in matters involving the national security." While the National Security Council (NSC) as a group does not make decisions--that is the responsibility of the president--it is a place where decisions of the highest order are analyzed. From the language of the National Security Act, few would have anticipated in 1947 how important its executive secretary--now known as the assistant to the president for national security affairs--would become in the high decision councils of the American government. The evolution of the office of the national security adviser is of special interest because of its most recent, turbulent years. The NSC has become involved in unprecedented levels of controversy as a result of the panel's staff entering into covert operations abroad, far beyond its original mandate to "advise" and "coordinate."

This research was designed to provide insights into various questions: How effectively has the NSC fulfilled its original mandate to "advise the President with respect to the integration of domestic, foreign, and military policies?" What factors have contributed to the rise in prominence of the national security adviser? What have been the consequences of this rise for the management of U.S. national security policy?

Independence Movement Violence and Government Oppression: Are They Related?

Researcher: Midshipman 1/C James P. Edwards, USN
Adviser: Assistant Professor Barbara Harff

Throughout the world groups of people continue to fight for political independence. This research project has sought to determine what type of relationship, if any, exists between the level of government oppression of independence movements and the level of independence movement violent activity. Two cases--the Basques in Spain and the Kurds in Iraq--were analyzed. In both cases the hypothesis, which states that a change in the level of government oppression results in a significant change in the level of independence movement violent activity, was partially supported.

In the case of the Basques, the government political liberalization program, which was undertaken after Franco's death, resulted in a split in the Basques independence movement. One faction of the Basques movement chose to forego armed attacks and took part in the legal political process by forming a political party. The behavior of this faction supports the hypothesis. However, a second faction of the Basques movement chose to increase its level of violent activity. Because a reduction in the level of Spanish government oppression resulted in two very different changes in the level of violent activity, additional variables will need to be considered in order to explain the peculiarities in this case.

Similarly, the analysis of the case of the Kurds resulted in partial support for the hypothesis. It was found that government oppression had to reach a certain level before a change in the level of Kurdish violent activity took place. Once this level was reached, the Kurds responded with an increase in the level of violent activity. Reductions in the level of Iraqi government oppression were followed by reductions in the level of Kurdish violent activity.

The Inter-American Dilemma

Researcher: Midshipman 2/C John H. Fischbach, USN
Adviser: Professor G. Pope Atkins

The Inter-American System is defined as the collection of Western Hemispheric international governmental organizations designed to foster multilateral cooperation, promote peace, maintain mutual security, protect human rights, and raise standards of living. The Inter-American System is composed of specific institutions (such as the Organization of American States, the Inter-American Development Bank, and others) that engage mechanisms (as established by the Rio Treaty, the Pact of Bogota, and other agreements) for cooperative arrangements among the American states to achieve the various agreed upon objectives. This paper first describes the development of the Inter-American System and the evolution of its various principles and procedures. It then summarizes the system's achievements and failures, analyzing the factors behind its decline as a workable set of international instruments over the past two decades. The paper finally evaluates the possible futures of the Inter-American system as the member states face a number of crucial regional international social, economic, and political problems.

American Voting Blocs: Past, Present, and Future

Researcher: Midshipman 2/C James W. Forrester Jr., USN
Adviser: Professor Stephen E. Frantzich

Individual voters often act in ways similar to others of their race, gender, or economic condition. This research analyzes the bloc voting patterns of women, Blacks, and Hispanics to discover patterns of partisanship. Interviews with party and bloc leaders were used to determine some of the reasons for bloc voting and its implications for the American political system.

Changing Soviet Images of Latin America

Researcher: Midshipman 2/C James M. Greene, USN
Adviser: Professor G. Pope Atkins

This paper traces recent changes in Soviet foreign policy perceptions toward Latin America with a series of country "case studies" and some commentary on the implications for United States policy. The Soviet Union appears to be in the midst of a profound social and political transition in the late 1980's under the new leadership of Mikhail Gorbachev. With regard to Latin America, the Soviet Union has renounced the export of revolution in Central America, has openly quarreled with Fidel Castro of Cuba over the policy bases for their alliance, and in South America has sought to establish normal state-to-state relations. What is the cause of this change in the Latin American policy? This paper first summarizes the history of Soviet involvement in the region, and then explores the general changes in Soviet foreign policy organization and decision making under Gorbachev and the application of these changes to Latin America in a regional sense. Against this background, the paper examines the nature of these changes in several representative countries--Cuba, Nicaragua, Argentina, and Peru. Finally, a brief section addresses the implications of the foregoing for United States foreign policy.

Campaign Strategy: Will It Play in Peoria?

Researcher: Midshipman 1/C Steven R. Hampson, USN
Adviser: Professor Stephen E. Frantzich

Modern political campaign strategies have changed dramatically in recent years. The goal of this research is to identify the basic contemporary strategies of campaigning for Congress and to apply them to a particular district. Peoria, Illinois, has long been a test market for new products and ideas under the assumption that it represents "middle America." The concept of "Will It Play In Peoria?" has entered the political lexicon. Through interviews and empirical research, this paper shows that Peoria has been less affected by modern campaign strategies than many areas of the country, but that these techniques are slowly becoming standard. With the departure of the current incumbent, the techniques used in other parts of the country will be adopted with more of a vengeance.

Terrorism in the United States

Researcher: Midshipman 2/C Aimee K. Hodges, USN
Adviser: Major John R. Allen, USMC

The research conducted centered on the domestic agencies and the measures employed by those agencies in the identification and eradication of terrorist threats within the United States. The researcher focused on the interagency mechanisms for prosecuting terrorist threats and those overseas agencies, both U.S. and foreign, who contribute to anti- and counter-terrorism operations at home and abroad.

International Event Interaction: The New York Times Versus The Los Angeles Times

Researcher: Midshipman 1/C Joseph T. Holland, USN
Adviser: Professor Rodney G. Tomlinson

International events provide some of the best indicators of the state of relations between and among nations. But determining which events to use as the indicators has long troubled researchers. In general, quality printed news media have been used, with researchers placing themselves in the hands of the editors of the quality newspapers. By quality is meant daily newspapers that, as a policy, seek to report "all the news that is fit to print." The *New York Times*, *Washington Post*, and *Los Angeles Times* meet these criteria and hence are employed most frequently by events researchers.

But modern communications now provide a deluge of events about the activities of nations, some important, most unimportant. Editors must make choices, and in so doing act as "gatekeepers" of the public's access to information. This research compares the reporting foci of the *New York Times* and the *Los Angeles Times*, the major east and west coast dailies, for the month of September 1988. Both newspapers were read daily and all originators, recipients, and types of action were cataloged according to the coding structure of the World Event/Interaction Survey.

The *Los Angeles Times* reported more international events (254 vs 159) than the *New York Times*. This more detailed reporting appeared for all geopolitical regions. But while quantities differed, the editors of both papers displayed an amazing consistency in their selection of news. The table below summarizes:

Geopolitical Areas

	Asia	Africa	West Europe	East Europe	Mid-east	Oths.
NY Times	31%	8%	8%	15%	16%	20%
LA Times	33%	5%	10%	17%	19%	17%

From this data the researcher concluded that quality journals attempt to project balanced (or perhaps shared) perspectives on world politics. In addition, it was found that less than half of the articles duplicated one another. But given this topical difference, their qualitative nature was found equivalent, again reflecting balance (shared) perspectives.

These findings suggest that multiple sourcing might provide little additional qualitative information about the state of relations for the major newsmakers (United States of America, Soviet Union, China) but greater detail to examine lesser international actors.

Service Doctrine and Military Response to Innovation: War Plan Orange and the Maritime Strategy

Researcher: Midshipman 1/C Paul J. Ling III, USN
Adviser: Associate Professor Gale A. Mattox

Doctrine and innovation are crucial to military effectiveness. This study asserts that peacetime service response to innovation is based on its perceived impact on the service's preferred doctrine. Innovations with perceived beneficial effects on doctrine will be viewed favorably by the service, while innovations with perceived negative effects will be viewed unfavorably.

Service doctrine is an intellectual paradigm; a set of beliefs, values, and goals determined at the service level which significantly guides official behavior with respect to service structure and employment. A service's doctrine is a mindset that reflects its preferred mission and operational methods, expresses its values, goals, and corporate "ethos," and provides the general guidelines necessary to resolve the wide variety of problems that confront any military organization.

Innovation is a new idea, process, practice, or technique that modifies existing organizational behavior, especially with regard to service structure and employment. This conception is relative; innovation is based more on organizational perception of novelty than on absolute originality. Service response to innovation is the attitude of key decision-makers toward it.

This theory is examined with two United States Navy doctrinal case studies: the 1919-1939 War Plan ORANGE period and the 1977-1989 Maritime Strategy period. These doctrinal time frames represent the clearest twentieth century examples of Navy doctrine. Nine innovations are examined for each doctrinal case. The doctrinal implications of each innovation are determined, and a theoretical service response is predicted by the hypotheses. When compared with the actual service response, the result determines the validity of the hypotheses in relating service doctrine and response to innovation.

U.S. Control of Narcotic Trafficking: The Presidential Certification Program

Researcher: Midshipman 1/C Kathleen J. Monaghan, USN
Adviser: Commander Charles D. Voros, USN

In an attempt to put pressure on foreign governments, the Presidential Certification Program requires the President to certify that countries receiving foreign aid are making an effort to curb narcotics emanating from their country. This paper analyzes the origin and effectiveness of this program.

Resistance to Economic Restrictions and Political Reform in the Soviet Union

Researcher: Midshipman 2/C Ernest R. Musseman Jr., USN
Adviser: Captain Steve F. Kime, USN

Historic attempts to reform the economic structure of the Soviet Union have encountered numerous road blocks. This paper discusses the structural impediments to change, and focuses on the unwillingness of existing power holders to relinquish power.

Maritime Strategy and the Northern Flank

Researcher: Midshipman 1/C Carl V. Petty, USN
Adviser: Associate Professor Gale A. Mattox

This research is an analysis of what has been known as "the Maritime Strategy" and the role it plays in the defense of the North Atlantic Treaty Organization's (NATO) Northern Flank. The results suggest that although the Maritime Strategy is an ambitious doctrine with obvious risks, it is the *only* means of defending the Northern Flank. This conclusion was reached by showing the balance of forces between the Soviets and NATO in the region, the political factors involved, and the consequences of alternative courses of action.

The researcher contends that an aggressive naval offensive into the Norwegian Sea to establish a forward line of defense is the only way to defend the Northern Flank. Whether the Northern Flank should be defended, of course, could be debated. However, the treaty commitments to the NATO partners in Norway, Denmark, and Iceland alone require the United States to defend the region. In addition to this, there are possibly even more significant reasons for defending the region. Should the Northern Flank be lost, as one example, the sea lines of communication supplying the army force on the Central Front would be under such a barrage of Soviet forces that no navy could hope to protect the convoys. This, of course, would spell certain defeat for NATO. Thus, the Maritime Strategy should not become an issue for inter-service rivalry, but rather a reason for mutual support.

Japan, Burdensharing, and the FSX Crisis

Researcher: Midshipman 1/C Walter W. Robohn, USN
Adviser: Assistant Professor Robert L. Beckman

This paper takes the approach that the United States, through the F-16 sales proposal, is trying to satisfy multiple foreign policy goals simultaneously; shift defense costs to the Japanese; restrict Japanese access to high technology; address domestic protectionist sentiments; prevent the perception and the reality of Japanese hegemonism in the region; and reinforce the containment net in East Asia. The paper traces the history and constraints on Japan's defense buildup. It tracks the record of Japan-United States military relations, along with Soviet and United States defense strategy in the area. In parallel, it chronicles the shifts of focus through United States administrations since 1945. The strength of the paper is the analysis of policy options and the socioeconomic analysis leading to policy prescriptions for both the United States and Japan.

Ideological Elements in Soviet Perceptions of Latin America

Researcher: Midshipman 1/C Michael J. Rodriquez, USN
Adviser: Professor G. Pope Atkins

The Soviet Union has demonstrated an evolving interest in Latin America since the Bolshevik Revolution of 1917. Soviet policy behavior has reflected a continually changing outlook on the Third World and the difficulty of integrating Latin America into a Third World conception. At the time of the Russian Revolution, the new Soviet leadership had virtually no interest in Latin America. Thereafter, and especially after World War II, the Soviet Union took increasing interest in Latin America but within very modest commitments of risk and resources. The Cuban Revolution of 1959 provided extraordinary opportunities from the Soviet point-of-view to erode United States influence in the Caribbean area; the Nicaraguan Revolution of 1979 was also viewed as an opportunity but within a revised framework based on "lessons learned" from the Cuban experience. Some analysts and policy makers assert that the Soviet Union's primary objective in Latin America has been to expand their strategic sphere of influence and to spread revolutionary Marxist-Leninist ideology; others argue that the primary Soviet objective, with perhaps the exception of the early 1960's (punctuated by the missile crisis of 1962), has been to weaken United States regional dominance. The objective of this paper is to investigate Soviet ideology and behavior in order to clarify these contending explanations.

The Effects of Constituency Income on Campaign Fund Contribution Patterns in Elections for the U.S. House of Representatives

Researcher: Midshipman 1/C Robert B. Samuels, USN
Adviser: Professor Stephen E. Frantzich

Congressional candidates draw largely on individuals and Political Action Committees (PACs) to fund their campaigns. While considerable research has focused on contribution strategies, little attention has been paid to the mix of various kinds of contributions received by different kinds of candidates. This research attempted to determine whether candidates from wealthy districts have an easier time acquiring individual contributions than candidates from poorer districts. Using statistical data, the paper concludes that while the relationship is not strong, it is consistent with the hypothesis.

The Effect of Candidate Image on Presidential Elections: The 1988 Image Campaign

Researcher: Midshipman 2/C Edward A. Simila, USN
Adviser: Professor Stephen E. Frantzich

Candidates attempt to portray themselves to the public with simple images that command support. The 1988 presidential campaign was filled with candidate images. This research traced the history of image-based campaigning and analyzed the 1988 election in the context of previous experience.

Political Changes in Taiwan

Researcher: Midshipman 1/C Rita G. Tauber, USN
Adviser: Assistant Professor Barbara Harff

Numerous changes in recent years have upset the traditional pattern of relations between the U.S. and Taiwan. This paper traces the impact of the Taiwan-American Relations Act and speculates on future changes.

All Volunteer Force

Researcher: Midshipman 2/C Jeffrey P. Varanini, USN
Adviser: Professor Stephen E. Frantzich

The All Volunteer Force in the U.S. military provides a number of lessons for those wishing to create universal service for American youth. This research analyzes the factors encouraging and discouraging youth from joining the all volunteer force and speculates the degree to which this experience can illuminate the potential for universal service.

Publications

ATKINS, G. Pope, Professor, *Latin America in the International Political System*, Second edition. Boulder, Colorado: Westview Press, 1989.

More than a decade has passed since the publication of the first edition of this book. Since then, significant events have occurred in the region, and the nature of Latin America's international relations has changed considerably. Although the purpose of this text is unchanged--that of providing students with a topical, current, and analytically integrated survey of Latin America's role in international politics--it has been completely updated and revised to reflect Latin American relations in all their current complexity. The discussion is organized around the idea of the region as a separate subsystem within the global international political system, with special emphasis given to subregions within Latin America, especially Mexico, Central America, the Caribbean, Brazil, and the Southern Cone. Within this framework the analysis focuses on the foreign policies of the Latin American states themselves and on the policies of other powers toward Latin America; the nature and role of transnational actors in the region, including the Roman Catholic Church, multinational corporations, international labor, transnational political parties, and guerrilla organizations; Latin American participation in international institutions, including the Inter-American System, the United Nations, and the Nonaligned Movement; and the international distribution of power and influence among states and actors, noting in particular how that balance is reflected in cooperative and conflictual interactions in the political, cultural, economic, and military arenas.

FRANTZICH, Stephen E., Professor, *Political Parties in the Age of Technology*. New York: Longman Publishers, 1989.

This comprehensive text on American political parties takes the perspective that new information technologies provide a window of opportunities for political party organizations to regain some of their lost power. While covering the basic literature on political parties, the text also analyzes the impact of new technologies on the parties and speculates on future implications.

FRANTZICH, Stephen E., Professor, "It is Time for Scholars to be Heard," *Political Science and Politics*, (March 1989), pp. 80-81.

The use of new information technologies by government for the storage and retrieval of traditionally public information has the potential for either limiting or expanding scholarly access to these materials. This article argues that scholars need to be vigilant in evaluating provisions for public access to government information in electronic form.

Presentations

ATKINS, G. Pope, Professor, "Foreign Policy Research at the University of Texas Latin American Collection," Lyndon B. Johnson Presidential Library, Austin, Texas, 19 July 1988.

ATKINS, G. Pope, Professor, "The Latin American Environment for U.S. Policy," Austin Rotary Club, Austin, Texas, 9 August 1988.

ATKINS, G. Pope, Professor, "Regional Conflict in Central America," (Discussant), Conference on Changing East-West Relations, Friedrich Nauman Foundation, Mt. Kesko, New York, 28 October 1988.

ATKINS, G. Pope, Professor, "U.S. Policy Toward the Southern Cone," Fundacion Universitaria del Rio de la Plata, Visitor Program of Meridian House International for USIA, Washington, DC, 13 February 1989.

ATKINS, G. Pope, Professor, "The United States and Latin America: Prospects for the Bush Administration," Panel Moderator and Discussant, Visiting European Community Delegation, Friedrich Ebert Foundation, Washington, DC, 3 March 1989.

FRANTZICH, Stephen E., Professor, "The Implications of Congressional Computerization," Pennsylvania Political Science Association, Gettysburg, Pennsylvania, 7 April 1989.

FRANTZICH, Stephen E., Professor, "C-SPAN in the Classroom: A Window on the Political Process," Benton Foundation Seminar for College Faculty, Washington, DC, 17-19 January 1989.

FRANTZICH, Stephen E., Professor, "Separation of Powers in the American Contest," Congressional Management Foundation Seminar for Latin American Parliamentarians, Washington, DC, 4 September 1988.

FRANTZICH, Stephen E., Professor, "New Technologies and American Elections," Center for the Study of the Presidency, Boston, Massachusetts, 10 November 1988.

FRANTZICH, Stephen E., Professor, "C-SPAN in the Classroom: A Window on the Political Process," American Political Science Short Course for Faculty, Washington, DC, 1-2 September 1988.

HARFF, Barbara, Assistant Professor, "State Perpetrators of Political Mass Murder Since 1945," Michigan State University, East Lansing, Michigan, 2-5 November 1988.

HARFF, Barbara, Assistant Professor, "Recognizing Genocides and Politicides," John Jay College of Criminal Justice, New York, New York, 22 May 1989.

MATTOX, Gale A., Associate Professor, "Future of German Defense Policy," (Panel Chair), Section on Military Studies, Annual Meeting, Atlanta, Georgia, 25 September 1988.

MATTOX, Gale A., Associate Professor, "Future West European Security Issues," (Chair), Annual International Security Studies Section, Rosslyn, Virginia, 4 November 1988.

MATTOX, Gale A., Associate Professor, "Europe After the Dismantling of Intermediate-Range Nuclear Forces," (Roundtable Presentation), Annual Meeting of the International Studies Association, St. Louis, Missouri, 2 April 1989.

MATTOX, Gale A., Associate Professor, "Viewing Security Issues across the Atlantic: American and West German Thinking," (Discussant), Annual Meeting of the International Studies Association, St. Louis, Missouri, 2 April 1989.

MATTOX, Gale A., Associate Professor, "Issues and Prospects for a Middle East Settlement," (Moderator), WIIS, Washington, DC, 26 April 1989.

PURKITT, Helen E., Associate Professor, "An Information Processing Perspective of Foreign Policy Decisionmaking: The Cuban Missile Crisis Revisited--One More Time," International Studies Association Annual Conference, St. Louis, Missouri, 30 March 1989.

RACHWALD, Arthur R., Associate Professor, "Strategic Importance of Eastern Europe," Christian-Albrechts University, 1988 Summer Seminar, Kiel, West Germany, 4 August 1988.

RACHWALD, Arthur R., Associate Professor, "U.S.-Polish Relations," International Club of Annapolis, Annapolis, Maryland, 4 November 1988.

RACHWALD, Arthur R., Associate Professor, "Soviet Policies Toward Poland, The Rescue of Communist Party, 1980-1988," International Studies Association, International Security Studies Section, Washington, DC, 3-5 November 1988.

RACHWALD, Arthur R., Associate Professor, "Poland Toward the Year 2000," Hoover Institution Conference on U.S. and Eastern Europe, Stanford, California, 17 November 1988.

RACHWALD, Arthur R., Associate Professor, "American Policy Toward Poland, 1944-1989," Conference on U.S.-Polish Relations, Pennsylvania State University, University Park, Pennsylvania, 9-11 April 1989.

RAU, Robert L., Professor, "Maritime Security Issues in ASEAN," Officers and Civilian Staff, Pacific Intelligence Command, CINCPAC, Honolulu, Hawaii, 29 July 1988.

RAU, Robert L., Professor, "The Future U.S. Naval Maritime Strategy in the Asia-Pacific Region," University College, University of New South Wales Seminar on Naval Strategy, Canberra, Australia, 20 October 1988.

RAU, Robert L., Professor, "PRC Strategic Capabilities and Intentions in the South China Sea," Senior Officers and Civilian Staff, Royal Australian Naval Intelligence Command, Canberra, Australia, 3 December 1988.

RAU, Robert L, Professor, "Impact of Defense Burden Sharing on U.S. Alliance Relations," Strategic and International Policy Division of the Australian Department of Defense, Canberra, Australia, 20 December 1988.

Index of Contributors

Faculty

Midshipmen

Robohn, Walter W., 251
Rodriquez, Michael J., 251
Rogers, Ransom R., 41
Rohrbach, Dale M., 59
Ryan, Paul P., 59

Salcedo, Frank C., 10
Samuels, Robert B., 252
Saunders, Robert P., Jr., 27
Schroder, James B., 59
Schwappach, James H., 42
Scribner, Matthew S., 42
Shoup, Michael D., 59
Simila, Edward A., 252
Smith, Loren J., 127
Smith, Piper A., 177
Snudz, Ronald T., 26
Stevens, Robert E. II, 11
Stewart, Joel D., 119

Tauber, Rita G., 252
Toppi, Edward F., 160
Tysler, Matthew S., 59

Varanini, Jeffrey P., 252
Villar, Raymundo J., 59
Voss, Kevin P., 59

Walker, David B., 38
Waters, James P. III, 59
Welborn, Matthew L., 53
West, Curtis, Jr., 11
Wigley, Jay F., 76
Wilson, John J., 192
Windland, Michael A., 59
Wolfe, John M., 42
Womack, Carol J., 59

Distribution List

COMMANDING OFFICER
U.S. ARMY RESEARCH OFFICE
RESEARCH TRIANGLE PARK, NC 27709-2211

ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, ENGINEERING AND
SYSTEMS)
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20350

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-20
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217-5000

CHIEF OF NAVAL AIR TECHNICAL
TRAINING
NAVAL AIR STATION, MEMPHIS (75)
MILLINGTON, TN 38054

CHIEF OF NAVAL EDUCATION AND
TRAINING
NAVAL AIR STATION
PENSACOLA, FL 32508

CHIEF OF NAVAL OPERATIONS
ATTN: OP-093
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20350

CHIEF OF NAVAL OPERATIONS
ATTN: OP-0[illegible]B7
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20350

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-11
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-10P3
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-11F
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

WRIGHT-PATTERSON AIR FORCE BASE
ATTN: AIR FORCE MATERIALS
LABORATORIES
DAYTON, OH 45433

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-111
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-112
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-113
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-114
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-12D
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-121
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-126
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-14
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

CHIEF OF NAVAL RESEARCH
ATTN: OCNR-20T
DEPARTMENT OF THE NAVY
ARLINGTON, VA 22217

DISTRIBUTION LIST

DEFENSE MAPPING AGENCY
ATTN: R&E/E.W. FINNEGAN
BLDG. 56, U.S. NAVAL OBSERVATORY
WASHINGTON, DC 20305-3000

DEFENSE TECHNICAL INFORMATION CENTER
CAMERON STATION
ALEXANDRIA, VA 22314-6145

DIRECTOR
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
1400 WILSON BOULEVARD
ARLINGTON, VA 22209

DIRECTOR
DEPARTMENT OF DEFENSE COMPUTER INSTITUTE
WASHINGTON NAVY YARD
WASHINGTON, DC 20374

DEPARTMENT OF ENERGY
400 1ST STREET, N.W.
WASHINGTON, DC 20545

COMMANDER
DAVID TAYLOR RESEARCH CENTER
ATTN: 00
BETHESDA, MD 20084

COMMANDER
DAVID TAYLOR RESEARCH CENTER
ATTN: 01
BETHESDA, MD 20084

COMMANDER
DAVID TAYLOR RESEARCH CENTER
ATTN: 012
BETHESDA, MD 20084

OFFICER-IN-CHARGE
DAVID TAYLOR RESEARCH CENTER
ATTN: 04
ANNAPOLIS, MD 21402

OFFICER-IN-CHARGE
DAVID TAYLOR RESEARCH CENTER
ATTN: 27
ANNAPOLIS, MD 21402

OFFICER-IN-CHARGE
DAVID TAYLOR RESEARCH CENTER
ATTN: 28
ANNAPOLIS, MD 21402

OFFICER-IN-CHARGE
DAVID TAYLOR RESEARCH CENTER
ATTN: 2844
ANNAPOLIS, MD 21402

ENVIRONMENTAL PROTECTION AGENCY
ATTN: ASST. ADMINISTRATOR FOR R&D
WASHINGTON, DC 20460

COMMANDING GENERAL
MARINE CORPS DEVELOPMENT AND EDUCATION CENTER
QUANTICO, VA 22134

ACADEMIC DEAN
MASSACHUSETTS MARITIME ACADEMY
P.O. BOX D
BUZZARDS BAY, MA 02532

SUPERINTENDENT
MERCHANT MARINE ACADEMY
KINGS POINT, NY 11024

DIRECTOR
LANGLEY RESEARCH CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
ATTN: OFFICE OF UNIVERSITY AFFAIRS
HAMPTON, VA 23665

NATIONAL SCIENCE FOUNDATION
ATTN: CISE
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: BBS
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: ENG
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: MPS
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: GEO
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: SEE
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: DRII
WASHINGTON, DC 20550

NATIONAL SCIENCE FOUNDATION
ATTN: STIA
WASHINGTON, DC 20550

NATIONAL ENDOWMENT FOR THE HUMANITIES
ATTN: DIVISION OF RESEARCH GRANTS
1100 PENNSYLVANIA AVE., N.W.
WASHINGTON, DC 20506

NATIONAL ENDOWMENT FOR THE HUMANITIES
ATTN: DIVISION OF EDUCATION PROGRAMS
1100 PENNSYLVANIA AVE., N.W.
WASHINGTON, DC 20506

STUDY CENTER
NATIONAL MARITIME RESEARCH CENTER
KINGS POINT, NY 11024

COMMANDER
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA 18974

COMMANDING OFFICER
NAVAL AIR ENGINEERING CENTER
LAKEHURST, NJ 08733

COMMANDING OFFICER
NAVAL AIR PROPULSION CENTER
TRENTON, NJ 08628

COMMANDER NAVAL OCEANOGRAPHY COMMAND
NAVAL SPACE TECHNOLOGY LABORATORIES
BAY ST. LOUIS, MO 39529-5000

COMMANDER
NAVAL AIR SYSTEMS COMMAND
ATTN: 93A
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20361

COMMANDER
NAVAL AIR SYSTEMS COMMAND
ATTN: 93D
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20361

COMMANDER
NAVAL SPACE COMMAND
DAHLGREN, VA 22448-5170

COMMANDER
NAVAL SUPPLY SYSTEMS COMMAND
WASHINGTON, DC 20376-5000

COMMANDER
NAVAL AIR SYSTEMS COMMAND
ATTN: 30
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20361

COMMANDER
NAVAL AIR TEST CENTER
PATUXENT RIVER, MD 20670

COMMANDING OFFICER
NAVAL COASTAL SYSTEMS CENTER
PANAMA CITY, FL 32407

COMMANDING OFFICER
NAVAL CIVIL ENGINEERING LABORATORY
PORT HUENEME, CA 93043

COMMANDER
NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CA 95152

COMMANDING OFFICER
NAVAL OCEANOGRAPHIC AND ATMOSPHERIC RESEARCH LABORATORY
ATMOSPHERIC DIRECTORATE
MONTEREY, CA 93943-5006

COMMANDING OFFICER
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER
INDIAN HEAD, MD 20640-5070

HEADQUARTERS
U.S. ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
ATT: SGRD-RMC
FREDERICK, MD 21701-5012

SPACE & NAVAL WARFARE SYSTEMS COMMAND
CODE: PDW 106T
2511 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202

COMMANDER
NAVAL FACILITIES ENGINEERING COMMAND
ATTN: 03
DEPARTMENT OF THE NAVY
ALEXANDRIA, VA 22332

COMMANDER
NAVAL FACILITIES ENGINEERING COMMAND
ATTN: 032
DEPARTMENT OF THE NAVY
ALEXANDRIA, VA 22332

DIRECTOR
NAVAL HISTORICAL CENTER
WASHINGTON NAVY YARD
WASHINGTON, DC 20374

COMMANDER
NAVAL INTELLIGENCE COMMAND
4600 SILVER HILL ROAD
SUITLAND, MD 20389

COMMANDING OFFICER
NAVAL INTELLIGENCE SUPPORT CENTER
ATTN: 20
4301 SUITLAND ROAD
SUITLAND, MD 20390

COMMANDING OFFICER
NAVAL INTELLIGENCE SUPPORT CENTER
ATTN: 30
4301 SUITLAND ROAD
SUITLAND, MD 20390

COMMANDING OFFICER
NAVAL INTELLIGENCE SUPPORT CENTER
ATTN: 40
4301 SUITLAND ROAD
SUITLAND, MD 20390

COMMANDING OFFICER
NAVAL INTELLIGENCE SUPPORT CENTER
ATTN: 50
4301 SUITLAND ROAD
SUITLAND, MD 20390

COMMANDING OFFICER
NAVAL ORDNANCE STATION
INDIAN HEAD, MD 20640

SUPERINTENDENT
NAVAL POSTGRADUATE SCHOOL
ATTN: 02 (PROVOST)
MONTEREY, CA 93940

SUPERINTENDENT
NAVAL POSTGRADUATE SCHOOL
ATTN: 0212 (LIBRARY)
MONTEREY, CA 93940

SUPERINTENDENT
NAVAL POSTGRADUATE SCHOOL
ATTN: 023 (DEAN OF RESEARCH)
MONTEREY, CA 93940

DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: 6000
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20375-5000

DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: 1000
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20375-5000

DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: 5000
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20375-5000

DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: 8000
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20375-5000

DIRECTOR
NAVAL RESEARCH LABORATORY
ATTN: 4000
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20375-5000

COMMANDER
NAVAL SEA SYSTEMS COMMAND
ATTN: 003
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20362-5101

NAVAL OCEANOGRAPHIC OFFICE
NAVY LIBRARY (CODE 4601)
NATIONAL SPACE TECHNOLOGY LABORATORIES
BAY ST. LOUIS, MS 39520

COMMANDER
NAVAL SURFACE WEAPONS CENTER
WHITE OAK
SILVER SPRING, MD 20910

DISTRIBUTION LIST

COMMANDER
NAVAL SURFACE WEAPONS CENTER
DAHLGREN LABORATORY
DAHLGREN, VA 22448

COMMANDING OFFICER
NAVAL TRAINING SYSTEMS CENTER
ATTN: N-2
ORLANDO, FL 32813

COMMANDING OFFICER
NAVAL TRAINING SYSTEMS CENTER
ATTN: N-21
ORLANDO, FL 32813

COMMANDING OFFICER
NAVAL TRAINING SYSTEMS CENTER
ATTN: N-23
ORLANDO, FL 32813

COMMANDING OFFICER
NAVAL UNDERWATER SYSTEMS CENTER
NEWPORT, RI 02840

PRESIDENT
NAVAL WAR COLLEGE
ATTN: 114
NEWPORT, RI 02840

COMMANDER
NAVAL WEAPONS CENTER
CHINA LAKE, CA 93555

COMMANDING OFFICER
NAVAL MEDICAL RESEARCH AND
DEVELOPMENT COMMAND
NATIONAL NAVAL MEDICAL CENTER
BETHESDA, MD 20014

COMMANDING OFFICER
NAVAL OCEANOGRAPHIC AND
ATMOSPHERIC RESEARCH LABORATORY
OCEAN DIRECTORATE
ATTN: 100
NATIONAL SPACE TECHNOLOGY
LABORATORIES
BAY ST. LOUIS, MS 39520

COMMANDING OFFICER
NAVAL OCEANOGRAPHIC AND
ATMOSPHERIC RESEARCH LABORATORY
OCEAN DIRECTORATE
ATTN:110
NATIONAL SPACE TECHNOLOGY
LABORATORIES
BAY ST. LOUIS, MS 39520

COMMANDING OFFICER
NAVAL OCEANOGRAPHIC AND
ATMOSPHERIC RESEARCH LABORATORY
OCEAN DIRECTORATE
ATTN: 300
NATIONAL SPACE TECHNOLOGY
LABORATORIES
BAY ST. LOUIS, MS 39520

COMMANDING OFFICER
NAVAL OCEANOGRAPHIC AND
ATMOSPHERIC RESEARCH LABORATORY
OCEAN DIRECTORATE
ATTN: 500
NATIONAL SPACE TECHNOLOGY
LABORATORIES
BAY ST. LOUIS, MS 39520

COMMANDING OFFICER
NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
ATTN: 00
SAN DIEGO, CA 92152-6800

COMMANDING OFFICER
NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
ATTN: 01
SAN DIEGO, CA 92152-6800

COMMANDING OFFICER
NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
ATTN: 02
SAN DIEGO, CA 92152-6800

COMMANDING OFFICER
NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
ATTN: 03
SAN DIEGO, CA 92152-6800

COMMANDING OFFICER
NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
ATTN: 04
SAN DIEGO, CA 92152-6800

OFFICER-IN-CHARGE
NAVY CLOTHING AND TEXTILE
RESEARCH FACILITY
21 STRATHMORE ROAD
NATICK, MA 01760

OCEANOGRAPHER OF THE NAVY
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20350

COMMANDING OFFICER
OFFICE OF NAVAL RESEARCH
LONDON BRANCH
FPO BOX 39
NEW YORK 09510

OFFICE OF NAVAL RESEARCH DET-BOS
ATTN: ADMIN OFFICE
495 SUMMER STREET, ROOM 613
BOSTON, MA 02210-2109

SCIENTIFIC DIRECTOR
OFFICE OF NAVAL RESEARCH
SCIENTIFIC LIAISON GROUP
AMERICAN EMBASSY
APO SAN FRANCISCO 96503

COMMANDER
PACIFIC MISSILE TEST CENTER
POINT MUGU, CA 93042

HEADQUARTERS
U.S. ARMY MATERIAL COMMAND
ALEXANDRIA, VA 22337

DIRECTORATE OF ACADEMIC AFFAIRS
U.S. ARMY WAR COLLEGE
CARLISLE BARRACKS, PA 17013

SUPERINTENDENT
U.S. AIR FORCE ACADEMY
ATTN: DIRECTOR OF RESEARCH
COLORADO SPRINGS, CO 80840

COMMANDING OFFICER
U.S. COAST GUARD
RESEARCH AND DEVELOPMENT CENTER
AVERY POINT
GROTON, CT 06340-6096

SPACE & NAVAL WARFARE SYSTEMS
COMMAND
DIRECTOR OF NAVAL LABORATORIES
CODE: SPAWAR-05
2211 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202

SUPERINTENDENT
U.S. COAST GUARD ACADEMY
NEW LONDON, CT 06320

COMMANDANT (G-D)
U.S. COAST GUARD
2100 SECOND STREET, S.W.
WASHINGTON, DC 20593

NATIONAL INSTITUTE OF SCIENCE
AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE
ATTN: ASSOCIATE DIRECTOR OF
ACADEMIC LIAISON
WASHINGTON, DC 20234

DC/S FOR RD&S
U.S. MARINE CORPS
ATTN: MC-RD
ARLINGTON ANNEX
ARLINGTON, VA 20380

SUPERINTENDENT
U.S. MILITARY ACADEMY
ATTN: ASSISTANT DEAN FOR ACADEMIC
RESEARCH
WEST POINT, NY 10996-5000

WRIGHT-PATTERSON AIR FORCE BASE
ATTN: AIR FORCE AERO PROPULSION
LABORATORIES
DAYTON, OH 45433

WRIGHT-PATTERSON AIR FORCE BASE
ATTN: AERONAUTICAL SYSTEMS
DIVISION
DAYTON, OH 45433

COMMANDER
NAVAL SEA SYSTEMS COMMAND
ATTN: 05R
DEPARTMENT OF THE NAVY
WASHINGTON, D.C 20375-5000

SPACE & NAVAL WARFARE SYSTEMS
COMMAND
DIRECTOR OF NAVAL LABORATORIES
CODE: SPAWAR-514
2211 JEFFERSON DAVIS HIGHWAY
ARLINGTON, VA 22202

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER USNA 3910-3 #14	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* SUMMARY OF RESEARCH Academic Departments 1988-1989		5. TYPE OF REPORT & PERIOD COVERED Annual, July 1988 to June 1989
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR*(s)* Compiled and edited by Professor Fred Fetrow		8. CONTRACT OR GRANT NUMBER*(s)*
9. PERFORMING ORGANIZATION NAME AND ADDRESS Office of the Academic Dean U.S. Naval Academy Annapolis, Maryland 21402-5000		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS N/A
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE December 1989
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)*
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This annual report summarizes the research work of the Naval Academy faculty and midshipmen for the period July 1988 through June 1989. Sponsored and independent research projects are listed by title, followed by the names of the investigators and an abstract. A list of publications and their abstracts are included as well as presentations at professional meetings, conferences, and seminars.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*