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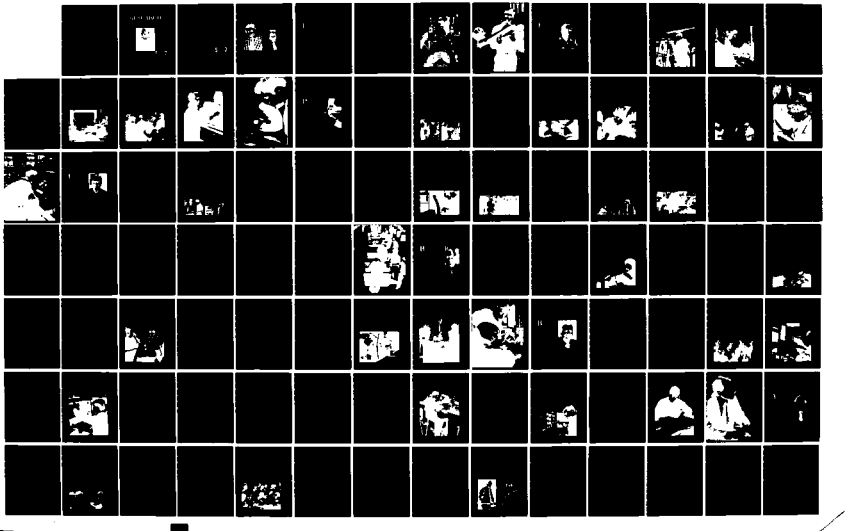
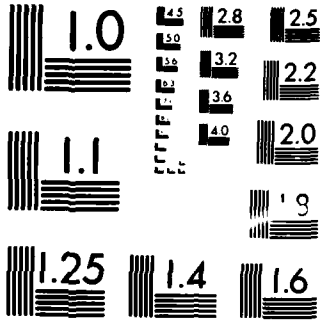


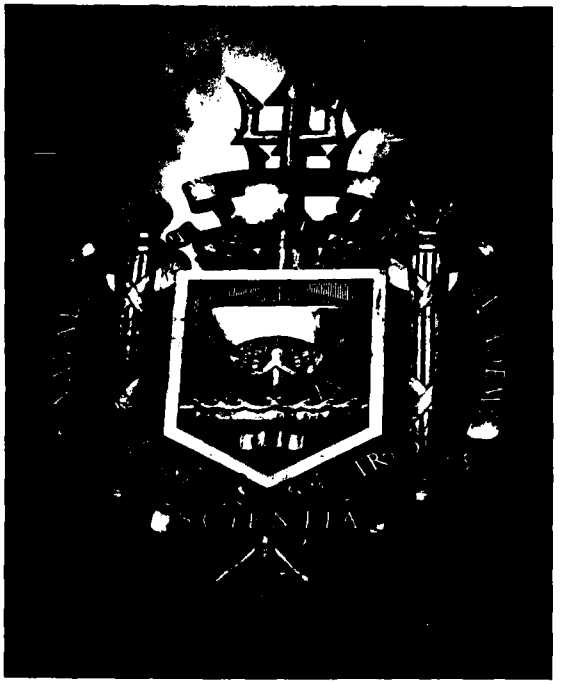


SUMMARY OF

RESEARCH

ACADEMIC DEPARTMENTS

1983 - 1984



OFFICE OF THE ACADEMIC DEAN

UNITED STATES NAVAL ACADEMY

ANNAPOLIS, MARYLAND

SUMMARY
OF
RESEARCH
1983 - 1984

COMPILED AND EDITED

BY

PROFESSOR WILSON L. HEFLIN

ENGLISH DEPARTMENT

OCTOBER 1984

UNITED STATES NAVAL ACADEMY

ANNAPOLIS, MARYLAND

21402

BRUCE M. DAVIDSON
Academic Dean

RICHARD D. MATHIEU
Director of Research/
Associate Dean

Foreword

The academic excellence of an educational institution is measured by the achievements of its faculty in teaching, research, and related scholarly endeavors. It is the policy of the Naval Academy to provide and maintain an environment in which research activities that contribute to the professional growth of the faculty and outstanding midshipmen may flourish.

The research activities of the faculty range from very applied cooperative studies with the Navy research and development community to very fundamental investigations concerned with extending the frontiers of knowledge. The broad scope of research described in this annual report reflects the interests and expertise of the participating faculty and midshipmen, as well as the availability of laboratory, library and computer facilities.

This publication was compiled to acquaint the reader with faculty and midshipmen research efforts being done behind the classroom scene. Research results are published in manuscripts, reports, and prestigious journals as well as presented at important professional meetings and conferences. In addition to their teaching and research, the faculty contribute to their profession through participation in professional societies and consulting activities. This publication contains summaries of completed and ongoing faculty projects, midshipmen research course projects including the Trident Scholar Program, and lists of presentations and publications. The work reported on was conducted during the period July 1983 through June 1984.

External support continues to increase significantly. This is undoubtedly due to the additional opportunities provided by new laboratory facilities and the initiative of the well-qualified civilian and military members of the faculty. It is important to acknowledge the strong and continuous support provided by the Chief of Naval Research, Director of Navy Laboratories and the numerous activities of the Naval Material Command, without which such progress could not be possible.

Comments and suggestions related to the research efforts will be gratefully received and sincerely appreciated.

BRUCE M. DAVIDSON
Academic Dean

RICHARD D. MATHIEU
Director of Research/Associate Dean

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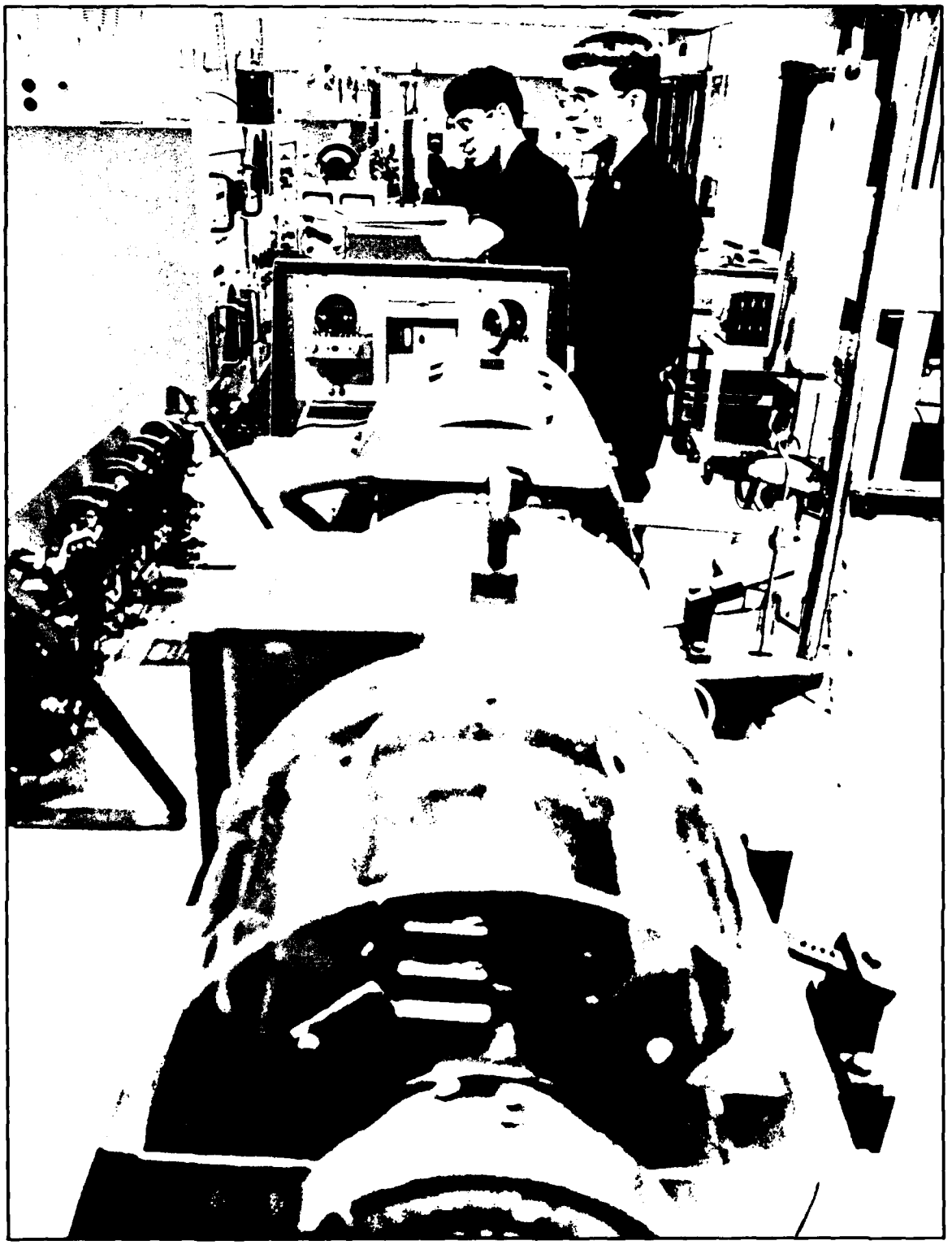
Division of Engineering and Weapons



DEPARTMENT OF

Aerospace Engineering

COMMANDER WILLIAM L. McCRACKEN, USN
CHAIRMAN

Faculty and midshipmen research in the Aerospace Engineering Department covers many diverse areas of advanced investigations. This broad spectrum of disciplines includes research in computer-aided design and manufacturing, structural analysis including advanced composite materials, computer simulation of aircraft performance, and both high and low speed aerodynamics.

Research is supported predominantly by the Naval Air Systems Command and its field laboratories as well as the Office of Naval Research and the U. S. Coast Guard. Faculty members also pursue independent research in their own areas of expertise, supported by the Department's operational funds. Five faculty members, four civilian and one military, have produced various research papers, one book, and several journal articles.

An important facet of this year's research is an effort to expand Navy laboratory sponsorship for midshipmen projects. This association, based on problems posed by the Navy, provides a more relevant academic environment for their professional development. The midshipmen are urged to present their scholarly papers before student and professional organizations. This year, Midshipman James Willson placed third at the American Institute of Aeronautics and Astronautics Middle Atlantic Region Student Conference. The primary impetus of the Department's research is both to pursue contemporary topics

and to develop the laboratory by a continual upgrading of the facility. A balance is sought in these two critical areas to enhance the student's education through his academic environment and the quality of the physical facilities.

Sponsored Research

Flow-Field Measurements in a Vortex-Controlled Radial Diffuser

RESEARCHER: ASSISTANT PROFESSOR JOHN E. ALLEN
SPONSOR: OFFICE OF NAVAL RESEARCH

In order to gain a better understanding of the flow mechanism in a complex axisymmetric turning and diffusing flow field, two-component, non-orthogonal LDV measurements were made in the backscatter mode. Frequency shifting and electronic mixing and filtering were used to resolve measurements in the diffuser inlet corner into velocity components. The objective of this study was to determine the effects of parametric variation on the overall diffuser performance as well as give insight into their effects on the separation, recirculation, and reattachment of the flow. Eight configurations were tested, exploring and the influence of bleed, corner longitudinal dimensions, and down stream fences on the flow in the corner region. Velocity vector plots and vorticity contours are being analyzed presently. The work is to be completed by 1 October 1984.

Computer-Aided Hull Design and Model System

RESEARCHER: PROFESSOR DAVID F. ROGERS
SPONSOR: U. S. COAST GUARD

A Computer-Aided Design/Computer-Aided Manufacturing (CADCAM) system for the design of ship hulls and the production of towing tank models is being developed. The design portion of the system is implemented on and supported by a three-dimensional interactive graphics device and a minicomputer. A microprocessor-based stand-alone graphics device simply, directly, and inexpensively interfaced to the CNC controller on the shop floor is used to provide support for the manufacturing portion of the system. A program running in the microprocessor-based graphics system provides all post-processing, a graphical display for the machine operator, and drives the machining center. All functions are accomplished on-the-fly in real time. All hardware components of the system are off-the-shelf items. Experiences with actual use of the system in both design and production are discussed.

Engine Performance Prediction

RESEARCHER: PROFESSOR MAIDO SAARLAS
SPONSOR: NAVAL AIR SYSTEMS COMMAND

In general, engine performance prediction and description for use in performance analysis requires extensive computing of graphical effort. In this ongoing study, an effort is being made to simplify engine performance description to the point that a relatively simple hand-held computer-calculator can be used for the task at hand. Present results indicate feasibility of this approach, but the resulting errors (sometimes up to 5%) need to be reduced.

Independent Research

Non-Linear Cylinder Buckling

RESEARCHER: ASSOCIATE PROFESSOR WILLIAM J. BAGARIA

Scale model aircraft fuselage cylinders are being fabricated and tested to determine their buckling behavior. The test results are being correlated with the predictions from the non-linear finite element program GIFT. The purpose is to determine if the non-linear programs can accurately predict the actual buckling modes and collapse loads.

Research Course Projects

Rigid Sails for Catamarans

RESEARCHER: MIDSHIPMAN 1/C MATTHEW AVILA
ADVISER: PROFESSOR BERNARD H. CARSON

As an independent research project for the Spring of 1984, the application of a rigid or wing sail to a catamaran sailboat was examined. The primary focus of the project was to examine the use of high lift devices such as multiple slats and flaps that may be deployed on opposite tacks rather than the use of a simple symmetrical section. The wind velocity profile and a method for correcting for this boundary layer along the span was also investigated. Once a planform had been chosen, the structural aspects of such a wing were studied. The final results of the project were to compare the performance of the rigid sail to a conventional sailing rig using computer methods.

ACV Skirt Drag Analysis Over Land

RESEARCHER: MIDSHIPMAN 1/C PAUL BEAUMONT
ADVISER: VISITING PROFESSOR BRIAN G. FORSTELL

Air Cushion Vehicles (ACV) are rapidly becoming a crucial element of civil transportation and national defense both over land and over water. Water-borne craft are *popular in Europe* as evidenced by their widespread use. While ACV performance over water has become closely approximated by reduction of experimental data, ACV performance over land will remain vague and uncertain due to incomplete testing over the wide variety of terrain types and velocities. While many areas of ACV performance over land have been mathematically modeled, drag due to the ACV skirt remains to be accurately predicted, due to its unique operating envelope. This paper investigates a possible solution to the problem of predicting ACV drag over land.

Presentations

ALLEY, Reuben E., Jr., Professor, "**John Smeaton, 18th Century Physicist and Engineer,**" Winter Meeting of American Association of Physics Teachers (AAPT), San Antonio, Texas, January 1984.

BRUNINGA, Robert E., Commander, USN, "**EASTNET: An East Coast Packet Radio Network,**" 9th Annual Trenton Computer Show, Trenton, New Jersey, April 1984.

BRUNINGA, Robert E., Commander, USN, "**HF Packets: Modems and Gateways,**" 9th Annual Trenton Computer Show, Trenton, New Jersey, April 1984.

BRUNINGA, Robert E., Commander, USN, "**The Racing Problem: A Packet Solution,**" 9th Annual Trenton Computer Show, Trenton, New Jersey, April 1984.

EBERHARDT, Francis J., and Richard L. MARTIN, Professors, "**Seventy-five Years' Experience in Teaching EE to Non-EE Majors,**" Frontiers in Education Conference, Worcester, Massachusetts, 18 October 1983.

EVANS, Alan G., Visiting Professor, co-author, "**Applications of the GEOSTAR Global Positioning System Receiver,**" American Geophysical Union Fall Meeting, San Francisco, California, December 1983.

EVANS, Alan G., Visiting Professor, "**The Effect of GPS Receiver Measurement Error on Gravity Anomaly Survey Accuracy,**" American Geophysical Union Spring Meeting, Cincinnati, Ohio, May 1984.

HARDING, David S., Assistant Professor, "**Computer Derivation of Equivalent-Circuit RLC Values for an Ultrasonic Transducer from Frequency-Response Measurements,**" American Society of Nondestructive Testing Spring Conference, 22 May 1984.

SARKADY, Antal A., Professor, David S. HARDING, Assistant Professor, and Herbert NEUSTADT, Associate Professor, "**Computer Derivation of Equivalent-Circuit RLC Values for an Ultrasonic Transducer from Frequency-Response Measurements,**" 1984 American Society of Nondestructive Testing Spring Conference, Denver, Colorado, 21-24 May 1984.

Publications

BRUNINGA, Robert E., Commander, USN, **"EASTNET: An East Coast Packet Radio Network,"** *Proceedings* of Third Annual ARRL Amateur Radio Computer Networking Conference, 15 April 1984, pp. 8-11.

The idea of a digital packet radio network linking the East Coast was envisioned in the late 1970's when the Department of Communications in Canada and later the Federal Communications Commission in the United States authorized the transmission of digital data over amateur radio frequencies. Today, EASTNET is a reality with relay sites becoming operational in Washington, D.C., Maryland, New Jersey, New York, Connecticut, and Boston. By 1985 connectivity from Boston to Norfolk will be established. This paper discussed the present status of EASTNET and proposed an orderly plan for development of a more sophisticated, higher data rate system. Repeater siting considerations and frequency planning were addressed.

BRUNINGA, Robert E., Commander, USN, ***"HF Packets: Modems and Gateways,"*** *Proceedings* of Third Annual ARRL Amateur Radio Computer Networking Conference, 15 April 1984, pp. 6-7.

With the increasing Packet Radio activity and need for long-haul linking between Local Area Networks (LANs), a number of experiments are being conducted on the viability of packet radio on the high frequency bands. The simplest approach is direct application of the existing 202 standard modem tones on HF using 300 baud. Although successful links have been demonstrated over long distances under ideal conditions, the performance degrades rapidly under typical interference conditions. The throughput falls to zero in the presence of interfering signals in the wide bandwidth of the Bell 202 standard modem. This paper introduces two experiments with alternative modems which significantly improve the error rate performance and describes the author's experimental HF to VHF gateway currently operational in the Washington, D.C., area. Using this gateway system, stations from the midwest and Canada have been able to link into the Washington, D.C., LAN on a reliable basis.

BRUNINGA, Robert E., Commander, USN, **"The Racing Problem: A Packet Solution,"** *Proceedings* of Third Annual ARRL Amateur Radio Computer Networking Conference, 15 April 1984, pp. 12-15.

Last June several colleagues participated in the *Old Dominion* horse ride and 100-mile endurance run near Front Royal, Virginia, by providing mobile and emergency communications. A dozen or so checkpoints were manned by radio amateurs as well as shotgun riders with each of the key event and emergency personnel to provide VHF communication throughout the several county area of rural roads and 1500-foot mountains. This paper described the design and implementation of a distributed data base system implemented with Commodore 64 and VIC-20 computers linked via amateur packet radio to maintain up-to-date status on every race entry and race asset. The distributed nature of the data base makes it very survivable in view of the temporary and mobile nature of the checkpoint battery-powered terminals. The automatic error-free communication link via packet radio demonstrated the tremendous potential application for portable and hand-held data communications in the field.

EBERHARDT, Francis J., and Richard L. MARTIN, Professors, **"Seventy-five Years Experience in Teaching EE to Non-EE Majors,"** Frontiers in Education Conference *Proceedings,* October 1983, pp. 373-378.

The role of electrical engineering in the U. S. Naval Academy curriculum over the past 75 years was discussed. Various teaching techniques and their effectiveness as well as problems encountered in the transition of the Naval Academy from the unified major approach to the present set of Accreditation Board for Engineering and Technology accredited majors were described. The laboratory configuration found best suited to the different levels of instruction was presented.

Research Course Projects

A Frequency Multiplexed Communications Network for the Apple Laboratory

RESEARCHER: MIDSHIPMAN 1/C CHRISTIAN T. NOAH
ADVISER: PROFESSOR RALPH P. SANTORO

A communication network for the EE461/462 APPLE Laboratory named ROBIN (Rap or Block Interface Network) has been developed. Eight communication channels are frequency division multiplexed over one of the laboratory Signal Circuit Channel (SCC) coaxial cables. The channel center frequencies are 6.135 KHz apart over the range from 24.540 to 67.485 KHz. Asynchronous serial communication at 1200 baud is based on amplitude shift keying with a logic 1 as zero amplitude and a logic 0 as full amplitude with each character containing 9 bits (1 start, 7 ASCII, and 1 stop). The system includes a self-contained receiver, transmitter card that plugs into the APPLE expansion bus and the control software that manages the communication process.

Characterization of Ultrasonic Transducers

RESEARCHER: PROFESSOR ANTAL A. SARKADY
SPONSOR: NAVAL RESEARCH LABORATORY

The aim of this research is to develop automated measurement systems and procedures to characterize ultrasonic transducers. A precise characterization of transducers is required to improve the uniformity of NDE measurements in naval shipyards. During the 1982-83 academic year a computer-based instrument was developed to measure the complex electrical driving-point impedance of ultrasonic transducers in the 0-6 MHz frequency range. In the 1983-84 academic year an equivalent circuit model was developed for ultrasonic transducers and the circuit parameters were synthesized from the complex driving-point impedance measurements. Measurement and synthesis are performed on-line in less than one minute by a 16-bit minicomputer. Future work will include establishing parameter limits which can be used to select "good" transducers and beam profile measurements of transducers.

Ultrasonic-Transducer Evaluation

RESEARCHER: ASSOCIATE PROFESSOR RAYMOND WASTA
SPONSOR: NAVAL RESEARCH LABORATORY

A study was completed of the performance of the high-voltage bipolar pulser which had been constructed during the previous summer. Various transducers were driven by the pulser. The investigation centered on the effects of pulse characteristics on the return echo. The rise time, duration, amplitude, and the repetition rate were altered to maximize the energy in the return signal. The transducers were interfaced with several different media, including blocks of steel and aluminum, and used with containers with varying depths of water. The spectrum of the optimum or maximum energy returns were recorded on an x-y plotter for each configuration.

The parameter having most control over the energy in the return was the pulse rise time, with faster pulses giving the most prominent returns and most of the pronounced spectra.

Computer Derivation of Equivalent-Circuit RLC Values for an Ultrasonic Transducer from Frequency-Response Measurements

RESEARCHER: ASSOCIATE PROFESSOR HERBERT M. NEUSTADT AND
ASSISTANT PROFESSOR DAVID S. HARDING
SPONSOR: NAVAL RESEARCH LABORATORY

The purpose of this project is to develop a microcomputer-based method for the measurement of the equivalent circuit parameters of an ultrasonic transducer. The equivalent circuit parameter values can be used to characterize the electro-mechanical properties of an ultrasonic transducer. This will enable improved quality control of transducers. A computer program derives the values of resistance, capacitance, and inductance from measurements of electrical, driving-point impedance using an iterative process. The branch three resistance has been found to vary significantly when the mechanical loading is changed. Thus, the value of this resistance can be used as an indicator of the efficiency of acoustic transmission.

Computer-Augmented Video Education (CAVE) Development

RESEARCHER: PROFESSOR RALPH P. SANTORO
SPONSOR: ACADEMIC COMPUTING CENTER

Refinement of the CAVE controller hardware and software continued during the past year. A second controller was constructed and the control software was extended to include the Pioneer PR7820-3, VP-1000, and VP-8210 video disc players; the latter players are inexperienced consumer models. The addition of a text to speech capability to the CAVE environment using a VOTRAX speech synthesizer is under development.

Nondestructive Pipe Condition Monitoring

RESEARCHER: PROFESSOR ANTAL A. SARKADY
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER,
ANNAPOLIS LABORATORY

The goal of this research is to develop sensors and an automated measurement system which can be used to nondestructively detect and characterize flows in naval boiler and condenser pipes. During the last year a multi-frequency differential eddy current probe was evaluated on faulty naval condenser pipes and a multi-element ultrasonic array probe was designed. A single element of this array was tested on naval boiler pipes. In addition, the preliminary design of the data acquisition/analysis system was completed. The project is a joint effort between the U. S. Naval Academy, Naval Station Research and Development Center, Oak Ridge National Research Laboratory, and Combustion Engineering, Inc.

Algorithms for Linear Predictive Encoding on Fleet Computers

RESEARCHER: ASSISTANT PROFESSOR SUSAN E. HAUSER
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The Department of Defense has supported research in secure narrowband voice communication for many years. Dr. George S. Kang of the Naval Research Laboratories (NRL) has done extensive theoretical and practical work on linear predictive encoding techniques for the analysis and synthesis of speech. The immediate objective of the project was to implement Dr. Kang's algorithms on the Naval Academy Time-sharing System and experiment with the effect of perception of slight modifications to the encoded speech parameters. Hardware and software were developed to support investigation on small portions (2 seconds) of speech. Sufficient speech data have been processed to indicate that the system functions correctly using the original algorithms from Dr. Kang. The next step should be to refine the entire investigative process, which is currently awkward and time consuming.

Total Dose Radiation Testing of CMOS RAMs

RESEARCHER: PROFESSOR RICHARD L. MARTIN
SPONSOR: NAVAL RESEARCH LABORATORY

The overall objective was evaluation of samples of CMOS Random Access Memories (CMOS RAMs) manufactured using special processing to provide hardness against radiation, specifically gamma radiation. Test procedures were developed and test boards designed and constructed in order to perform irradiation and testing of the parts at the NRL Co60 facility.

These tests included: (a) setting of specific patterns into the RAMs prior to irradiation; (b) testing for hard failures (stuck memory bits); and (c) testing for soft failures (out of specification current drain or access times). Several sizes and configurations of memories were tested.

Sponsored Research

Transducer Performance Evaluation

RESEARCHER: ASSOCIATE PROFESSOR WILLIAM E. BENNETT
SPONSOR: NAVAL RESEARCH LABORATORY

This project was responsible for the design of a high-speed data acquisition system involved in determining the electrical impedance of transducers. The system is composed of the latest high-speed digital and analog integrated circuits. The control of this system is handled by an interface to a minicomputer.

Development of a Network Protocol for Wireless Digital Communications

RESEARCHER: COMMANDER ROBERT E. BRUNINGA, USN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The goal of this research is to explore and develop suitable protocols, hardware, and software to demonstrate the viability of a radio-linked local data network. The approach includes experimentation with existing cable system protocols to extrapolate the modifications necessary to allow for wireless application. Two single-board microprocessor interface controllers are being constructed to prove the techniques over a single radio channel to link a portable terminal with the Naval Academy Timesharing System (NATS) or the SHINPADS Bus System. A third controller will be used to demonstrate multi-user access and to experiment with the principles of extending radio range through the use of automatic digital repeaters.

A digital transponder was located on the state forest lookout tower at Elk Neck, Maryland, for relay experiments up the Chesapeake Bay in February 1984. Demonstration of the protocols and data-link hardware will form the basis for follow-on research in the proof-of-concept for a worldwide low earth orbiting satellite communications system using lightweight portable terminals.

Computer-Aided Machine Design

RESEARCHER: PROFESSOR FRANCIS J. EBERHARDT
SPONSOR: DAVID TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The researcher implemented "user friendly" computer programs for advanced concept propulsion motors. Existing design equations were programmed to provide design profiles of superconducting propulsion motors for destroyer-size vessels and certain SWATCH ships. Later modifications permitted calculation of efficiencies, fuel weights, etc. for a given mission profile.

DEPARTMENT OF

Electrical Engineering

LIEUTENANT COLONEL GEORGE D. PETERSON, USAF
CHAIRMAN

Provision of a technically current education in any academic discipline requires that the faculty be professionally active and currently contributing to the general body of knowledge in their field. This is particularly true in a fast developing technical area such as electrical engineering. The research program serves to keep the faculty actively involved in the development of the discipline and therefore contributes directly to the quality of electrical engineering education for midshipmen. A related benefit is the opportunity for some midshipmen to participate directly in research projects under faculty guidance.

Sponsored research within the Department is supported by the Naval Research Laboratory (NRL), David Taylor Naval Ship Research and Development Center (DTNSRDC), and internally within the Academy. A major addition to the Department was the integration of two AN/UYK-20 computers, with peripherals from PSM-408, and the loan of the Canadian Forces' SHINPADS data-bus system, received during the summer of 1983. This combination of equipment was used in support of Professor Hauser's summer research and will provide a basis for significant research next year and in the future. This system benefits the midshipman undergraduate program in electrical engineering through introduction of an actual fleet computer system.

The general character of research problems currently being investigated by the faculty is related directly to existing fleet problems. The results of these efforts contribute directly to our operating forces and introduce midshipmen to relevant topics which benefit their professional as well as academic development.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Publications

CAMPBELL, Richard W., Major, USMC, **"CCTERM,"** *The Color Computer Magazine,* (March 1984).

This is a magazine article describing machine language software for a Motorola 6809 microprocessor that permits a microcomputer to be used as a telecommunications terminal utilizing the RS232C protocols.

CARSON, Bernard H., Professor, **"Boundary Layer Research in Small, General Purpose Flow Facilities,"** *Forschungsbericht Aus Dev Whertechnik,* BMVg-FBWT 83-84 (Federal Republic of Germany).

Various aspects of adapting a small supersonic wind tunnel, primarily intended for instructional purposes, to serious boundary layer research, are discussed. The boundary layer studied is the one that naturally forms on the inner walls of the tunnel. Experiments and parallel numerical studies indicate that this turbulent boundary layer conforms closely to the classical boundary layer profile on a flat plate, but the effective leading edge is a function of Mach number. Direct surface shear forces were also measured and agree very well with previous flat plate investigations. A method for determining skin friction coefficients on roughened surfaces is presented. General indications are that considerable potential exists for boundary layer studies in such facilities, providing sufficient preliminary diagnostic studies are performed to allow adequate understanding of the idiosyncracies of the particular tunnel. This requires a certain amount of parallel numerical work.

Pocket-Sized Performance Computer for the F-33A Bonanza

RESEARCHER: MIDSHIPMAN 1/C JAMES G. WILLSON
ADVISER: PROFESSOR BERNARD H. CARSON

The objective of this project was to develop an algorithm to be used with the HP-41C pocket computer for determining an optimum cruise point with maximum fuel efficiency and minimum time.

The finished product of this project was a workable program. It consisted of one main program and six sub-routines. The program has been debugged. Dry runs consisting of realistic and not-so-realistic wind and temperature conditions were performed giving expected results. One surprising result has been noted. The Bonanza, according to the program, has a more efficient flight at lower altitudes than at higher ones. It is believed that flying at "Carson speed" is the reason for this. When most pilots say that it is more efficient to fly higher up, they are in fact saying one can achieve the same True airspeed at less power because the Calibrated airspeed is less than that altitude. By flying at Carson speed, for the same Calibrated airspeed one gets more True airspeed, but it takes more power to fly the same Calibrated airspeed at the higher altitude. The effect of altitude on fuel flow (power) is greater than the correction for True airspeed. The cost per knot of True airspeed is greater with increasing altitude. It will become, however, more efficient to fly at the higher altitude if higher tailwinds are present up there.

Mechanical Properties of Fiberglass/Epoxy Composite Laminates

RESEARCHER: MIDSHIPMAN 1/C SAMUEL BOVINGTON
ADVISER: MAJOR RICHARD W. CAMPBELL, USMC

Many home-built aircraft are now employing the construction technique of hand lay-up laminates of fiberglass/epoxy composites. However, the resultant laminates are of unorthodox composition compared to industrial fabrications. As such, reference handbooks normally exclude these materials, e.g., MIL-HDBK-17A, "Plastics for Aerospace Vehicles."

The purpose of this project was to develop the baseline material property data for fiberglass/epoxy laminates that are common to home-built aircraft. The work will consist of developing a test plan, constructing the required test specimens, and conducting the experimental analysis in accordance with the Ameican Society for Testing Materials procedures. Various laminate orientations and volume fractions were investigated. The results will serve as a basic reference for further analysis of aircraft components constructed of this material.

Transonic Wind Tunnel Flow Analysis

RESEARCHER: MIDSHIPMAN 1/C GREGORY CRABTREE
ADVISER: ASSISTANT PROFESSOR JOHN E. ALLEN

Accurate determination of operating Mach Number in the Transonic flow regime is critical to the use of the present facility for research or laboratory exercises. This project involved investigation of the influence of tunnel settings on the flow quality in the test section obtained from the Mach Number distributions. The operating regimes of the tunnel were documented and guidelines established for future researchers using this facility.

DEPARTMENT OF

Mechanical Engineering

ASSOCIATE PROFESSOR JACK H. SMITH
CHAIRMAN

Faculty and midshipmen research in the Mechanical Engineering Department covers many of the areas of specialization in mechanical engineering. These include research in direct energy conversion, combustion, fluid mechanics, heat transfer, solid mechanics, acoustics, dynamic effects, lubrication, corrosion, fracture mechanics, composite materials, welding and design, and computer-aided graphics.

Research is supported mainly through funds from government agencies with the David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory, providing opportunities for several faculty members to work on projects during the intersessional period. Additionally, some faculty members have undertaken independent research in their areas of expertise. Fourteen civilian and one military faculty member have been active in the reported research of the Department this year which follows.

An important part of the Department's research effort each year is the involvement of midshipmen in independent research, design, and development projects even though there were only two such midshipmen/faculty projects this year. Both projects were involved with combustion.

Supporting the research effort in mechanical engineering are the extensive laboratory facilities located in Rickover Hall. The Department maintains facilities for performing experimental research in several areas: fluid mechanics, solid mechanics, materials science, experimental-stress analysis, control systems, mechanical vibrations, heat transfer, and thermodynamics.

The primary driving force behind the Department's research is the need for the faculty to stay abreast of developments in many diversified areas of mechanical engineering, thereby enabling them to be more effective classroom teachers.

Sponsored Research

CAD/CAM Software for Fan Blade Production

RESEARCHER: PROFESSOR J. ALAN ADAMS
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Continued development was accomplished on the design and manufacturing programs for N/C milling of fan blades which were initially written during the summer of 1982. This development work was partially funded by David W. Taylor Naval Ship Research and Development Center, Annapolis, Maryland, which is gratefully acknowledged.

The three current versions of the computer-aided design and manufacturing programs were provided to David W. Taylor Naval Ship Research and Development Center, Annapolis, Maryland, on a floppy disk as well as hard copy listings. A magnetic tape must be used for input and output when running these programs as currently written.

1. Program DESIGN generates 2-D data for either NACA series 4 or series 6 airfoil sections. The output data is stored on magnetic tape.
2. Program LAYOUT converts the 2-D data into 3-D data wrapped around a cylindrical hub. Alternately, 2-D data can be added in the form of DATA statements within the program in lieu of using the 2-D data generated by DESIGN. The output is stored on a magnetic tape.
3. Program NCMILL displays the blades and tool cutting path after checking for interference with other parts of the blade. Commands are sent to the N/C mill to control the actual cutting.

The three programs developed for a CAD/CAM fan blade system must be used in an interactive manner. The optimum angles for cutting depend upon the type of airfoil sections, twist of the blades, and blade spacing. It is necessary to first cut a model of the blade to check for proper cutting orientation once a set of choices has been made. A foam board material was used during the summer of 1983 for model cutting. This was a significant improvement over the wood models out in 1982. The foam board gave a much truer representation of the data since chipping and splintering did not occur.

A recessed ball end mill was used to cut some blades which would have experienced interference with a standard cutter. This was successful in foam board but is not recommended for metal. The best solution is to take advantage of the added flexibility now available in the program NCMILL and use initial orientations and surface point selection to avoid interference while using a standard ball end mill for cutting.

Additional software development was also begun during July-August, 1983. This was related to computing interference by the cutting tool with adjacent blades, changing hub shapes to cones and spheres, and machining the hub between blades. None of this work has been completed to date.

Lightweight Armor Materials Testing

RESEARCHER: PROFESSOR THOMAS W. BUTLER
SPONSOR: NAVAL SURFACE WEAPONS CENTER, WHITE OAK LABORATORY

This continuing project involves development of innovative testing techniques for candidate materials to be used as lightweight armor. It also involves the testing of candidate materials. Some testing has been done; more is expected to be done as specimens are provided to the investigator.

Component Performance Analysis and Measurement Error Effects

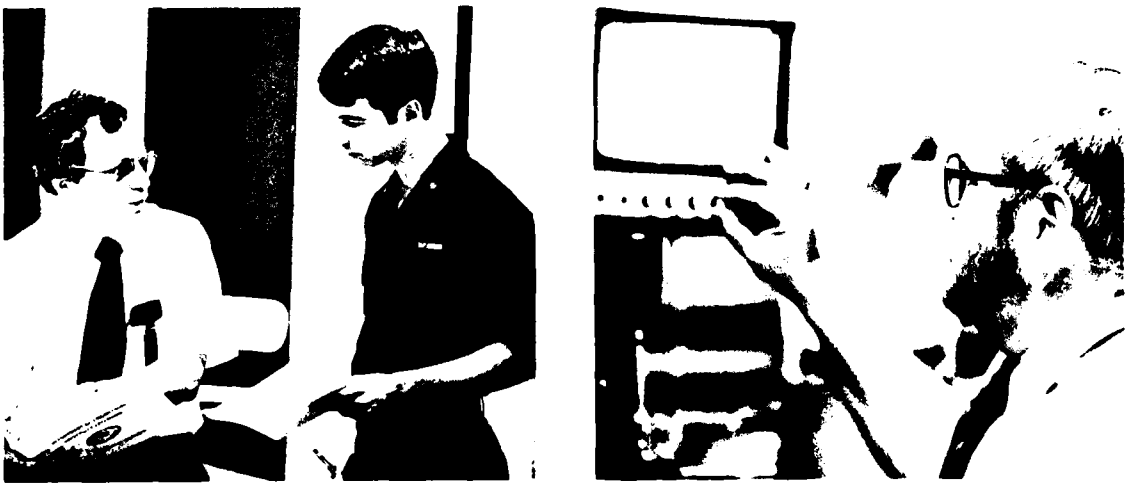
RESEARCHER: ASSOCIATE PROFESSOR ELLIOTT E. DODSON
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

This project consisted of a review of the thermodynamic analysis of the propulsion plant components (boilers, main feed pumps, forced draft blowers, ship service turbine generator sets and main turbines) for two ships, *USS Jesse L. Brown* (FF 1089) and *USS Blakely* (FF 1072); determination of error effects of individual measured parameters of the components; and a determination of accuracy requirements of measurements based on overall component performance parameters.

An Investigation of Transition to Turbulence in Circular Cylinder Boundary Layers

RESEARCHER: ASSISTANT PROFESSOR SHIRLEY T. FLEISCHMANN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

Transition to turbulence is a topic of considerable interest in the area of fluid dynamics. In flow around bluff bodies (long circular cylinders in particular) transition is accompanied by a significant drop in the drag coefficient. For flow around slender cylinders, transition is also accompanied by a cessation of the 2-dimensional vortex shedding which leads, or can lead, to vibration normal to the freestream direction. To date there is no method by which transition can be predicted other than experimentally testing each case since both freestream turbulence and surface roughness affect transition. There is evidence in the literature that a relation such as: $Re_D Re_K^{\gamma}$ = Constant ($K \equiv$ roughness length scale; $D \equiv$ cylinder diameter; and $\gamma \equiv$ turbulence parameter) exists for flow around circular cylinders. It can be shown that the relation $Re_D^{\gamma} Re_K$ = constant holds but that the constant here is different for different wind tunnels. This difference is most likely due to differences in the freestream turbulence. The research will continue with a survey of the freestream turbulence characteristics of the Naval Academy's subsonic wind tunnel and a study of the effect of changing the turbulence frequencies on transition. A link to linear stability theory is also being sought.



Screening Test Plans for Nine Variable Corrosion Studies

RESEARCHER: PROFESSOR JOHN O. GEREMIA
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Contaminants in fuels used by Naval ships are known or suspected to have some effect in causing corrosion in the ship's power plant. Further, operating temperature level also influences the degree and rate of corrosion. Consequently, it is desirable to know which contaminants cause corrosion, what role temperature level plays in the corrosive process and to what degree each variable affects the rate of corrosion. Nine variables, therefore, may be the important parameters of the corrosion process in gas turbines or in the superheater/economizer sections of a boater. These are: temperature, weight percent sulfur, parts per million (ppm) of sodium, potassium, copper, lead, iron, nickel and vanadium. As a first step in evaluating the importance of each variable, screening tests were designed to determine the relative significance of each. Once this is accomplished, further testing may be planned to quantify the effect of the most significant variables. Screening plans described in this report are intended to identify the most significant of the 9 variables with a minimum of test runs.

Investigation of Vortex/Control Fin

RESEARCHER: ASSOCIATE PROFESSOR JOSEPH D. GILLERLAIN, JR.
SPONSOR: NAVAL SURFACE WEAPONS CENTER, WHITE OAK LABORATORY

The objective of this investigation is to develop predictive methods for the aerodynamic behavior of missiles and aircraft experiencing vortex impingement on control surfaces. Detailed knowledge of the three-dimensional viscous flow field, as determined from wind-tunnel experiments, is required in order to model the vortex-fin interaction and to develop predictive methods.

The experimental measurements will be made in the U. S. Naval Academy Aerodynamics Laboratory subsonic wind tunnel. A pressure distribution model consisting of a rectangular fin with a cylindrical leading edge has been constructed. The fin is adjustable for angle-of-attack.

Non-intrusive flow measurement and flow visualization techniques will be used, to include three-dimensional laser Doppler velocimetry (LDV) and the fluorescent mini-tuft method, respectively. The pressure distribution data will be integrated to obtain aerodynamic forces, which will be compared with force balance data. Results of various conventional methods of wing/fin analysis will be compared to the measured aerodynamic loads.

Design and Construction of a Research Recirculatory Water Tunnel

RESEARCHER: PROFESSOR ROBERT A. GRANGER
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The objective was to obtain meaningful normalized mean velocity profiles, root mean square profiles, and power spectra and co-spectrum results so that the water tunnel can be used successfully as a research facility.

The apparatus used to study the flow was the 16in × 16in × 5ft test section free-surface Naval Academy water tunnel. The velocity measurements were made at a point 0.5 in downstream from the channel entrance with a DISA 55L modular optical system. Spectral analysis was performed for most runs by fast Fourier transforms with frequency smoothing.

Results showed a typical distribution of the normalized mean velocity versus the normalized depth. The maximum point-wise difference between the mean velocities was about 6%. Signal quality did not appear to be a factor in the measurement of the mean velocity.

Results showed a typical normalized RMS profile. Here signal quality was important. The signal-to-noise ratio (SNR) was fairly high, and it affected the RMS and also the power spectra. Tracing the source of the high SNR, it was found that the incoherent background lighting was one of the major factors. A possible second source is ambiguity broadening. Thus, a power spectrum analysis was performed to judge the quality of the signal.

Measurements near the wall were hindered by construction panels along the test section. Here large velocity gradients exist, some being in direction of the optical axis. Thus, the dimensions of the probe volume are of critical importance.

Surface Ship Acoustic Wake Modeling

RESEARCHER: PROFESSOR ROBERT A. GRANGER
SPONSOR: NAVAL COASTAL SYSTEMS CENTER

An experimental measurement of the bubble wake from a three-dimensional hydrofoil with traveling bubble cavitation was performed. A Naval Ship Research and Development Center microbubble detector was used to measure bubble spectra. The operation of the microbubble detector is based on a dark-field specular reflection technique that can differentiate a solid particle from a micro-bubble. The experiment involves withdrawing water continuously from a predetermined location downstream of a fixed hydrofoil. The sample water, which contains microbubbles, flows through a 2-inch plastic pipe to the bubble detector, and is discharged at the downstream end of the tunnel's section. Quantities measured were the number of bubbles per unit volume and bubble diameters. The model was a NACA 66-006 (a = 0.8 mean line) hydrofoil. The geometry was programmed on the CADIG UNIX system, especially developed for this class of foil. The output was fed to a numerically-controlled milling machine. Seven pressure taps were drilled on the surface of the foil: four spanwise and three chordwise. Pressure transducers measured the pressure distribution over the surface at various foil angles-of-attack and for two flow velocities. The measured data is currently being evaluated. Cavitation inception was obtained near the minimum pressure location at a freestream velocity of 14.5 ft/s. Care had to be exercised as ventilation would occur at the extreme limits of tunnel operation.

A short television tape was made of the experiment.

Steel and Titanium Weld Mechanical Properties

RESEARCHER: ASSOCIATE PROFESSOR DENNIS F. HASSON
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The goal of this research is to study the mechanical properties of steel and titanium alloy weldments. Tensile, CVN-impact energy and hardness tests will be performed. Dynamic fracture toughness values, K_{Id} and J_{Id}, are also planned. Supporting metallography, scanning electron microscope fractography and energy dispersive x-ray analyses will be performed. Non-destructive evaluation techniques for the study of the materials are also in progress. The output of the work will be a research paper.

Corrosion Fatigue on Advanced Materials

RESEARCHER: ASSOCIATE PROFESSOR DENNIS F. HASSON
SPONSOR: NAVAL SURFACE WEAPONS CENTER, WHITE OAK LABORATORY

Corrosion fatigue tests in completely reversed bending will be performed on Al-Li alloys and Al-SiC metal matrix composite materials. It is anticipated that the research will be published.

Fatigue Damage Development in Fiber-Reinforced Composite Materials

RESEARCHER: ASSISTANT PROFESSOR RUSSELL D. JAMISON
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This research examines the influence of stress level upon the way in which damage nucleates, grows, and coalesces to cause failure in fiber-reinforced composite materials subject to cyclic tensile loading. The materials examined are graphite/epoxy and glass/epoxy, both widely used in aerospace applications and increasingly important in structural ship components. The goals of the research are twofold: to determine whether results of accelerated laboratory testing typically performed at stress levels substantially higher than design limits can be transferred to the lower stress, longer lifetime environment of actual components; and to compare the basic mechanisms of the fatigue damage operating in these two dissimilar fiber systems.

Dynamic Key Curve Test Method Development

RESEARCHER: ASSOCIATE PROFESSOR JAMES A. JOYCE
SPONSOR: NUCLEAR REGULATORY COMMISSION

The objective was to utilize the key curve method to obtain J-R curves for A302 B pressure vessel steel and A106 piping steel at loading rates of 100 in/sec. This is an extension of previous work done on the Navy alloys HY80 and HY130.

Steering and Diving Linkage System Review

RESEARCHER: ASSOCIATE PROFESSOR WILLIAM M. LEE
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

A study was undertaken to find material combinations that would reduce or eliminate the corrosion and accelerated components of the steering and diving linkage system. The specific problems addressed in the study included guide cylinder wear, cylinder and cap corrosion and wear, linkage bearing wear and thread corrosion.

As a result of the recommendations made, the following actions have occurred: A Ship-alt has been issued for the use of a successful thread sealant found from a testing program; drawings are being prepared for a shipboard evaluation to determine the suitability of a redesigned piston with non-metallic sleeves to reduce wear of the piston and cylinder wall, reduce linkage corrosion and a redesigned end cap to reduce wear and corrosion; and a shipboard study evaluating non-metallic bearings in the linkage elements of the steering and diving plane mechanisms is to be initiated this summer.

Wave-Induced Pressure Distributions

RESEARCHER: PROFESSOR VINCENT J. LOPARDO
SPONSOR: OFFICE OF NAVAL RESEARCH

The objective of this project was to evaluate the pressure variation in the 36-m wave tank at the U. S. Naval Academy for a number of wave profiles and to compare the results with linear theory. Five pressure transducers were used and the resulting pressures were plotted as a function of the distance from the still water line. Preliminary analysis shows good correlation with the Airy linear theory over a large range of wave heights and periods.

Quiet Submarine Piping System Design

RESEARCHER: PROFESSOR J. PAUL ULDRICK
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The purpose and objectives of the projects are: (1) to develop fundamental principles to characterize and predict the vibrational excitation mechanisms and system response characteristics of fluid conveying piping systems on modern submarines, (2) to design and construct an experimental mechanical system to test the validity of coherence analysis in source identification, and (3) to develop software and synthesize the necessary hardware for text and graphic processing, communications, and data transfer and analysis for microcomputers.

The plan of the investigation was to design and implement experimental configurations for laboratory and sea trial measurements and to develop digital time series analysis techniques to characterize and model known and unknown excitation mechanisms in submarine piping systems; to design and implement the necessary software to transfer information to and from remote laboratory instrumentation and analysis systems to microcomputer stations over commercial telephone lines; and to develop the analysis software to model dynamic flow noise phenomena

Zeotropic Mixed Refrigerants

RESEARCHER: PROFESSOR CHIH WU
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

A feasibility study on the use of zeotropic mixed refrigerants for naval ships was conducted. The zeotropic mixed refrigerators may have a potentially higher coefficient of performance than the conventional refrigerators. Basic equations from thermodynamics, fluid dynamics, heat transfer, and physics were used to analyze the proposed energy conversion system. A computer simulation program on the zeotropic machine was written. Results show that improvement of the naval ship air conditioning systems by using zeotropic mixture refrigerants is possible.

Independent Research

Growth of Isolated Vortex Structures

RESEARCHER: PROFESSOR ROBERT A. GRANGER

The growth of shear flow at high Reynolds number has been investigated by this researcher for many years. The structures or physics are based on the Bradshaw model regarding the coalescence of similar vorticity regions that produce the wave-like two-dimensional initial behavior described by Granger, Betchov, and Bradshaw. For certain conditions, one can obtain stable regions.

Studies have been conducted with the merger process of vortices, investigating point vortices merging with either other point vortices or established vortex filaments. Work is progressing on this fascinating area.

Investigation of the Solution of the Long Wave Equation

RESEARCHER: PROFESSOR ROBERT A. GRANGER

The long wave equation can be written in the form

$$\partial u/\partial t + (\delta^{-1})\,\partial u/\partial x + (2u)\,\partial u/\partial x + \partial^2 T_u/\partial x^2 = 0$$

in the region $-\infty < x < \infty$, where

$$T_u = -1/2\delta \int_{-\infty}^{\infty} (\coth \pi/2\delta)(x-\zeta)u(\zeta)\,d\zeta$$

The integral can be evaluated in the principal value sense, and the differential equation can thus be solved, hypothetically, using the inverse scattering transform. An alternate solution was investigated assuming

$$T_u = 1/2L \int_{-L}^{+L} \tilde{T}(x-\zeta;\delta, L)\,u(\zeta)\,d\zeta$$

where the kernel function $\tilde{T}$ involves complete and Jacobian elliptic function and integrals in one sense or in terms of a Fourier series.

$$\tilde{T}(x;\delta, L) = i \sum \coth(u\pi\delta/L)\exp(iu\pi x/L)$$

This is rather exciting, as $\tilde{T}(x;\delta, L)$ approaches the Hilbert kernel as $\delta \to \infty$ and L fixed. Work is progressing using this formulation.

Dynamic Fracture Toughness of Naval Materials

RESEARCHER: ASSOCIATE PROFESSOR DENNIS F. HASSON

Dynamic fracture toughness of Naval High Yield Strength steels Al/SiC metal matrix composite (MMC) materials are in progress in two independent programs. Testing of side-grooved precracked Charpy specimens of HY-steels has been completed. Supporting metallography and fractography are also complete. A report is in preparation. The MMC program is also almost complete. This program utilizes Charpy V-notch specimens and PT-compact tension specimens. Fractography is in progress. A report will be prepared.

Measuring Crash Severity from Police-Recorded Data

RESEARCHER: PROFESSOR RUSSELL A. SMITH

The objective of this work is to develop a means of computing a measure of crash severity using police-recorded accident data. Such a measure is essential to estimating changes in the accident environment and to estimating the effectiveness of changes in motor vehicles that promote injury mitigation through improved crash worthiness.

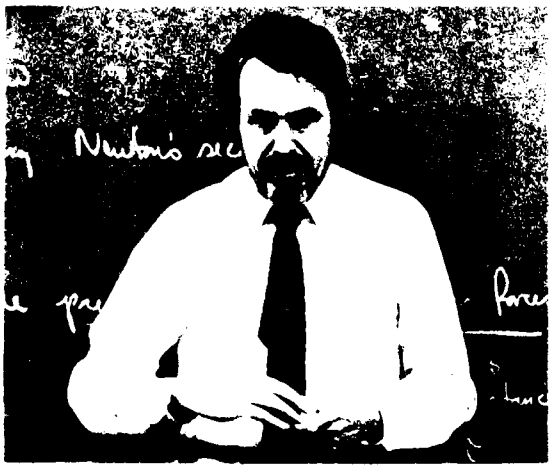
A technique to accomplish this was developed in 1983 and tested with data from staged collisions. The method was found acceptable over ranges of medium to high crash severity, but insufficient data was identified to prove the method at low crash severity.

Continuing the project in 1984, the researcher identified data in selected research by the insurance industry on vehicle damageability. These data are being incorporated into a test or verification of the model at low crash severity with the goal of completing this work in 1984. Subsequently, the model will be exercised on accident files using data from the State of North Carolina.

Alternative Energy Conversion Demonstration

RESEARCHER: PROFESSOR CHIH WU

This project develops an alternative energy conversion demonstration laboratory which supplements classroom theory in a senior engineering elective course in energy conversion in the Department of Mechanical Engineering at the U. S. Naval Academy. Oil, nuclear energy, and other conventional sources of power have been the dominant sources for industrial society and the U. S. Navy, and will continue to be so for the foreseeable future. There are possibilities, however, including wind powers, solar power, ocean thermal power and tidal power. A need for alternative sources of energy for the Navy was recognized at the time of the Arab oil embargo in 1973, and an academic program in alternative energy was developed to help satisfy that need. Specific demonstrations in energy awareness, wind energy, ocean thermal energy, wave energy, solar energy, and chemical energy storage are described in the paper. Some of these devices are unfamiliar to the students. The demonstrations greatly enhance the alternative energy course material. The demonstrations also add immeasurably to the students' interest as well as illustrate the use of basic principles that the students have learned in other courses.



Research Course Projects

Parametric Compression Ignition Heat-Balanced Engine Study

RESEARCHER: MIDSHIPMAN 1/C LEONARD J. HAMILTON
ADVISER: ASSOCIATE PROFESSOR EUGENE L. KEATING

A fuel-injected Cooperative Fuel Research compression ignition engine was used to investigate the performance of the Diesel Heat-Balanced Engine. Experimental parameters which were varied included compression ratio, speed, fuel injection rate, and air-fuel ratio. The performance parameters that were measured included brake and indicated thermal efficiency, mean effective pressure, and specific fuel consumption. Comparisons were made to a base engine.

Propane-Air Sparks Ignition Engine Test

RESEARCHER: MIDSHIPMAN 1/C LEONARD J. HAMILTON
ADVISER: ASSOCIATE PROFESSOR EUGENE L. KEATING

This project investigated the experimental performance of an 8 hp single cylinder Briggs and Stratton spark ignition engine. The engine was converted to operate on propane-air mixtures. Data collected allowed both brake and indicated performance maps to be obtained. Results provided emissions, horsepower, thermal efficiency, specific fuel consumption, and torque as a function of engine parameters. The development of this facility will be for future use in the Mechanical Engineering laboratory program.

Publications

GEREMIA, John O., Professor, "**Screening Test Plans for Nine Variable Corrosion Studies,**" David W. Taylor Naval Ship Research and Development Center Report, 12 August 1983.

Contaminants in fuels used by Naval ships are known or suspected to have some effect in causing corrosion in a ship's power plant. Further, operating temperature level also influences the degree and rate of corrosion. Consequently, it is desirable to know which contaminants cause corrosion, what role temperature level plays in the corrosive process and to what degree each variable affects the rate of corrosion. Nine variables, therefore, may be the important parameters of the corrosion process in gas turbines or in the superheater/economizer sections of a boiler: temperature, weight percent sulfur, parts per million (ppm) of sodium, potassium, copper, lead, iron, nickel, and vanadium. As a first step in evaluating the importance of each variable, screening tests were designed to determine the relative significance of each. Once this is accomplished, further testing may be planned to quantify the effect of the most significant variables. Screening plans described in this report are intended to identify the most significant of the nine variables with a minimum of test runs.

GILLERLAIN, Joseph D., Jr., Associate Professor, "**Vortex/Control Fin Interaction Experiments,**" Division of Engineering and Weapons Report EW-31-83, September 1983.

Accurate prediction of the aerodynamic behavior of missiles and aircraft experiencing vortex impingement on control surfaces becomes more essential as high angle-of-attack maneuvering requirements increase. Detailed knowledge of the three-dimensional viscous flowfield, as determined from wind tunnel experiments, is required in order to develop predictive methods based on the vortex/fin interaction. Tests were conducted in the U. S. Naval Academy Aerodynamics Laboratory subsonic wind tunnel using a rectangular fin model adjustable for angle of attack. The impinging vortex was generated upstream of the fin at the juncture of two adjacent airfoils set at equal but opposite angles of attack. Force, moment, and pressure distribution data were obtained for one freestream velocity and one vortex strength. Flow visualization tests utilized a fluorescent mini-tuft technique. The three-dimensional flowfield was surveyed using a laser Doppler velocimeter. The experimental data are presented.

GRANGER, Robert A., Professor, "**Acoustic Wake Model,**" Division of Engineering and Weapons Report EW-13-84, June 1984.

This paper describes and discusses the towed sensing submersible system which was designed, constructed, and recently put into service at the United States Naval Academy. The most unusual feature of the system is the method used to impart the longitudinal and heaving motions to a given submerged body. This method enables the accurate determination of individual motions, whether in pure axial translation or pure vertical translation, or coupled together.

The instrumentation measuring apparatus is self-contained and readouts of the pitch, roll, yaw, axial acceleration and vertical acceleration can be measured simultaneously.

The recording system is automatic upon command and contains features which are intended to reduce data processing to a minimum. The steady state data can be obtained digitally or recorded on strip charts or recording tape. The oscillation measurements are recorded as essentially discrete values of inphase components for prescribed tow velocities, cable tow lengths, heaving and longitudinal excitation frequencies, and heaving and longitudinal excitation amplitudes.

HASSON, Dennis F., Associate Professor, co-author, "**Arc Welding of Titanium Alloys,**" *Welding, Brazing and Soldering of Metals Handbook*, 9th Edition, American Society for Metals, 1983, pp. 446-456.

This article includes consideration of weldability, welding processes, filler metals, shielding gases and joint preparation. Both in-and-out-of-chamber welding are discussed. Practical examples with process details are illustrated. Procedures are presented for various types of welding processes, such as gas tungsten arc, hot wire gas tungsten arc, gas metal arc, and plasma arc. Brief remarks on subsequent stress relieving and repair welding are also included.

HASSON, Dennis F., Associate Professor, co-author, "**Bending Fatigue of a Particulate SiC/Al 6061 Metal Matrix Composite,**" Division of Engineering and Weapons Report EW-20-83, September 1983.

The bending fatigue behavior of 20 volume *percent* SiC particulate reinforced Al 6061-T6 sheet was investigated. Improved mechanical properties and ductility in the material, as compared to past results and Al 6061-T6 sheet, provided higher fatigue resistance. Low cycle fatigue specimens failed immediately after crack initiation. High cycle fatigue specimens exhibited a coarse step morphology, but classic striations were not observed. The existence of crack propagation at lower stresses was not verified. Preliminary results suggest that the fatigue resistance of particulate SiC reinforced Al 6061 composite exhibits *orientations* dependence. Also particulate SiC reinforced/Al 6061 composite has less fatigue resistance than whisker reinforced material. Improvement in surface finish also needs to be made over presently available material.

JAMISON, Russell D., Assistant Professor, co-author, "**Assessment of Microdamage Development During Tensile Loading of Graphite/Epoxy Laminates,**" Virginia Polytechnic Institute and State University Technical Report, January 1984.

One of the notable attributes of graphite/epoxy laminates is their high damage tolerance. This quality, however, has served to obscure the precise nature of failure in these materials. While it is recognized that failure results from the nucleation, growth, and coalescence of damage which occurs at the microstructural level, the modes, sequence, and rate of development of this subcritical micro-damage is not yet well-understood. The present work examines in a systematic way the development of micro-damage in several laminates of graphite/epoxy material during quasistatic tensile loading. Emphasis is placed upon discriminating and quantifying matrix and fiber damage. Penetrant-enhanced x-ray radiography and edge replication were used to map the progression of matrix damage. The recently developed technique of specimen deply was used to follow the progression of fiber fracture. By complementary application of these destructive and non-destructive techniques a more complete and coherent picture of micro-damage was developed.

This physical picture of damage development was compared to acoustic emission measurements recorded during loading. Of primary interest was the discrimination between matrix damage and fiber fracture using differences in the amplitude distribution of the acoustic emissions. Correlations are reported for unidirectional and cross-ply laminates.

Among the significant results is the establishment for the first time of the relationship between applied tensile stress and the *in situ* density and distribution of fiber fractures. Also observed for the first time was the dominant role of matrix cracks in the development of fiber fractures in adjacent load-bearing plies. From the acoustic emission analysis, evidence is provided which questions some common assumptions regarding the relative "strengths" of fiber fracture and resin cracking events in composite materials.

Wave-Energy Conversion Turbine

RESEARCHER: MIDSHIPMAN 1/C MATTHEW MARRON
ADVISER: PROFESSOR MICHAEL E. MCCORMICK

The final objective of this project was the testing of a counter-rotating energy conversion turbine. Construction of the turbine itself was completed early this semester and a connecting belt system was devised to transfer power from the turbine shaft to a 1-kW generator for testing purposes. Power received from the generator was dissipated in a compatible electrical resistor. Initial testing was conducted in the Aerospace Department wind tunnel to estimate turbine endurance and efficiency. In addition, tests were run in uniform and random seas generated by the 380-foot wave tank in the hydromechanics laboratory. It is hoped that the results of this project will be used to determine the suitability of the turbine design for future applications.

Comparison of Dose from the AN-PDR 70 to the USNA Neutron Spectrometer

RESEARCHER: MIDSHIPMAN 1/C HEIDI M. MERK
ADVISER: PROFESSOR MARTIN E. NELSON

The major objective of this project was to compare the dose reading from the AN-PDR 70 to that of the Naval Academy neutron spectrometer. The AN-PDR 70 is used by the Navy extensively and it measures neutron dose with the use of a BF_3 counter and a polyethylene moderator which can detect fast neutrons and slow them to thermal neutrons so they can be picked up by the detector. The Naval Academy neutron spectrometer employs a NE-213 detector whose output can be collected and analyzed through the use of a computer program developed—UNFOLD. The UNFOLD program takes data from the high gain and low gain runs and determines the fluence of the 14 MeV peak and determines the dose of the neutron spectrum. Since the output of the AN-PDR 70 has units of mrem/hr and the UNFOLD program yields an output in rads/sec, the quality factor will need to be determined in order to relate the two dose readings. This quality factor was obtained from ANSI. This paper yields specific results from experiments conducted in the last few months.

Wave Forces on a Vertical Pile

RESEARCHER: MIDSHIPMAN 1/C JOHN P. CORDEL
ADVISER: ASSOCIATE PROFESSOR THOMAS H. DAWSON

The objective of this work was to determine experimentally the forces and moments exerted on a fixed vertical pile by waves of various heights and periods and correlate these with engineering theory. The work differs from earlier efforts in its concentration of the overturning moment caused by the waves and its implication with respect to the wave force distribution on the pile.

Computer-Aided Generation of Ship Hull Geometry

RESEARCHER: MIDSHIPMAN 1/C ANDREW C. W. KIM
ADVISER: PROFESSOR RAMESWAR BHATTACHARYYA

The "B-Spline" function is a powerful and flexible mathematical tool that has many applications in the development of ship hull geometry. The "B-Spline" is a mathematical curve defined by a polygon and dependent on some interpolation approximation method to develop a relationship of the polygon to the curve. Each vertex in the "B-Spline" function defines a unique base function which allows each vertex point to control the curve only in its vicinity. The "B-Spline" function is defined mathematically as a polynomial spline function of the "k^{th}" order.

Using the computer facilities of the Naval Academy, the geometry of a ship hull form utilizing "B-Spline" function softwares was developed. This objective required an in-depth study of the "B-Spline" function software available in the Computer-Aided Design and Interactive Graphics (CADIG) facilities. The final product was a ship hull formed by using the interface between Computer-Aided Milling (CAMILL) and "CADIG."

Experimental Study of the McCabe Wave Pump System

RESEARCHER: MIDSHIPMAN 1/C DAVID KOWALICK
ADVISER: PROFESSOR MICHAEL E. MCCORMICK

This project involved the testing of the McCabe wave pump system, a simple wave energy conversion device. Oscillations of a 15-foot pontoon cause the reciprocation of a four-valve pump. It is this pump that was the focal point of this semester's testing and modifications. Wave tank testing involved four sets of runs where power spectra of the undamped pontoon, unloaded pump, and loaded pump at two different heads were compared. These tests disclosed the actual damping characteristics of the pump and led to future modifications of the system.

Research Course Projects

Sensitivity Analysis of U. S. Naval Academy Spectrometer

RESEARCHER: MIDSHIPMAN 1/C STEVEN J. BERNINGER
ADVISER: PROFESSOR MARTIN E. NELSON

The Naval Academy neutron and gamma spectrometer, which employs an NE-213 detector, is presently being used to measure shielding coefficients and the adequacy of certain neutron and gamma detection equipment. For a given measurement the spectrometer gives the energy spectrum and dose associated with a given radiation field. However, the basis of the analysis involves a number of analytical techniques such as data renormalization and smoothing. In addition, the analysis is apparently affected by such factors as differences in neutron intensity between runs. The purpose of this paper is to investigate the influence of these factors on determination of the shielding coefficients and energy spectrum as determined by the analysis of the spectrometer data.

Computer Simulation of Ship Motions

RESEARCHER: MIDSHIPMAN 1/C JOEL G. BISHOP
ADVISER: PROFESSOR RAMESWAR BHATTACHARYYA

The objective of this project was to take the ship motion simulation program (SIXDOF) developed last semester and expand its capabilities and data base. The program was modified to simulate ship motions in six degrees of freedom (i.e., submarines) as well as three degrees of freedom. The integration subroutine used by the program was improved to yield a closer approximation of the rate of change of the ship motion equation variables. At present the hydrodynamic coefficients necessary for solving the ship equations of motion have been obtained only for an 80,000 DWT tanker. This project included determining the hydrodynamic coefficients for as many ship types as possible. Experimental, empirical, and analytic methods were researched.

Effect of Added Mass on Spherical and Rectangular Flat Plates

RESEARCHER: MIDSHIPMAN 1/C LUNDY J. CAMPBELL
ADVISER: PROFESSOR MICHAEL E. MCCORMICK

The objective of this project was to determine the accuracy of the adviser's new theory of added mass. This theory was tested using a vibrating machine in water which was designed to measure both frequency of vibration and the voltage required to maintain the given frequency. From this data, the added mass was calculated.

Permeable Membrane Separations of Gases

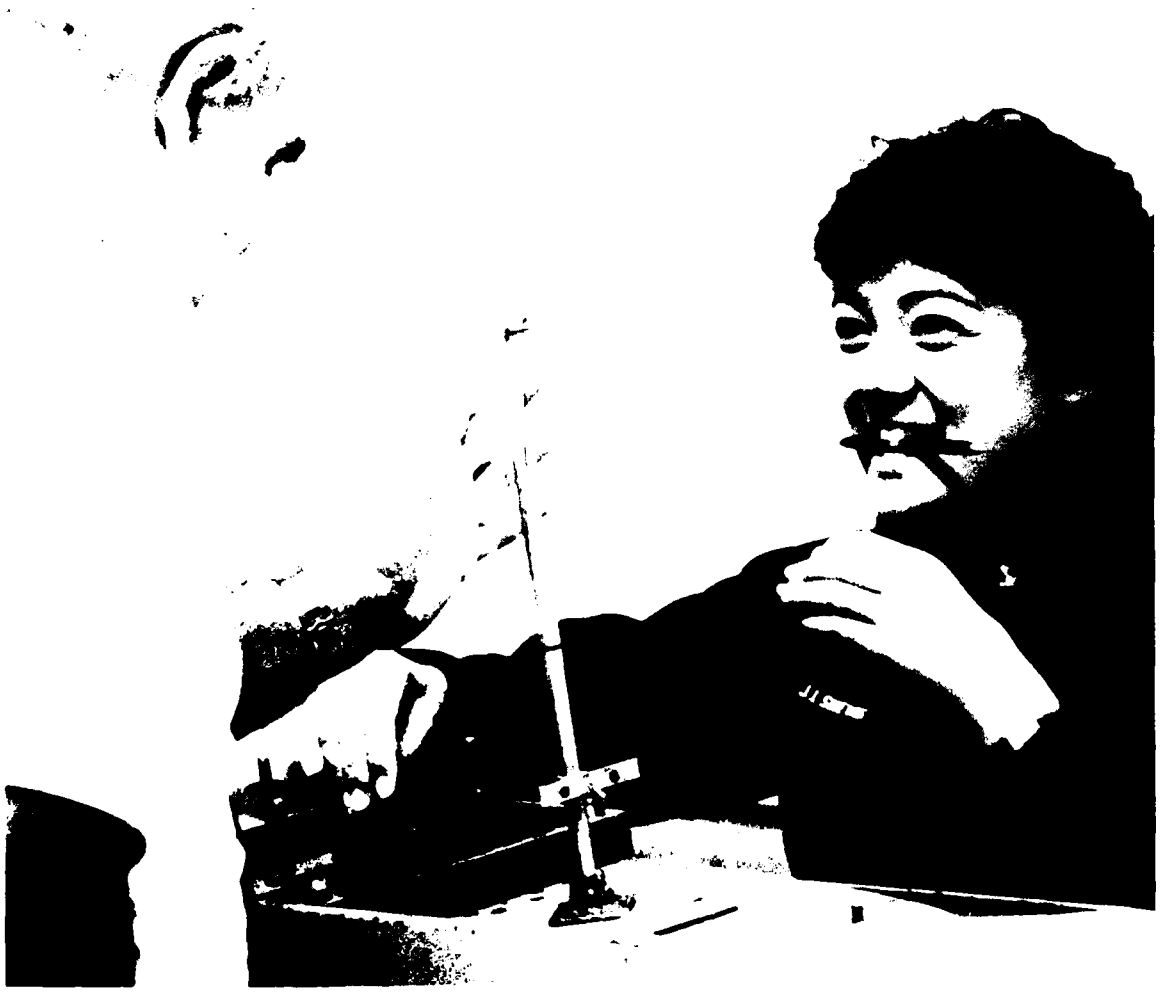
RESEARCHER: LIEUTENANT COMMANDER ACE J. SARICH, USN
SPONSOR: NAVAL SURFACE WEAPONS CENTER, DAHLGREN

Semi-permeable membrane technology is used for the enrichment of helium gas recovered from saturation diving complexes. Permeator effectiveness is evaluated for various gas contaminants including Nitrogen, Oxygen, and Argon.

Heat Transfer Analysis of Diving Chamber

RESEARCHER: LIEUTENANT COMMANDER ACE J. SARICH, USN
SPONSOR: NAVY EXPERIMENTAL DIVING UNIT

The heat transfer coefficients for a Standard Navy Decompression Chamber and a commercial heat exchanger were determined for various pressures and temperatures. From this, energy requirements for the expected range of operational conditions is predicted.



Effect of Bow Bulb and Stern Wedges on FFG-7 Performance

RESEARCHER: PROFESSOR BRUCE JOHNSON
SPONSOR: NAVAL SEA SYSTEMS COMMAND

This is the continuation of a five-year research program concerning the effect of appendage on powering and sonar performance. The initial study concerns the addition of a bow bulb of the "Maestral type" and stern wedges to FFG-7 class frigates. A matrix of tests were run on a 16.5-ft. Model in several bow and stern configurations. Significant drag reductions were measured at speeds above 15 knots. Future plans include the search for a below-baseline bow bulb which could enclose a bow-mounted sonar and also give fuel economy or speed improvements.

Shallow Water Resistance Studies on a Chinese-Developed Hullform

RESEARCHER: ASSOCIATE PROFESSOR BRUCE C. NEHRLING
SPONSOR: UNITED STATES COAST GUARD

As part of an ongoing Coast Guard-sponsored shallow water resistance program, the resistance characteristics of a Chinese-developed flat bow and cochlea-channeled stern hullform will be investigated during the summer of 1984. Existing models incorporating variations of this supposedly efficient hullform will be tested in shallow water using the Naval Academy's 120′ towing tank. Compararative studies between the resistance characteristics of these models and previously tested hullforms will be made.

Shallow Water Resistance Studies of a Paddle Wheel Propelled River Buoy Tender

RESEARCHER: ASSOCIATE PROFESSOR BRUCE C. NEHRLING
SPONSOR: UNITED STATES COAST GUARD

As a part of a continuing Coast Guard shallow water resistance study, modifications were made to the propeller configured stern of a 160′ river buoy tender in order to investigate the feasibility of installing a stern paddle wheel. While there is a paucity of analytic data about the design of paddle wheel propelled boats, good vessels have been built and a parametric study of these hulls proved very useful in establishing a new hullform. A towing-tank model incorporating these changes was built. Still water EHP tests in shallow water were conducted in the Naval Academy's 120′ towing tank. A favorable resistance profile was produced and the decision has been made to build a larger model for testing in the 360′ towing tank.

Sponsored Research

The Resistance of a Systematic Series of Semiplaning Transom Stern Hulls

RESEARCHER: PROFESSOR ROGER H. COMPTON
SPONSOR: NAVAL SEA SYSTEMS COMMAND

The results of a model test program involving a family of six systematically varied patrol craft hullforms are presented as a contribution to the early stage design data base for low to medium speed, transom-sterned, coastal vessels. Hullform parameters that were varied were section shape (hard chine versus round bilge), length-to-beam ratio, displacement-length ratio, and longitudinal position of the center of gravity. Speeds from zero to that corresponding to a Froude Number (based on waterline length) of 0.65 were investigated in calm water conditions. Measured experimental variables included model speed, model resistance, and vertical attitudinal changes. The results are presented in both graphical and numerical form.

Nonlinear Ship Response Models

RESEARCHER: VISITING RESEARCH PROFESSOR JOHN F. DALZELL
SPONSOR: NAVAL SEA SYSTEMS COMMAND

The purpose of this study is to reduce to practice the existing theoretical approaches to the statistics of maxima of cubic level nonlinear systems. Included are a literature search, work on theoretical development and computer simulation, and programming to estimate probability density of maxima given the general properties of the nonlinear system.

Towing-Tank Wave Generation

RESEARCHER: VISITING RESEARCH PROFESSOR JOHN F. DALZELL
SPONSOR: NAVAL SEA SYSTEMS COMMAND

The purpose of this investigation is to improve the capability of generating desired wave spectra in the Naval Academy towing tanks. Two software systems have been developed. The first is now in use; the second, to enhance the actual realization of the desired spectra and to allow operating of wave generators in alternate modes, is at the point of physical check-out and possible adoptions.

Wave Forces on Vertical Cylinders

RESEARCHER: ASSOCIATE PROFESSOR THOMAS B. DAWSON
SPONSOR: OFFICE OF NAVAL RESEARCH

The objective of this research is to determine the degree that the Morison equation can predict forces on vertical cylinders in deep-water regular and random waves. The Naval Academy 380-ft towing tank is used to generate such waves and provide an experimental basis for the study.

DEPARTMENT OF

Naval Systems Engineering

PROFESSOR RAMESWAR BHATTACHARYYA
CHAIRMAN

Research in the Naval Systems Engineering Department continues to play a vital role in the professional enrichment of both midshipmen and faculty. During Academic Year 1983-1984, faculty members and midshipmen participated in numerous and varied projects in the fields of marine engineering, ocean engineering, and naval architecture.

A variety of projects were undertaken. These include faculty research in the areas of nonlinear ship response models, towing-tank wave generation, wave forces on vertical cylinders, effects of low bulb and stern wedge on FFG-7 performance, shallow water resistance studies, permeable membrane separation of gases, and heat transfer analysis of a diving chamber. The faculty-sponsored midshipmen projects were in the areas of spectrometer sensitivity analysis, computer simulation of ship motions, added mass effects of spherical and rectangular plates, wave forces on a vertical pile, computer-aided generation of ship hull geometry, experimental study of the McCabe wave-pump system, wave energy conversion turbine, comparison of dose from the AN-PDR-70 to the USNA neutron spectrometer, measurement of neutron attenuation coefficients, study of surface water waves, small waterplane area twin hull (SWATH) motion in beam seas, alternate design of McCabe wave energy pump, designing for speed, and prediction of slamming in ship design.

Support for research was found in many sources, from departmental operating funds to contracts and grants from such diverse organizations as the Naval Academy Research Council, the Naval Sea Systems Command, the U. S. Coast Guard, the Naval Underwater Systems Center, the Office of Naval Research, and the Naval Surface Weapons Center, Dahlgren.

KEATING, Eugene L., Associate Professor, "**Thermodynamic Analysis of the Gerace Cycle,**" AIAA/ASME/SAE 20th Joint Propulsion Conference, Cincinnati, Ohio, 11-13 June 1984.

READ, Kenneth E., Assistant Professor, "**Surprising Energy Efficiency of the OTEC Power Plant,**" Japanese Institute of Electrical Engineers 1983 International Power Electronics Conference, Tokyo, Japan, 27-31 March 1983.

WALKER, Thomas D. L., Lieutenant Commander, USN, "**Casualty Reporting, A Micro-Computer Management Tool,**" Navy Micro '84, Virginia Beach, Virginia, 19 April 1984.

WU, Chih, Professor, "**Stochastic Modelling of Two-Dimensional Mixed Lubrication,**" Navy Tribology Workshop, Annapolis, Maryland, 28-30 June 1983.

WU, Chih, Professor, "**Surface Roughness Effect on a Very Thin Curved Slide Bearing Lubrication,**" 1983 International Conference on Numerical Methods in Laminar and Turbulent Flow, Seattle, Washington, 8-11 August 1983.

WU, Chih, Professor, "**Thermophysical Properties of Zeotropic Mixed-Refrigerants,**" 20th Annual Meeting of the Society of Engineering Science, Newark, Delaware, 22-24 August 1983.

WU, Chih, Professor, "**An Innovative Energy Self-Sufficient Offshore Oil Rig Application of Ocean Thermal Energy Conversion,**" Energy Symposium, Orlando, Florida, 9-11 November 1983.

WU, Chih, Professor, "**Uncertainty Simulation Analysis of a Zeotropic Mixed-Fluids Machine,**" International Symposium on Simulation and Modelling, Orlando, Florida, 9-11 November 1983.

WU, Chih, Professor, "**Alternative Energy Conversion Demonstration Laboratory at the U. S. Naval Academy,**" Sixth Miami International Conference on Alternative Energy Sources, Miami Beach, Florida, 12-14 December 1983.

WU, Chih, Professor, "**A Computer Program for Teaching and Analysis of Zeotropic Mixture Cycles,**" 1984 Association for Computing Machinery Computer Science Conference, Philadelphia, Pennsylvania, 14-16 February 1984.

WU, Chih, Professor, "**Teaching Factorial Analysis in an Undergraduate Mechanical Engineering Laboratory,**" 1984 American Society for Engineering Education Middle Atlantic Section Annual Meeting, Kings Point, New York, 5 May 1984.

WU, Chih, Professor, "**Effects of Voids on Contact Heat Conduction Transfer,**" 1984 International Applied Simulation and Modelling Conference, San Francisco, California, 4-6 June 1984.

WU, Chih, Professor, "**An Educational Modulated Single Tidal Pool Power Plant,**" International Energy, Power, and Environmental Systems Conference, San Francisco, California, 4-6 June 1984.

Presentations

GEREMIA, John O., Professor, "**Cable Fire Studies Using the Ohio State University Release Rate Apparatus,**" 32nd International Wires & Cables Symposium, Cherry Hill, New Jersey, 15-17 November 1983.

GEREMIA, John O., and Chih WU, Professors, et al., "**Teaching Factorial Analysis in an Undergraduate Mechanical Engineering Laboratory,**" 1984 American Society for Engineering Education Middle Atlantic Section Annual Meeting, Kings Point, New York, 5 May 1984.

GRANGER, Robert A., Professor, "**Problems in Mathematics that Confuse Engineering Students,**" Mathematics Department, U. S. Naval Academy, Annapolis, Maryland, 6 February 1984.

HASSON, Dennis F., Associate Professor, co-author, "**Fatigue and Corrosion Fatigue *of Discontinuous* SiC/Al Metal Matrix Composites,**" Symposium on Failure Mechanisms in High Performance Materials, 39th Meeting-Mechanical Failures Presentations Group, National Bureau of Standards, Gaithersburg, Maryland, 1-3 May 1984.

HASSON, Dennis F., Associate Professor, "**Materials Research at the U. S. Naval Academy,**" United States Naval Reserve, Voluntary Training Unit 0601 Research, Annapolis, Maryland, November 1983.

JAMISON, Russell D., Assistant Professor, "**The Role *of Microdamage in* Tensile Failure of Graphite/Epoxy Laminates,**" Symposium on Failure Mechanisms in High Performance Materials, 39th Meeting-Mechanical Failures Presentations Group, National Bureau of Standards, Gaithersburg, Maryland, 1-3 May 1984.

JOYCE, James A., Associate Professor, "**Drop Weight J-R Curve Testing Using the Key Curve Method,**" ICF International Symposium on Fracture Mechanics, Beijing, China, 22-25 November 1983.

JOYCE, James A., Associate Professor, "**Observations on the Technical Re-Awakening of the Peoples Republic of China,**" Chemistry and Metallurgy Department Colloquium, Royal Military College of Science, Shrivenham, Swindon, United Kingdom, 25 January 1984.

JOYCE, James A., Associate Professor, "**Development of Size Requirements for a J-R Curve Test Standard,**" Berkeley Nuclear Laboratory, Berkeley, United Kingdom, 2 February 1984.

JOYCE, James A., Associate Professor, "**J-Integral Fracture Toughness and Tearing Instability Behavior of ASTM A106 Steel Pipes,**" American Society *of Mechanical Engineers* Symposium on Circumferentially Cracked Pipe, Seattle, Washington, November 1983.

JOYCE, James A., Associate Professor, "**A One Day Short Course on Automated Testing,**" Railway Institute, Beijing, China, 28 November 1983.

JOYCE, James A., Associate Professor, "**An Automated Method of Computer Controlled Low Cycle Fatigue Crack Growth Testing Using the Elastic-Plastic Parameter Cyclic J,**" Symposium of Automated Testing (ASTM), Pittsburgh, Pennsylvania, 15 November 1983.

KEATING, Eugene L., Associate Professor, "**Internally Regenerative Engine Cycle Analysis,**" American Society of Mechanical Engineers 1983 Winter Annual Meeting, Paper 83-WA Aero 3, Boston, Massachusetts, 18 November 1983.

the turbine, instead of the conventional electric starter; guy cables and a small y-shaped foundation are used instead of large and bulky concrete blocks; and a light and strong frame is used instead of heavy solid walls.

The installation of the military wind turbine is also very different from the more complex installation of a commercial one. It is estimated that the installation requires only four men working six hours, using hand shovels, standard hand tools, and a trolley.

The Air Force Academy Turbine was donated to the U. S. Naval Academy in early 1983. A team of eight midshipmen reinstalled the turbine without any formal manual. The reinstallation experience, evaluation, and recommendations made by the team are also included.

WU, Chih, Professor, "**Introduction to Zeotropic Energy Conversion,**" Division of Engineering and Weapons Report EW-5-84, January 1984.

The growing interest in zeotropic mixtures for energy conversion applications has led to the need for a basic understanding of the zeotrope energy conversion at the undergraduate level.

An ideal zeotrope is defined in this paper. Properties and equations of zeotropic mixture systems are described and developed from fundamental multi-component and multi-phase equilibrium thermodynamics. Concepts and theories are also presented to explain why the zeotrope energy conversion devices may have a potentially better performance in either thermal cycle efficiency or coefficient of performance for energy savings than have conventional single working fluid energy conversion systems.

WU, Chih, Professor, "**A Simulation Model for a Shipboard Heat Pump,**" Division of Engineering and Weapons Report EW-11-84, April 1984.

A computer simulation model has been developed for a water-to-water heat pump. The simulation model is intended to evaluate the thermal performance of this water-to-water heat pump system. It can also be used as a computer-aided design analysis tool since it has many built-in design options. The modeling techniques used and the different types of operational modes and component options relevant to shipboard environment are presented.

WU, Chih, Professor, "**The Influence of Smoke and Dust on the Performance of Shipboard Fans,**" Division of Engineering and Weapons Report EW-12-84, May 1984.

The effects of smoke and dust on the performance of shipboard fans are relatively unknown. Shipboard fans need to remove smoke and fire which have high temperature and contain particle-dust. The effects on the performance of these fans may be of considerable significance in a number of severe smoke and fire cases.

There is not much literature, to the author's knowledge, on this subject and there is no correlation, experimentation, and evaluation either. Since there is a need for finding the effects of smoke and dust on the performance of shipboard fans, this report tries to predict these effects for future fan designs and more detailed investigation.

High temperature effect and dust effect on the performance of shipboard fans are treated separately first by this report in section 1 and 2 respectively. The overall high temperature and dust combined effect is discussed in section 3.

WU, Chih, Professor, "**Computer-Aided Design of a Non-Azeotropic Mixed-Refrigerants Heat Pump,**" *Proceedings* of the 1983 International Conference on Engineering Design, 15-18 August 1983, Vol. I, pp. 162-165.

There has been an increasing interest in recent years in the use of non-azeotropic refrigerants to improve heat pump performance. Heat pumps using these mixtures may have a better coefficient of performance. However, there is lack of a practical tool for design engineers to select different possible combinations of non-azeotropic refrigerants, to evaluate the performance of a mixed-refrigerants cycle, and to examine design parameter influence over a wide range. This paper describes a pilot interactive computer-aided design program used in the early phases of a non-azeotropic mixed-refrigerants heat pump design. The program provides enough information to allow users to predict and evaluate their designs.

WU, Chih, Professor, "**A Preliminary Assessment of Using the New Developing Freon-Ether Absorption Air Conditioning System on Naval Ships,**" Division of Engineering and Weapons Report EW-23-83, July 1983.

Lithium bromide-water absorption systems had been used in naval submarine air conditioners until a few years ago. The main problem experienced was corrosion and crystallization due to air or hydrogen in the system. A purge cycle was used to remove noncondensable gases from the machine, and an inhibitor was needed to limit corrosion. It was found that the corrosion of the submarine lithium bromide-water absorption units was too severe and maintenance of the systems could not be done as frequently as required. The lithium bromide systems had to be removed from our submarines.

Because of these limitations and problems, other potential fluid pairs needed to be investigated for use in naval ship absorption air conditioning systems. The most promising of these potential fluid pairs is made of a fluorocarbon-type refrigerant and an ether absorber.

The objective of this report is to supplement a previous report investigating the feasibility of applying some newly developed freon absorption units for naval ship air conditioning systems.

WU, Chih, Professor, "**Uncertainty Analysis of a Rankine Mixture Refrigeration Cycle,**" Division of Engineering and Weapons Report EW-29-83, September 1983.

The growing interest in zeotropic refrigerant mixtures for refrigerators, air conditioners, and heat pumps has led to the need for a mathematical tool of analyzing the vapor zeotropic refrigerant mixture cycles for engineers. The researcher developed a computer simulation program for the analysis of an ideal reversible zeotropic mixed-refrigerant Rankine cycle in 1982. The program involves 103 nonlinear as well as linear simultaneous equations and 103 unknown variables. The program was modified by Dr. R. Murphy of the Oakridge National Laboratory of Oakridge, Tennessee, in 1983. Several important parameters, including overall heat transfer coefficients in the condenser and evaporator, involved in the cycle simulation program are roughly estimated values. Since there is a lack of reliable experimental information on these parameters, estimated values on the newly developed mixed-refrigerant cycles have to be made. Consequently, any estimating error made in these parameters causes errors in the coefficient of performance of the refrigerating machines. An uncertainty analysis is required to judge the value of simulation data.

WU, Chih, Professor, "**Second Law Analysis on a Conventional Boiler and Its Potential Performance Improvement by Temperature Matching Process,**" Division of Engineering and Weapons Report EW-32-83, October 1983.

In a conventional boiler, a hot fluid H gives up heat to a cold fluid C. The temperature of the hot fluid, T_H, must be higher than the temperature of the cold fluid, T_C, at every heat transfer area in the boiler. If the temperature difference between the two fluids is large, the boiler thermal efficiency suffers because the temperature difference is a well-known major factor contributing to the undesirable thermodynamic irreversibility.

A temperature matching process by using a multi-pressure steam system is proposed in this paper. Second Law analysis on the temperature matching boiler is performed.

WU, Chih, Professor, "**Installation of a Military Wind Turbine at the U. S. Naval Academy,**" Division of Engineering and Weapons Report EW-33-83, October 1983.

The special characteristics of a military wind turbine are that it is light and portable; it can be installed using only hand tools, without concrete or heavy equipment; it is self-starting and self-sustaining; it can be varied to create maximum power; and it is safe in storms. A military wind turbine may be used to heat buildings and to generate electricity on short notice for airfield operations, communications, etc., at a remote base, an unprepared field location or at a frontier site.

The design of a military wind turbine is very different from that of a commercial wind turbine. The design of a military wind turbine by the faculty of the United States Air Force Academy is described. This machine employs Savonius Buckets to start

KEATING, Eugene L., Associate Professor, **"Thermodynamic Analysis of the Gerace Cycle,"** AIAA/SAE/ASME Paper 84-1304.

An Air Standard model of the constant volume combustion Gerace engine has been analytically investigated. The ideal thermodynamic cycle was parametrically studied to determine the influence of changes in geometry and heat input on predicted indicated engine performance. Values for the cycle state points as well as mean effective pressure and thermal efficiency were obtained from the analysis as a function of variations in charge and gasifier compression ratio and heat input. Results obtained indicate that for fixed total heat input and charge compression ratio the mean effective pressure, thermal efficiency and expansion ratio can be increased above the Otto cycle case. Combustion efficiency is shown to have a marked influence on theoretical cycle performance. This indicates a need for experimental studies to identify the actual combustion processes present in such a unique environment.

KEATING, Eugene L., Associate Professor, **"Review and Assessment of Thermochemical Engines for Submersible Applications,"** David W. Taylor Naval Ship Research and Development Center Report PASD-CR 6-83, April 1983.

Open cycle heat engines, such as the Otto, Diesel, Brayton, or Stirling engines, are considered for application to deep ocean requirements. Development of a closed-cycle engine based on those cycles is reviewed in terms of pertinent factors such as efficiency, power, emissions, and availability. A review of the heat engine options suggests that two types of closed-loop combustion systems need to be developed: those compatible with external combustion systems such as Stirling, Brayton, or Rankine engines, and those adaptable to internal combustion systems, such as Otto or Diesel engines.

KEATING, Eugene L., Associate Professor, **"Thermochemical Analysis of Closed Cycle Diesel Propulsion Plants,"** David W. Taylor Naval Ship Research and Development Center Report PASD-CR 5-84, June 1983.

Open cycle heat engines, such as the Otto, Diesel, Brayton, or Stirling engines are candidates for application to air-independent deep ocean system requirements. Development of a closed-cycle engine based on these cycles must begin first with the ideal indicated performance of the fuel-oxidant gas combustion and exhaust processes that must occur in such missions. A computer program has been written for use in the development of the closed-loop Diesel cycle for underwater applications. The program was executed for a wide range of engine options including geometry, alternative working gases, and fuel-oxidant heat inputs. Results suggest that the design and operation of a closed Diesel cycle system may be optimized by running at elevated pressure and substituting the normally air-aspirated charge with an inert gas such as argon.

KEATING, Eugene L., Associate Professor, **"Internally Regenerative Engine Cycle Analysis: A Parametric Study,"** ASME 1983 Winter Annual Meeting, Paper 83-WA Aero-3.

The Air Standard analysis for the Regenerative Otto and Diesel cycles has been investigated analytically. The ideal thermodynamic characteristics of internal regeneration occurring within a single piston-cylinder geometry was considered. By use of a constant temperature internal regenerative reservoir, heat can be absorbed from the hot gases and be rejected to the cooler charge later in the cycle. This parametric study considered the influence the ideal regeneration mechanisms had on the predicted ideal indicated engine performance. Values for the cycle state points as well as mean effective pressure and thermal efficiency were obtained from the analysis as a function of variations in compression ratio, heat input, and regeneration mode. Comparisons are made with compatible Air Standard Otto and Diesel cycles. Results show that the regenerative Otto and Diesel cycles for equal compression ratios and total heat input can, in certain circumstances, exceed the performance of the Otto cycle in power output as well as thermal efficiency.

JAMISON, Russell D., Assistant Professor, **"Composite Materials Research and Development in the United Kingdom and West Germany,"** Report to Army Research Office, October 1983.

This report describes research, development, and application of composite materials in a number of academic and industrial centers in the United Kingdom and the Federal Republic of Germany. Visits to these institutions were undertaken during the period September 1982 through August 1983 as part of the author's activities as a senior Visiting Research Fellow in the School of Materials Science of the University of Bath, England. These visits were supported by the Defense Advanced Research Projects Agency (DARPA) under contract number DAAG29-82-K-0190.

A summary of activities at each of seventeen centers — ten in the United Kingdom and seven in the Federal Republic of Germany — is provided.

JOYCE, James A., Associate Professor, **"Drop Weight J-R Curve Testing Using the Key Curve Method,"** *Proceedings* of ICF International Symposium on Fracture Mechanics, Beijing, China, 1983, pp. 507-516.

The Key Curve Method was developed by Ernst et al as a method for determination of material J-R curves directly from fracture specimen and load displacement records without the use of additional crack length measurement techniques. The method has been used previously by the researcher on static specimens of A533B steel and on high rate loading tests on HY130 and A533B steel alloys. In the static cases the key curve method was shown to give J-R curves which agreed closely with J-R curves obtained by more conventional unloading compliance methods. The key curve method demonstrated an ability in all cases to accurately predict the extent of crack growth and yields a J corrected for crack growth and other test non-linearities. For static tests the complexity of the key curve method and the necessity of additional specimens in general negates many positive features, but for high rate tests the key curve method shows great promise for J-R curve determination.

The objective of the present test program has been to develop a capability to evaluate J-R curves from fracture mechanics specimens at test rates in the range of 100 in/sec. Methods being utilized are the multi-specimen-stop block approach utilizing a potential drop crack length measurement technique and the key curve method. In this report only the key curve is discussed.

JOYCE, James A., Associate Professor, **"Instability Testing of Compact and Pipe Specimens Utilizing a Test System Made Compliant by Computer Control,"** Elastic-Plastic Fracture: Second Symposium, Vol. II, American Society for Testing and Materials, 1983, pp. 439-463.

The aim of this paper is to demonstrate that a computer-controlled test machine can replace a test machine made compliant by a mechanical spring for tearing instability testing of simple compact and cracked pipe geometries. For both geometries tested herein, close agreement was demonstrated between the "computer compliant" and "spring compliant" test systems. The results show that though the computerized system utilized here is slower than the spring machine, this is not a serious drawback for structural materials with low to moderate rate dependence. The "inertia free" response of the computerized system is in fact a positive feature for studying tearing instability arrest, and it promises to be very useful in further studies in that area.

Experimental results obtained in this study on the circumferentially cracked pipe geometry show that J-R curves from the pipe geometry lie well above J-R curves obtained from subscale compact specimens removed from the pipe wall. Tearing instability occurs in the pipes at crack extension values well in excess of what was obtained from compact specimens of the scale utilized, and a prediction of pipe instability based on the compact J-R curve alone would give very conservative results.

Measurement of Neutron Attenuation Coefficients with a NE-213 Detector

RESEARCHER: MIDSHIPMAN 1/C DEAN MILLER
ADVISER: PROFESSOR MARTIN E. NELSON

Accurate dose measurement due to neutron and gamma radiation are an essential requirement for the nuclear engineering, for health safety purposes as well as shielding design references. A portable detector that accurately determines doses from both thermal and fast neutrons and gamma radiation is then beneficial to the nuclear industry. To demonstrate the potential of a NE-213 detector system for such use, neutron attenuation coefficients for 14-MeV neutrons were determined for several materials.

The NE-213 detector is an organic scintillating detector and is used in a neutron spectrometer system. The detector is sensitive to both neutron and gamma radiation, which are distinguished by the phenomena of rise time. To obtain a neutron or gamma ray spectrum, the output of the detector is counted by a dual parameter multi-channel analyzer. The two inputs to the analyzer are rise time and incident radiation energy. Since neutrons have a longer rise time than gamma radiation, the counts are usually separated along the rise time axis into two sets of data: Counts versus energy for both types of influence as a function, from which a highly accurate dose calculation is obtained. To calculate the neutron attenuation coefficient for a material, the fluence under the neutron source peak is found for several thicknesses. The exponential decrease of the source peak is the attenuation coefficient, which is compared to existing values.

The results of the research confirmed the ability of the system as a neutron spectrometer and therefore a dose detection device. Several neutron and gamma ray spectrums were obtained as well as neutron attenuation coefficients for many materials.

Study of Surface Water Waves

RESEARCHER: MIDSHIPMAN 1/C MARK F. OPENSHAW
ADVISER: ASSOCIATE PROFESSOR THOMAS H. DAWSON

The objective of this research was to determine, by measurement in the Naval Academy towing tanks, the water pressure at various depths associated with overhead surface waves. The results were compared with various wave theories to determine the appropriate best theory for describing these waves.

Small Waterplane Area Twin Hull (SWATH) Motion in Beam Seas

RESEARCHER: MIDSHIPMAN 1/C DAVID H. RUEDI
ADVISER: PROFESSOR ROGER H. COMPTON

The objective of this project was to determine the motions of a two-strut SWATH model of zero speed in regular, long-crested beam seas. The measured responses are absolute vertical motions amidships (deck edge and C_L) and forward end of the box structure (on C_L). Potentiometers were used to measure the above motions. Additionally, vertical accelerations were measured on centerline at amidships and at the bow. Wave time histories were measured by a resistance wave gage. Results using this method of response measurement are compared with results from a similar investigation undertaken in 1983.

McCabe Wave Energy Pump

RESEARCHER: MIDSHIPMAN 1/C SCOTT VOGELSANG
ADVISER: PROFESSOR MICHAEL E. MCCORMICK

The objective of this project was to design a single pontoon McCabe wave energy converter. The converter was attached to the fantail of a small ship and was used to produce some type of energy (i.e., recharging batteries). The project consisted of the design of a bracket that attached the device to the fantail of the ship, the design of the energy converter, the construction of the system, and the testing of the system in the 120-foot wave tank at the U. S. Naval Academy. Various wave heights and periods were used to simulate an at-sea environment.

Designing for Speed

RESEARCHER: MIDSHIPMAN 1/C GARY H. WATSON JR.
ADVISER: PROFESSOR RAMESWAR BHATTACHARYYA

The objective of this project was to determine the design speed of a ship in its prospective real work environment when in the preliminary design stage. A computer program was developed which, given the principal dimensions of a ship, operating conditions, powering, and other applicable factors, determined the maximum attainable ship speed. The program used accepted regression equations for estimating ship resistance, ship motions, effects of weather, etc. and allowed the user to input changes to observe how they impact on ship speed. The possibility exists for the program to become an optimization method for initial design of a ship.

Prediction of Slamming Phenomenon in Ship Design

RESEARCHER: MIDSHIPMAN 1/C WILLIAM D. WATSON
ADVISER: PROFESSOR RAMESWAR BHATTACHARYYA

The objective of this project was to predict the slamming characteristics of a ship, given a set of line drawings and a particular sea state. Using accepted analytical expressions for ship and wave surface movement, the normal impact pressure responsible for slamming was calculated. Having understood the method of analysis through manual calculations, a computer program was adopted from existing slamming programs at David Taylor Naval Ship Research and Development Center for use on the Naval Academy Time Sharing (NATS) system to facilitate timely slamming characteristics computations for any given hull form and sea state.

Publications

CHATTERTON, Howard A., Associate Professor, **"Resistance and Seakeeping Data Base for a U. S. Coast Guard 210 Ft MEC with Midbody Section Added,"** Division of Engineering and Weapons Report EW-2-84, January 1984.

This report is the first in a series to document resistance and seakeeping characteristics of U. S. Coast Guard cutters. The purpose is to provide a current design data base for evaluation of proposed new designs. This model was tested for calm water resistance at three displacements, and for heave and pitch response, and resistance, in regular head and following seas.

CHATTERTON, Howard A., Associate Profesor, co-author, **"A State of the Art Evaluation of Small Waterplane Area Twin Hull (SWATH) Vessel Research,"** Division of Engineering and Weapons Report EW-36-83, December 1983.

This report documents the results of a literature search performed for the U. S. Coast Guard Office of Research and Development. Technical documents relating to SWATH powering, resistance, seakeeping, maneuvering, trials, structures, weights, systems, costs, and design are listed in 36 categories. An analysis of applicability to the design process is presented with recommendations for further research.

CHATTERTON, Howard A., Associate Professor, **"Investigation of Resistance and Static Stability Characteristics of a Small Waterplane Area Twin Hull (SWATH) Vehicle,"** Division of Engineering and Weapons Report EW-25-83, July 1983.

This report presents the results of resistance and stability tests of a SWATH model with variable strut spacing. The purpose of these tests was to validate computer prediction methods in use by the Naval Sea Systems Command and U. S. Coast Guard Headquarters. The model was tested in two towing tanks to check the effect of blockage, and the ability of the programs to predict blockage.

CHATTERTON, Howard A., Associate Professor, **"Investigation of Capsizing in Breaking Waves of the U. S. Coast Guard 44-Foot Motor Life Boat,"** Division of Engineering and Weapons Report EW-18-83, May 1983.

This report documents capsizing experiments performed with a 1/6 scale model of the U. S. Coast Guard 44-foot motor life boat (44 MLB). The purpose of these tests was to investigate the effect of a large rub rail, located low on the hull, with respect to tendency to capsize. The rail was not found to be a significant factor in capsizing.

DAWSON, Thomas H., Associate Professor, **"In-Line Forces on Vertical Cylinders in Deep-Water Waves,"** Offshore Technology Conference *Proceedings*, Houston, Texas, 1984, pp. 463-468.

Laboratory measurements of the total in-line forces on a fixed vertical 2-in diameter cylinder in deep-water regular and random waves are given and compared with predictions from the Morison equation. Results show this equation, with constant drag and inertia coefficients of 1.2 and 1.8, respectively, provides good agreement with measurement.

JOHNSON, Bruce, Professor, "**A Transient Wave Generation Technique and Some Engineering Applications,**" *Proceedings* of the 20th American Towing Tank Conference, Stevens Institute of Technology, Hoboken, New Jersey, August 1984, pp. 949-968.

Another method has been developed for generating transient waves utilizing the dispersion relationship of water waves. This technique consists of generating a drive signal which combines decreasing frequency with an exponentially increasing amplitude of specified form. The resulting wave energy which is focused at some point downstream of the wavemaker can result in some non-linear, asymmetric, and/or breaking waves occurring repeatedly at the same location in the tank. The location of the breaking wave relative to the predicted convergence point is discussed. The derivation and computation of the drive signal as generated on a Tektronix 4051 microcomputer is described herein.

Some specific examples of the model testing and research applications of this wave generation technique are also described. These include controlled extreme environment testing, capsizing of small vessels in breaking waves, ship responses to "episodic" waves, and a continuation of deck wetness experiments.

JOHNSON, Bruce, Professor, co-author, "***The Effects of a Bow Bulb and Stern Wedge on the EHP of a FFG-7 Class Frigate,***" Division of Engineering and Weapons Report EW-6-84, February 1984.

Still water effective horsepower tests were conducted on a 16.5' LWL model of the FFG-7 Hull. The model was outfitted with a removable bow bulb and a series of removable fixed angle stern wedges. A matrix of tests were run with and without the bulb, in combination with the various wedges. Significant reductions were measured at speeds above 15 knots with several of the hull configurations.

McCORMICK, Michael E., Professor, "**On the Correlation Functions Associated with Deep Water Wave Spectra,**" Division of Engineering and Weapons Report EW-28-83, August 1983.

Expressions describing the auto-correlation of deep-ocean wind-waves are derived from both the Pierson-Moskowitz and Neumann types of point spectral representations. Results obtained from these expressions are obtained for 10, 20, and 30 knot wind speeds. These results display the typical characteristics of a narrow-band phenomenon.

Using the auto-correlation expression, an expression for the cross-correlation is formulated. The transformation of the cross-correlation function yields an expression for the directional spectrum which displays the same behavior as those cross-correlations experimentally observed. Thus, the analytical method can be used with a high degree of confidence.

MAYER, Robert H., Assistant Professor, co-author, *Quantitative Construction Management*, New York: John Wiley & Sons, 1983.

This new work shows how to apply the computer-based technology of linear optimization to construction management problems, with step-by-step instruction in formulating managerial problems for computer-aided solutions and the proper management decisions. Included are numerous examples of how linear optimization is used in earthmoving logistics, quarrying, bidding, cash flow, project selection, and more.

NELSON, Martin E., Professor, and Clyde C. RICHARD, Associate Professor, "**The Availability Improvement Methodology (AIM) for Evaluating Power Plant Improvement Projects,**" *IEEE Transactions on Power Apparatus and Systems*, PAS-102, (June 1983), 1543-1551.

The Availability Improvement Methodology (AIM) presented in this paper describes a method for calculating the increase in the power plant equivalent availability factor resulting from a proposed improvement project. AIM uses the recently developed IEEE definitions, along with other reliability parameters for establishing unit availability

and performance. Additionally, AIM calculations are based primarily on data being collected for the Generating Availability Data System (GADS) of the National Electric Reliability Council. Many utilities are presently collecting equipment outage data on the GADS performance and Event Report Forms. These data, if properly developed, are sufficient for performing AIM calculations.

Once collected and sorted, these data are used to develop reliability parameters describing past plant operation. Based on assumptions concerning the effect of a specific improvement project to increase plant production, hypothetical reliability parameters are developed and compared to the historical parameters. A hypothetical reliability parameter is an estimate of the future value a reliability parameter will have if a given improvement project is implemented. The differences in the historical and hypothetical reliability parameters show the resultant increase in plant equivalent availability factor that results from the improvement project under study.

Included in this paper are a description of the data requirements of AIM, the most pertinent AIM equations, and a discussion of the above seven steps needed to perform an AIM analysis. Using GADS-type data and the AIM equations, an example is presented that shows the increase in plant equivalent availability factor resulting from an improvement project. Combining this calculation with a cost/benefit analysis, a utility engineer can evaluate the merits of this improvement project.

BANKIN, Bruce H., Professor, and Clyde C. RICHARD, Associate Professor, **"Propulsion for Future (Swimmer Delivery Vehicles),"** *Division of Engineering and Weapons* Classified Report, February 1984.

A more powerful and smaller propulsion plant is needed for Swimmer Delivery Vehicles. This report evaluates batteries, fuel cells, and chemical systems for propulsion. Included are powering calculations and hull shape development. Fuel systems are covered. Recommendations are made concerning the experimental and development work that should be done during the next 10-year period to develop the needed high power density plants.

SARICH, Ace J., Lieutenant Commander, USN, co-author, **"A Thermodynamic Analysis of an Aluminum Recompression Chamber with Heat Exchanger,"** *Proceedings,* Fourteenth Annual International Diving Symposium, 6-8 February 1984, 1-10.

An engineering thermodynamic balance of a standard two-lock aluminum recompression chamber operating in a closed circuit mode with carbon dioxide and scrubber heat exchanger is presented. Tests were conducted at the NAVY Experimental Diving Unit, Panama City, Florida, in order to analyze the cooling capacity of a Kinergetics Model CCU-01 S/N heat exchanger. The chamber was exposed to a hot air environment to simulate the deck of the ship on a hot summer day. Heat transfer coefficients for the chamber and the heat exchanger were determined for the chamber without external insulation. Heat transfer rates for various external insulations are predicted. Basic applicable heat transfer theory is discussed.

SARICH, Ace J., Lieutenant Commander, USN, **"Evaluation of a Cellulose Acetate Permeator for Helium Reclamation,"** Division of Engineering and Weapons Report EW-34-83, October 1983.

A spiral wound, cellulose acetate permeator element is evaluated for helium enrichment for diving gas recovery applications. Feed gas compositions of 80, 90, 95% helium and the remainder oxygen and nitrogen were run through the permeator at varying differential pressures and flow rates and the feed permeate, and residue analyzed. Results of the analysis indicate that permeators offer a potentially viable means of helium recovery for saturation diving operations.

WHITE, Gregory J., Assistant Professor, co-author, "**An Analysis of the Ultimate Strength of Deck Structures Under In-Plane Loads,**" *Marine Technology*, 20 (July 1983), 230-251.

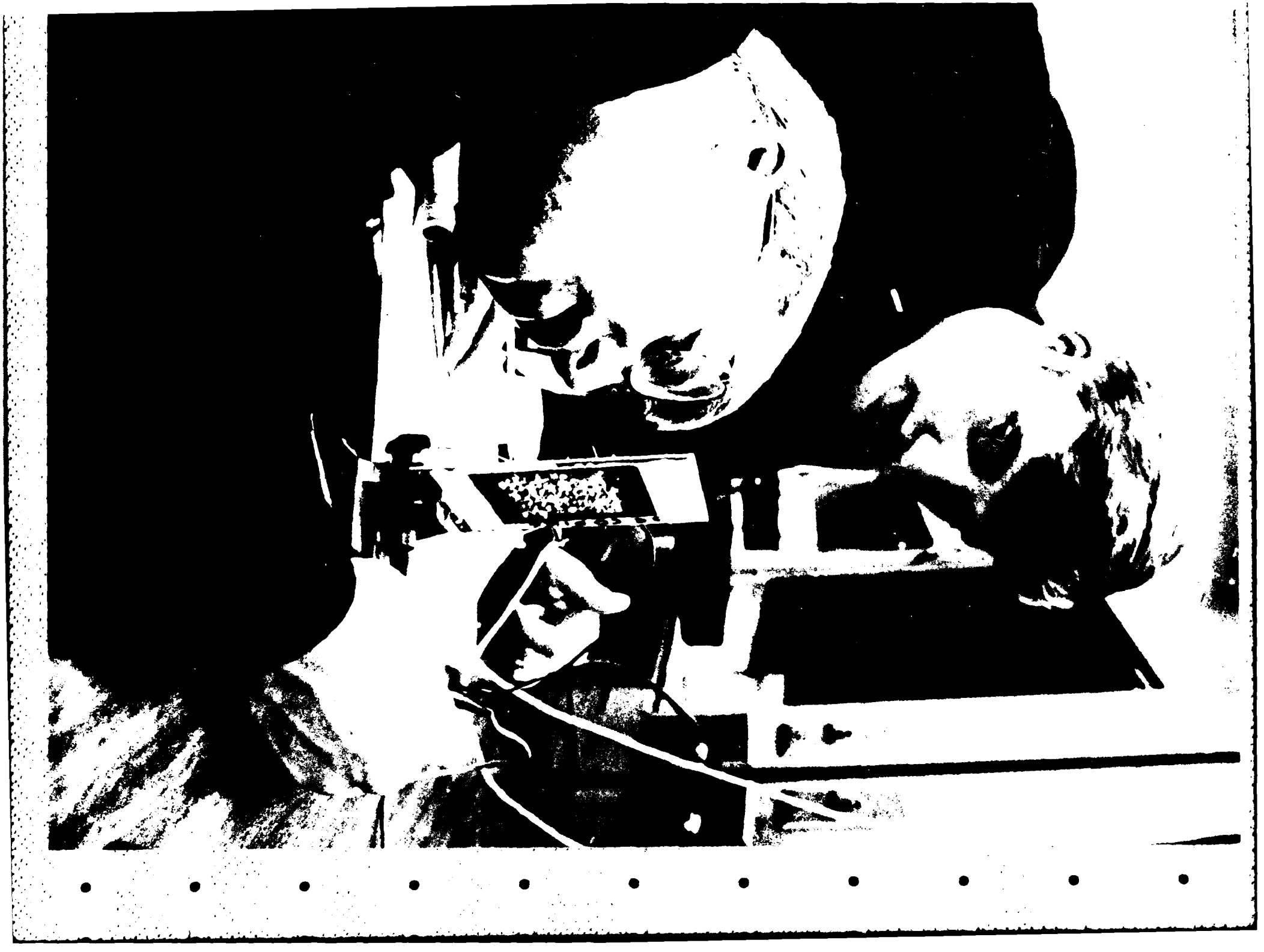
A step-by-step procedure for determining the mode of failure and the ultimate strength of ship deck structure under in-plane compressive loads is developed. A comparison of several analytical theories for the buckling strength of deck structures in the elastic and inelastic zones is presented and the reason for the approach taken at each step is explained. The final result is a simple flow chart for this procedure and an algorithm which is easily adapted to most computer systems. The procedure is compared with experimental results and a method for determining reasonable size factors of safety (or correction factors) to account for initial deflections, residual stresses, etc., is presented. An example coding in FORTRAN IV for use as a subroutine in larger programs, or as a simple program itself, is given. An example structure is solved to explain each of the steps of the procedure.

WIGGINS, Peter E., Professor, co-author, "**Gamma Ray Calibration Standards Using Californium-252 Neutrons,**" *Journal of the Washington Academy of Science*, 73 (1984), 51.

A Californium-252 Neutron source of 10 micrograms (2.3×10^7 neutron/sec) in a small shielded experimental arrangement with a few known target elements can readily provide all series of gamma ray energy standards from about 1 MeV to 10 MeV. This overlaps and extends the gamma ray energy level of the usual decay gamma ray standards. This convenient assembly, constructed at modest cost, is very attractive in expanding the calibration standards used in nuclear spectroscopy studies.

Presentations

SABICH, Ace J., Lieutenant Commander, co-author, "**Evaluation of a Carbon Dioxide Scrubber in a Two-lock Recompression Chamber,**" International Diving Symposium, New Orleans, Louisiana, 6-8 February 1984.



DEPARTMENT OF

Weapons and Systems Engineering

PROFESSOR CHARLES F. OLSEN
CHAIRMAN

Research within the Weapons and Systems Engineering Department provided the faculty an environment for continued professional growth and the opportunity to remain current in today's rapidly advancing systems technology. Additionally, every graduating Systems Engineering major participated in independent research, design, and development projects which reinforce the essential interface between academics and practical application. The establishment of a new Robotics Laboratory, the acquisition of new Z-20 minicomputers, and the upgrade of the Hybrid Computer Laboratory have provided the tools essential for keeping the Weapons and Systems Engineering Department on the forefront of current system engineering technology.

Every faculty member, both civilian and military, participated in independent research directed at solving current U.S. Navy problems or in support of the midshipmen research programs. Faculty research areas included an AEGIS doctrine study, magnetoelastic strain gauges, hydraulic controls systems, robotics, and gas turbine engine dynamics.

This year, emphasis has been placed on the faculty-midshipmen 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 oral and written presentations. Thus, the student is introduced to all aspects of the research process. Typical examples of the fifty midshipmen research topics included optical scanning systems, robotic systems, energy control systems, optical star tracking systems, voice recognition systems, and analog and digital control systems.

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 support from within the Naval Academy. This year's sponsors included the Naval Surface Weapons Center, Dahlgren, the David W. Taylor Naval Ship Research and Development Center, and the Defense Nuclear Agency.

Sponsored Research

Effects of Radiation on Electric Cables

RESEARCHER: COMMANDER GENE P. BENDER, USN
SPONSOR: DEFENSE NUCLEAR AGENCY AND ARMED FORCES RADIOBIOLOGICAL RESEARCH INSTITUTE

The effects of gamma radiation from a Cobalt 60 source on coaxial electronic cable was investigated. Through photo-compton interactions induced signals on the order of 1.0×10^{-7} amps were measured utilizing standard RG-59 coaxial cable. An analysis of dose vs. induced current for different type cables, including very low-noise cables, was evaluated. Interaction mechanisms and cable construction were used to develop specific qualities sought for low doximetry work. A development plan for cable retrofit of the exposure chamber was developed.

AEGIS Doctrine Study

RESEARCHER: ASSOCIATE PROFESSOR C. GEORGE BROCKUS
SPONSOR: NAVAL SURFACE WEAPONS CENTER, DAHLGREN

In the AEGIS combat system, the decision-making procedures have become very rapid and parallel in nature. In most cases, human intervention takes the form of forbidding actions recommended automatically by the computers of the various components of the system. Each of the three main components — the Radar system, the Command and Display system, and the Weapons Control system — has its own computer control system, and each processes a set of IF (conditions are met) THEN (take the appropriate Action) Doctrine statements. Since that facility is new, and because it is quite complex and interdependent, it is very difficult to fabricate and judge for completeness a set of Doctrine Statements.

Three functional simulations of the combat system were planned. The first very simple one was completed. It performed satisfactorily. The second intermediate version received the center of attention for this period. The environment and the Production System Interpreter were programmed in the new Department of Defense Higher Order Language Ada. These were delivered to an Artificial Intelligence group in order that the study could be continued utilizing Genetic Algorithms.

Development of Metglass as a Strain Sensor

RESEARCHER: ASSOCIATE PROFESSORS ROBERT DEMOYER, JR. AND E. EUGENE MITCHELL
SPONSOR: NATIONAL BUREAU OF STANDARDS

Metglass is a metallic glass, which, when properly annealed, exhibits a high degree of mechanical to magnetic coupling. The objective of this research is to utilize this property to produce a highly sensitive strain sensor. It is shown that strain induced magnetic property changes are most effectively measured as a change in impedance magnitude of a coil wound around the material. Temperature tests show that, as is the case for a resistance strain gauge, the metglass does not react directly to small temperature changes but does accurately measure temperature induced strain in the material upon which it is mounted. At this point in its development the overall metglass signal-to-noise ratio is only slightly inferior to that of a resistance strain gauge. Work is continuing to exploit the very large metglass gauge factor with the objective to surpass the overall sensitivity of a resistance strain gauge and its signal conditioning.

High Level Real-Time Software for Hydraulic Control Systems in Deep Submergence Vehicles

RESEARCHER: ASSOCIATE PROFESSOR RICHARD V. HOUSKA
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The objective of this research is to develop a "skeleton" real-time controller in a programming language (such as BASIC, PASCAL, or MODULA II) which is easy to modify and use by hydraulic systems engineers. The control system model is of the state variable feedback type, and the microcomputer development system includes a 4 MHz Z-80 running under CP/M. Real-time clock interrupts are generated by a Z-80 CTC. This work, as of June 1984, is ongoing and results to date include similar real-time control. These system problems are expected to be resolved in the next fiscal year.

36-Inch Variable Pressure Water Tunnel Design Review

RESEARCHER: ASSOCIATE PROFESSOR KENNETH A. KNOWLES
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The objective of this research is to perform ongoing theoretical reviews of critical areas of the 36" Variable Pressure Water Tunnel update contract submittals in the areas of computer simulation and to develop control system algorithms. Contract submittals of control laws which are designed to give the required dynamic response with adequate stability for the entire operating range of the facility subsystems are being reviewed. The same type of reviews are being performed for the Large Cavitation Channel project as it moves through the 95 percent design phase.

Power Line Carrier Systems Study

RESEARCHER: ASSOCIATE PROFESSOR OLAF N. RASK
SPONSOR: NAVAL SURFACE WEAPONS CENTER, DAHLGREN

The objective of the research was to analyze the problem of transmitting digital signals over 400-volt, three-phase power lines. These digital signals would be used for load shedding in case of failure of one of two on-line power generators, preventing the other generator from also failing due to an overload.

Three commercially available systems were tested and found to be satisfactory to the extent of the tests. Concurrently, a similar system was developed and used for further evaluation and analysis of the transmission problem. During the course of the research, it was determined that the original need for prompt load shedding was not required. The load shedding project was terminated, and a final report was prepared.

Dynamic Models of Simple Cycle and Regenerative Cycle Gas Turbine Engine

RESEARCHER: ASSISTANT PROFESSOR JERRY W. WATTS
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Recently the simple cycle transient response model developed by this researcher was used to generate transient curves for add-load and drop-load of a DDA501 gas turbine engine. There are three of these engines supplying auxiliary power aboard each DD963 class destroyer. Problems with load alignments resulting in brownouts and blackouts required a determination of how the DDA501 behaves during certain load transients. The investigation is still ongoing.

The regenerative cycle DDA501 model has been completed. The researcher is in the process of checking a dynamic model for an auxiliary sized engine employing a free power turbine.

Independent Research

Short-Term State Variables in Engineering Systems

RESEARCHER: ASSOCIATE PROFESSOR C. GEORGE BROCKUS

The concept of short-term state variables was introduced to permit the size of the state space of a system to be viewed as an *invariant property* of the system. Several practical benefits are realized for the analysis of differential systems as a result of the adoption of that concept. Several new definitions for proper and improper systems become available under that viewpoint, and new analysis techniques were developed for that variety of systems. A subset of those realizations, newly available for a given system, were shown to be derived with a minimum amount of work.

DEPARTMENT OF

English

PROFESSOR DAVID O. TOMLINSON
CHAIRMAN

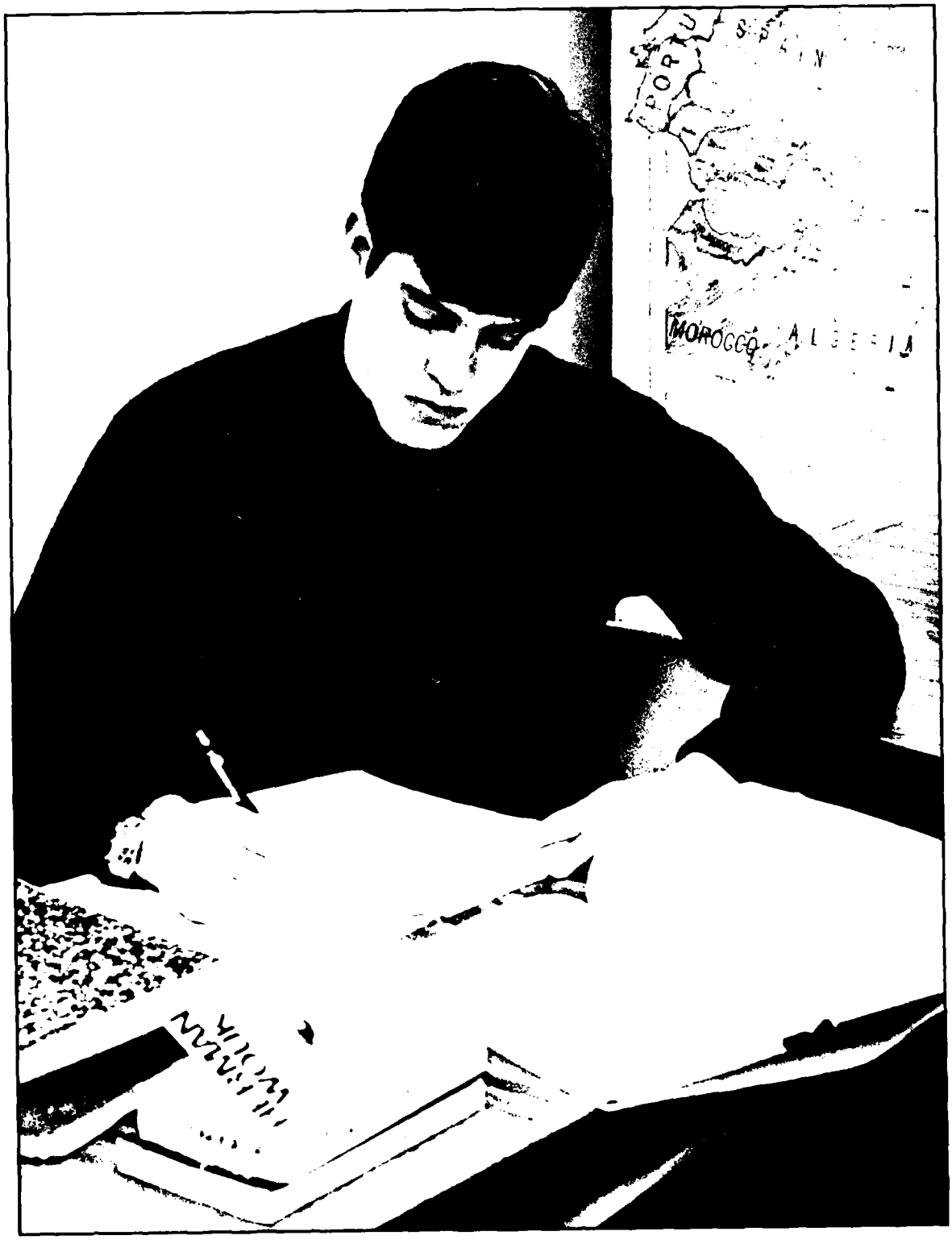
Again in Academic Year 1983-1984 the English Department faculty and midshipmen majors demonstrated the quality of the English program through the extent and variety of their scholarly research, critical studies, and creative projects. Three faculty members pursued sponsored research funded by the Naval Academy Research Council: the textual editing of a scholarly edition of James Fenimore Cooper's fifth sea novel, a comprehensive analysis of the influence of liberal education on the careers and writings of two prominent naval professionals, Richard McKenna and Vice-Admiral James Stockwell, USN (Ret). Another researcher, sponsored by the National Endowment for the Humanities, continued her investigation of the uses of enchantment in Victorian literature.

The rich variety of independent (non-funded) research included studies in American fiction on film, an introductory survey of two Herman Melville novels; a study of arrangement strategies in poetry collections; an anthology of the writings of John James Audubon; an analysis of character motivation in Ernest Hemingway's fiction; a history of the Saybrook Arras at Yale University; and a textbook on rhetorical considerations in the composition process. Other independent work on projects in creative writing has yielded an impressive assemblage of short stories, poetry, and a completed novel.

Perhaps the benefit of research to quality classroom instruction is most tangibly reflected in the research course projects directed by English faculty members and completed by midshipmen English majors. Ten such projects were completed this year, ranging in subject from Shakespeare's drama and poetry to Russian philosophical novels to modern detective fiction, and including two projects in the composing, editing, and publishing of creative writing.

Faculty publications included four books and over a dozen critical or scholarly articles. The faculty also continued its traditionally close rapport with professional colleagues and the lay community through the medium of twenty presentations on diverse subjects.

Division of English and History



Presentations

BROCKUS, C. George, Associate Professor, **"Short Term State Variables in Modelling Engineering Systems,"** Pittsburgh Modelling and Simulation Conference, Pittsburgh, Pennsylvania, 19-20 April 1984.

DeMOYER, Robert Jr., Associate Professor, **"A Sampled Data Digital Control Lab,"** Mid-Atlantic Section of American Society for Engineering Education, Merchant Marine Academy, Kings Point, New York, May 1984.

HOUSKA, Richard V., Associate Professor, **"A Simple Digital Speed Control System,"** Americal Society for Engineering Education National Conference, Rochester, New York, 20 June 1983.

HOUSKA, Richard V., Associate Professor, **"Using Simulation to Investigate the Stability of Digital Speed Control in a DC Motor,"** Summer Computer Simulation Conference, Vancouver, British Columbia, 12 July 1983.

HOUSKA, Richard V., Associate Professor, **"Using Stochastic Optimal Control to Find Shortest Paths in Networks,"** Fourth International Conference on Mathematical Modelling, Zurich, Switzerland, 16 August 1983.

KNOWLES, Kenneth A., Associate Professor, **"Robot Antics,"** Fifth Annual Anne Arundel County Mathematics Conference, Anne Arundel County Community College, Arnold, Maryland, 26 March 1984.

MITCHELL, E. Eugene, Associate Professor, **"Status of the Metglass Strain Gauge,"** National Bureau of Standards Project Presentation, Washington, D.C., June 1984.

WATTS, Jerry W., Assistant Professor, **"Modelling and Control of an Inverted Pendulum,"** Fifteenth Annual Pittsburgh Conference on Modelling and Simulation, Pittsburgh, Pennsylvania, 18-20 April 1984.

WATTS, Jerry W., Assistant Professor, **"Comparison of Digital Control Algorithms for a Second Order System,"** American Society for Engineering Education Middle Atlantic Section Spring Meeting, U. S. Merchant Marine Academy, Kings Point, New York, 5 May 1984.

provides a simple means of extending a standard analog servomotor laboratory into the realm of digital controls.

HOUSKA, Richard V., Associate Professor, **"Using Stochastic Optimal Control to Find Shortest Paths in Networks,"** *Mathematical Modelling in Science and Technology*, New York: Pergamon Press, 1984, pp. 295-298.

This paper describes a method for finding the distance of the shortest path through a network. The method is based on a special type of stochastic control model which identifies the optimal control as a permutation of system states. A computationally efficient algorithm for finding the optimal control is described and then applied to several example problems. The algorithm can be programmed easily on a small digital computer and can be modified somewhat easily to investigate adaptive properties.

WATTS, Jerry W., Assistant Professor, **"Simulation of a Linear Time-Varying Deterministic Control Problem,"** *Modelling and Simulation* 14 (November 1983), 225-229.

A flexible polyhedral search and a golden section search are used to find the optimal control law for a cart moving in a straight line from point 0 to point 1. The dynamics of the cart are simulated on both the digital and the analog computers. The surface of solutions forms a steep valley the bottom of which is difficult to traverse in the search pattern to the global optimum. Traversal to the optimum is impeded by an impenetrable trough at the bottom of the solution valley. The trough results from every feasible solution having a finite final velocity. There is a range of solutions that produces about the same performance index. This result was obtained with both the hybrid and digital simulations.

Publications

BROCKUS, C. George, Associate Professor, **"Shortest Path Optimization Using a Genetic Search Technique,"** *Modeling and Simulation* 14 (November 1983), 241-245.

Genetic Algorithms, a development from the field of Artificial Intelligence, and an optimal method for Stochastic Control System, are combined to provide a technique to use in searching for an optimal path in the context of the "Traveling Salesman problem." The application of those disparate methods in a common cause provides a search technique which performs well, although it has been bettered by other methods tailored specifically for this application. The study provides another datum in the diverse range of applicability for Genetic Algorithms.

DeMOYER, Robert Jr. and E. Eugene MITCHELL, Associate Professors, **"Strain Gauge and Metglass Sensitivity,"** Division of Engineering and Weapons Report EW-27-83, September 1983.

Metglass is a metallic glass which, when annealed, exhibits a high degree of mechanical-to-magnetic coupling. Stress in the material causes a large change in magnetic susceptibility. This report describes progress in the development of the material as a strain gauge. It is shown that change in susceptibility is most effectively measured as a change in impedance magnitude of a coil wound around the metglass. Analog signal conditioning circuitry which converts this impedance magnitude change to a computer compatible voltage level is described. Packing factor calculations suggest a means of mounting the strain sensor in such a way as to take maximum advantage of its sensitivity.

DeMOYER, Robert Jr. and E. Eugene MITCHELL, Associate Professors, **"Strain Gauge and Metglass Temperature Tests,"** Division of Engineering and Weapons Report EW-9-84, April 1984.

Further progress is described in the effort to utilize the mechanical-to-magnetic coupling of metglass as the basis for a metglass strain sensor. This report contains a parallel study of a metglass strain sensor with its signal conditioning in comparison to a typical strain gauge and its signal conditioning. It is shown that, over a narrow range of temperature, the metglass and the strain gauge do not react directly to temperature induced strain in the material upon which they are mounted.

A strain gauge is a small signal device which, when combined with a stable high-gain amplifier, can produce a usable voltage proportional to strain. The metglass sensor is a large signal device, which with moderate amplification, can also produce a usable voltage. Work is continuing to exploit the very large metglass gauge factor with the objective to surpass the overall sensitivity of a strain gauge and its signal conditioning.

HOUSKA, Richard V., Associate Professor, **"Using Simulation to Investigate the Stability of Digital Control in a DC Servomotor,"** *Proceedings* of the 1983 Summer Computer Simulation Conference Vol. I, July 1983, pp. 255-258.

This paper describes the simulation and analyses of the response of a digital speed control system which was developed for a laboratory course in Systems Engineering at the U. S. Naval Academy. The control system consists of a DC servomotor, a digital tachometer in the feedback loop, and an 8-bit digital speed setpoint control for the system input. Addition of the digital tachometer to an otherwise very stable system leads to potential instability because of the inherent time delay associated with updating motor speed in the tachometer circuit. The effect of this time delay on system stability is illustrated vividly by digital simulation techniques which provide numerical integral of the system differential equations. The results of the simulation enable one to see precisely how a system goes unstable as the time delay is increased, and more importantly, to determine values of the time delay which lead to acceptable system performance. The complete system is inexpensive to build and analyze and

Teleoperator Operator Sleeve

Midshipman 1/C Matthew Wallace
Adviser: Lieutenant Commander Gary L. Smith, USN

Headlight Control Sensor

Midshipman 1/C Brian D. Wittick
Adviser: Lieutenant Commander John H. McKim, USN

Pulse Width Modulator Control and Testing

Midshipman 1/C Kerim L. Powell
Adviser: Lieutenant Commander William E. Beyatte, USN

Robot Vision Device

Midshipman 1/C Marjorie A. Rawhouser
Adviser: Lieutenant Commander Carl E. Wick, USN

SWATH Controller

Midshipman 1/C Jon R. Rees
Adviser: Commander John A. Van Devender, USN

Telephone Operated Remote Control

Midshipman 1/C Javier J. Roquebert
Adviser: Lieutenant Commander Gene P. Bender, USN

Air Fuel Mixture Control

Midshipman 1/C Jonathan Scholl
Adviser: Lieutenant Commander Hugh C. Dawson, USN

Pneumatic Light Tracker

Midshipman 1/C Jonathan J. Smith
Adviser: Major Roger L. Nesslage, USMC

A High Level Real-Time Software Approach to State Variable Control of a High Order System

Midshipman 1/C Robert K. Stevick
Adviser: Lieutenant Commander George T. Vrabel, USN

Digitally Controlled Open Loop Sun Tracker

Midshipman 1/C Thomas D. Stubbs
Adviser: Lieutenant Colonel John C. Wiles, USAF

Direction Finder for an Emergency Locating Transmitter

Midshipman 1/C William Sympson
Adviser: Lieutenant Commander Leslie R. Carter, USN

Pattern Recognition

Midshipman 1/C Stacy Lee Turner
Adviser: Lieutenant Commander Carl E. Wick, USN

Microprocessor Cruise Control/Tachometer

Midshipman 1/C John C. Martinez
Adviser: Lieutenant Commander George T. Vrabel, USN

Ultrasonic Burglar Alarm

Midshipman 1/C Henry P. Matlosz
Adviser: Lieutenant Commander Richard W. Dawson, USN

A Closed-Loop Light Intensity Control System Employing Digital AC Power Control

Midshipman 1/C Mark W. McCann
Adviser: Lieutenant Commander Michael B. Candalor, USN

2920 Analog Signal Processor

Midshipman 1/C Matthew McKelvey
Adviser: Lieutenant Commander Michael B. Candalor, USN

Digital Controller

Midshipman 1/C Andres Muñoz
Adviser: Lieutenant Charles J. Leidig, USN

Optical Tracker

Midshipman 1/C Joseph B. Murray
Adviser: Lieutenant Commander David B. Frieden, USN

A Mobile Remote Controlled Robot Transport Device

Midshipman 1/C Robert Oakenell
Adviser: Lieutenant Commander Rodger B. Carter, USN

Windmill Control

Midshipman 1/C Scott C. Orren
Adviser: Lieutenant Commander Gene P. Bender, USN

Ultrasonic Homing Vehicle

Midshipman 1/C David M. Osen
Adviser: Lieutenant Commander Rodger B. Carter, USN

Ultrasonic Pulse Transmission and Reception

Midshipman 1/C Randall D. Pierce
Adviser: Lieutenant Commander Rodger B. Carter, USN

Helm Autopilot

Midshipman 1/C Philip G. Howe
Adviser: Lieutenant Commander Joseph S. Krajnik, USN

Temperature Control for Solar Heating System

Midshipman 1/C Richard Johnson
Adviser: Lieutenant Commander John H. McKim, USN

Self Harmonizer

Midshipman 1/C John J. Jordan
Adviser: Lieutenant Commander Gene P. Bender, USN

Optical Star Tracker

Midshipman 1/C Jonathan H. Kan
Adviser: Lieutenant Colonel John C. Wiles, USAF

Microcomputer Based Control Unit for a Mobile Platform

Midshipman 1/C Kent E. Koehler
Adviser: Lieutenant Commander Carl E. Wick, USN

Light Guided Cart

Midshipman 1/C Richard J. Laufer
Adviser: Lieutenant Commander Gary L. Smith, USN

Voice Recognizer

Midshipman 1/C Walter C. Lee
Adviser: Lieutenant Commander Hugh C. Dawson, USN

Bearingless Robot Arm

Midshipman 1/C John D. Lenda
Adviser: Lieutenant Charles J. Leidig, USN

Sun Tracker

Midshipman 1/C Joseph V. Long, Jr.
Adviser: Lieutenant Commander Allen W. Moored, USN

Analog/Digital Multiplexer

Midshipman 1/C Todd C. Lutton
Adviser: Lieutenant Commander William E. Beyatte, USN

Digitally Controlled Audio Mixer

Midshipman 1/C Alexander E. Farrell
Adviser: Lieutenant Colonel John C. Wiles, USAF

Ultrasonic Ranging System

Midshipman 1/C Robert Froncillo
Adviser: Lieutenant Joseph S. Krajnik, USN

Multiple Input Intruder Alarm System

Midshipman 1/C Thomas Gallagher
Adviser: Lieutenant Commander Allen W. Moored, USN

Control of Air Duct Flow for Standard HVAC Systems

Midshipman 1/C Jeffrey E. Giangiuli
Adviser: Commander Maurice A. Gauthier, USN

Robotic Arm as a Computer Plotter

Midshipman 1/C Christine Gromek
Adviser: Major Roger L. Nesslage, USMC

Automatic Volume Control for a Car Stereo System

Midshipman 1/C Robert A. Hammett
Adviser: Captain Gary J. Magnuson, USMC

Automatic Traction Control

Midshipman 1/C James W. Hannan
Adviser: Lieutenant Commander Richard W. Dawson, USN

Digital Remote Control System

Midshipman 1/C William T. Harms
Adviser: Lieutenant Commander Gene P. Bender, USN

Optic Random Access Memory Interface for Microcomputer

Midshipman 1/C Christian Haugen
Adviser: Lieutenant Commander Carl E. Wick, USN

Morse Code Converter

Midshipman 1/C William S. Heys
Adviser: Lieutenant Commander Leslie R. Carter, USN

Design Course Projects

Each Systems Engineering major enrolls in ES402, Systems Engineering Design, the capstone course of the major during his senior year. The student is required to propose, design, construct, test, and evaluate a system, a system in which he has a particular interest. The results of academic year 1983-84 follow.

Associate Professors C. George Brockus, Robert DeMoyer, Richard V. Houska, Kenneth A. Knowles, E. Eugene Mitchell, and Olaf N. Rask and Assistant Professor Jerry W. Watts provided technical and systems design assistance and expertise for the listed design course projects.

An Optical Scanner

Midshipman 1/C John F. Abbot
Adviser: Lieutenant Commander Carl E. Wick, USN

Six Degree of Freedom Robotic Arm

Midshipman 1/C Lee A. Barker
Adviser: Lieutenant Commander George E. Schall, USN

Computer Controlled Heat Control

Midshipman 1/C Mark W. Barranco
Adviser: Lieutenant Commander Allen W. Moored, USN

Light Controlled Platform

Midshipman 1/C Warren C. Belt
Adviser: Lieutenant Commander George E. Schall, USN

Automatic Light & Temperature Controller

Midshipman 1/C Alexander T. Casimes
Adviser: Commander Maurice A. Gauthier, USN

Ultrasonic Stereo Volume Control

Midshipman 1/C Timothy Daesler
Adviser: Lieutenant Commander Michael B. Candalor, USN

A Wind Rotor Control

Midshipman 1/C Mark J. Dvorak
Adviser: Lieutenant Commander William E. Beyatte, USN

Digital Model Railroad Controller

Midshipman 1/C Matthew M. Eves
Adviser: Lieutenant Commander David R. Frieden, USN

Pulse Width Modulator-Controller Development

RESEARCHER: MIDSHIPMAN 1/C KERBY POWELL
ADVISER: ASSOCIATE PROFESSOR RICHARD V. HOUSKA

The purpose of this research is the design and development of a simple and efficient proportional controller using an electronic pulse-width modulator and servo solenoid valve. In addition to the testing and analysis of a prototype device, the research work includes the use of this control device in an experimental position and rate control system for deep submergence vehicles.

The results of this research include successful development and testing of a prototype circuit which can be interfaced to an 8-bit microcomputer controller. The prototype circuit is now being integrated into a hydraulic test bed for further testing and evaluation at the David Taylor Naval Ship Research and Development Center.

Research Course Projects

The Hero Mobile Robot

RESEARCHER: MIDSHIPMEN 2/C DAVID A. MAGNONI AND PATRICK PIERCEY
ADVISER: ASSOCIATE PROFESSOR E. EUGENE MITCHELL

The Hero is a versatile, multi-function, quite complex mobile robot from Heath Company. In addition to a four-degree-of-freedom arm and a mobile platform, the unit contains several ultrasonic rangefinder sensors, contact sensors in all directions, speech synthesis, voice recognition, and a half dozen other functions. The unit is controlled by a 6809 microprocessor chip with the hardware and software to be up and down loaded from a cassette tape. The unit may be programmed via the 6809 assembly language or by use of a special robot language command set.

The main goals of the project were to develop the software and hardware to allow the robot to be down loaded from another microcomputer which had mass storage, and to develop a robot language cross-assembler on another computer which had mass storage. Neither of these steps was completely finished.

Modeling and Simulation of a Hydraulic Control System

RESEARCHER: MIDSHIPMAN 1/C ANDRES MUÑOZ
ADVISER: ASSOCIATE PROFESSOR RICHARD V. HOUSKA

The primary purpose of this research is to model an efficient and quiet hydraulic control system for a deep submergence vehicle. The hydraulic system to be controlled consists of a battery operated DC power supply, an AC motor, a hydraulic supply pump and multiple hydraulically driven "loads." Each of these loads requires rate and/or position control on operator demand while hydraulic power is supplied in a manner which minimizes overall battery power consumption.

The model developed was of the multiple input-multiple output state variable type involving two or three states for each of the hydraulic loads. The dynamic model of the system was programmed on an analog computer and is currently being verified and validated. The controller will be implemented with a Z-80 microcomputer system.

Sponsored Research

Studies in the Uses of Enchantment in Nineteenth-Century English Literature

RESEARCHER: ASSISTANT PROFESSOR EILEEN TESS JOHNSTON
SPONSOR: NATIONAL ENDOWMENT FOR THE HUMANITIES

Fairy tales figure importantly in the major works of a number of nineteenth-century English writers, especially Alfred Tennyson, Charles Dickens, and George Eliot. The researcher has begun to investigate these authors' uses of fairy tale plots, characters, imagery, and values, as well as the theory and history of the fairy tale as it is presented in numerous articles and books.

This year the researcher participated in a National Endowment for the Humanities (NEH) Summer Seminar in study of the emergence of children's literature, 1840-1920. The seminar met for eight weeks at Princeton University under the direction of Professor Ulrich C. Knoepflmacher. The seminar provided additional background in the field. The researcher's specific project for the seminar is a study of Charles Dickens' *Bleak House,* in which the author's attempts to show "the romantic side of familiar things" depend upon fairy lore and fairy tale structure.

The researcher proposes ultimately to define and study the spectrum of works by Victorian authors who find childhood and children's literature thematically, structurally, and rhetorically relevant enough to appropriate to their fictional purposes.

A Scholarly Edition of James Fenimore Cooper's *Homeward Bound*

RESEARCHER: ASSISTANT PROFESSOR ROBERT D. MADISON
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The researcher is engaged in the long-term project of editing James Fenimore Cooper's fifth sea novel, *Homeward Bound, or, The Chase,* for the SUNY Press edition of The Writings of James Fenimore Cooper. Following editing principles and procedures developed by W. W. Greg and Fredson Bowers, and subsequently modified by Hershel Parker, G. Thomas Tanselle, and others, the investigator is trying to reconstruct Cooper's text to reflect as closely as possible the author's final intentions. This project requires the simultaneous examination of multiple texts. All necessary materials have been assembled, and partial collation of the manuscript is underway. Full collation of one printing is complete.

Thomas Carew and the Court of Charles I

RESEARCHER: ASSISTANT PROFESSOR MICHAEL P. PARKER
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This project will constitute a comprehensive study of the life and poems of Thomas Carew. The most accomplished poet working at the court of Charles I, Carew played a role in shaping the public image the Stuart monarchy attempted to project; his poetry enunciates the standards of cool elegance and restrained playfulness that the king demanded of his court. Carew, nevertheless, maintains a distance from the courtly culture that he helped to create. His works dedicated to private patrons suggest values different from those he embraces in the poems on affairs of state, and the tension between these realms of experience provides the field for Carew's poetic utterances. This study will place Carew within his literary, social, and political contexts and, in doing so, illuminate the complex sensibility that underlies his best work.

Of Liberal Education and the Naval Profession; A Study

RESEARCHER: COMMANDER ROBERT E. SHENK, USNR
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This project is a comparative study of the writings and experiences of two naval professionals on liberal education and related subjects. One of these was the career naval machinists' mate, Richard McKenna, who on retirement as a Chief Petty Officer took up creative writing, and suddenly burst on the public scene with *The Sand Pebbles*, a highly successful and very high quality novel about the Chinese Rebellion of 1926-1927. The other is Vice-Admiral James Bond Stockdale, USN (Retired), who in the midst of a very successful career as a naval aviator was forced to endure eight years as a POW in Vietnam, and then went on to become the President of the Naval War College. Both of these men attributed much of their professional success, ability to endure hardship, and personal insight to their reading of literature, history, and philosophy. This essay will compare the careers and writings of these two men, focusing on their views of the significance of liberal education to a naval career.

Independent Research

Images of America in Film and Literature

RESEARCHER: ASSOCIATE PROFESSOR NEIL BERMAN

This project is an outgrowth of the teaching of three courses: Types of Fiction, Modern American Literature, and Contemporary American Literature. The canon of American fiction in the twentieth century is remarkably well-represented in film. Interestingly, there is an ironic relationship between the stature of modern American fiction and its rendition on film. The works of Ernest Hemingway and William Faulkner, for example, are represented by some wretched films, while lesser known but significant works like Thomas Berger's *Little Big Man* and Raymond Chandler's *The Big Sleep* are marvelous recreations of their fictional counterparts. Furthermore, both films take some significant liberties with their fictive originals in order to remain true to the spirit of those fictions. The changes help us understand the differences between two media as well as important aspects of American culture and cultural history. While this project is in its formative stages, a substantial amount of work will be accomplished while the researcher is on sabbatical.

Redburn and *White-Jacket*

RESEARCHER: PROFESSOR WILSON L. HEFLIN

The project is to write a chapter on two of Herman Melville's works, *Redburn* (1849) and *White-Jacket* (1850), for a book to be entitled *An Introduction to Melville Studies.* For both of Melville's books there will be a general introduction, and for each of them the following sections: introduction, summary of plot, reception of the work, sources for the text, editions, summary of criticism, and problems for further study. The finished manuscript will be approximately 12,000 words long.

The Book of Poems as Genre

RESEARCHER: PROFESSOR PHILIP K. JASON

Ever since Walt Whitman's practice of arranging and rearranging old and new poems for the various editions of *Leaves of Grass,* poets have been concerned with shaping the ideal context for their individual poems. The placement of poems in collections is a creative act that leads, in many cases, to a comprehensive and meaningful design. The ways in which a poet's separate works interact and the ways in which the book itself becomes an artwork are the subject of this investigation.

Selected Writings of John James Audubon

RESEARCHER: ASSISTANT PROFESSOR ROBERT D. MADISON

The researcher has assembled an anthology of the writings of the naturalist and artist, John James Audubon (none has existed to this point). Arranging these materials to reflect Audubon's interests and accomplishments, the researcher presents this author in various aspects ranging from delineations of American scenery and manners to an account of his method of drawing birds, and including excerpts from some of Audubon's several journals and selected correspondence. In addition to editing the texts, the researcher is supplying notes and introductions. The project is near completion.

Matthew Arnold Centenary Essays

RESEARCHERS: MAJOR LAURENCE W. MAZZENO, USA, AND PROFESSOR ALLAN B. LEFCOWITZ

To celebrate the centenary of the death of Matthew Arnold in 1988, a collection of essays by Arnold scholars in the United States and England is being assembled and edited for publication for a major trade or university press.

Shooting the Sergeant: Frederic Henry's Puzzling Action

RESEARCHER: ASSOCIATE PROFESSOR CHARLES J. NOLAN, JR.

The scene in *A Farewell to Arms* in which Frederic Henry shoots a deserting sergeant has often puzzled readers. Because it is clear that Hemingway intends his protagonist to be an heroic figure, Frederic's violent act seems a mistake in characterization. Fitzgerald, in fact, urged Hemingway to delete the scene, though whether in conversation or in the more famous author's long critique of *Farewell* is uncertain. Rightly read, however, the scene reveals a man still fulfilling the obligations he accepted when he took his commission in the Italian Army. During the disastrous retreat from Caporetto, Frederic continues to work his way toward Udine with his ambulances. When the two sergeants refuse to help and walk off down the road, Frederic first warns and then orders them to return; only after they refuse and start to run off does he shoot at them. The act, about which Frederic feels ambivalent, is part of what Henry sees as his duty. Later, when the Carabinieri try to execute him, he will make his separate peace, but for the moment he will do what he believes he must, however distasteful his actions are to him.

The Saybrook Arras

RESEARCHER: ASSISTANT PROFESSOR MICHAEL P. PARKER

The Saybrook Arras, presented to Saybrook College in Yale University to commemorate its founding in 1934, incorporates a wealth of historical and iconographic detail. This study provides a brief history of Old Saybrook, Connecticut, and of the early years of the College; it gives capsule biographies of the hundred-odd ornaments that embellish the Arras. This work represents a valuable contribution to the history of Yale College and to the study of applied arts in America.

The Writer: Studies in Rhetorical Stance

RESEARCHER: ASSISTANT PROFESSOR NANCY R. WICKER

The researcher is co-authoring a rhetorical writing textbook for use in the teaching of composition. In each chapter, the introduction, the writing assignments, and the description of the writing process emphasize the techniques and methods that writers use. All the assignments lead students through a multiplicity of overlapping stages and encourage a variety of rhetorical choices. These tasks are framed for the world beyond academe; in addition to analyzing how to write essays, the assignments explain how to carry out research, how to conduct interviews, how to deliver effective oral presentations, and how to work together on group projects.

The approach of the text is unusual but it is not altogether new. The book provides ample discussion of the traditional modes of writing, and adapts them to the important concerns of rhetorical stance—occasion, audience, purpose and voice.

Research Course Projects

Miller, O'Neill, and Williams

RESEARCHER: MIDSHIPMAN 1/C JAMES H. BISHOP
ADVISER: PROFESSOR MICHAEL JASPERSON

In the introduction to his book, *Contour in Time: The Plays of Eugene O'Neill,* Travis Bogard describes O'Neill with a cryptic line from one of his plays, "You were born with ghosts in your eyes and you were brave enough to go looking into your own dark . . . ." Later, speaking of O'Neill more directly, Bogard states, "Eugene O'Neill's work as a playwright was such an effort at self-understanding." What Bogard says of O'Neill is also true—though probably to a lesser extent—of Arthur Miller and Tennessee Williams. Much of the work of these playwrights was autobiographical in nature. This fact about these brilliant authors is fascinating because all three of them had many traumatic and painful experiences in their lives. Yet, as Bogard asserts, their works were mirrors of their lives. The researcher studied this aspect of their plays as autobiographical mirrors of themselves.

The Nature of Evil as Seen by Dostoyevsky and Solzhenitsyn

RESEARCHER: MIDSHIPMAN 1/C JAMES H. BISHOP
ADVISER: ASSISTANT PROFESSOR DAVID A. WHITE

The researcher addressed the problem of evil in this study. From the Christian perspective several questions concerning evil arose: Is a universe with evil better than a universe without evil? Are there limits on what an omnipotent being can do? If "no," then why is there evil in the world? If "yes," then is that really being omnipotent?

The intent of this special study was to continue pursuit of such problems, analyzing the nature of evil to see if and how it controls man's political and religious ideology. The researcher examined evil as manifested in works by Dostoyevsky and Solzhenitsyn, authors who have extensively explored this question in such writings as *The Possessed, The Brothers Karamazov, The First Circle,* and *The Gulag Archipelago.* The researcher culminated the study by writing an in-depth paper discussing the philosophical nature of evil and Dostoyevsky's and Solzhenitsyn's perceptions of it.

"Hotspur" in History and Drama

RESEARCHER: MIDSHIPMAN 1/C LUNDY J. CAMPBELL
ADVISER: PROFESSOR MICHAEL JASPERSON

The researcher read, studied, and wrote on the Percy family, focusing especially on the character of Harry Percy (Hotspur). A comparative analysis was made between Shakespeare's stage version of the character and the actual historical character. To this end the researcher read Shakespeare's history plays, *King John; Richard II; Henry IV, Parts I and II; Henry V; Henry VI, Parts I, II and III; Richard III;* and *Henry VIII,* and consulted the following texts: *Shakespeare's English Kings,* by Peter Saccio; *Shakespeare: The Histories,* edited by Eugene M. Waith; and *The Chronicles of England, Scotland, and Ireland,* by Raphael Holinshed. The researcher also kept an informal notebook of thoughts and ideas about the Shakespeare plays as the research progressed.

Detective Fiction

RESEARCHER: MIDSHIPMAN 1/C GEORGE S. CARRADINI
ADVISER: ASSOCIATE PROFESSOR NEIL BERMAN

The purpose of this independent research was to study the genre of detective fiction as practiced by prominent masters of the mode. The researcher concentrated on the works of three representative authors: Raymond Chandler, Sir Arthur Conan Doyle, and Dashiell Hammet. While conducting the study, the researcher looked closely at several works by each of the above authors and reported on the generic characteristics of detective fiction in a lengthy term paper at the end of the semester.

"Travel" and "Exploration" as Metaphors for Education and the Art of Writing

RESEARCHER: MIDSHIPMAN 1/C RICHARD CASSETTA
ADVISER: ASSISTANT PROFESSOR HARDY C. WILCOXON, JR.

This project involved study of accounts of travel and exploration, both real and fictional. Its main aim was to examine the relationship between language and learning. Books about travel and exploration are especially revealing in this context because the situation of the explorer or traveler is rather like that of the student: he is confronted with something new and has to give order to this "newness" in ways that make it intelligible and yet do not falsify it.

Thus learning is like a building process. In order for a person to formulate new ideas, he needs new information to serve as building material; but he also needs a base of previously understood information, from which he can draw to make models and comparisons to formulate new ideas. Travel and exploration constantly involve such a process. Examining how travelers and explorers build upon what they already know in order to learn new information may further illuminate the very nature of learning processes, and help one to understand the role of language in this process.

In addition to reading eight books for this study, the researcher wrote his conclusions in three five-page papers and a more substantial culminating treatise.

"I Had a Brother, But He's Dead": O'Neill and His Family

RESEARCHER: MIDSHIPMAN 1/C RICHARD B. COX
ADVISER: PROFESSOR MICHAEL JASPERSON

This project was an examination of the relationships between Eugene O'Neill and members of his immediate family, particularly the relationship of the playwright with his brother, as portrayed in O'Neill's so-called "family plays": *A Long Day's Journey into Night, A Moon for the Misbegotten,* and *Ah! Wilderness.* The nature of this relationship, which provided the framework for some of O'Neill's most powerful plays, was critically evaluated. In a long paper, the researcher sought to determine how the playwright's personal experiences shaped his work and, conversely, how his work influenced his relationships with others.

Experiments with Language in Shakespeare's Non-Dramatic Poetry

RESEARCHER: MIDSHIPMAN 1/C PHIL DOBBS
ADVISER: ASSISTANT PROFESSOR DAVID A. WHITE

In this project, the researcher examined the ways in which Shakespeare used sonnets and narrative poetry to explore the possibilities of language, thereby developing his unique poetic gifts. The study began with a close reading of Shakespeare's *Love's Labor's Lost,* scrutinizing how the author, in that early dramatic comedy, dealt with the problem of using honest and original language to express the profound emotion of love. After examining other contemporary writers in the sonnet tradition (Wyatt, Surrey, Sidney, Spenser), the researcher made a close study of Shakespeare's sonnets and his other important poetry, narrative and lyric. The resultant paper discussed the development of Shakespeare's poetic gifts through the sonnet sequence, the kinds of experiments he makes with language in his early poetry, and the successful balance between language and emotion the poet maintains in his best work.

Women in Modern Theater: Strindberg and O'Neill

RESEARCHER: MIDSHIPMAN 1/C SCOTT D. RIPLEY
ADVISER: PROFESSOR MICHAEL JASPERSON

In this project the researcher completed an in-depth study of several of Eugene O'Neill's plays. The focus of the study was a concentration on the influences of August Strindberg on O'Neill's work for the stage. Perhaps most prominent among these influences was the playwrights' respective treatment of female characters. A comparative analysis was made of how Strindberg's *The Father* and *The Dance of Death* could be discerned in the female characterization of O'Neill's *Long Day's Journey into Night* and *A Moon for the Misbegotten.* The project resulted in a presentation, designed for the stage, consisting of carefully edited speeches and scenes from the plays of the two playwrights, and narrated with explanations of the connections between O'Neill and Strindberg.

Creative Writing

RESEARCHER: MIDSHIPMAN 1/C KAREN A. WINERING
ADVISER: ASSOCIATE PROFESSOR MOLLY B. TINSLEY

First through a series of individual exercises the researcher reviewed the varied techniques of creative writing. Then by keeping a journal and through practicing the writing of poems, descriptive passages, and dialogue, she honed her skills in shaping her thoughts into finished products, both poetry and prose. As a strength in one genre emerged, the writer concentrated on that mode, with the ultimate objective of creating a substantial manuscript of poetry or prose comparable to a term paper of at least fifteen pages. Such a manuscript was submitted at the conclusion of the project.

Creative Writing and Publication

RESEARCHER: MIDSHIPMAN 1/C DIANE WUESTENBERG
ADVISER: ASSOCIATE PROFESSOR MOLLY B. TINSLEY

As an HE496 class project, the researcher increased her proficiency in the publication of the *Labyrinth* by editing and producing the 1984 Spring issue. The researcher also completed a series of exercises designed to enhance creative writing skills in both poetry and prose, and completed a manuscript of poetry and prose suitable to be submitted for publication.

Publications

FETROW, Fred M., Associate Professor, *Robert Hayden.* Boston: G.K. Hall and Company, 1984.

While the organization of the content of this book is determined by the biographical-critical premises and format of the Twayne's United States Authors series, the primary thesis of the work is an investigation of the poet's voice in evolution — how, when, and why Robert Hayden developed as a unique poetic voice. Through a sequential, chronological treatment of the poet's primary themes, modes, and methods, the researcher traces Hayden's development and demonstrates his importance and relevance as a chronicler of American culture. Finally, because Hayden expressed the black experience with transcendent art, he proved that form and feeling could subsume personal biography and racial heritage without denying either. Robert Hayden's work clearly proves that black poetry need not be limited to racial utterance; his life demonstrated the humane element in a commitment to art.

JASON, Philip K., Professor, **"The Gemor Press,"** *Anais: An International Journal,* 2 (1984), 24-39.

When Anais Nin returned to the United States in 1939, she found no commercial publisher for her work. Desiring to reach a public, and wishing to find productive employment for her friend Gonzalo More, Nin started Gemor Press — an alternative press modeled after the small enterprises that had flourished in France between the wars. From 1942-1947, Gemor published new editions of Nin's early work, first editions of recent work, and editions of fiction and poetry by other authors whose writings did not attract commercial publishers. Gemor publications were notable not only for maverick content, but also for design values: most were handsomely illustrated limited editions that won praise as examples of the bookmaker's art. Through Gemor, Nin became the center of an artistic community that flourished on the fringe of the cultural establishment. By the middle forties, Nin was able to publish her works with commercial houses. No longer able to absorb the press's financial drain or the loss of time to her writing, and having broken through the editorial barriers of the literary tastemakers, Nin decided to give up the press. However, she always valued the control it had given her over the manner in which her work reached its public, and she cherished the sense of community it had fostered among various artists and writers and their small but loyal audiences.

JASON, Philip K., Professor, *Near the Fire,* Washington, D.C.: Dryad Press, 1983.

The writer's domain in this collection of forty-five poems is both reassuringly domestic and disturbingly exotic. He treats with subtle, sometimes dark, and often comic irony the commonplaces and nuances of contemporary American life in suburbia, as well as departing from the familiar with a set of poems which provide an evocative tour of modern Israel, that pastiche of incongruities. The structure of the collection, as suggested in its title, moves the reader closer to a vicarious shedding of emotional armor, as the poems progressively reveal the minor yet important threats and disappointments which underlie the calm of the suburbs and the facades of human relationships.

LEFCOWITZ, Allan B., Professor, **"The Place of the Writer's Center,"** *New Virginia Review Newsletter* (Spring, 1984), 20-31.

This reference article discusses the place of the Writer's Center as a model of the literary center movement. The major impulse is to create a non-academic place where the entire business of writing can occur — editing, book production, audience development, and interaction. The ideal goal, of course, is to provide the type of support a developing writer needs. And what the administrators of such alternate resources hope is that one day the very existence of a literary center will create the conditions under which or within which a writer of genius can flourish.

LEFCOWITZ, Allan B., Professor, **"A Future Without Poetry,"** *World Future Society Bulletin*, 11 (May/June, 1983), 12-16.

In an era of mechanical and scientific power, language loses its significance. Instead of being seen as *the* instrument of power with which one can control the forces of the universe, language becomes merely a sub-set of the scientific set. The effect will be that literature, particularly poetry, in the future will have less social force. Language will be part, not the whole, of the future art. The signs of this change are already visible (1) in the contraction of audiences, (2) in the growth of poetry written for poets and students, and (3) in such phenomena as psycho-poetry and aleatory poetry. The change is not to be regretted but acknowledged as reflecting the changes in the sources of power.

MADISON, Robert D., Assistant Professor, **"*Redburn*'s Seamanship and Dana's Guidebook,"** *Melville Society Extracts*, 57 (February, 1984) 13-15.

Richard Henry Dana, Jr.,'s *The Seaman's Friend* may not account for all the seamanship in Herman Melville's *Redburn*, but the remarkable similarity between certain passages and the availability in Dana's book of technical information employed in *Redburn* suggest that Melville turned to Dana to aid a flagging imagination. The nature of *Redburn's* parallels to *The Seaman's Friend* — drawn from clusters of paragraph beginnings, glossary entries, or the table of contents itself — suggests that Melville did not find inspiration from a thorough reading of the latter, but rather went to it cursorily to find the detail he needed to fill out his own in-progress fictional account of a first voyage.

NOLAN, Charles J., Jr., Associate Professor, **"Aaron Burr (1716-1757),"** *American Writers Before 1800: A Biographical and Critical Dictionary*, eds. James A. Levernier and Douglas Wilmes. Westport, Connecticut: Greenwood Press (1983), pp. 243-245.

Father of an infamous son and son-in-law of the celebrated Jonathan Edwards, Aaron Burr achieved prominence in his own right. He helped to found the College of New Jersey (now Princeton) and became the school's second president. Thereafter, he was indefatigable in his efforts for the college and in his attempts to alert his fellow citizens to the spiritual, political, and physical dangers of their times. His works reflect his principal functions as Puritan minister and civil leader.

NOLAN, Charles J., Jr., Associate Professor, Contributions to the *Annual Bibliography of English Language and Literature*, Volume 55, eds. Michael Smith and Mary Jean DeMarr. Leeds: Modern Humanities Research Association, 1983.

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 or American language or literature and any ancillary work that bears significantly on those fields. Using a specialized format, he then prepares bibliography cards for such items and forwards them to the American editor, who, in turn, sends the American contribution to Leeds, England, where the *Annual Bibliography* is published. The result each year is one of the two major bibliographies in English studies.

NOLAN, Charles J., Jr., Associate Professor, **"Hemingway's Women's Movement,"** *The Hemingway Review*, 3 (1984), 14-22.

Hemingway's troubles with women are legendary. Beginning with his quarrels with his mother and running throughout his relationships with his four wives and with others, Hemingway's sometimes public disagreements helped to create his popular image as woman-hater. As if biographical detail were not enough, stories like "The Short Happy Life of Francis Macomber," with its unforgettable depiction of five-letter Margot and, by extension, of all of American womanhood, worked to solidify the portrait.

But for all the clamor, recently joined by feminist critics, there is another side to this major, if troubled, artist. Whatever his personal idiosyncrasies (and there were many), as a writer he saw more clearly than perhaps even he knew. Throughout his work up to the late thirties, there runs a strong sympathy for the plight of women, a sympathy that at one point, in fact, is expressed in contemporary rhetoric and rage.

PARKER, Michael P., Assistant Professor, co-author, *Annapolis: A Walk Through History*. Centreville, Maryland: Tidewater Publishers, 1984.

This is the first book-length guide to Annapolis written in almost one hundred years. The book, organized by street, contains a historical introduction; it provides information on nineteenth and twentieth-century structures as well as the better known eighteenth-century sites. The work marks an important contribution to state and local history.

PROTHRO, Nancy W., Assistant Professor, **"The Experience of Wilderness,"** *South Dakota Review*, 22 (Spring, 1984), 23-31.

This is a non-fiction "personal essay" which tries to define the significance of the time the researcher spent, three years ago, working in Montana as a poet-in-the-schools. The writer describes her encounter with the wilderness, and tries to come to a workable definition of the wilderness and what it means for a civilized society. Her starting point is the definition given in the Wilderness Act of Congress of 1964: an area "where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." She then relates her expectations of wilderness, as filtered through her reading, particularly of the English *Romantic poets, and her own experiences in* Montana that seemed somehow wilderness experiences.

PROTHRO, Nancy W., Assistant Professor, **"'On the Edge of Space': Wallace Stevens's Last Poems,"** *New England Quarterly*, 58 (Summer, 1984), 1-10.

In discussion of the last poems that Stevens wrote, those collected in *Opus Posthumous* after his death, the researcher analyzes the imagery and tone and discovers a *profound joy and vitality*, unusual in the writing of the aged. These poems, too long neglected as obscure and difficult to understand, deserve, argues this writer, more attention for what they can teach readers about the way to live in the face of death. The poems show a depth and range of emotional *responsiveness not* before recognized in Stevens. This article functions as a first step in revealing their strength and wisdom.

SHENK, Robert, Commander, USNR, **"Introduction,"** *The Sand Pebbles*, Richard McKenna. Annapolis, Maryland: United States Naval Institute Press, 1984, pp. vii-xxii.

The researcher has provided a critical introduction to Richard McKenna's *The Sand Pebbles, long admired as a readable* and entertaining story of the American navy in China. But the novel is an excellent work of literature as well. McKenna's unique background contributed to the quality of his work: he was a naval enlisted man who, after twenty-two years of service in the enginerooms of U.S. Navy ships, went on to college at the University of No th Carolina, and after graduating with high honors succeeded in becoming an excellent creative writer. He later said he had kept his mind alive during those long years of tending engines by reciting English poetry and by reading every book he could get. His novel is not only an adventure tale, but a story of personal and philosophical awakening, as a young man awakens to life and love first through his love of steam engineering and his friendship with the Chinese coolie, and then through the crucible of events, when he is caught up along with his ship in the Chinese revolution of 1926-1927. The introduction emphasizes the thematic concerns discernible in plot events and characterization.

SHENK, Robert, Commander, USNR, co-editor, *Literature in the Education of the Military Professional,* United States Air Force Academy, Colorado: U.S. Air Force Academy, 1982.

The researcher had edited a collection of essays on the uses of a knowledge of literature for military professionals. In addition to commenting in general on the value of the humanities, these essays suggest that considering human character and action in drama, fiction, and poetry can develop the imagination, give a person a sense of perspective, and create an awareness of human values, virtues useful for anyone who has to lead and serve in the military. Moreover, reading good literature can often inculcate a realization of the ends for which wars are to be fought, and comment on the measured means that must be employed if the military is to be constructive rather than destructive in its support of modern civilization and traditional values. Vice Admiral James B. Stockdale, USN (Retired) contributed the thought-provoking foreword to the collection. The volume includes a selected, annotated bibliography of other articles and essays pertinent to the subject.

SHENK, Robert, Commander, USNR, **"The Classics, the Military, and the Missing Modern Element,"** *Literature in the Education of the Military Professional,* United States Air Force Academy, Colorado: U.S. Air Force Academy, 1982, pp. 11-20.

A recent military conference had as its subject this question: "Fight Outnumbered and Win?". Virtually all of the respondents provided answers that were quantitative, technical, tactical, and material in nature. Unlike these modern technicians, ancient writers knew very well that, as Napolean put it, "In warfare the moral is to the material as three is to one." The researcher's study of Greek and Roman classical literature demonstrates that Western civilization was founded by men who won against all odds because they were men of intelligence and moral purpose, and because their virtues and ideals had been cultivated by their great national epics and myths. The history, literature, and biography of the ancient world all emphasize the human element in warfare. Modern military leaders would be wise to reread the classics, works which portray the origins of our culture, the ideals for which it stands, and the awe-inspiring ways in which it has been defended.

WHITE, David A., Assistant Professor, **"Miguel de Unamuno,"** *Critical Survey of Foreign Poetry,* ed. Frank N. Magill. Englewood Cliffs, New Jersey: Salem Press, 1984, pp. 1554-1560.

The essay explores the prominence of Miguel de Unamuno as the leading twentieth-century Spanish poet and his influence on European philosophers and poets. Emphasis is placed on Unamuno's use of poetry as the ground on which to test his own religious doubts and beliefs and to define his sense of the tragic nature of life. A close reading is provided of Unamuno's poetic masterpiece, *The Christ of Velazquez,* as the key work in Unamuno's poetic canon and the principal poetic definition of his philosophical views.

WOOTEN, John C., Associate Professor, **"Sir Henry Wotton,"** *Critical Survey of Poetry,* ed. Frank N. Magill. Englewood Cliffs, New Jersey: Salem Press, 1984, pp. 3139-3145.

This essay on Sir Henry Wotton, seventeenth-century English poet and diplomat, gives pertinent information about editions, collections, and criticism of Wotton's poetry. In addition, a section analyzes Wotton's literary achievement; another briefly describes his life; while a more extended section analyzes particular poems in an effort to make very specific the nature of Wotton's modest but influential poetic talent.

Presentations

LLILAND, C. Herbert, Lieutenant mmander, USNR, **"The Seventeenth-ntury Animadversion: A Lost Genre,"** uth Atlantic Modern Language Association, lanta, Georgia, 30 October 1983.

SON, Philip K., Professor, **"The Literary arketplace,"** Nuts and Bolts Conference, ne Writer's Center, Bethesda, Maryland, May 1984.

ADISON, Robert D., Assistant Professor, **'he American Naval Ballad in the Early 840's,"** American Culture Association nvention, Toronto, Ontario, 29 March 1984.

ADISON, Robert D., Assistant Professor, **ooperstown's Contribution to Cooper cholarship,"** Milne Library, State University f New York at Oneonta, Oneonta, New York, March 1984.

IAZZENO, Laurence W., Major, USA, and obert E. SHENK, Commander, USNR, **Effective Writing for Military xecutives,"** Commanders' Conference, .S. Military Entrance Processing Command astern Sector), Philadelphia, Pennsylvania, May 1984.

OLAN, Charles J., Jr., Associate Professor, **Professional Ambivalence,"** College nglish Association Convention, Clearwater each, Florida, 13 April 1984.

ARKER, Michael P., Assistant Professor, **The Lady's Not for Burning: Lucy, ountess of Carlisle, among the Poets,"** lodern Language Association of America, ew York City, 28 December 1983.

ARKER, Michael P., Assistant Professor, **Davenant, Van Dyck, and the adagascar Romance,"** Carolinas Symposium on British Studies, Clemson University, Clemson, South Carolina, 16 October 1983.

PROTHRO, Nancy W., Assistant Professor, **"'The Subversive Function of the Imagination': The Poetry of Adrienne Rich,"** Twentieth-Century Literature Conference, University of Louisville, Louisville, Kentucky, 24 February 1984.

PROTHRO, Nancy W., Assistant Professor, **"Aztec Poetry,"** District of Columbia Poetry Society, Poetry in Translation Annual Reading, The Writer's Center, Bethesda, Maryland, 11 December 1983.

PROTHRO, Nancy W., Assistant Professor, **"Poetry Reading,"** Montpelier Cultural Arts Center, Laurel, Maryland, December 1983.

PROTHRO, Nancy W., Assistant Professor, **"The Experience of the West in Contemporary American Poetry,"** National Council of Teachers of English, Denver, Colorado, 19 November 1983.

PROTHRO, Nancy W., Assistant Professor, **"Learning to See through Poetry,"** Southeast Regional English Teachers Conference, Charleston, South Carolina, 29 October 1983.

ROSS, Stephen M., Associate Professor, **"Monumental Language in Faulkner,"** The Third International Faulkner Colloquium, University of Salamanca, Salamanca, Spain, 28 April 1984.

TOMLINSON, David O., Professor, **Testing for Competency and for Excellence in English,"** Maryland Association of Departments of English, Bowie State College, Bowie, Maryland, 27 April 1984.

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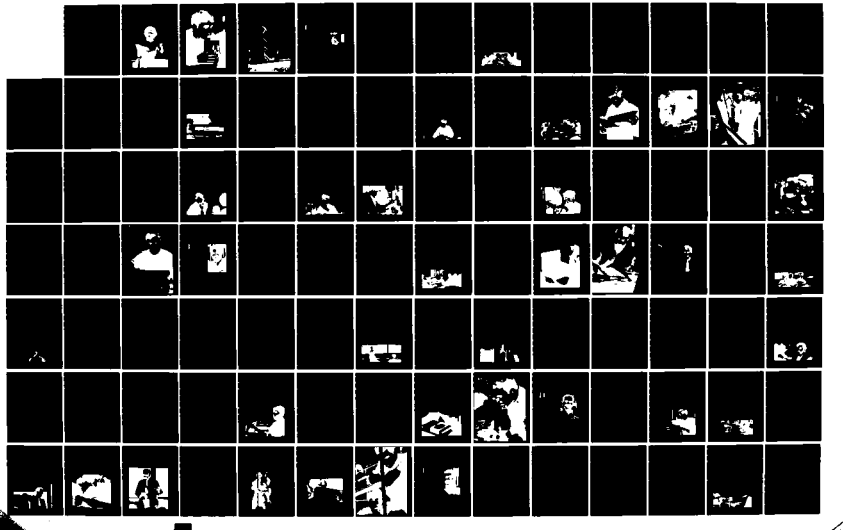
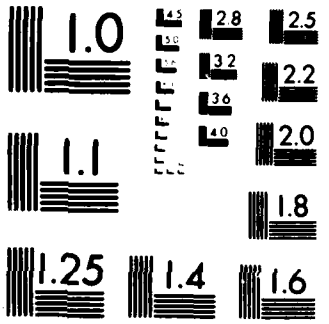


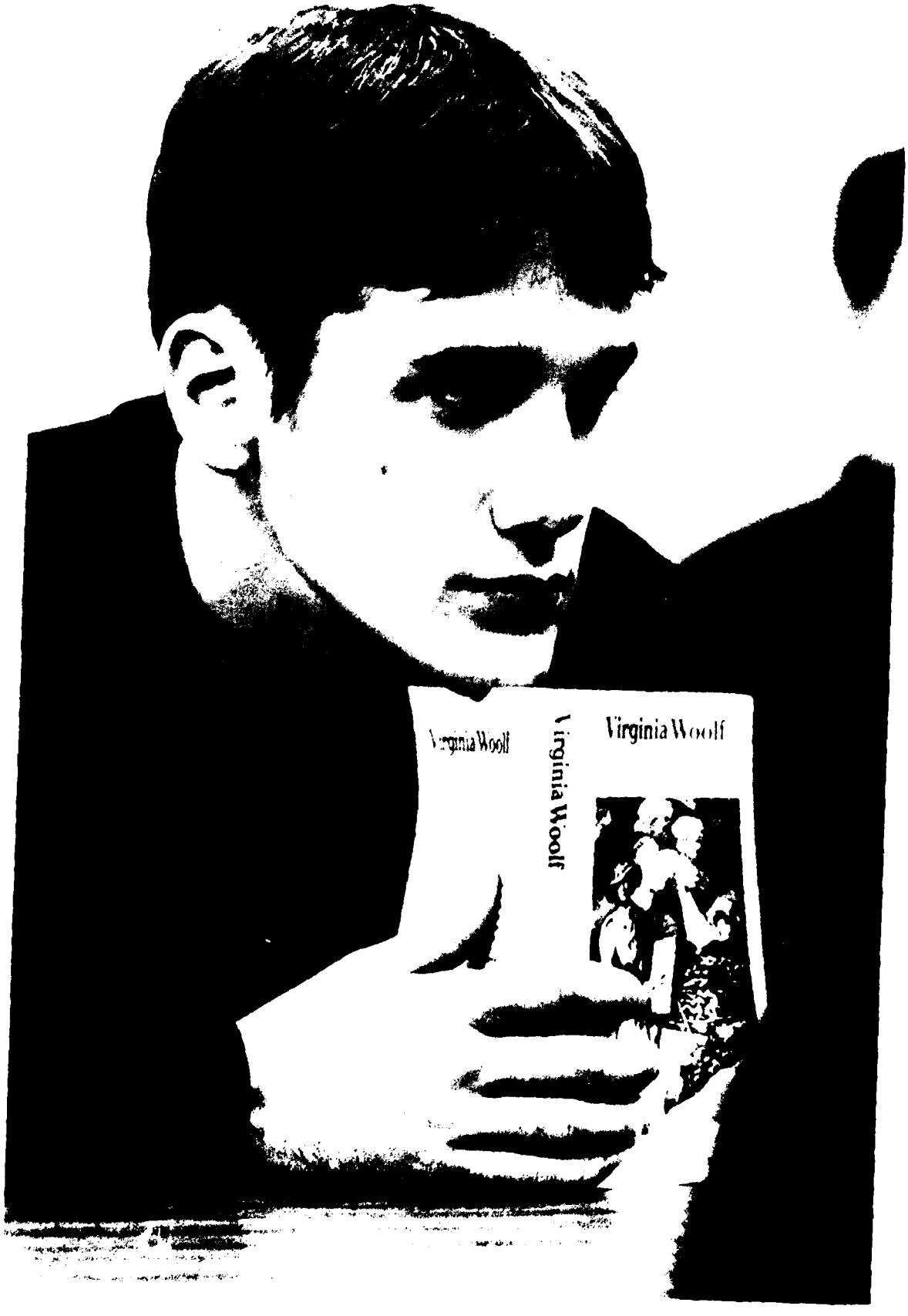


TOMLINSON, David O., Professor, **"July 4: Celebrations in the Nineteenth Century,"** Sons of the American Revolution, Old Saint Paul's Church, Baltimore, Maryland, 3 July 1983.

WICKER, Nancy R., Assistant Professor, Respondent, **"The Writing Process: Twenty Years Later,"** Conference on College Composition and Communication, New York City, 29-30 March 1984.

WICKER, Nancy R., Assistant Professor, **"Tennyson and the Conventions of Madness,"** Victorians Institute Conference, Longwood and Hampden Sydney Colleges, Hampden Sydney, Virginia, 8 October 1983.

WOOTEN, John C., Associate Professor, **"Milton's Violence: A Deconstruction,"** Carolinas Symposium on British Studies, Clemson University, Clemson, South Carolina, 16 October 1983.


Virginia Woolf
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DEPARTMENT OF

History

PROFESSOR PHILIP W. WARKEN
CHAIRMAN

For the History Department, 1983-1984 was an outstanding year in publication and research. The faculty published one book and fifteen articles, papers, and encyclopedia entries in the field of history. In addition, there was a translation of a book, the editing of a reprinted volume, and a book series by faculty members.

The Department continued to participate actively in professional conferences across the country. At eleven of these, faculty members presented papers. Also, presentations were made to twelve military and civic audiences.

The results of the History Department's deep involvement in research are reflected in the ongoing enrichment of the classroom experience offered the midshipmen as well as in the production of scholarly publications and papers.

Sponsored Research

Lordship and Military Obligation in Anglo-Saxon England

RESEARCHER: ASSISTANT PROFESSOR RICHARD P. ABELS
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The subject of this research project is a study of military obligation in England from the seventh to the eleventh century. It analyzes the manner in which military institutions and the practice of war was affected by changes in Anglo-Saxon land tenure, by the challenge of the Viking invasions, and by the growth of royal lordship. The aim of this study is to answer a specific question that has wide-ranging implications for medieval military and social history: what was the precise relationship between the obligations arising from the lordship bond and military service in pre-Conquest England? The answer to this question will help to clarify one of the knottiest problems in English history, namely, the impact of the Norman Conquest upon the military organization of England.

This project will result in a full-length monograph, which will represent a synthesis of the written sources and the archaeological record. The techniques employed include statistical analysis of *Domesday Book*, a pioneer study of the geography of lordship, and charter criticism.

Energy Awareness: Faculty Interdisciplinary Seminars

RESEARCHER: ASSOCIATE PROFESSOR P. ROBERT ARTIGIANI
SPONSOR: NAVAL SEA SYSTEMS COMMAND

In Academic Year 1983-1984 the Energy Awareness Committee focused its five meetings on "The Navy in the Year 2000." The first meeting was addressed by Dr. James H. Probus, Special Assistant to the Assistant Secretary of the Navy, who provided a clear demonstration of how the Navy thinks about its future. Captain C. D. Allen, USN, (Ret), Delex Corporation, offered a critique of present planning and several scenarios for alternative developments. Commander H. K. Ullman, USN, (Ret), Center for Strategic and International Studies, discussed "Naval Power in Transition." Mr. Kenneth Spaulding, Navy Department, described surface ships available for development by the twenty-first century. Finally, Dr. Kenneth Lobb, Center for Naval Analysis, briefed the seminar on the "Outer Air Battle."

Seminars met about every six weeks and attracted a wide range of auditors -- civilian and military, scientists, engineers, and humanists. Most discussants also addressed midshipmen honor societies in appropriate disciplines as well as the faculty. Speakers contributed significantly to faculty understanding of the Navy and future circumstances and to the midshipmen's knowledge of the fleet in which they will serve.

Siegfried Sassoon and the Crisis of Modernity in the Great War

RESEARCHER: ASSISTANT PROFESSOR THEODORE W. BOGACZ
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This study discusses the English soldier-poets of the First World War as representative figures of the generation of 1914. At the center of this study is the English war poet, Siegfried Sassoon (1886-1967), who exemplifies a radical shift in consciousness in the generation of Englishmen who came of age in the First World War. This study emphasizes three major crises which Sassoon and his comrades encountered during the war: those of language, politics, and psychology. So far one major article on the crisis of language has been finished. A second article connected with this study, "Shell-Shock and Modernity in England in the Great War," is in the process of being finished.

Taverns and Popular Sociability in Eighteenth-Century Paris

RESEARCHER: ASSISTANT PROFESSOR THOMAS BRENNAN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The taverns of pre-revolutionary Paris will be the focus of a new book on early modern popular culture and laboring-class communities. The book will rely on judicial records to give a concrete and quantified foundation to an investigation into the lives of the "nameless poor" and their use and perceptions of taverns. This study analyzes violence, recreation, and sociability in taverns, the economics and epistemology of drinking and drunkenness, and the nature of social identities and relations of the laboring classes. The approach that the study takes to these questions is based on a combination of the statistical skills of the quantitative historian with ethnographic methods of the anthropologist.

A State-of-the-Art Evaluation of Small Waterplane Area Twin Hull (SWATH) Vessel Research

RESEARCHERS: PROFESSOR WILLIAM L. CALDERHEAD AND
ASSOCIATE PROFESSOR HOWARD A. CHATTERTON
(DIVISION OF ENGINEERING AND WEAPONS HYDROMECHANICS LABORATORY)
SPONSOR: NAVAL SEA SYSTEMS COMMAND

This project produced a summary of available research material on Small Waterplane Area Twin Hull (SWATH) vessels to provide an aid in identifying technology gaps and to give direction for the planning of future research and development programs. This summary was based upon extensive search of the relevant literature, and it resulted in the identification of approximately five hundred scientific articles which dealt with some aspect of a SWATH-type vessel. This report outlines the process and the basic elements required in the design of a ship. The results of the literature search are then tabulated by design element and supplemented by a summary and recommendations.

Purging the English Navy: An Examination of the Committee for Regulation, 1649-1653

RESEARCHER: ASSISTANT PROFESSOR WILLIAM B. COGAR
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

From the outset of the English Civil War in 1642 to the summer of 1648, the Navy supported the Parliament against King Charles I. Only when the Army and the radicals in the House of Commons demanded the dissolution of the monarchy and the establishment of a republican Commonwealth did a part of the Navy defect to the royalists. This Naval Revolt had considerable repercussions on the Navy after the King was executed and the Commonwealth established. It was quickly learned within the new regime that a considerable number of men in the Navy had either sided with the defectors or had supported the Naval Revolt in principle. For this reason, the Parliament created a "Committee for Regulation," consisting of zealous and radical London merchants, to purge the Navy of those malignant and disaffected elements.

This project is twofold. First, it will assess the Committee's membership and determine why the new regime turned to London merchants for this task. Secondly, the project will show that while purging the Navy and its administration on grounds of political probity, the Committee also effectively administered the Navy when there was so much political and administrative dislocation and confusion. The minute book for the Committee, from which most of the research will be made, was only recently discovered and housed in the Tower of London.

The Souls: High Society and Politics in Late Victorian Britain

RESEARCHER: ASSISTANT PROFESSOR NANCY W. ELLENBERGER
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

"The Souls" is a study in the social history of the British upper classes at the end of Victoria's reign. It examines a group of some three dozen aristocrats who figured prominently in the social and political life of the nation before the First World War. The work is based on a number of collections, of family papers that are still in private hands and that have not been seen by historians. Using these personal effects, the researcher analyzes the ideas, attitudes, and behavior of the group within the context of social, political, and economic changes affecting their class as a whole. Most of the research on this manuscript is completed.

Popular Education in Nineteenth-Century France: A Social History of the Women's Normal Schools

RESEARCHER: ASSISTANT PROFESSOR ANNE T. QUARTARARO
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This study of popular education in France and the women's normal schools represents an original contribution to the social history of nation-building in the nineteenth century. Recent scholarship in French political and social history has begun to focus on the relationship between educational opportunity and social/cultural change. It is impossible, however, to understand social change for the lower orders of society without investigating the professed values of a modern, secular state. This project on the normal schools taps new archival sources in order to understand the mission of education for the masses. In particular, it shows how the national government began to incorporate women's education into a model for a progressive, modern state.

This manuscript on French popular education represents the culmination of several years of research and writing. At present, the research is most preoccupied with the social background of the young women who attended the normal schools in the nineteenth century. The manuscript is near completion and will be structured in a way that will allow investigation of these students' social status.

Western Civilization Computer-Assisted and Video Disc Program

RESEARCHERS: PROFESSOR LARRY V. THOMPSON;
ASSOCIATE PROFESSORS P. ROBERT ARTIGIANI, PHILIP R. MARSHALL,
DANIEL M. MASTERSON, CRAIG L. SYMONDS; AND
ASSISTANT PROFESSOR JACK SWEETMAN
SPONSOR: NAVAL ACADEMY INSTRUCTIONAL DEVELOPMENT ADVISORY COMMITTEE

The investigators created new Computer-Assisted Instruction (CAI) programs and modified previously developed CAI for the new six-credit History Plebe Core Course. Additionally, two printed volumes comprising the data base for the entire program were revised and issued as instructor guides. The investigators also constructed a new Student Information Guide to explain the program's structure and mechanics.

The video-disc component was expanded to include a guide which indexed the images contained on the prototype disc previously developed. The History Department now has a video-disc classroom capability, but usage is restricted due to equipment scarcity as a result of budgetary limitations.

The total program package has been an unqualified success. Student response remains positive and usage statistics are impressive. Future modifications will occur as program evaluation dictates.

Independent Research

"Social Physics": The Uses of Thermodynamics in the Philosophy of History

RESEARCHER: ASSOCIATE PROFESSOR P. ROBERT ARTIGIANI

Physicists and biologists have shown the profound importance of the Second Law of thermodynamics in explaining the processes by which ordered structures can emerge through random interactions. It seems also clear that the development of ordered structures reveals a hierarchical relationship among natural processes. Some theorists — A. Iberall and I. Prigogine — have argued that the pattern found in physical, chemical, and biological sciences can be translated into the humanities. If that is so, then a major step forward in the philosophy of history is possible. Before taking that step, however, the project will involve a careful analysis of the physical and biological arguments as well as the development of a substantial systems theory.

The Romans in Italy: A Milennium of Material Life 500 B.C.-500 A.D.

RESEARCHER: ASSOCIATE PROFESSOR PHYLLIS CULHAM

The original project for which a NARC grant was received for work in the summer of 1982, namely a study of transport in central Italy, has been expanded to include a Braudelian study of the material life of the inhabitants of the Italian peninsula within the time limits listed above. A number of papers and articles are anticipated, but the eventual product will be a lengthy, scholarly book.

Ekaterina Breshkovskaia: A Russian Populist in America

RESEARCHER: ASSOCIATE PROFESSOR JANE E. GOOD

This is a paper to be presented at the national conference of the American Association for the Advancement of Slavic Studies (AAASS) in New York City in October 1984. The paper is one of three in a panel entitled "Russian Radicals Visit America," which was organized by the eminent Russianist Paul Avrich. This paper is based on research already completed for a biography of Breshkovskaia that has been in progress for several years.

In Peace and War: Interpretations of American Naval History 1775-1984

RESEARCHER: ASSOCIATE PROFESSOR KENNETH J. HAGAN

This is the second edition of this anthology, of which the researcher is the editor. This edition includes updated bibliographies and a new chapter covering 1976-1984. Publication is expected in July 1984.

M. C. Perry

RESEARCHER: ASSOCIATE PROFESSOR KENNETH J. HAGAN

A brief sketch of Perry, is scheduled for publication in the newest edition of the *Encyclopedia Americana*. He was the younger brother of O. H. Perry the "hero of Lake Erie" in the War of 1812, and the U.S. naval officer who "opened Japan" to the West. He was also active in the anti-slavery patrol in the 1850's.

The Wartime Diary of General Henry H. "Hap" Arnold, 1941-1945

RESEARCHER: PROFESSOR JOHN W. HUSTON

This diary consists of twelve chapters written by General Henry H. Arnold, Chief of the Army Air Forces during World War II. His attendance at many meetings held outside of the United States was carefully recorded by him in a diary, the originals of which are in the Manuscript Division of the Library of Congress, Washington, D.C. The author carefully recorded his impressions of the physical surroundings in which he found himself from the Argentia Conference of August 1941 through the Potsdam Conference of July 1945. Other wartime conferences such as those at Quebec, Cairo, Casablanca, and Teheran are also included along with meetings with British officials in separate trips to Great Britain as well as a visit to the Normandy beachhead only six days after the invasion of June 1944. Arnold commented on the strategy proposed, the needs of the U.S. Army Air Forces, the politics and compromises involved, and efficacy and weaknesses of Allied as well as enemy air forces. Two trips within this period were made to the Pacific and his comments there parallel those dealing with Europe.

The researcher has just completed editing these chapters, furnishing an introductory chapter to each diary, identifying the events and personnel noted by General Arnold and assessing the accomplishments of General Arnold in these twelve visits overseas during World War II.

The conclusion is that Arnold was a careful protector of the interests of the Army air arm of the American military during World War II yet was keenly aware of the restrictions under which he operated as a member of the U.S. Army and responsible to its Chief of Staff, General George C. Marshall. Arnold recorded keen analyses of these meetings and of his candid conversations with Churchill, the British political and military leadership, and many others. Analyses of leading personalities of the period such as Joseph Stalin, Winston Churchill, Charles DeGaulle, and General Douglas MacArthur are to be found in the diary. The diary has been almost untouched by researchers.

John L. Sullivan and His America

RESEARCHER: COMMANDER MICHAEL T. ISENBERG, USNR

All research has been completed for a cultural biography of John L. Sullivan (1858-1918), America's first truly national individual sporting hero. Sullivan's career has never been examined by professional historians. Using rarely examined sporting newspapers and books of the period, not only Sullivan's boxing career as heavyweight champion, but also the social meaning of his rise to fame, is being reconstructed.

John L. Sullivan was a seeming anomaly in the American culture of the decade of the 1880's. He was an Irishman in an age when the Irish were not integrated into the mainstream of American life. He was a Catholic at a time when American religious preference was overwhelmingly Protestant and it was unusual to find a national figure who was Catholic. And, most importantly, Sullivan performed in a sport, boxing, which was outlawed in every state in the Union. Yet he became, during that decade, a symbol of sporting excellence to many Americans and a symbol of violent brutality and atavism to many more.

The task of Sullivan's biographer is to explain the anomaly of Sullivan and place him solidly in the context of his times. Professional historians are only beginning to examine the rise of American sport and the phenomenon of the American sporting hero; only a handful of monographs and biographies exist at present. Thus the field is still novel and of great potential importance in the examination of nineteenth- and twentieth-century American culture.

Ethical Implications of Terrorism

RESEARCHER: PROFESSOR DAVID E. JOHNSON

This topic is the theme for the January 1985 meeting of the Joint Services Committee on Professional Ethics (JSCOPE), and this paper is to be read at that meeting. The purpose of this project is to achieve some clarity on the concept of terrorism in the light of the current world situation (many terrorist groups and also charges of state terrorism) and the history of this nation. The argument both for and against terrorism will be examined on two levels: strategic and ethical. There may be sufficient material to expand this approach to this topic into a monograph.

Politics and Military Professionalism in Peru

RESEARCHER: ASSOCIATE PROFESSOR DANIEL M. MASTERSON

This is a book-length manuscript to be completed in 1985 which will analyze the professional development of the Peruvian military in the period 1939-1968. Special emphasis will be directed toward the Peruvian military's educational system, its relations with the civilian sector, and junior-senior officer rivalries within both the Army and Navy.

Lieutenant General Samuel B. M. Young

RESEARCHER: ASSISTANT PROFESSOR WILLIAM R. ROBERTS

This study of the U.S. Army's first chief of staff will focus on the reasons for General Young's selection as chief of staff as well as his actions while in office. Official War Department records, Young's private correspondence, and the observations of his contemporaries provide the information on which this biographical study is based. This essay will be published as part of a larger study of all the chiefs of staff.

The Transformation of the Nineteenth-Century American General Staff

RESEARCHER: ASSISTANT PROFESSOR WILLIAM R. ROBERTS

This study examines the adoption of the modern general staff system in the U.S. Army in 1903. By examining earlier staff reform proposals, this study suggests that the origins of the modern general staff were predominantly American, not European as previous historians have maintained. In addition, the new staff system that was created in 1903 contributed more to the bureaucratization and less to the professionalization of the military establishment than has generally been realized.

The Chronology of U.S. Naval and Marine Corps History

RESEARCHER: ASSISTANT PROFESSOR JACK SWEETMAN

The object of this project is to provide an annotated, book-length chronology of the significant events in the history of the U.S. Navy and Marine Corps from 1775 to the present. Coverage is given to social, administrative, and technological as well as operational history, and major "external" events, such as the Roosevelt Corollary, which have influenced the development of the American sea services are also included. Such a reference should be of value to anyone working in the field of naval history. The project is approximately ninety-five percent complete.

Medalists and Mutineers: A Test of Social Order Theory

RESEARCHER: *LIEUTENANT COMMANDER JAMES W. WILLIAMS, USNR*

This project extended research begun the previous year under a Naval Academy Research Council grant to study possible situational variables in instances leading to the award of the Medal of Honor. This continuation focused on Army awards during World War II, seeking to develop an index of risk associated with studies of casualty rates among different theaters of operation, types of tactical operations, rank, military occupational specialty, and types of weapons involved in the engagements. The goal was to see whether or not the apparently perceived risk to participants in the engagement seemed to correspond to the objective risk, and, thus, to assess whether Medal of Honor winners as a group were peculiarly indifferent to the danger in the situation or perhaps more accurately perceived the degree and nature of the danger, and responded accordingly. Analysis of the data is incomplete at this time.

General Philip H. Sheridan

RESEARCHER: LIEUTENANT COMMANDER ROGER T. ZEIMET, USNR

This study continues the investigation of the life and military career of General Philip H. Sheridan, one of the American Civil War's most prominent military commanders. Work has continued along two parallel tracks: (1) revision of the study for possible publication, and (2) research into the remaining years of Sheridan's life.

During the past year, basic historical research continued into the primary source material on Sheridan at the Library of Congress, the National Archives, and the U.S. Army Military Institute at Carlisle, Pennsylvania. In addition, a visit was made to Sheridan's hometown of Somerset, Ohio. Revision should be completed by the end of 1985 and will be submitted then for possible publication. The work on the remainder of Sheridan's life will take approximately two more years to complete.

DEPARTMENT OF

Chemistry

COMMANDER WILLIAM H. RIVERA
CHAIRMAN

The growth of the research activity and reputation of the Chemistry Department is mirrored in the descriptions that follow. The Department presented 32 invited or contributed papers at meetings which ranged from an international meeting on theoretical chemistry held in Canada to several presentations made as part of a tour speaking on Black scientists and their contributions. Sixteen papers were submitted in the literature with strong contributions in the areas of theoretical chemistry, organometallic chemistry, and the chemistry of alkaloids and natural products. Two U.S. Patents were granted to members of the Department. Contributions to various journals that relate to chemical education continue along with patents granted on some equipment used to protect the environment. Seven students undertook research under the tutelage of the faculty including Midshipman Douglas Brown, who as a Trident Scholar, made a major contribution to a portion of the organometallic work and was well received by the Intercollegiate Student Chemists Convention, where his paper was presented in competition with other seniors from the Middle Atlantic States.

The ongoing programs of the Department are as broad as chemistry itself, reaching into areas that range from the mathematically sophisticated realms of molecular theory to the practical questions that deal immediately with Navy needs. Support was received from groups including the Italian "National Science Foundation," Research Corporation, the U. S. Army Medical Research and Development Command, Los Alamos Scientific Laboratory, David W. Taylor Naval Ship Research and Development Center, the Naval Research Laboratory, and the Naval Academy Research Council.

Division of Mathematics and Science

HUSTON, John W., Professor, "**Maryland and the American Revolution**" St. John's Lecture Series, St. John's College, Annapolis, Maryland, 17 January 1984.

HUSTON, John W., Professor, "**The Aerial War in Europe During World War II: Some Personal and Historical Perspectives,**" Military Roundtable, Baltimore, Maryland, 16 February 1984.

HUSTON, John W., Professor, "**The Golden Age of Annapolis Culture,**" Anne Arundel County Library Centennial Celebration, Annapolis, Maryland, 14 May 1984.

LOVE, Robert W., Associate Professor, "**Anglo-American Naval Diplomacy and the Falkland Islands, 1820-1854,**" Society for the History of American Foreign Relations, Washington, D.C., 18 August 1983.

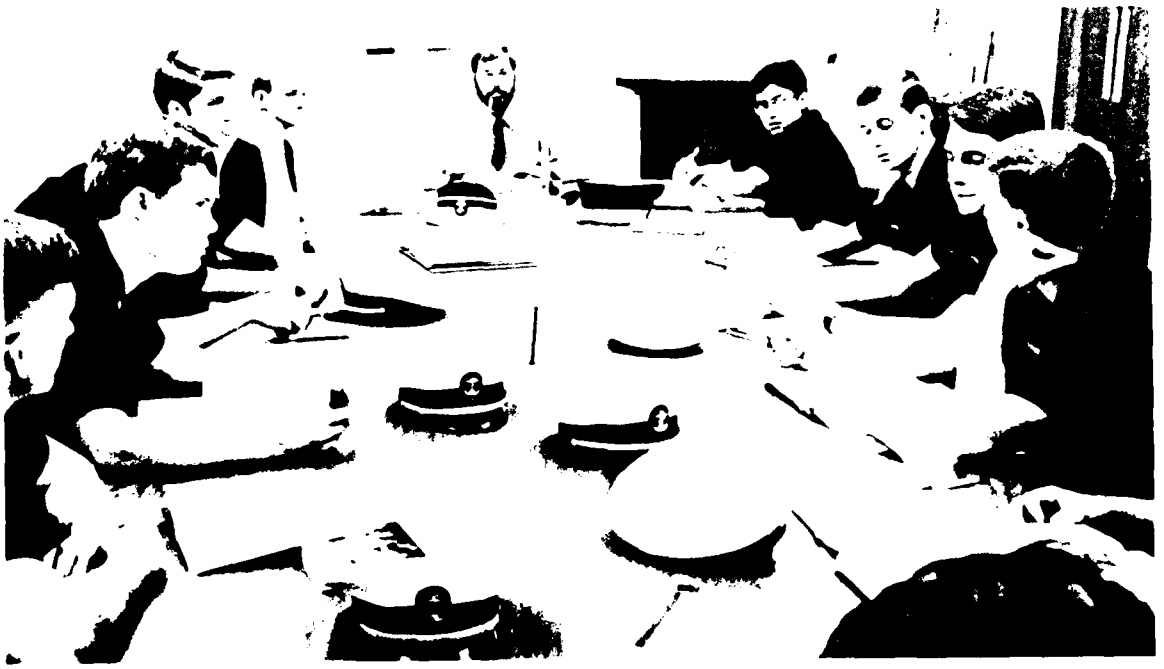
WILLIAMS, James W., Lieutenant Commander, USNR, "**Medal of Honor Winners,**" Annual Conference of Society for Values in Higher Education, Carlton College, Northfield, Minnesota, 14 August 1983.

WILLIAMS, James W., Lieutenant Commander, USNR, "**Basics — Getting to Know Computers,**" Joint Conference, U.S. Naval Academy and St. John's College, Computers and the Humanities, Annapolis, Maryland, 17 October 1983.

WILLIAMS, James W., Lieutenant Commander, USNR, "**War and Peace in the Nuclear Era,**" Fourth Annual Single Adult Forum, Catholic Archdiocese of Baltimore, St. Mary's Seminary and University, Baltimore, Maryland, 6 May 1984.

WILLIAMS, James W., Lieutenant Commander, USNR, "**The Just-war Tradition in the Light of Current Combat Development Doctrine (AIRLAND BATTLE 200),**" Religious Education Class, (Greek Orthodox) Cathedral of the Annunciation, Baltimore, Maryland, 14 May 1984.

ZEIMET, Roger T., Lieutenant Commander, USNR, "**The Years of Apprenticeship: The Pre-Civil War Life and Career of Philip H. Sheridan,**" 18th Annual Meeting of the Northern Great Plains History Conference, Grand Forks, North Dakota, September 1983.



Presentations

ABELS, Richard P., Assistant Professor, "**The Introduction of Bookland Tenure and the Military Dilemma of the Eighth Century,**" Second Annual Conference of the Haskins Society for Viking, Anglo-Saxon, Anglo-Norman, and Angevin History, University of Houston, Texas, 11-13 November 1983.

ABELS, Richard P., Assistant Professor, "**Bookland and Military Obligation in Late Anglo-Saxon England: The Domesday Custumals for Berkshire and Worcestershire,**" 19th International Congress on Medieval Studies, Medieval Institute of Western Michigan, Kalamazoo, Michigan, 10-13 May 1984.

ARTIGIANI, P. Robert, Associate Professor, "**The *Name of the Wave*: Science and Civilization in Prigogine and Eco,**" International Society for the Comparative Study of Civilization, Appalachian State University, Boone, North Carolina, 14-16 June 1984.

BOGACZ, Theodore W., Assistant Professor, "**Psychiatry, Mental Illness and the 'Moral Code' in England from the Outbreak of the First World War to the Report of the Shell-Shock Commission of 1922,**" Second Annual Hudson Valley Historical Conference, Bard College, Annandale-on-Hudson, New York, 22 October 1983.

BOGACZ, Theodore W., Assistant Professor, "**George Orwell's Generation and the Origins of *1984*,**" Principia College, Elsah, Illinois, 12 January 1984.

BOGACZ, Theodore, W., Assistant Professor, "**Orwell and 1984,**" Churchill Society, U.S. Naval Academy, Annapolis, Maryland, 9 February 1984.

BRENNAN, Thomas E., Assistant Professor, "**Cabaret Life in Eighteenth-Century Paris,**" Annual Conference of Social Science History Association, Washington, D.C., 29 October 1983.

BRENNAN, Thomas E., Assistant Professor, "**Social Drinking in the Old Regime,**" Conference on the Social History of Alcohol, University of California, Berkeley, California, 3 January 1984.

CULHAM, Phyllis, Associate Professor, "**Military Acts, Economic Consequences: Roman Expansion into Umbria, the Marches, and the Po Valley,**" American Philological Association Annual Meeting, Cincinnati, Ohio, 26 December 1983.

DARDEN, William M., Associate Professor, "**Annapolis, 1860-1865,**" Friends of St. John's, Annapolis, Maryland, February 1984.

DARDEN, William M., Associate Professor, "**Alvarado' Hunter,**" Aztec Club of 1847, United States Naval Academy Alumni House, Annapolis, Maryland, May 1984.

HUSTON, John W., Professor, "**The Wartime Leadership of General Henry H. 'Hap' Arnold,**" Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 29 August 1983.

HUSTON, John W., Professor, "**A Study in Contrast: General Carl Spaatz and World War I Leadership,**" Air Command and Staff College, Air University, Maxwell Air Force Base, Alabama, 30 August 1983.

SYMONDS, Craig L., Associate Professor, *A Battlefield Atlas of the Civil War*, Annapolis: Nautical & Aviation Press, 1983.

From Fort Sumter to Appamattox, this slim volume offers a concise overview of the Civil War in full-page two-color maps and accompanying text. The maps were rendered by William J. Clipson. The text is divided into four parts: The Amateur War saw civilian armies slug it out at Bull Run and Shiloh; the Organized War saw the emergence of managers of war like George B. McClellan as well as the rise of Robert E. Lee; the period of Confederate High Tide in 1863 saw Southern hopes crest only to collapse again after Gettysburg and Vicksburg; and ultimately Total War witnessed the complete metamorphosis of the war from its chivalric beginnings to its emergence as the world's first modern war, under the leadership of Grant and Sherman.

SYMONDS, Craig L., Associate Professor, **"Sea Power and the Civil War"** *The Longglass*, 1 (September 1983), 19-22.

This article shows how the lack of a strong industrial base in the southern Confederacy doomed that embryonic nation to inferiority at sea and on the rivers and contributed significantly to the Confederate defeat.

WILLIAMS, James W., Lieutenant Commander, USNR, **"Basics — Getting to Know Computers,"** C. Herbert Gilliland, *editor*, *Proceedings* of the Conference on Computers and the Humanities, Annapolis: U.S. Naval Academy, 1984.

This article summarizes a presentation to introduce people interested in making computers a part of their instructional program in the humanities to basic terms, concepts of operation, and examples of applications. Among the points made were that, while there is no need to be a programmer to use computers, some knowledge of programming is still extremely helpful, if not essential, to success in applying computers to instruction. Learning the rudiments of programming enables the user to work more effectively with the skilled programmer, who seldom has any knowledge of the particular subject the humanist wants to address. The article also lays out some questions that should be addressed before trying to incorporate computers into humanities instruction, to decide whether or not the diversion of time and energies required of both instructor and students can be justified.

QUARTARARO, Anne T., Assistant Professor, **"Clean and Decent Students: Health Care Practices Inside Women's Normal Schools, 1830-1900,"** *Proceedings* of the Tenth Annual Meeting of the Western Society of French History, 10 (1984), pp. 394-403.

This paper deals with the change in health care practices, diet, and hygiene at women's normal schools in France during the nineteenth century. During the first half of the century, living conditions were primitive at these institutions. Attitudes toward these health-related issues began to shift in the 1860's and 1870's. Government officials spoke more and more of their young teacher-trainees as an investment in the future. Order, cleanliness and proper eating habits were increasingly viewed as an extension of a modern state with decidedly bourgeois values. In sum, advances in health care, diet and hygiene at the women's normal schools underscored the growing commitment of the national government to popular education by the end of the nineteenth century. The common people would finally be exposed to bourgeois notions of cleanliness and order. Above all, the normal schools' mission was to prepare clean and decent students for popular education.

SWEETMAN, Jack, Assistant Professor, Series Editor, **"Classics of Naval Literature,"** Annapolis: Naval Institute Press, 1984.

The aim of this series is to bring back into print outstanding works of naval history, autobiography, and fiction. In addition to the unabridged, original text, each volume will include a substantial, historical introduction and, in most cases, notes by an authority in the field. Four works will be released annually. The following have appeared or are in preparation: Richard McKenna, *The Sand Pebbles,* edited by Commander Robert W. Shenk, USNR; Admiral Charles E. Clark, *My Fifty Years in the Navy,* edited by Jack Sweetman; Admiral William S. Sims, *The Victory at Sea,* edited by David F. Trask; Leonard F. Guttridge and Jay D. Sims, *The Commodores,* edited by James C. Bradford; William Harwar Parker, *Recollections of a Naval Officer, 1841-1865,* edited by Craig L. Symonds; Charles Nordhoff, *Man-o'-War Life,* edited by John B. Hattendorf; and Joshua Slocum, *Sailing Alone Around the World,* edited by Rear Admiral Robert W. McNitt, USN (Ret).

SWEETMAN, Jack, Assistant Professor, Editor, Rear Admiral Charles E. Clark, *My Fifty Years in the Navy.* Annapolis: Naval Institute Press, 1984.

Admiral Clark is known to naval history as the commander of the battleship *Oregon* (BB-3) during the Spanish-American War. This delightful memoir, originally published in 1917, traces his naval career from his arrival at the Naval Academy in 1860 until his retirement in 1906. The editor's introduction and notes set Clark's experiences in the context of American naval history and amplify sections of the text.

SWEETMAN, Jack, Assistant Professor, **"The U. S. Naval Academy,"** in Donald R. Whitnah, ed., *The Greenwood Encyclopedia of American Institutions: Government Agencies.* Westport, Connecticut: Greenwood Press, 1983.

The article surveys the institutional history and function of the Naval Academy from its date of foundation until 1982. It includes a bibliographic note.

SWEETMAN, Jack, Assistant Professor, and James L. HOLLOWAY, Jr., Admiral, USN (Ret), **"Recollections, 1915-1920,"** *Shipmate,* 47 (April 1984), 17-20.

Admiral Holloway, who died after this piece had been accepted for publication, was a member of the Naval Academy Class of 1919. That class was among those graduated early to take part in World War One. In this memoir, he recalls his three years at the Academy, service aboard the destroyer *Monaghan* (TBD-32) in the European War Zone in 1918, and the postwar demobilization.

HUSTON, John W., Professor, **"George Washington and Maryland"**, *Maryland Heritage News*, 1 (1984), 3-7.

This is an assessment of George Washington's relations with nearby Maryland from the decade of the 1760's, when the Virginia plantation owner found it delightful to journey to Annapolis to enjoy the racing and theater days normally in September each year, to his somewhat dangerous trip into Annapolis via ship from Chestertown in a storm in 1791. Washington's relations with western Maryland as a soldier in the Virginia militia as a land speculator, and as the man who fired the first shot in the French and Indian War are covered in this study. His command of Fort Cumberland during the latter stages of the French and Indian War is examined along with his other visits during the American Revolution and in passing through the state to and from his official duties as the first President of the United States.

HUSTON, John W., Professor, **"'To Surrender . . . the Trust Committed to Me'; Washington's Resignation in Annapolis,"** *Maryland Heritage News*, 1 (1984), 4-8.

This is an assessment of the Commander in Chief's resignation of his responsibilities for the Continental Army to the Congress of the United States then assembled in Annapolis.

ISENBERG, Michael T., Commander, USNR, **"Hollywood Films in the History Classroom,"** Organization of American Historians *Newsletter*, 2 (November 1983), 21-22.

The use of war films in a classroom context is discussed, including a brief analysis of the film's content and remarks on the usefulness of the film in discussing and illuminating specific historical topics.

JOHNSON, David E., Professor, Translator from Swedish to English of Anders Wedberg, *A History of Philosophy*, Vol. III, *From Bolzano to Wittgenstein*. New York: Oxford University Press, 1984.

This is the final volume of a three-volume history of Western philosophy, from ancient Greece to the present. The purpose of the work is to give an insight into the nature of problems, themes, and theories of present-day, and possibly permanent, philosophical interest. Wedberg writes in the analytical tradition. Volume III covers the development of philosophy from the reaction against transcendental idealism in the early nineteenth-century to modern analytical philosophy. Wedberg begins with a survey of the period, discussing the influence of scientific growth and theory on philosophy. Subsequent chapters are devoted to detailed discussion of some key figures in the development of the modern analytical tradition: Bernard Bolzano, Gottlob Frege, Bertrand Russell, Rudolf Carnap, G.E. Moore, and the earlier and later Wittgenstein.

MASTERSON, Daniel M., Associate Professor, **"Caudillismo and Institutional Change: Manuel Ordia and the Peruvian Armed Forces, 1948-1956,"** *The Americas*, 40 (April 1984), 479-491.

This article examines the leadership role of a traditional Peruvian *caudillo* as he seeks to blunt and then co-opt the surging reformist impulse within the armed forces. In an effort to hold on to power, he adopts major structural reforms within the military which will have an important impact on the mentality of the younger, more reform oriented officers of the 1960's and 1970's.

Publications

ABELS, Richard P., Assistant Professor, **"The Council of Whitby: A Study in Early Anglo-Saxon Politics,"** *The Journal of British Studies*, 23 (Fall 1983), 1-25.

This article reexamines one of the most famous church councils in British history, the Council of Whitby of 664 A.D. At this council, King Oswin of Northumbria resolved the "Easter Controversy" in favor of the Roman Catholic practices. The article argues that Whitby was more than a liturgical debate over the proper calculation of Easter; it was also the climax of a political struggle both within and outside the Northumbrian kingdom.

ABERCLANE, P. Robert, Associate Professor and Gregory P. HARPER, Lieutenant Commander, USN, **"The Flying Frigates?"**, U.S. Naval Institute *Proceedings*, 109 (June 1983), 53-62.

The authors discuss the history of seaplanes and their possible utility in future naval plans. Based on analyses of technical documents from the National Advisory Committee for Aeronautics, Bureau of [illegible]erties, and tow tank reports, the p[illegible]ty of available water-based tech[illegible]ogy is defended. At the same time, changes in the environment affecting water-based aviation are considered. The latter show that pressures from commercial interests suggest support for seaplanes exists outside the Navy and might help defray development costs. Finally, consideration is given to naval strategies favoring non-conventional technologies.

CLELAND, Phyllis, Associate Professor, **"'Strange Characters' the Results of a Classical Education?"** *The Classical Outlook*, 61 (December-January 1983-1984), 37-41.

The article discusses "the Greek papers" of the *Somers* mutiny of 1842 and reproduces a facsimile text from the *Proceedings* of Commander Alexander Slidell Mackenzie's court martial. The paper argues that Philip Spencer's keeping of notes in Greek letters resulted from the methods by which the classical languages were taught in the 19th century.

GALPIN, Timothy J., Lieutenant (Junior Grade), USN, **"The Democratic Roots of Athenian Imperialism in the 5th Century B.C.,"** *The Classical Journal*, 79 (1983-1984), 100-107.

This project began as an HH262 project in 1981 and was rewritten for publication in an HH496 project in the spring of 1982. Associate Professor Phyllis Culham was the adviser in each instance. The article argues that the Athenians perceived no contradiction between their democratic practices at home and their repression of other peoples abroad. Their imperialism, *on the contrary*, sprang from their implementation of values of equality before the law, free speech, and equality in the assembly, the values most central to the Athenian democracy.

GOOD, Jane E., Associate Professor, **"Petrovsky Farming and Forestry Academy,"** *Modern Encyclopedia of Russian and Soviet History*, Vol. 28, 1983, pp. 40-43.

This article describes this educational institution that was a center of revolutionary populist activity in Russia from 1865-1894. Founded in the aftermath of emancipation, the Academy was to provide a center for the study of agronomy. Naturally it attracted *young people* who saw *the peasantry* as the path to revolution and social change in Russia. Because of the radicalism of the student body, the government eventually decided to close the school despite the nation's desperate need for agronomists.

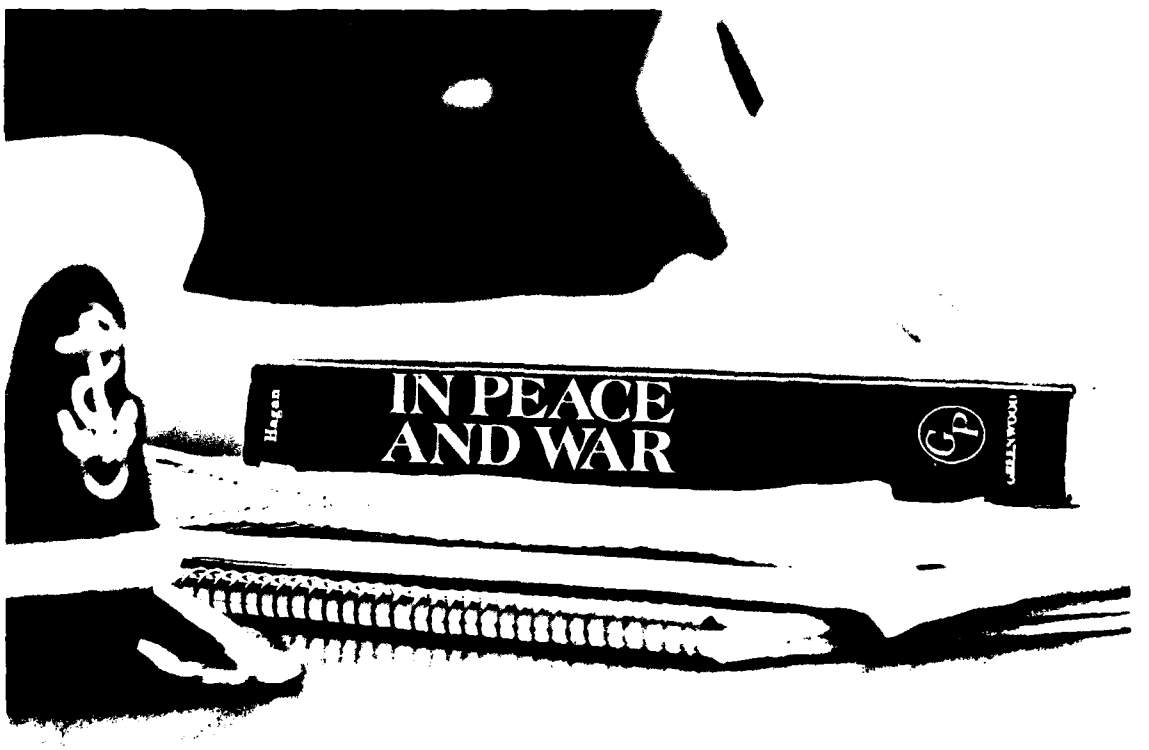
The U.S.S. *San Francisco* in the Naval Battle of Guadalcanal, 12-13 November 1942

RESEARCHER: MIDSHIPMAN 3/C KARL J. ZINGHEIM
ADVISER: ASSOCIATE PROFESSOR ROBERT W. LOVE

The subject of this independent study was the actions of the cruiser *San Francisco* during the cruiser phase of the Naval Battle of Guadalcanal from the afternoon of 12 November to late morning, 13 November 1942. The objective was to collect firsthand information on the battle from those who were there and from official sources. The researcher contacted fifty-eight crewmen from the *San Francisco*, either personally, over the telephone, or through the mail. Microfilms of the ship's deck logs and after action reports are being duplicated by the Naval Historical Center. With at least another one hundred fifty people still to be contacted, the research is only beginning.

Using the above sources, the researcher hopes to focus eventually on the following topics: (1) the state of battle readiness of the U.S. fleet at that time; (2) the morale of the crew of the *San Francisco* before and after the battle; (3) an analysis of how the battle was conducted (a particular action without parallel); (4) a detailed examination of the extraordinary damage control measures taken to keep the *San Francisco* afloat; and (5) an account of the action itself as seen by the crew.

This course has enabled the researcher to start his project in earnest and has educated him in some of the techniques involved in original historical research. In examining the crew of this special ship, he has learned several important lessons concerning life in the Navy. The *San Francisco* was a very well-run ship from the bottom up. The examples of leadership shown by the junior officers in particular as well as the quality of the enlisted personnel provide a valuable laboratory for observing what can be accomplished by men dedicated to their duty.



Guerrilla Warfare in South America: A Historical Perspective

RESEARCHER: MIDSHIPMAN 1/C DONALD W. MERINO
ADVISER: CAPTAIN DON W. ALEXANDER, USA

The subject of this independent study was the strategies and tactics of South American guerrillas from the late 1950's to the mid 1970's. The objective was to examine the changes in strategy and tactics of these guerrillas as they shifted from rural areas to urban centers.

This objective was achieved by reading a large number of related texts. These texts ranged from broad studies and anthologies to tactical analyses and personal accounts. Both liberal interpretations favoring the rebels and reactionary interpretations favoring the incumbent regimes were used. The researcher tried to chart the historical views of revolutions starting from Lenin and covering Mao and Che. These men all had different views on how to ferment a change in regimes, and it is important to understand their views and how they relate to South America.

By focusing on four major countries (Argentina, Brazil, Bolivia, and Guatemala) and the doctrines of Lenin, Mao, and Che, the researcher was able to develop the following conclusions:

(1) Countries are only vulnerable to revolution during the early stages of industrialization. Revolutions that are attempted during the latter stage of industrialization are doomed to fail.

(2) The move from the rural battleground to the city was profoundly affected by Carlos Marighella's *Mini Manual of the Urban Guerrilla.* This movement is a change back to the Leninist style of guerrilla warfare. Additionally, rural guerrilla movements fail usually due to technology, rural apathy, lack of sanctuary, and foreign supply.

(3) The shift from the rural battlefield to the urban centers was hastened by Che's assassination in Bolivia. This disproved the idea of the *foquismo* (small guerrilla cadre). Therefore, Cuba is the lone example of the *foquismo* working and one of the few examples (Nicaragua is the other) of successful rural campaigns.

(4) Urban guerrillas have effected change, but, not radical social revolution. This type of campaign is far tougher to stop and has usually produced more repressive governments.

Gogol: A Realist and a Moralist?

RESEARCHER: MIDSHIPMAN 1/C JOHN C. STECKEL
ADVISER: ASSOCIATE PROFESSOR JANE E. GOOD

In the mid-nineteenth century, Nikolai Gogol wrote several plays and poems in a humorous tone describing life in Russia. Some critics labeled Gogol a social commentator; others claimed Gogol's world was lacking a sense of reality. Gogol felt that he was destined to pave the roadway for Russia to follow to salvation. This paper attempts to look at the arguments of Gogol's critics and determine whether Gogol's literary world was realistic or not, and whether Gogol was a moralist or social critic.

The sources for this paper are the author's works: *Dead Souls, The Inspector General, Selected Passages from Correspondence with Friends,* and *Letters of Nikolai Gogol.* Also used were the memoirs of Pavel Annenkov and several studies of Russian literary criticism including Vladimir Nabokov's *Nikolai Gogol,* Simmons' *Introduction to Russian Realism,* Bowman's *Vissarion Belinski,* Mathewson's *The Positive Hero in Russian Literature,* and Yarmolinsky's *The Russian Literary Imagination.* Finally, an invaluable source was Troyat's biographical study of Gogol, *Divided Soul.*

From researching these sources, one could see the arguments acclaiming Gogol to be a social critic. Yet, when considering Gogol's political and religious beliefs, one could deduce that Gogol was not a social critic. Gogol was driven by a desire to send Russia down a path of righteous development. He pursued this course by writing a realistic account of the world about him. So, Gogol was a realist writer whose literary undertones were not those of a social critic, but those of a moral crusader.

Annapolis Economy as Reflected in the *Maryland Gazette* 1763-1775

RESEARCHER: MIDSHIPMAN 1/C GINA M. DINICOLO
ADVISER: PROFESSOR JOHN W. HUSTON

The objective of the research was to show the extent to which the economic news and advertisements in this colonial newspaper reflected the economic dynamics of the community. While concentrating on the advertisements and economic news in this paper, the researcher examined the background and character of its editor Jonas Green. At the same time attention was paid to the economic facets of Maryland society as served by this newspaper, and contrast was made with the content of the Virginia and Pennsylvania newspapers for the same period. The research in the *Maryland Gazette* concentrated on the vast geographical area served by this newspaper and the changing economic factors during a period when the economic power of Annapolis and its environs appeared to be at its zenith.

Changes which were occurring were clearly reflected in the economic news and advertisements of the newspaper. Problems of marketing, shipping, currency exchange and evaluation, personal debt, payment of and control of laboring classes in a mixture of urban, rural, and maritime interests were covered and assessed in this study of the *Maryland Gazette.*

Readings in American History

RESEARCHER: MIDSHIPMAN 1/C WILLIAM FEW
ADVISER: ASSOCIATE PROFESSOR CRAIG L. SYMONDS

This independent research study project was a reading program to explore the principal interpretations of American history. The researcher selected seven books (listed below) which espouse different approaches to and explanations of American history. The researcher read each book, wrote a brief (two-page) summary of it, and discussed each one with the adviser, often comparing one view with another. It proved to be especially important to note the date of each book's publication, for the historical context in which the book was written often determined the author's outlook. At the end of the semester, the researcher discussed *all* seven of these books before a panel of five of the Department's history professors who asked him questions about several of them and asked *him to* compare them one with another.

Books studied include Arthur Schlesinger, Jr., *The Age of Jackson* (1940); Frederick Jackson Turner, *The Rise of the New West* (1906); Richard Hofstadter, *The Age of Reform* (1958); William A. Williams, *The Tragedy of American Diplomacy* (1959); Louis Hartz, *The Liberal Tradition in America* (1956); David Potter, *People of Plenty* (1954); and Robert Weibe, *The Segmented Society* (1960).

Research Course Projects

U. S. West German Disunity: Prospects for the Future

RESEARCHER: MIDSHIPMAN 1/C GORDON CATLIN
ADVISER: PROFESSOR LARRY V. THOMPSON

Research focused on two areas of concern: (1) the historical reality of a divided Germany maneuvering between two superpowers, and (2) the potential for disunity between West Germany and the United States created by increased West German determination to maintain the "bridges" built to East Germany and the Soviet Union by Willy Brandt's *Ostpolitik* in the early seventies.

Investigation within the first area revealed that the goals of West German foreign policy have remained surprisingly unchanged, while the means for achieving them have certainly undergone transformation. *Ostpolitik* is an outstanding example of "means" alteration to achieve a goal: that is, West German independence from United States preponderance in a foreign and economic policy sense.

An analysis of the second area suggests that trade with Eastern Europe and the current NATO nuclear policy for Western Europe are potentially the most decisive elements within a U.S.-West German relationship. A possible amelioration of these tensions is the granting of increased West German responsibility for NATO military decisions.

Agrarstaat vs. Industriestaat: The Center Party and the Workers

RESEARCHER: MIDSHIPMAN 1/C RICHARD B. COX
ADVISER: PROFESSOR LARRY V. THOMPSON

Research was pursued in two areas: (1) the changes German society underwent during the Industrial Revolution, as reflected by the fluid leadership of the Center Party and its changing outlook; and (2) the failure of the Center Party to switch its constituency from agrarian Catholics to urban proletarian Catholics.

An examination of the first area led to the realization that the old, non-secular Catholic Center Party was shaped by the forces of modernity, particularly from 1874 on. The leadership changed in 1893, and the new leaders primarily non-business *bourgeoisie*, could not draw upon traditional power blocs within the party for support. Consequently, they sought to lure Catholic industrial workers into the party.

The analysis of the second area revealed the reasons for the failure of a Center-Labor alliance: lack of sincerity on the part of the Center's leadership, ineffective support for social reform by the Center, and the strength of the agrarian faction within the party.

Sponsored Research

Synthesis and Reductive Elimination of Dihydrogen from Bimetallic Complexes

RESEARCHER: ASSISTANT PROFESSOR THOMAS E. BITTERWOLF
SPONSOR: RESEARCH CORPORATION

Bimetallic organometallic compounds in which two metal atoms are in closely adjacent positions present a unique opportunity to study the interactions of ligands on two metal centers. Over the past several years, this research program has resulted in the synthesis of several new bimetallic compounds of iron, chromium, and manganese. In addition, complexes containing mixed metals such as Fe/Cr, Cr/Mn, and Cr/Mo have been generated. Reactions of these compounds with strong acids have been studied. It has been found that in strong acids, dihydrogen is liberated from the bimetallic compounds by a reductive elimination reaction from two metal centers.

Molten-Salt Electrochemistry of the BBL "Ladder-Polymer" System

RESEARCHER: ASSISTANT PROFESSOR GRAHAM T. CHEEK
SPONSOR: NAVAL RESEARCH LABORATORY

The BBL (Benzimidazobenzophenanthracene Ladder) polymer itself was found to be insoluble in the 1.2 : 1.0 aluminum chloride : 1-methyl-3-butylimidazolium chloride molten salt system; however, the electrochemical characteristics of Vat Orange 7 (VO 7), which is structurally very similar to the repeating unit of the BBL polymer, were investigated. Cyclic voltametric scans of the dissolved VO 7 showed two one-electron reversible systems, probably corresponding to redox behavior of carbonyl groups in the molecule. Coulometric electrolysis at a potential positive of these systems confirmed that two electrons are involved in the system as a whole. Spectroscopic investigations are planned in order to determine the extent to which the carbonyl groups of VO 7 are complexed by aluminum chloride in the acidic melt.

The Effect of Nucleophiles on the Electrochemical Oxidation of $(SN)_x$

RESEARCHER: ASSISTANT PROFESSOR GRAHAM T. CHEEK
SPONSOR: NAVAL RESEARCH LABORATORY

Investigations at $(SN)_x$ paste electrodes have shown that the potential for $(SN)_x$ oxidation is shifted to more negative potentials in the presence of nucleophiles in solution. This effect was observed for a series of substituted pyridines (4-methyl-2, 6-dimethyl-2,4,6-trimethyl-pyridines), indicating that the potential shift increases with increasing nucleophilicity of the solution species. In other work, the protonation of p-benzoquinone was studied at the $(SN)_x$ paste electrode and was found to be significantly slower at this electrode than at glassy carbon or platinum.

The Stability of a Helical Isomer of *CIS*-Polyacetylene

RESEARCHER: ASSOCIATE PROFESSOR MARK L. ELERT
SPONSOR: NAVAL RESEARCH LABORATORY

Recent experimental evidence indicates that *cis*-polyacetylene may exist in a helical conformation in addition to the well-known planar form. We have performed Modified Neglect of Differential Overlap (MNDO) calculations which demonstrate that planar *cis*-polyacetylene is indeed unstable towards helix formation. Due to an unusual competition between steric and electronic effects, the potential energy curve for helix formation is sessentially flat over an extremely broad range of carbon-carbon single-bond twist angles; this result is consistent with the fact that both the planar and the helical isomers are found experimentally.

Synthetic Fuel Stability Program

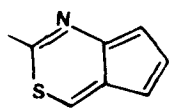
RESEARCHER: ASSOCIATE PROFESSOR FRANK J. GOMBA
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Several physical and chemical testing methods were examined to determine their precision and reliability when studying accelerated oxidation of synthetic fuels.

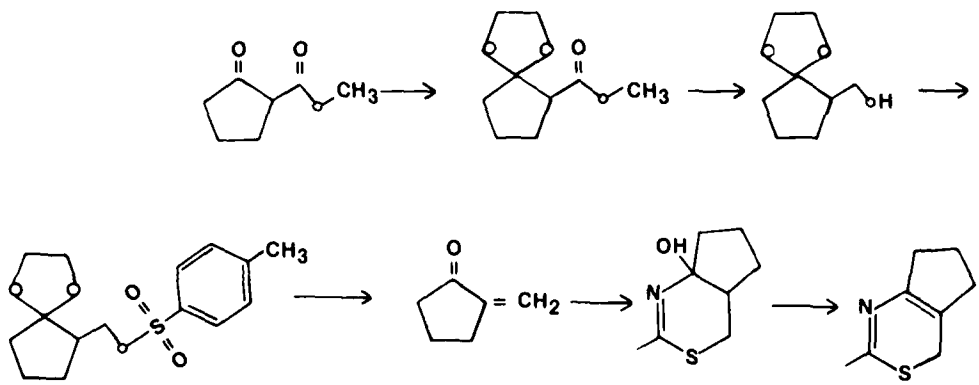
Synthesis of 3-Methyl-2-OZA-4-Thiobicyclo [4,3,0] Bicyclomonatetraene

RESEARCHER: MAJOR RALPH D. HADDOCK, USMC
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The objective of this project is to synthesize the titled compound shown at right.



It is a heteroanalog of azulene electronically and should yield interesting tests concerning the present theories of aromatic character. This compound should be stable enough to isolate and analyze as shown by MNDO calculations done here at the Academy using NATS. The immediate precursor to this compound has been prepared starting from readily available materials:



This last compound should yield to dehydrogenation producing the desired product.

Flow Visualization Coatings on Towing Basin and Water Tunnel Models

RESEARCHER: ASSISTANT PROFESSOR TAYLOR B. JONES
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, CARDEROCK LABORATORY

The purpose of this study is to develop water-resistant liquid crystals which are shear-sensitive for use as flow visualization coatings on models employed at the David Taylor Naval Ship R&D Center, Carderock Laboratory.

The method of investigation is to explore the possibility of using additives to known shear-sensitive liquid crystal mixtures or partial or complete polmerization of one component of a known shear-sensitive liquid crystal mixture.

The components of the liquid crystal mixture have been obtained and the various possibilities of additives and polmerization of compounds containing unactivated double bonds are being considered through a literature search.

Investigation of the Mechanism of the Catalytic Reforming of Methanol

RESEARCHER: MAJOR JOSEPH KING, USA
SPONSOR: LOS ALAMOS SCIENTIFIC LABORATORY

This research centered on investigating the mechanism for the reaction of methanol and water over a copper/copper oxide catalyst to reform hydrogen and carbon dioxide. A methanol reformer is planned to be a direct dual source for a hydrogen/oxygen fuel cell system to be used as an efficient and quiet power supply with both civilian and military applications. The presence of small quantities of carbon monoxide byproduct in the reformer hydrogen, however, interferes with the functioning of the fuel cell. Preliminary mechanistic studies were undertaken in an attempt to better understand how variations in external conditions and reactant ratios affected product distributions.

The project had two main goals — the assembling of a laboratory scale reforming apparatus and its associated analytical system (gas chromatograph), and the fabrication of a cell to be used in an *in-situ* study of the surface chemistry of the catalytic process using Fourier transform infrared spectroscopy. At the end of this stage of the study, the reformer was assembled and producing hydrogen, although still in its "shakedown" phase. The infrared cell was designed and fabricated and a series of spectra of reaction mixtures were taken at an instrument available at another facility. The method appeared to be generally applicable but time did not permit a thorough validation. A number of specific observations were made that led to preliminary mechanistic speculations.

The Synthesis of Basic Esters of Cyclohexyl Acetic and Cyclohexyl Glycolic Acids and Related Compounds for Study in Chemical Defense Systems

RESEARCHER: PROFESSOR SAMUEL P. MASSIE
SPONSOR: U. S. ARMY MEDICAL RESEARCH & DEVELOPMENT COMMAND, FORT DETRICK

A major need of our military is chemicals which can counteract the effect of toxic nerve gas agents, should they be used. One type of chemical antidote is found in anti-cholinergic agents, of which atropine is the model. These studies were designed to prepare related compounds which might be more effective.

Several central intermediates have been prepared and strategy for general syntheses has been developed.

Clarification of Organo-Tin Polymer Limitations as Surface Coatings

RESEARCHER: ASSOCIATE PROFESSOR JOHN W. SCHULTZ
SPONSOR: DAVID W. TAYLOR SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Continuing application of laser Raman spectroscopy and other spectroscopic techniques has permitted further clarification of the impurities and by-products found in the starting materials and in the polymers prepared for use as candidates for anti-fouling coatings. The significance of these adventitious materials in performance during Fleet use may now be determined by coordinated field and laboratory correlation.

Synthesis and Characterization of Organometallic Complexes Using Phase-Transfer Catalysis and Photochemical Techniques

RESEARCHER: ASSISTANT PROFESSOR JOYCE E. SHADE
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

Synthesis of cyclopentadienyl carbonyl complexes of iron and ruthenium through the use of phase-transfer techniques has been investigated. Reactions of $(\eta^5-C_5H_5)$ M $(CO)_2X$ (where M = Fe or Ru and X = Br, Cl or I) with methyl, allyl or crotyl organic reagents have been studied. The intent has been to synthesize the substituted complexes $(\eta^5-C_5H_5)$ M $(CO)_n$ (R) where n = 1 or 2. It has been determined that several factors affect the identity and selectivity of the products obtained in such reactions. These include: (1) the nature of the halide ligand on the metal of the starting material; (2) the rate and manner of addition of reactants; (3) the polarity of the solvent used as the organic phase; and (4) the identity of the leaving group on the organic reagent. For the allyl-iron system, sigma and pi products are produced, with yields and ratios dependent upon the reaction conditions employed. Analogous ruthenium reactions demonstrate that a strong preference for the pi complexes exist with little or no sigma product generated. In the case of the crotyl system, pi complexes are thought to form but the isolation and characterization of the separated products is not complete.

Exploratory studies on the synthesis of $[\eta^5-C_5H_5)$ M $(CNCH_3)_2$ $(C_2H_4)]^+$ PF_6^- complexes (where M is Fe or Ru) have been initiated. Preliminary results indicate that such cationic complexes can be prepared by the photochemical decarbonylation of the bisisocyanide metal species $[\eta^5-C_5H_5)$ M (CO) $(CNCH_3)_2]^+$ X^- while ethylene gas is being bubbled through the reaction solution.

Synthesis of tin-amide carbonyl derivatives of Mo, Cr and W is being investigated. Photochemical decarbonylation of hexacarbonyl metal complexes in the presence of tin-amide ligands results in the substitution of one or two carbonyl ligands. Due to the extreme air-sensitivity of the tin ligand and the substituted products, extensive use of Schlenk techniques, a dry box and an inert-atmosphere vacuum line is mandatory. Characterization of all products is possible through standard spectroscopic techniques such as infrared and nuclear magnetic resonance spectroscopy.

Photochemistry of Triatomic Molecules

RESEARCHER: ASSISTANT PROFESSOR BOYD A. WAITE
SPONSOR: NAVAL RESEARCH LABORATORY

A model was developed for describing the rotational state distributions of the CN fragment produced upon excitation of HCN with a laser of appropriate wavelength. The problem was studied using classical trajectories and explained the experimental results very adequately with the model potential energy surface developed. A further objective was to ascertain the usefulness of using classical trajectories in dealing with problems like photodissociation. Work exploring the insights that were uncovered appears to validate their usefulness.

Synthesis of Stereoisomeric - Metal Complexes Using Phase-Transfer Catalysis and Photochemical Transformations

RESEARCHER: MIDSHIPMAN 1/C DOUGLAS J. BROWN
ADVISER: ASSISTANT PROFESSOR JOYCE E. SHADE
SPONSOR: TRIDENT SCHOLAR PROGRAM

Cyclopentadienyl carbonyl complexe of iron and ruthenium have been shown to have broad applications in organic synthesis. The viability of these complexes as intermediates is dependent upon convenient and rapid synthetic routes for their preparation. This research has primarily been directed towards the extension of phase-transfer techniques to the preparation of iron and ruthenium allyl and crotyl complexes. In addition, the synthesis of iron and ruthenium olefin complexes by photochemical techniques has been investigated.

The reactions of $(\eta^5 - C_5H_5)$ Fe $(CO)_2X$ (where X = Br, Cl, I) complexes with allyl derivatives under phase-transfer conditions have been examined. It has been determined that product identity and selectivity are sensitive to the nature of the halide ligand on the metal center, the rate and manner of addition of reactants, the polarity of the organic solvent and the leaving group on the allyl ligand. These studies suggest that two mechanisms are operative in the formation of sigma and pi allyl complexes. Analogous reactions with the ruthenium bromide starting material have been conducted and demonstrate that ruthenium shows a strong preference for the production of the pi-allyl complexes with little dimeric by-product being formed. Preliminary studies of the ruthenium-bromide with crotyl bromide indicate that four pi complexes are being formed.

Exploratory studies on the synthesis of $[\eta^5 - C_5H_5)$ M $(CNCH_3)_2$ $(C_2H_4)]^+ PF_6^-$ complexes where M = Fe or Ru were conducted. It was found that the introduction of ethylene by the photochemical decarbonylation of the bisisocyanide metal species, $[\eta^5 - C_5H_5)$ M $(CNCH_3)$ $(CO)]^+ X^-$ is complicated by photochemical decomposition of the olefin product. Synthetic modifications for correcting this problem appear to be the use of a filter sleeve in the photochemical unit to alter which radiation reaches the solution sample. Further studies need to be conducted on this system.

Independent Research

Effect of Metal Ligands on Haptotropic Rearrangements of Organometallic Complexes

RESEARCHER: ASSISTANT PROFESSOR THOMAS E. BITTERWOLF

Organometallic compounds in which fused-ring aromatic compounds are pi-bonded to metal centers exhibit a complex set of molecular rearrangements in which the metal center may move from ring to ring. These motions are referred to as haptotropic since the number (or identities) of the carbon atoms bound to the metal may change.

Synthetic work at the Naval Academy has established procedures for the synthesis of a wide variety of metal complexes with aromatic compounds, and procedures have been developed to vary several of the metal ligands. For example, a variety of compounds have been prepared in which phosphine and phosphite ligands have been substituted for carbonyl ligands. These ligands alter the electronic properties of the metal as evidenced by IR spectra, NMR spectra and UV-visible spectra of the compounds.

An Italian group under the direction of Dr. Alberto Ceccon through the Italian National Research Council has been interested in examining the haptotropic rearrangements of several chromium aromatic compounds, and has joined the Naval Academy group in expanding this investigation to an examination of the effects of varying the ligands on the rearrangements.

Research Course Projects

Cycloaddition Crosslinks in Polyacetylene

RESEARCHER: MIDSHIPMAN 1/C ROBERT BUDICIN
ADVISER: ASSOCIATE PROFESSOR MARK L. ELERT

It has previously been suggested that crosslink formation during *cis* to *trans* isomerization of polyacetylene might be responsible for the appearance of persistent unpaired spins in the material during the isomerization process. The tetrahedral crosslinks investigated previously, although qualitatively supporting this model, give unrealistic predicted barrier heights and endothermicity for crosslink formation. The researcher proposed instead that crosslinking occurs via a cycloaddition mechanism which essentially produces two new sigma bonds rather than one for each crosslink formed. The crosslink prevents recombination of the unpaired electrons which are formed in this process. Preliminary MNDO (modified neglect of differential overlap) molecular orbital calculations on polyacetylene chain segments, using reasonable starting geometries for incipient crosslink formation, support this model and give reasonable barrier heights and lower endothermicity than previous studies.

Studies on the Synthesis of Cyclohexyl α-Oxoacetic Acid

RESEARCHER: MIDSHIPMAN 1/C RICHARD E. HADDAD
ADVISER: PROFESSOR SAMUEL P. MASSIE

A study has been made of the synthesis of cyclohexyl-α-oxoacetic acid. The methods studied involved the preparation of cyclohexyl methyl ketone by the addition of acetaldehyde to cyclohexyl magnesium chloride, subsequent hydrolysis, followed by chromic acid oxidation to the ketone. Oxidation of the ketone to the desired acid by selenium dioxide in pyridine was then attempted.

A second proposed synthesis involved formation of the 1,3-dithiane from cyclohexylcarboxaldehyde and 1,3 propandithiol, lithiation of the anion, carbonation, and hydrolysis. In addition, a review of chemical warfare agents, anticholinergic agents and the synthesis of α-oxoacetic acid was also prepared. This study was not completed.

Comparison of Crayfish Predation

RESEARCHER: MIDSHIPMAN 1/C ROBERT E. MOHLE
ADVISER: ASSOCIATE PROFESSOR D. LAWRENCE WEINGARTNER

The purpose of this study was to ascertain if differences exist between the trophic ecologies of two species of crayfish. One species was a troglobite highly adapted to a cave-stream habitat, and the other was a troglophile inhabiting both cave and surface streams. Both species were tested for their predation rates, with substrate (bare versus rocky) and prey species (isopod versus amphipod) serving as variables. Under simulated cave conditions of darkness and temperature, a crayfish was placed in a 0.2 square meter chamber with a single prey individual for a period of two hours. Prey capture percentages were evaluated by a two-sided symmetric binomial test, but no statistically significant differences were found.

New Heteropolytungstates

RESEARCHER: MIDSHIPMAN 1/C DALLAS R. ROPER
ADVISER: PROFESSOR ORVILLE W. ROLLINS

In recent years a series of new heteropolytungstates have been prepared and studied in the Chemistry Department. These are undecatungstogallates (III) whose complex anions have the general formulation,

$$[H_2\,OM^{(m)+}O_5\,GaO_4\,W_{11}\,O_{30}]^{(9-m)-},$$

in which $M^{(m)+}$ is a metal ion. These isomorphs have a modified "Keggin" structure.

When salts containing these heteropoly anions are treated with mineral acid or are subjected to protons of their free acid solutions, they react with 4.0 to 4.4 moles of protons per mole of the complex.

Samples of the following salt,

$$(NH_4)_{3.7}Na_{2.3}[H_2O^{3+}Er_{1.1}O_5\,Ga_{0.9}$$
$$O_4W_{11}O_{30}]\cdot 12\,H_2O,$$

which had been prepared and analyzed for all constituents (except constitutional oxygen), were subjected to the above mentioned studies.

The experiment with mineral acid revealed that this complex had reacted with 4.4 moles of protons per gram formula weight. Also, beyond the first endpoint in a potentiometric back titration of the excess acid (with standard base) a plateau was reached where erbium hydroxide, $Er(OH)_3$, should have precipitated but did not. In another experiment it was shown that this rare earth hydroxide is very strongly adsorbed by Teflon. This phenomenon seems to be quantitative.

A free acid solution was prepared employing Dowex 50W-X8 resin in the H^+ form. By atomic absorption analysis it was shown that all gallium was in the free acid solution. In addition, titration with standard base revealed that 4.9 moles of protons were titrated per mole of complex. This is in accord with the following: the free acid solution would contain 6.0 moles of protons from NH_4^+ and Na^+ ions and 3.3 moles from Er^{3+} for a total of 9.3. Subtracting 4.4 moles for reaction with the anion would leave 4.9 moles to be titrated.

When the erbium(III) undecatungstogallate(III) heteropoly anion reacts with protons, two or more polyanionic species are formed.

Organic Synthesis and Natural Products Isolation

RESEARCHER: MIDSHIPMAN 1/C BARRY WITTE
ADVISER: ASSISTANT PROFESSOR TAPPEY H. JONES

This research covered four topics: the development of a general synthesis of the iridoid monoterpenes; the development of a synthesis of gyrinidione; a water beetle defensive compound; and the isolation of the venom of the imported fire ant for *x*-ray crystallography studies. Techniques for isolating relatively large quantities of venom from the ant were developed and significant progress was made toward the synthesis of gyrinidone.

Taft Constants of Organometallic Complexes

RESEARCHER: MIDSHIPMAN 1/C MAUDE E. YOUNG
ADVISER: ASSISTANT PROFESSOR THOMAS E. BITTERWOLF

The electronic properties of metals in organometallic compounds are known to be sensitive to the identities of the ligands on the metal atoms. One promising method to measure the relative effects of a series of ligands is to measure the Taft substituent constants of appropriate organometallic complexes. By measuring the ^{19}F NMR chemical shifts of substituted fluorobenzenes it is possible to evaluate the ligand's contributions.

A broad range of compounds of Cr and Mn have been prepared and the ^{19}F NMR spectra recorded. It has been found that a family of phosphine ligands have the same relative effect on the electronic properties of both Cr and Mn compounds. This suggests that the ligands interactions with the metals are substantially the same in both series of compounds.

Publications

BITTERWOLF, Thomas E., Assistant Professor, **"Reductive Elimination of Dihydrogen from Arenechromium Dimers,"** *Journal of Organometallic Chemistry,* 252(1983), 305-316.

Biphenylbis (chromium dicarbonyl)-μ-bis (diphenylphosphido) methane and its arsenic analog have been prepared in good yield by UV irradiation of biphenylbis (chromium tricarbonyl) and bis (diphenylphosphido) methane or bis (diphenylarsino) methane in benzene. Addition of strong acid to these dinuclear compounds results in rapid dihydrogen evolution and subsequent decomposition of the oxidized chromium species. A scheme for the dihydrogen elimination reaction is proposed in which both metal centers are protonated in an oxidative addition step, followed by reductive elimination of dihydrogen from the two metal centers.

BITTERWOLF, Thomas E., Assistant Professor, and Michael J. GOLIGHTLY, Ensign, USN, **"Metallocene Basicity VII. Protonation of Ring Substituted Ferrocenophanes,"** *Inorganica Chimica Acta,* 84 (1984), 153-159.

The protonation of a series of eleven alkyl and dialkylferrocenophanes has been examined using H NMR. In trifluoroboric acid, the protonated species are found to be long-lived on the NMR time scale and stable to decomposition. In many cases the conformations of the protonated species could be determined. In all cases, it was found that only one conformation was observed in solution indicating a strong structural preference presumedly driven by the steric demands of the ring substituents and the bridges. Several examples of spin-spin coupling between the iron-hydrogen and the ring hydrogens are reported.

ELERT, Mark L., Associate Professor, co-author, **"Cross-Links in Polyacetylene,"** *Journal de Physique,* C3 (1983), 443-446.

The *cis* to *trans* isomerization of polyacetylene generates mobile free radicals that have been associated with solitions. The fact that these free radicals persist in the *trans* film is difficult to understand within an isolated chain context. The researcher proposes that the generation of these radicals can be considered a natural consequence of assuming that cross-links form during the isomerization process. Results of self-consistent quantum mechanical calculations that support and illustrate this model are reported.

ELERT, Mark L., Associate Professor, co-author, *"Tight-Binding Studies for Electroactive Organic Polymers," Journal de Physique,* C3 (1983), 451-453.

A tight-binding model is presented which accurately reproduces the valence band structure of both graphite and diamond. The model is used to calculate the band structure and density of states of polyacetylene, and agreement with experimental XPS results is seen to be excellent. It is suggested that the model should be useful in predicting the valence band electronic structure of a wide range of carbon-based polymers.

ELERT, Mark L., Associate Professor, co-author, **"Effects of Off-Diagonal Disorder on Soliton- and Polaron-Like States in trans-Polyacetylene,"** *Journal de Physique,* C3 (1983), 481-484.

Exact results are reported which show that off-diagonal disorder can have a significant effect on the Peierls band edges of polyacetylene as well as polaronlike gap states in this system. These results also prove that such disorder leaves many of the more important properties of soliton-like defects largely unaffected.

ELERT, Mark L., Associate Professor, co-author, **"Helical versus Planar cis-Polyacetylene,"** *Physical Review,* B28 (1983), 7387-7389.

An established quantum chemical self-consistent-field method, the modified neglect of diatomic overlap approach, has been used to study the equilibrium geometry of cis-polyacetylene. This study was stimulated by very recent experiental results suggesting the existence of helical cis-polyacetylene. For a single chain of this material the researcher finds that the planar structure is unstable towards the formation of a helical conformation. Owing to a remarkable flatness in the potential energy surface over a wide range of carbon-carbon single-bond twist angles, the results account for the experimentally implied existence of both planar and helical cis-polyacetylene.

JONES, Tappey H., Assistant Professor, co-author, **"Chemistry of Cephalic Secretion of Fire Bee Trigona (Oxytrigona) tataira,"** *Journal of Chemical Ecology*, 10 (1984), 451-461.

Analysis of the volatile compounds derived from cephalic glands of the fire bee Trigona (Oxytrigona) tataira by GC-MS was undertaken. The following compounds were readily identified: hydrocarbons: n-C_{11} H_{24}, n-C_{13} H_{28}, n-C_{14} H_{30}, n-C_{15} H_{32}, n-C_{17} H_{36}, n-C_{23} H_{48}, n-C_{15} H_{30}, n-C_{17} H_{34}, n-C_{21} H_{42}, and n-C_{23} H_{46}; carboxylic acids; palmitic acid, linoleic acid, linolenic acid, stearic acid, and oleic acid; carboxylic esters: dodecyl acetate, tetradecyl acetate, hexadecyl acetate, octadecyl acetate, and dodecyl decanoate; monoketones: 5-kepten-2-one, 3-hepten-2-one, 2-heptanone, and 5-nonen-2-one. Two major components of the mixture were identified as E-hepten-2,5-dione and E-3-nonen-2,5 dione and E-3-nonen-2,5-dione. Structures of these novel compounds were suggested by their GC-MS behavior and the GC-MS behavior of their dimethoximes and proved by comparison with authentic synthetic samples. Trace amounts of the corresponding Z isomers and the saturated analogs, heptan-2,5-dione and nonan-2,5-dione, were also found. The possible functions of these glandular constituents are discussed.

JONES, Tappey H., Assistant Professor, co-author, **"Thermal Concomitants and Biochemistry of the Explosive Discharge Mechanism of Some Little Known Bombardier Beetles,"** *Experentia*, 37 (1983), 366-368.

The quinonoid defensive spray of 2 carabid beetles of the subfamilies Metriinae and Paussinae is ejected hot (55°C and 65°C) with a heat content of 0.19 and 0.17 cal/mg. Hydroquinone(s) and hydrogen peroxide are identified as precursors of the quinones, indicating that in these lesser known 'bombardier beetles' the explosive discharge mechanism is similar to that of the familiar bombardiers of the genus Brachinus (subfamily Carabinae, tribe Brachinini).

JONES, Tappey H., Assistant Professor, co-author, **"E-6-(1-Pentenyl)-2H-Pyran-2-one from Carpenter Ants (Camponotus spp.),"** *Tetrahedron Letters*, 24 (1983), 5439-5440.

A novel synthesis of the title compound, 3, is reported along with its identification as a component of the male mandibular gland secretion of some carpenter ants.

JONES, Tappey H., Assistant Professor, co-author, **"Caste-Specific Esters Derived from the Queen Honey Bee Sting Apparatus,"** *Compte Biochemie et Physiologie*, 75B (1983), 237-238.

The sting apparatus of the queen honey bee (Apis mellifera) contains a series of aliphatic hydrocarbons and novel long-chain esters. Decyl decanoate, the main ester present, is accompanied by decyl octanoate, dodecyl decanoate, tetradecyl decanoate, hexadecyl decanoate and tetradecyl dodecanoate. The presence of these esters did not inhibit oviposition by the queen in worker cells or result in sealed queen cells being destroyed by workers. The significance of caste-specific compounds on the sting of both the queen and worker honey bee is discussed.

JONES, Tappey H., Assistant Professor, co-author, **"Exocrine Chemistry of the Monotypic Ant Genus Gigantiops,"** *Compte Biochemie et Physiologie*, 75B (1983), 15-16.

The mandibular gland secretion of the formicine ant Gigantiops destructor is dominated by 3-octanone with 3-octanol and 3-heptanone constituting minor concomitants. n-Nonane and 2-tridecanone constitute the major Dufour's gland products, being accompanied by n-octane, n-undecane, 2-pentadecanone, n-nonyl acetate and n-decyl acetate. No demonstrable behavior was elicited in workers of this formicine by extracts of either gland. The exocrine chemistry of G. destructor is comparatively analyzed in terms of the position of this monotypic genus in the subfamily Formicinae.

KOUBEK, Edward, Professor, **"An Apparatus Designed to Measure Vapor Pressures and Demonstrate the Principles of Raoult's Law,"** *Journal of Chemical Education*, 60 (1983), 1069.

An apparatus is described which can be used to demonstrate the principles of Raoult's Law. This apparatus is designed for classroom use as an aid in teaching general chemistry.

MASSIE, Samuel P., Professor, co-author, **"Derivatives of 2-acetyquinoline as Potential Antimalarial Agents,"** *European Journal of Chemistry - Chemical Therapy*, 19 (1984), 49-53.

A series of 2-acetylquinoline thiosemicarbazones with potential antimalarial properties was prepared by the reaction ofmethyl hydrazinecarbodithioate with 2-acetylquinoline to afford methyl 3-[1-(2-quinolyl) ethylidene] hydrazinecarbodithioate (II). Displacement of the 5-methyl group of the latter compound by amines gave the desired 2-acetylquinoline thiosemicarbazones (III). Related thiosemicarbazides were obtained by reduction of the azomethine group of II with sodium borohydride to give methyl 3-[1-(2-quinolyl] hydrazinecarbodithioate (IV). The S-methyl group of IV was displaced by amines resulting in the formation of 1-[1-(2-quinolyl) ethyl] thiosemicarbazides (V). Evaluation of the antimalarial activity of compound types III and V, performed in mice infested with *Plasmodium berghei*, showed that most of the test compounds effected cures in the dose range of 320-640 mg/kg.

VERZINO, William J., Commander, USNR, co-author, **"The Effects of Additives upon the Thermal Degradation of Subbituminous Coals,"** *Journal of Analytical and Applied Pyrolysis*, 5(1983), 9-26.

The effects of homogeneous additives upon the thermal degradation of subbituminous coal are described. Additives consisting of zinc chloride, sodium carbonate, lead nitrate, sodium titanate or sodium molybdate were blended into separate coal samples. Using Curie-point pyrolysis at 610°C monitored by mass spectrometry, data were determined on the samples, both in an "as received" state and following reduction in a flowing $H_2 - H_2O$ stream.

Data show that specific chemical additives are effective in altering pyrolysis distributions. Likewise additives alter the extent of methanol retention during sample preparation. These data are explained through a coal model that suggests these additives alter mass transport rates of volatile compounds exiting from these coaly materials and that such volatiles are the predominant features produced during coal pyrolysis.

WALTON, Edward D., Assistant Professor, **"The Interest and Involvement in Science Program,"** *News-Letter of the National Organization of Black Chemists and Chemical Engineers*, 4(September 1983), 3.

This report describes the need for educational programs for minority youth throughout the country. It outlines the *Interest and Involvement in Science Program* begun by the researcher in Annapolis some years ago. This program now has been adopted by many of the chapters over the country. The activities and plans for this program are presented in this report.

WALTON, Edward D., Assistant Professor, *Demonstrations to Ignite Interest in Science*, Silver Spring, Maryland: Kemtec Educational Corporation, 1984.

This booklet is part of a chemical demonstration kit developed for elementary and junior high school teachers. The kit is being used in teacher workshops in many areas of the country. The National Science Teachers' Association has sponsored some of these

workshops. The booklet contains descriptions of and instructions for nine demonstrations which those school teachers can do. The kit provides all the "special" materials that the teachers need for the demonstrations. The demonstrations have been designed to be safe, easy to do, and fascinating.

WEINGARTNER, D. Lawrence, Associate Professor, "**A Case of Peloria and a Case for Mutants,**" *American Orchid Society Bulletin*, 52(July 1983), 722-725.

A case of peloria, or flower malformation with petals taking on lip-like characteristics, was described for the orchid *Doritaenopsis* Amy Campbell 'Shiloh Cave.' Such deformities are rare, but other such occurrences described in the orchid literature were presented. The possible environmental and genetic causes of such peloric deformities were discussed; aneuploid chromosome numbers and other genetic imbalances in hybrids may be factors. The merit of including such mutants, either induced or spontaneously produced, in orchid breeding programs was emphasized.

Dynamic Models in Mathematics

RESEARCHER: ASSOCIATE PROFESSOR MICHAEL W. CHAMBERLAIN
SPONSOR: NAVAL ACADEMY INSTRUCTIONAL DEVELOPMENT ADVISORY COMMITTEE

The short-range purpose of this project has been to create appealing, eye-catching, and informative graphics segments to be mixed with the researcher's videotaping of Calculus I, II, and III lessons. The project's long range goal is to develop an "animated blackboard" whereby mathematical topics which deal with motion or which are best described by motion can be presented via color-animated computer graphics.

To date, seven narrated videotapes have been prepared covering the following topics: the circular functions, the slope of a line, the slope of a function, the derivative, velocity and acceleration, curve sketching and extrema, and Newton's Rule.

Solid Modeling and Robot Vision

RESEARCHER: ASSISTANT PROFESSOR CAROL G. CRAWFORD
SPONSOR: U. S. NAVY AND AMERICAN SOCIETY FOR ENGINEERING EDUCATION FACULTY FELLOWSHIP PROGRAM

In a totally automated manufacturing facility, a tremendous amount of data must be generated to provide machines with sufficient information to produce parts. These data are in the form of programs for robots and machine tools, parts descriptions for vision and tactile image processing systems, information about equipment characteristics, and so forth. An impediment to the efficient utilization of automated manufacturing techniques is the reliance on hand, or semi-automated coding, to produce the data.

The investigator is developing a method to transfer geometric information directly, and automatically, from a solid modeler to a robot vision system. The test bed for this effort is the robot vision system created by the Machine Vision Group of the Industrial Automation Division of the National Bureau of Standards.

The technique is based on encoding geometric information in structures called aspect graphs. The aspect graph, together with functions which contain geometric and metric information, then becomes part of a world model which is referenced by the vision system. The aspect graphs are produced automatically from the boundary file within the solid modeler. The major effort to date has developed algorithms to generate aspect graphs for 2½-D objects with planar and cylindrical faces, and containing holes.

Sponsored Research

Mode Selection For Proteus Processor

RESEARCHER: ASSOCIATE PROFESSOR PETER P. ANDRE
SPONSOR: NAVAL SEA SYSTEMS COMMAND
(ANTI-SUBMARINE WARFARE SYSTEMS PROJECTS OFFICE)

A processor is a piece of electronic equipment which analyzes the power spectrum of an acoustic signal to help determine whether an underwater target is in the vicinity. An operator of the Proteus processor must select one mode for the processor from a rather large number of possible modes. The technical strength of the processor, in fact, comes from the great flexibility caused by this large number of possible settings. Because of the large number of possible modes, the operator needs some help to select the best one.

The goal of this project was to construct a method for selecting the optimal mode for the Proteus processor, given information about the mean source levels of the possible targets at the frequencies of interest. It also used the variances of the source levels and the correlation coefficients between the source levels. A measure of effectiveness called the equivalent FOM was constructed earlier and was applied to the Proteus processor. A program was written which uses both tactical and environmental information as input, and which produces a list of the top modes in order of their equivalent FOMs. This list will give the operator a choice of many good modes from which to choose.

Even Paths in Lattice Graphs

RESEARCHER: ASSISTANT PROFESSOR CRAIG K. BAILEY
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

A rectangular array of points in the plane with integer coordinates is a lattice. Two such points are adjacent if their distance is $\sqrt{2}$ or less. Paths through these graphs have been studied for a long time. A path is an even path if each point of the path is connected to an even number of its predecessors in the path.

Criteria were developed to apply to lattice graphs to determine whether complete even graphs could exist. The criteria involved topological properties of the plane as well as graphical properties of the lattice. It was shown that complete even paths could not exist in rectangular lattice graphs.

Assistant Professor Mark Kidwell was a collaborator on this project.

DEPARTMENT OF

Mathematics

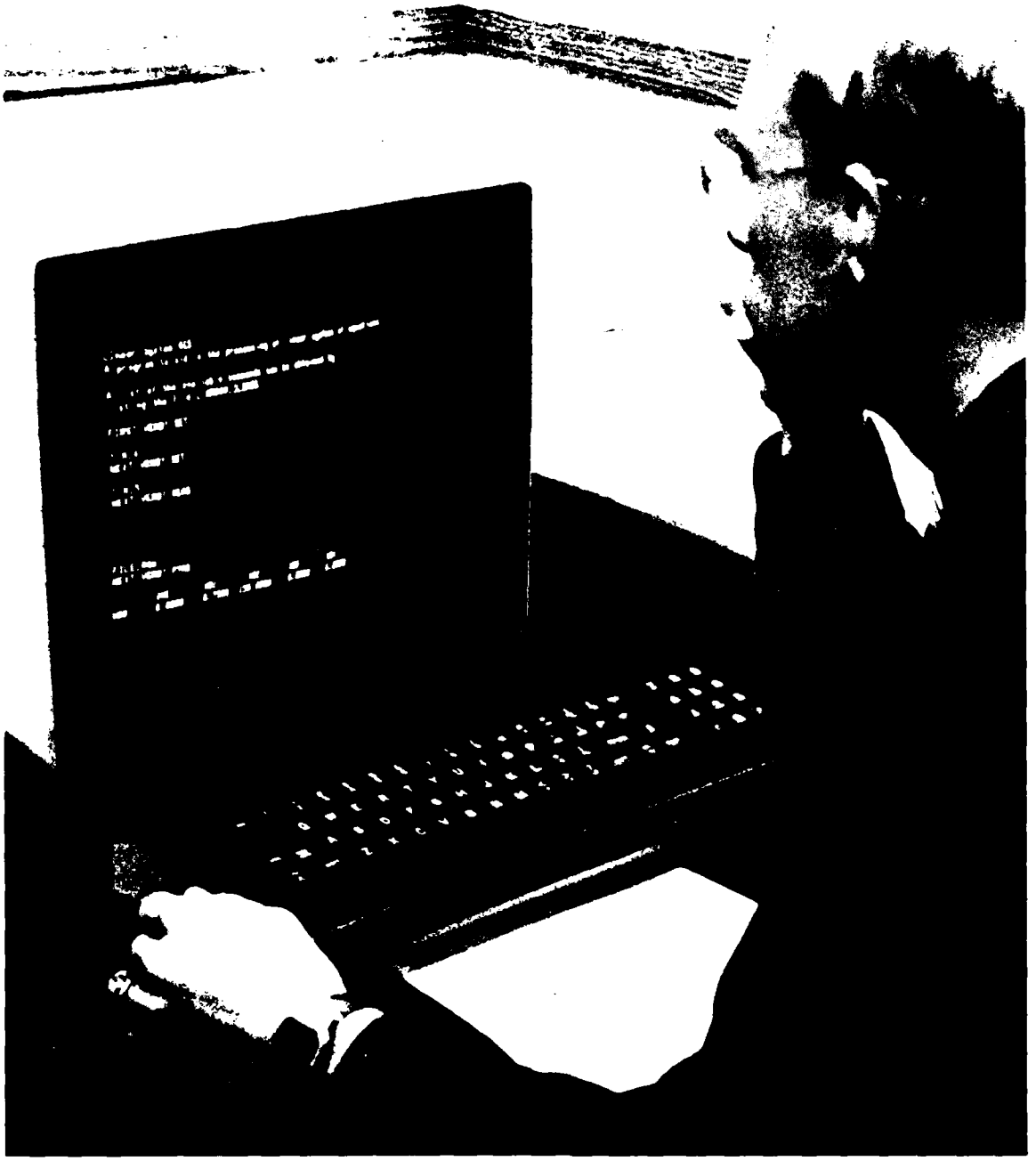
PROFESSOR FREDERIC I. DAVIS
CHAIRMAN

Scholarly activity in this Department continues at a considerable pace and along a broad frontier of mathematics. This activity is manifested in research in both pure and applied mathematics as well as studies in mathematical pedagogy and philosophical questions. In an institution where teaching undergraduate students receives the highest priority, scholarly output as measured in terms of papers published in journals or presented at professional meetings has been quite impressive. This activity not only enhances the Department's reputation as well as the Naval Academy's, but it also invigorates the teaching of those who are involved in it. To be an effective teacher, one must continually be involved in the process of learning and the struggle to understand.

Some of the work described in the following pages was done independently, but much of it was sponsored. Most of the sponsored research has been in areas of direct application to naval problems. Support came from the Naval Academy Research Council, the David Taylor Naval Ship Research and Development Center, the Anti-Submarine Warfare Systems Projects Office, the American Society for Engineering Education, and the National Science Foundation.

Presentations

WEBER, Lisa E., Ensign, USN, "**CADIG Robotic Arm Simulation System,**" Faculty Lunch Seminar, U. S. Naval Academy, Annapolis, Maryland, October 1983.



Publications

CHI, Frank L. K. Associate Professor, "**On the Hydrodynamic Self-Similar Cosmological Models**", *Journal of Mathematical Physics*, 24 (October 1983), 2532-2533.

The hydrodynamic self-similar cosmological models are considered and a new solution is presented. Of all the self-similar solutions, only the Newtonian analogy of the Einstein-deSitter model represents an expanding universe.

NORCIO, Anthony F., Associate Professor, co-author, "**Accuracy of Software Development Activity Data: the Software Cost Reduction Project,**" Naval Research Laboratory Report 8780, December 1983.

This report discusses the accuracy of self-reported programmer activity data and valid ways to analyze the data. The results indicate that the programmers report relatively accurate data with the activity report if they made notes of their activity, or if they promptly submitted their reports. If they do not keep notes of their programming activities, prompt reporting is critical to ensure the accuracy of reported data. The results also indicate ratios between activity categories and valid metrics of project activity.

SKOVE, Frederick A., Assistant Professor, co-author, "**Initial Attempts at Modeling River Data,**" Defense Mapping Agency Report OCDR-83-01, 1983.

Optical data taken over the period 1980-1983 have been analyzed with particular attention being given to the effect of meteorological parameters such as wind and rain on turbidity. Particle size analysis of typical samples has also indicated the presence of two discrete particle populations: the suspended silt and the plankton. It is, therefore, of some interest to relate turbidity measurements to the presence of dissolved nutrients such as nitrate and phosphate. Due to these two populations, which vary in relative size with season, weather, location, etc., there is some indication that the ratios between the various optical parameters should be specified for varying environmental conditions.

SKOVE, Frederick A., Assistant Professor, Jerome WILLIAMS, Professor, and John W. FOERSTER, Associate Professor (both, Oceanography), "**The Effect of Suspensoids on Optical Parameters in a Typical Estuary,**" United States Naval Academy Oceanography Department Technical Report OCTR-84-01, May 1983.

As a first step in optical modeling of coastal areas, the effects of various suspensoids on optical parameters were studied in the Patuxent River, a subestuary of Chesapeake Bay. Particle populations were measured using a Coulter Counter, while both inherent and apparent optical properties were being monitored. Results are presented, indicating strong relationships between beam attenuance and total suspensoids, including both suspended sediments (particle diameters between 1 and $5x10^{-6}$m). Relationships of natural phenomena such as tidal currents and daylight period with sediment and plankton populations are also demonstrated. As expected, efforts at predicting inherent optical properties from apparent optical properties, and *vice versa*, were not too successful.

From these studies it appears possible to develop models capable of predicting, within reasonable limits, optical properties of coastal waters when local conditions such as weather, input stream characteristics, and local topographic conditions are known.

Independent Research

Contemporary Executive Development in the Private Sector

RESEARCHER: COMMANDER JAMES F. DUFFY, USN

Executive development in the private sector varies widely. Most executives today begin development through formal management training programs in colleges and universities. Follow-on education/training includes rotational training to provide a broad spectrum of exposure in the various management specialties e.g., finance, marketing, and personnel. Mid-level managers frequently are provided additional training and education through tailored programs at colleges or through the American Management Association courses. However, the experiential approach predominates.

Computer-Aided Design and Interactive Graphics Robotic Arm Simulation System

RESEARCHER: ENSIGN LISA E. WEBER, USN

Existing software was adjusted and added to in order to easily use a Computer-Aided Design and Interactive Graphics Robotic Arm Simulation System (CADIG) for simulations. The system runs on the Evans and Southerland Picture System 300, with some software support running on Digital Equipment Vax 780. The purpose of this work is (1) to provide support for the robotics course taught in the Weapons and Systems Engineering Department, and (2) apply graphics to solving engineering problems. There is a possibility of future faculty/midshipmen research which may use the system.

An Analysis of Cost Improvement Curves

RESEARCHER: MIDSHIPMAN 1/C GREGORY A. SHORE
ADVISER: LIEUTENANT COMMANDER WILLIAM E. EAGER, USN
SPONSOR: CHIEF OF NAVAL OPERATIONS (OP-95)

The purpose of this project was to assess the value of a report prepared for the Office of the Assistant Secretary of Defense by Tecolote Research, Incorporated, on the TOW missile system. The objective was to determine if the results of the cost/effectiveness analysis produced by Tecolote were, in fact, valid. The method employed was to compare least squares regression lines and a statistical computing package available on the Naval Academy Time Sharing System. The results obtained by Tecolote and the results obtained from Minitab differed significantly, indicating that, at worst, Tecolote Research may have "fudged" their results, or more likely they presented inadequate information on their methods to permit publication of their results, which violates the scientific method. This is a definite failing of the manual prepared by Tecolote Research.

Underwater Visibility of the Patuxent River

RESEARCHER: ASSISTANT PROFESSOR FREDERICK A. SKOVE
SPONSOR: NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER

A data-gathering program was initiated in which the Patuxent River was studied in some detail. A total of five stations in the Patuxent River were sampled starting in June at bimonthly periods. In addition, a 26-hour station was occupied to measure the variations in water clarity as a function of tide. These data will be used in an attempt to develop a mathematical model for prediction of water clarity in estuarine systems. The area chosen to develop this model is the Patuxent River, selected because it has been modeled for other purposes, the river is more or less within "commuting" distance of the Naval Academy. The Patuxent is small enough and well enough known so that it should be possible to develop a meaningful model in a reasonably short time. Preliminary efforts have been made in this direction and a box model is now being prepared.

Optical Properties of Coastal Waters

RESEARCHER: ASSISTANT PROFESSOR FREDERICK A. SKOVE
SPONSOR: DEFENSE MAPPING AGENCY

Bay-wide cruises sampling water from 26 stations ranging from the very northern portion of the Chesapeake Bay entrance were continued. This sampling program included making water clarity measurements at all depths where possible. This was done twice a year, once during the summer growing season, and once during the winter quiescent season. For some time the researcher has believed that water clarity is related not only to the suspended sediments but also to the living organisms growing in the water, in particular, the algae or phytoplankton. Data were analyzed with the objective of determining relationships between meteorological and topographic parameters and the suspended sediments and plankton. Relationships appear to exist but more data are required.

Exploratory Data Analysis Package

RESEARCHER: MIDSHIPMAN 1/C SCOTT K. NELSON
ADVISER: MAJOR WILLIAM J. HAFFEY, USMC
SPONSOR: CHIEF OF NAVAL OPERATIONS (OP-95)

Researcher incorporated several data analysis algorithms into a user-friendly "EDA Package". Work included the writing of a memory introducing new uses to the package and guiding all users in the use of the package; introduction of an inter-active terminal input or GET-FROM-FILE input of data; and coordination with the Computer Center on implementation of the package into the triple-star library.

Software Design Methodology

RESEARCHER: ASSOCIATE PROFESSOR ANTHONY F. NORCIO
SPONSOR: NAVAL RESEARCH LABORATORY

This research continued investigations into alternative design methodologies as part of a larger Naval Research Laboratory (NRL) project, which is exploring the feasibility of using specific software engineering techniques as abstract interfaces, information hiding and concurrent sequential process for developing large complex real time systems.

The emphasis in this aspect of the study was to examine the WARS relation of the software cost reduction data. The study attempted to identify and compare patterns in the software design and development processes within and across the system's modules.

Demographic and Recruitment/Retention Turbulence Study of Primary Navy Enlisted Classification Codes

RESEARCHER: MIDSHIPMAN 1/C SCOTT P. PORTER
ADVISER: COMMANDER JAMES D. BUTTINGER, USN
SPONSOR: CHIEF OF NAVAL OPERATIONS (OP-95)

Analyses of Primary Navy Enlisted Classification Codes (PNEC) qualified people structured and analyzed for demographic and time until End of Obligated Active Service (EAOS). Results show a white, high school graduate, male community in P3C electrician PNEC with turbulence in time-until EAOS. Massive files were converted and reduced for subsequent use by the all-Volunteer Force Study Groups in the Economics Department.

Sponsored Research

Numerical Solutions of Unsteady Fluid Flow in a Single-Screw Compressor

RESEARCHER: ASSOCIATE PROFESSOR FRANK L. K. CHI
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

McCormack's explicit method of compressible fluid flow is found useful in solving the complex fluid flow problem in a single-screw compressor. To the first order approximation, the effects of heat loss, mass leak, and friction are neglected. The problem is very complicated because of the odd geometry, non-idea gas, and the moving boundary. Two computer programs in F78 are being developed. One is to describe the geometry accurately. The other is to determine the fluid variables of the problem.

Chemistry Track Placement Procedure

RESEARCHER: MIDSHIPMAN 1/C AUDIE-A EMBESTRO
ADVISER: MAJOR WILLIAM J. HAFFEY, USMC
SPONSOR: CHIEF OF NAVAL OPERATIONS (OP-95)

The researcher is investigating the possibility of using past biographical/-historical data on plebes instead of the traditional placement exam to place them in the proper chemistry track. Correlations among placement exam scores and such information as Scholastic Aptitude Test (SAT) scores and high school and college Chemistry grades were investigated using a file of the Class of 1986. A linear multiple regression model was then constructed as a suggested means of predicting placement exam scores. Independent variables in the model included SAT math scores and the number of high school and college Chemistry courses taken.

Statistical and Physical Science Time Series Analysis of Midshipmen Quality Point Ratios

RESEARCHER: MIDSHIPMAN 1/C PAUL S. ESCH
ADVISER: COMMANDER JAMES D. BUTTINGER, USN
SPONSOR: CHIEF OF NAVAL OPERATIONS (OP-95)

Analysis of grade profile was made for Physical Science (SPS) and General Engineering (EGE) majors. The project analyzed grades of SPS and EGC majors against grades of a class of midshipmen as a whole. A time series was developed for three groups. Results showed SPS grades rise over semesters in the major while EGE grades drop, with both being lower than the class average. Equally important results were a set of computer programs to aid the Registrar in maintaining grade files.

DEPARTMENT OF

Computer Science

COMMANDER WILLIAM L. LUPTON, USN
CHAIRMAN

The twenty-first century will be the information century. The movement toward a more information-oriented society has already placed computers at the nexus of all further growth and development. The impact of computer-related technology will become even more pervasive, as may be noted in the developments forecast in the other academic disciplines in this report.

The Computer Science Department of the Naval Academy is at the forefront of computer science technology, providing many with a first exposure to computer systems application and research challenges. The research work reported on has direct military applicability to both the Navy of today and that of tomorrow.

The bulk of the midshipmen research was supported by an annual grant from the Chief of Naval Operations (OP-953) and administered by the Operations Analysis faculty. Their funds allowed the faculty members to work closely with operational units and development agencies within the Navy to provide projects of current interest for midshipmen research.

Faculty research was funded by a wide range of interests, both government and civilian, and encompassed many areas of scientific study. As is always the case, the ultimate beneficiaries of these studies are the midshipmen whose educations are enriched by the constant study of the faculty.

Research in the Computer Science Department will continue to play a vital role in the professional enrichment of both the midshipmen and the faculty.

SHADE, Joyce E., Assistant Professor, **"A Research Overview - The Role of the Trident Scholar in the Chemistry Department at the Naval Academy,"** VTU0601 Navy Reserve Unit, Annapolis, Maryland, October 1983.

SHADE, Joyce E., Assistant Professor and Douglas J. BROWN, Midshipman 1/C, **"Synthesis of Allyl and Crotyl Derivatives of Pentahaptocyclopentadienyl Metalcarbonyl Complexes Using Phase-transfer Conditions,"** 1984 Intercollegiate Student Chemists Convention, Lancaster, Pennsylvania, April 1984.

WAITE, Boyd A., Assistant Professor, **"Mode-specificity of the HNC-HCN Unimolecular Isomerization: A Classical-plus- tunneling Model,"** 8th Canadian Symposium on Theoretical Chemistry, Halifax, Nova Scotia, Canada, 7-12 August 1983.

WALTON, Edward D., Assistant Professor, **"The Need for Minority Participation in Science and Engineering,"** Annual Awards Banquet, College of Physical Science, Engineering and Technology, University of the District of Columbia, 9 May 1984.

WALTON, Edward D., Assistant Professor, **"Chemical Demonstrations; Tools for Teaching,"** Teacher Workshop in Science Education, Orlando, Florida, 2 May 1984.

WALTON, Edward D., Assistant Professor, **"The Role of Minority Scientists and Engineers in the Development of Scientific and Technical Literacy of Young People,"** Annual Meeting of the National Organization of Black Chemists and Chemical Engineers, Houston, Texas, 20 April 1984.

WALTON, Edward D., Assistant Professor, and Ronald E. WATRAS, Major, USAF, **"Science Demonstrations for Elementary School Teachers,"** Spring Meeting of the Maryland Science Teachers' Association, Baltimore, Maryland, 25 February 1984.

WALTON, Edward D., Assistant Professor, **"Of Matter and Energy,"** Maryland Academy of Sciences, Student Science Seminar Program, 18 February - 17 March 1984.

WATRAS, Ronald E., Major, USAF, **"Science is Fun: Chemistry Demonstrations for Elementary School Teachers,"** Maryland Association of Science Teachers, Baltimore, Maryland, 25 February 1984.

WATRAS, Ronald E., Major, USAF, **"Contributed Papers in Chemical Education,"** Presider and Program Evaluator, Society for College Science Teachers/National Science Teachers Association, Boston, Massachusetts, 6 April 1984.

WEINGARTNER, D. Lawrence, Associate Professor, **"Determining Respiratory Rates by the Winkler Method,"** Association of Biology Laboratory Education Workshop, Clemson, South Carolina, 15 June 1983.

Presentations

BITTERWOLF, Thomas E., Assistant Professor, **"Synthesis and Chemistry of Basic Metal Dimers,"** National Science Foundation National Organometallic Workshop, Tucson, Arizona, July 1983.

BITTERWOLF, Thomas E., Assistant Professor, **"Taft Substituent Constants of Organometallic Complexes,"** Middle Atlantic Regional Meeting of the American Chemical Society, Newark, New Jersey, May 1984.

BITTERWOLF, Thomas E., Assistant Professor, **"Bimetallic Monomers for Incorporation into Organometallic Polymers,"** Symposium on Organometallic Polymers, National Meeting of the American Chemical Society, Washington, D.C., August 1983.

BITTERWOLF, Thomas E., Assistant Professor, **"Synthesis and Chemistry of Basic Metal Dimers,"** Graduate Seminar, University of Maryland, College Park, Maryland, November 1983.

CHEEK, Graham T., Assistant Professor, **"Studies of the Lithium/Benzoyl Chloride Cell System,"** Lithium Battery Symposium, Fall 1983 Electrochemical Society Meeting, Cincinnati, Ohio, October 1983.

ELERT, Mark L., Associate Professor, **"The Geometry of *cis*-Polyacetylene: A Quantum-Mechanical Study,"** American Physical Society National Meeting, Detroit, Michigan, 26-30 March 1984.

ELERT, Mark L., Associate Professor, **"Helical *cis*-Polyacetylene: Geometry and Electronic Structure,"** Fifth American Conference on Theoretical Chemistry, Jackson, Wyoming, 15-20 June 1984.

JONES, Tappey H., Assistant Professor, **"Indolizidine Ant Venom Alkaloids",** 35th Southeast Regional Meeting of the American Chemical Society, Charlotte, North Carolina, November 1983.

JONES, Tappey H., Assistant Professor, **"Ant Venom Alkaloids,"** Department of Pharmacology, Johns Hopkins University, Baltimore, Maryland, October 1983.

JONES, Tappey H., Assistant Professor, **"Ant Venom Alkaloids,"** Virginia Institute of Marine Sciences, Gloucester Point, Virginia, 16 March 1983.

JONES, Tappey H., Assistant Professor, **"Indolizidine Ant Venom Alkaloids,"** Poster Session at National Institutes of Health Conference on Molecular Messengers in Nature, Bethesda, Maryland, 16-18 May 1983.

JONES, Tappey H., Assistant Professor, **"Synthesis for the Structure Proof of Ant Venom Alkaloids,"** Virginia Polytechnic Institute and State University Symposium: Latest Trends in Organic Synthesis, Blacksburg, Virginia, 29-31 May 1983.

MASSIE, Samuel P., Professor, **"Synthesis of Chemical Defense Agents,"** Conference on Chemical Defense Systems and Anti-radiation Agents - U.S. Army Medical Research & Development Command, St. Louis, Missouri, 4-6 April 1984.

MASSIE, Samuel P., Professor, **"Blacks in Science,"** Chapter of Black Engineers, Purdue University (Indiana), February 1984; Black Cultural Group, Indiana University (Indiana), February 1984; Convocation Speech, Bishop College (Texas), February 1984; Jarvis Christian College (Texas), February 1984; Honor Science Students, Cardoza High School (Washington, D.C.), March 1984; National Society of Black Engineers (Washington, D.C.) April 1984; Chapel Speech, Oakwood College (Alabama), April 1984; and National Engineering Society, Lehigh University (Pennsylvania), May 1984.

Acoustic High Frequency Scattering From Prolate Spheroidal Shells

RESEARCHERS: ASSOCIATE PROFESSOR JAMES M. D'ARCHANGELO
AND ENSIGN PHILIP SAVAGE, USN
SPONSOR: DAVID TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER,
ANNAPOLIS LABORATORY

The object of this research is to mathematically model the underwater acoustical response of prolate spheroidal shells to high frequency sonar. It employs a technique called the "Singularity Expansion Method" (SEM). Recently, SEM was developed to study radar scattering, and its use indicated the importance of poles in the scattering amplitude. These poles are located at the scatterer's complex eigenfrequencies. For acoustic or electromagnetic scattering problems, locating the poles is equivalent to finding the zeros in the complex frequency plane of the prolate radial spheroidal function of the third kind and its derivative.

The investigators have computed and plotted these zeros for varying spheroidal eccentricities for both the prolate radial spheroidal function and its derivative. Until now, it appears that these zeros had not been calculated directly from asymptotic expansions due to the complexity of the expansions involved.

Survival Analysis of Test Panels of Antifouling Paints

RESEARCHER: ASSISTANT PROFESSOR GARY O. FOWLER
SPONSOR: DAVID TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT
CENTER, ANNAPOLIS LABORATORY

The U.S. Navy tests antifouling paint by exposing test panels. Several questions related to the statistical analysis of the collected data have arisen. How many test panels should be exposed? Can a model be constructed that will use early results to predict future fouling? How should several paints be compared? Can the data and results be graphically displayed for easier understanding? Computer programs have been written and will be modified and tested as more data becomes available. There is agreement that approximately twenty panel sides should be exposed. In addition, a large test of one hundred panel sides has begun as a control group. The results from this test are awaited. These data will be used to verify the prediction model or to construct a new model.

Quasitriangularity of 2-Tuples of Operators

RESEARCHER: ASSISTANT PROFESSOR GAIL KAPLAN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

An operator T is called quasitriangular if it can be written as the sum of a triangular and a compact operator. Necessary and sufficient conditions for the quasitriangularity of 2-tuples of operators in a restricted setting can be found in the investigator's doctoral dissertation. A natural question to consider is how to extend these results. If the joint essential spectrum of a 2-tuple of operators is a subset of a surface of revolution obtained from a smooth curve, there is virtually no change in the necessary and sufficient conditions for quasitriangularity. However, the techniques employed do not yet yield information when the joint essential spectrum is a more general 2-manifold.

Operators with closed range can be characterized by the existence of a pseudo inverse. An operator T has closed range if and only if there exists a bounded linear operator S such that STS = S and TST = T. In the Calkin algebra the notion of range does not make sense; however, operators with essentially closed range do have a pseudo inverse in this setting.

A Four Processor Sensitivity Analysis

RESEARCHER: ASSOCIATE PROFESSOR ARTHUR A. KARWATH
SPONSOR: NAVAL SEA SYSTEMS COMMAND
(ANTI-SUBMARINE WARFARE SYSTEMS PROJECT OFFICE)

This project is a comparative analysis of four different acoustic signal processors and a study of their sensitivities as a function of variations in the acoustic energy received by the detectors. The work is classified.

Periodic Points in Maps of the Unit Interval

RESEARCHER: ASSISTANT PROFESSOR MARK E. KIDWELL
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

Maps of the unit interval which have a unique maximum and depend on a single parameter go through characteristic changes as the parameter is increased. The investigator studied the appearance of stable and unstable periodic points by means of a rooted tree. Paths through the tree represent possible orbits of the maximum point of the function for different values of the parameter. The rules for generating this rooted tree allow only those orbits required by the Intermediate Value Theorem to exist. The behavior of the family of "tent functions" $g_r(x) = 1 - r \mid x \mid$ for $r > \sqrt{2}$ is exactly as predicted by the rooted tree. As the parameter is increased, periodic orbits of every period appear in the order, from top to bottom, 4, 6, 3, 8, 10, 5, ... , 4k, 4k + 2, 2K + 1, ... , 2, 1.

Fuzzy Set Theory and Applications to Robotics and Computer Vision

RESEARCHER: ASSISTANT PROFESSOR BAO-TING LERNER
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, CARDEROCK LABORATORY

This research project deals with the applications of fuzzy set theory to robotics and computer vision. Using the notion of fuzzy sets the problem of inferring the nature or shape of an object given fuzzy, incomplete, or imprecise sensory data in computer vision systems is under study. Also under investigation are methods of applying fuzzy sets and approximate reasoning to the problem of object recognition by robotic systems using sensory feedback devices, the comparability of the theoretical structure with the existing internal computer representations of objects (such as those derived from computer-aided design systems), and the informational limits on the use of real-time sensory feedbacks.

Probabilistic Foundations of Metric Multidimensional Scaling

RESEARCHER: ASSISTANT PROFESSOR ROBERT L. MANICKE
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

Existence theorems are derived to guarantee a unique solution to the problem of scaling patterns. This is accomplished by the stochastic identification of a stimulus space as a metric space. Relations between distributions and random variables over stimulus pattern spaces are derived. Applications are developed for modeling patterns from passive sonar data.

Applications of Stochastic Estimation and Control Theory

RESEARCHER: ASSISTANT PROFESSOR PAUL B. MASSELL
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

In recent years, mathematical biologists have tried to determine optimal schedules for radiotherapy and chemotherapy treatments of cancer patients. These therapies exploit the different growth patterns of normal and cancer cells. For growth between treatments, an exponential model is used for cancer cells; for normal cells a logistic model is used. The effect of radiation, or an anti-cancer drug, on the cells is represented with a multi-target single hit survival model. Although dynamic programming simulation methods have been applied to a specific model to find optimal schedules, this researcher believed an investigation of a simple but clearly defined discrete-stage optimization problem was needed to understand more fully the earlier results and to generalize them to more realistic models. The result of this investigation was the determination of a nearly-optimal algorithm of wide applicability.

Calculations of Heat Transfer in Submarine Seal Face Materials

RESEARCHER: ASSOCIATE PROFESSOR PETER A. MCCOY
SPONSOR: DAVID TAYLOR NAVAL SHIP RESEARCH DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The goal of this project is to develop algorithms and codes to model wear and heat transfer across sliding surfaces in contact.

Base Change For SL(2)

RESEARCHER: ASSISTANT PROFESSOR COURTNEY MOEN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

It has been conjectured that there is a correspondence between automorphic representations for the F-rational points of a reductive group G defined over F and those for the E-rational points of G, where E/F is an extension of number fields. This conjecture has been proved when G is GL (2) or G(3) and E/F is a prime cyclic extension and the proof is essentially completed when G = SU (2,1) and E/F is a quadratic extension. This project proposes to study the conjecture in the case when G = SL (2) and E/F is a prime cyclic extension. The case is important due to the fact that complications which have not arisen in previously studied cases and which will appear in resolving the general problem occur for the group SL (2), although not to an intractable extent. The method to be employed is that of the global form of the Selberg-trace formula.

Usage and Needs for Computers in Astronomy and the Geosciences

RESEARCHER: ASSOCIATE PROFESSOR HOWARD L. PENN
SPONSOR: NATIONAL SCIENCE FOUNDATION

This project was to determine the status of use and the future needs for computers in the fields of astronomy, atmospheric sciences, earth sciences, and ocean sciences. The study also was concerned with future hardware developments that will impact on the computer needs. The results of this project are being used to plan the allocation of funds in these areas. The proposals in the report are based on contacts in person and by phone with over 200 scientists. Areas of concern include better access to supercomputers, improved computer graphics and image processing, and increased storage capacity. Some important developments include the widespread use of super microcomputers and the development of optical disk storage technology.

Extremal Traces on Fixed-Point Algebras

RESEARCHER: ASSISTANT PROFESSOR GEOFFREY L. PRICE
SPONSOR: NATIONAL SCIENCE FOUNDATION

A positive linear functional ϱ on a C*-algebra A with identify I is said to be a trace if $\varrho(I) = 1$, and $\varrho(ab) = \varrho(ba)$, for all a and b in A. A major part of the classification scheme for C*-algebras is to distinguish between C*-algebras admitting a faithful family of traces and those which do not. If A enjoys a faithful family of traces, then it is useful to classify the extremal traces on A. The Choquet theory then guarantees that any other trace can be realized via a barycentric decomposition into the extremal traces, E(A).

Now let G be a compact connected Lie group, T a maximal torus of G, and let G act on A as a group of *-automorphisms of A. We have the corresponding fixed-point algebras $A^G \leq A^T \leq A$. In the case where A is a matroid algebra, and G a group of product automorphisms, Handelman has announced the result that every extremal trace on A^G is the restriction of an extremal trace on A^T. Using this result the investigator has shown that $E(A^G) = E(A^T)^W$, where W is the Weyl group of G.

Extremal Traces on Fixed-Point Algebras, II

RESEARCHER: ASSISTANT PROFESSOR GEOFFREY L. PRICE
SPONSOR: NATIONAL SCIENCE FOUNDATION

This collaborative project is related to the project described above ("Extremal Traces on Fixed Point Algebras"). In this project the investigators are attempting to strip the K-theory from Handelman's proof (also, perhaps, to correct his proof) to find a leaner alternative to his extendability result. One promising approach is to use some known results of extendability of traces from hereditary C*-algebras up to the "parent" algebra.

The investigators also recently discovered that the classification of extremal traces on A^G may have some implications for determining the "innerness" of certain modular automorphism groups on A^G.

Generators on C*-Algebras

RESEARCHER: ASSISTANT PROFESSOR GEOFFREY L. PRICE
SPONSOR: NATIONAL SCIENCE FOUNDATION

A linear operator δ defined on a uniformly dense *-subalgebra $D(\delta)$ of a C*-algebra A is called a *-derivation if it satisfies the identify $\delta(x^*y) = (\delta x)^*y + x(\delta y)$, for x and y in $D(\delta)$. Determining conditions on a derivation which guarantee that it is a generator of a C*-dynamics is a topic currently undergoing intensive study by numerous authors. One line of this research considers derivations which commute with certain (usually compact) groups of automorphisms on a C*-algebra. The investigator has recently shown that for a matroid C*-algebras A, a closed derivation which commutes with the unitary group of a maximal abelian subalgebra of A, is necessarily a generator.

Extendability of Derivations

RESEARCHER: ASSISTANT PROFESSOR GEOFFREY L. PRICE
SPONSOR: NATIONAL SCIENCE FOUNDATION

Returning to the notation of the investigator's abstract above ("Generators on C*-Algebras"), he has recently produced examples of derivations on C*-algebras (in the present case, of $A^T \leq A$, where A is matroid) which are generators on A^T but which fail to extend to closed densely-defined derivations on A. This result is a by-product of a comparison of the centers of A and of its fixed-point subalgebra A^T. It would be interesting to try to pin down necessary and sufficient conditions for a commutative *-derivation on A^T to admit densely-defined extensions to A.

Transmission Loss in the Chesapeake Bay

RESEARCHER: LIEUTENANT CAL T. SWANSON, USNR
SPONSOR: NAVAL SEA SYSTEMS COMMAND

In this project, which was carried out with Visiting Professor R. L. Jennette, acoustic transmission loss was measured in the main shipping channel of the Chesapeake Bay, near Annapolis, Maryland. The measurements were made by towing a calibrated, multitonal projector on radial tracks from a hydrophone suspended from a moored platform. The water depth over a fairly flat bottom was 16 meters. Tones having one-third octave separation were simultaneously transmitted from 81 Hz to 953 Hz. Two different source depths were examined. Transmission loss was computed to a maximum range of 1 km. The resulting transmission loss curves show the area to be one of good transmission which also displays a high degree of frequency independence.

Dynamics and Control of Robot Manipulators

RESEARCHER: ASSISTANT PROFESSOR JAMES M. STORMES
SPONSOR: DAVID TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, CARDEROCK LABORATORY

Industrial robots are relatively massive, and the base of such a robot is rigidly fixed. Under such conditions, simple feedback control systems have performed adequately. Many potential naval applications do not satisfy these conditions. The performance of existing control systems must be evaluated and new control systems must be designed.

An attractive aid is computer-based simulation. The objective is to design and implement motion simulation on the facilities of CADIG, and to use these facilities in the design and evaluation of feedback control systems.

The dynamics of a robot manipulator form the mathematical basis for both the motion simulation and an open-loop control subsystem which takes base motion and end effector forces and torques into account. The open-loop control subsystem has been implemented as a FORTRAN subroutine. Implementation of the motion simulation has begun. Research into the principles and practice of control systems design is proceeding.

Computer Analysis of Polymer Structures

RESEARCHER: ASSOCIATE PROFESSOR PETER J. WELCHER
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The investigator proposes to model defect structures in polymers, notably polyethylene oxide and polyvinylidene fluoride. He will continue revision of the MMI computer program, which models organic molecules and will use this program to study conduction and ion motion in polymers.

This application of polymer modeling is a novel approach: there appears to be no previous work on computer simulation of a charged molecule's motion in polymers. The subject is of great interest because of its applications to solid-state batteries.

The Weil Transform

RESEARCHER: ASSISTANT PROFESSOR WILLIAM E. YANCEY
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The Fourier transform has applications to signal processing among other things. An Uncertainty Principle is an expression of the inherent limitations of Fourier analysis. The Heisenberg Uncertainty Principle, for example, says that the product of the standard deviations of the signal and its transform is bounded below by a known constant.

The Weil representation is a system of transforms that represent a large group from analytic number theory. If one restricts to the group of rotations in the plane, one obtains a system of transforms that interpolate between the Fourier transform and the identity transform. Using these, the investigator has established an analog of the Heisenberg Uncertainty Principle in which the lower bound can be made as small as desired.

The investigator intends to examine the properties of the Weil transform further. Among subjects for study are an analog to the Uncertainty Principle with direct application to signal processing; development of a discrete version of the transform; determination of conditions under which a function is a Weil transform of a causal function; quantification of the Gibbs-like phenomenon as the Weil transform converges to the identity at a point of discontinuity; and adaptation of the Weil transform to resolve the ambiguity surface of the Wigner transform.

Independent Research

Order and Ideal Properties of Boolean-Like Rings

RESEARCHERS: PROFESSOR JAMES C. ABBOTT AND ASSISTANT PROFESSORS
RALPH S. BUTCHER, REBECCA LEE, AND KAREN E. ZAK

The investigators have applied the idempotent ordering of a ring to A. E. Foster's Boolean-like rings in order to illuminate their algebraic properties and to gain more understanding of them as ordered structures.

The ideals of such rings have been characterized and the investigators have found necessary and sufficient conditions for a Boolean-like ring to be isomorphic to a Foulis-Randall manual.

Some Studies on Character Sums Over Finite Fields

RESEARCHER: ASSISTANT PROFESSOR PRISCILLA S. BREMSER

Let L(X) be the vector space of maps from X, an n-dimensional vector space over a finite field F_q, to the complex numbers. The investigator exhibits a basis $\{\psi_\zeta\}$ for L(X). To each nonsingular linear transformation α of X, there may be associated the linear transformation $\alpha^\#$ of L(X) given by

$$(\alpha^\# f)(\xi) = q^{-n/2} \sum_{x \in X} f(x)\, \psi_\zeta(\alpha x).$$

The properties of $\alpha^\#$ are developed and its eigenvalues are found using Gaussian sums.

In another application of character sums, a well-known system of Diophantine equations is considered. A solution in nonzero integers to this system would be called a perfect rational cuboid. It is a long standing conjecture that none exists. If the system is considered over the field F_q, the investigator is able to estimate the number of solutions. In particular, it shows that a solution always exists for q large enough.

Boundary Value Problems for Pascali Systems

RESEARCHER: ASSISTANT PROFESSOR JAMES L. BUCHANAN

Pascali systems are a special case of the general $2n \times 2n$ first order elliptic system of two variables. Systems of higher order equations with an iterate of the Laplacian as their principal part transform to Pascali systems. The investigator has solved the Hilbert and Riemann-Hilbert problem for such systems and is presently studying the implications of this for solving the general linear boundary value problem for higher order equations. In particular, solution by computer algebra is being considered.

Producing A Ranking Consonant with the Rankings of a Panel

RESEARCHER: ASSISTANT PROFESSOR GARY O. FOWLER

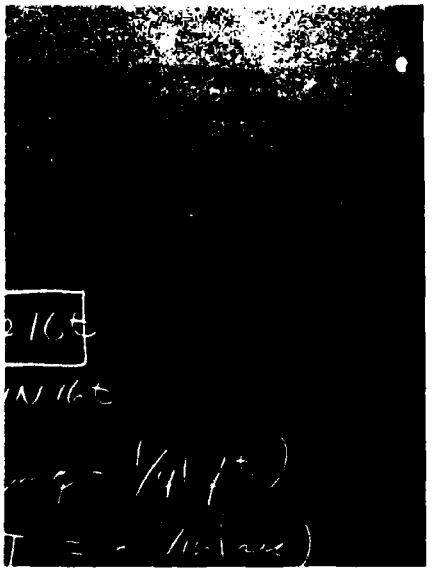
A common procedure for ranking candidates using the ranks of a panel of judges proceeds by rejecting the hypothesis that the panel has no preference and then ranking the candidates using rank sums. It is also possible to order the candidates by direct pairwise comparisons. That is, if A is ranked better than B by a majority of the judges, then rank A above B. It is possible for the results of these two methods to differ, even in the selection of the best candidate. The relation between the significance level used in testing the hypothesis that the panel has no preference and the question of agreement of these two ranking methods is being examined. Enumeration by computer is being used to examine cases of a few judges and a few candidates. It is expected that an induction argument will produce results.

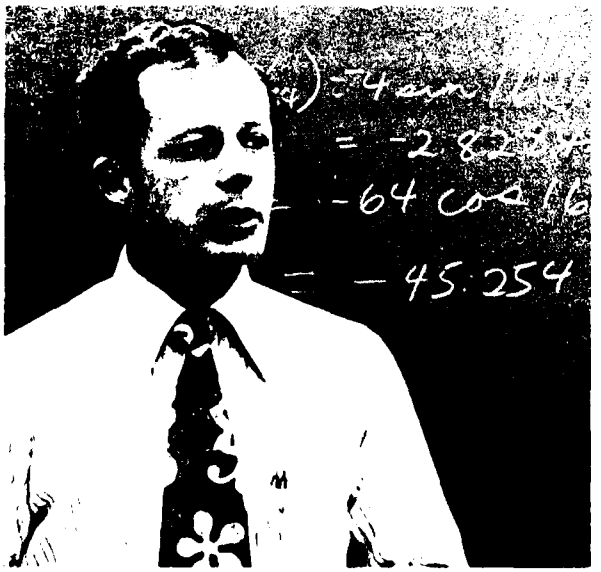
The Commutator Calculus Applied to Nilpotent Products

RESEARCHER: ASSOCIATE PROFESSOR ANTHONY M. GAGLIONE

Let G be a free product of a finite number of cyclic groups: i.e., G has presentation $G = \langle c_1, c_2, \ldots, c_r ; c_1^{\alpha_1}, c_2^{\alpha_2}, \ldots, c_r^{\alpha_r} \rangle$ where $\alpha_i = 0$ if c_i has infinite order. Here it is assumed that $\sum_i \alpha_i > 0$. Let G_n denote the nth subgroup of the lower central series of G. (The lower central series of G is defined inductively by putting $G_1 = G$ and G_{n+1} = group generated by all commutators $(a,b_n) = a^{-1} b_n^{-1} a b_n$ where $a \in G$ and $g_n \in G_n$.)

The main objective of this research project is to investigate the structure of the quotient groups $\overline{G}_n = G_n/G_{n+1}$ for n = 1, 2, 3, ... These $\overline{G}_n$ are called nilpotent products of cyclic groups. The goal is to "completely determine" all the $\overline{G}_n$ for all positive integers n. The statement "completely determine" here means to find presentations for these groups in terms of generators and defining relations.





Dimensions of Graded Rings

RESEARCHER: ASSOCIATE PROFESSOR CHARLES C. HANNA

A homogenous graded ring is a direct sum $A = A_0 \oplus A_1 \oplus \dots$, where A_0 is a commutative ring with identity, each A_i is a finitely-generated A_0 – module, and multiplication satisfies $A_iA_j = A_{i+j}$. In addition to the traditional Krull dimension of A, a number of other dimensions may be defined.

For example, it is possible to show that if f(n) denotes the minimum number of generators of A_n as an A_0 – module, then there is some polynomial $F \in Q[n]$ such that $f(n) = F(n)$ for all sufficiently large n. If F has degree d, then $d + 1$ is a reasonable "dimension" for A.

Another example is the minimum number h of homogeneous elements $x_1, x_2, \dots, x_h$ of positive degree such that any prime ideal of A which contains $\{x_1, \dots, x_h\}$ must contain A_1.

In the classical case, when A_0 is a field, all these dimensions coincide with the Krull dimension. The objective of this research is to determine which inequalities hold among these and other dimensions in the general case (or at most assuming that A_0 is j-noetherian of finite j-dimension), whether these inequalities can be strict, and under what conditions equality holds. The results should lead to improvements in earlier theorems on locally free sheaves on projective schemes, and may have other uses in algebraic geometry and related areas.

This is a long-term research project. The subject is difficult and, in the absence of noetherian hypotheses, essentially unexplored. So far, a string of six inequalities has been established and work is underway on examples where strict inequality may hold.

Nonstandard Consequence Operators

RESEARCHER: ASSOCIATE PROFESSOR ROBERT A. HERRMANN

In this investigation it is shown that C, the set of all consequence operators defined on a language L, is an essentially atomic meet-semi-lattice. There are definable distributive subalgebras of C that are not chains. Moreover, C is not a meet-semi-Boolean algebra. If B is well-ordered subset of L, then any member of C is the first element of a well-ordered chain in C that has cardinality equal to that of B. The chains in C are investigated with respect to a nonstandard model. After obtaining numerous results relative to subtle (nonstandard) consequence operators, a procedure is given utilizing internal and external objects that indicates how nonstandard logics technically bypass a small portion of Gödel's first incompleteness theorem.

D-World Alphabets

RESEARCHER: ASSOCIATE PROFESSOR ROBERT A. HERRMANN

In this investigation a nonstandard analysis of deductive logical processes is utilized and D-world subtle logics and superwords are formally investigated. This analysis is not relative to formal languages but is now applied to intuitive first-order languages within word theory. It is formally shown that the D-world language contains infinitely many purely subtle alphabet symbols. A mathematical process is then to be introduced that will formally transform an infinite set of statements describing the behavior of elementary superparticles. It will be shown that the uni-word process that generates developmental paradigms must also generate some superparticles. As a final step in this particular investigation an attempt will be made to show that the entire class of D-world structures is a First Cause.

Nature: The Supreme Logician

RESEARCHER: ASSOCIATE PROFESSOR ROBERT A. HERRMANN

This will be a continuation of the investigator's work on the properties of the Deductive World model for developmental natural systems. One of the major concerns is to refine the descriptive content of the modeling process and extend it to general paradigms. This will allow the model itself to generate meta-descriptions for the behavior of elementary particles as viewed from the D-world. It will be shown that the following concepts, among many others, *indirectly verify the existence of the* D-world. (1) It is the only universal first cause model. (2) With respect to human behavior, the Gödel effect, the progression of "I" and other similar paradoxes are eliminated. (3) The discreteness paradox of Quantum Physics and quantum transitions are D-world manifestations. (4) All of the consequences of the Special Theory of Relativity are D-world manifestations. (6) The "initial state" or the "initial singularity" associated with some cosmological theories follows from D-world properties. (7) The apparent natural contradiction produced by *local realism (the Bell inequality) and the* state of affairs generated by quantum theory has a complete D-world explanation.

Acoustic Signal Processing

RESEARCHER: ASSOCIATE PROFESSOR JOHN S. KALME

The object of this project is to develop new and improved techniques for acoustic signal processing. The investigator has conducted research in the following areas: noise cancelling adaptive arrays applied to passive sonar; high resolution maximum entropy spectral analysis applied to passive sonar; digital signal processing; digital and analog filters; electromechanical transducers and wave filters; and the statistical pattern recognition of time series. Additionally, to improve the computational speed of some signal processing algorithms, he has rewritten them from FORTRAN to the Macro II assembly language.

Boolean-Like Rings

RESEARCHER: ASSISTANT PROFESSOR REBECCA LEE

A Boolean-like ring (BLR) is a commutative ring, R, with unit and of characteristic 2, in which $x(1+x)\,y\,(1+y) = 0$ for all ring elements x and y. In 1946, Foster gave necessary and sufficient conditions for an algebraic extension of a Boolean ring to be a BLR. In this research, the investigator has found necessary and sufficient conditions for the extension of a BLR to be a BLR. Also investigated were the order properties of a BLR, properties of ideals, properties of quotient rings and rings of quotients of a BLR.

Sheltered Modules in a Noetherian Lattice Module

RESEARCHER: ASSISTANT PROFESSOR REBECCA LEE

Over the last 20 years, many ideas from ring theory have been generalized to lattices. In 1962, Dilworth defined principal elements of multiplicative lattices and Noetherian lattices and abstracted a number of ring theoretic results.

In analogy with ring theory one may define the notion of shelters in Noetherian lattices. It is shown that a sheltered element is m-primary, and properties interrelating covered elements and sheltered elements are examined.

Formation of Singularities for a Conservation Law with Memory

RESEARCHER: ASSISTANT PROFESSOR REZA MALEK-MADANI

The formation of singularities in smooth solutions of the model Cauchy problem

$$u_t + \phi(u)_x + a' * \psi(u)_x = 0$$

$$u(x, 0) = u_0(x)$$

$$x \in R,\ t \in [0, \infty]$$

is studied. The constitutive functions ϕ, ψ: $R \to R$ are smooth, a: $R^+ \to R$ is a given memory kernel, and * denotes the convolution on [0, t]. Under physically reasonable assumptions concerning the functions ϕ, ψ, and a, it is shown that a smooth solution u develops a singularity in finite time, whenever the smooth datum u_0 becomes "sufficiently large" in a precise sense.

Regularity of Minimizers of a Nonlinear Isotropic Incompressible Hyperlastic Material

RESEARCHER: ASSISTANT PROFESSOR REZA MALEK-MADANI

The regularity of local minimizers and almost local minimizers, are considered for the functional

$$E(u ; \Omega) = \int_{\Omega} [\mathrm{tr}(\nabla u \cdot \nabla u^T) + \alpha |\det \nabla u|^{1/3} \, dx$$

where $u : \Omega \times R^3 \to R^3$, Ω is bounded and open, $u \Big|_{\partial\Omega} = F(x)$ is given, and α is arbitrary scalar. The following theorem is proved: Let $u \in W^{1,2}(\Omega, R^3)$ be a local minimizer or almost minimizer of E. Then u is everywhere (Hölder) continuous in Ω. In particular, this theorem shows that cavitation does not occur in a solid material where the nonlinearity $|\det \nabla u|^{1/3}$ is dominated by the quadratic term $\mathrm{tr}(\nabla u \cdot \nabla u^T)$.

Some Results on the Radius of Starlikeness for Certain Classes of Analytic Functions

RESEARCHER: ASSISTANT PROFESSOR EDWARD J. MOULIS, JR.

$P^k(\mu, t)$ denotes the class of functions p(z) regular in $E = \{z: |z| < 1\}$ which have the integral representation

$$p(z) = \frac{\mu}{2\pi} \int_0^{2\pi} \frac{1 + tze^{i\theta}}{1 - ze^{i\theta}} \, d\psi(\theta) + (1 - \mu)$$

where μ is complex, $|\mu| \leq 1$, $-1 < t < 1$, $z = re^{i\theta}$, $0 \leq r < 1$, and $\psi(\theta)$ is a function with bounded variation in $[0, 2\pi]$, satisfying $\int_0^{2\pi} |d\psi(u)| < k\pi$, $k \geq 2$ and $\int_0^{2\pi} d\psi(\theta) = 2\pi$.

When $k = 2$, $\mu = e^{-i\alpha \cos \alpha}$ and $t = 1 - 2\varrho$, and p(z) has the form $1 + zf''(z) / f'(z)$ (respectively $zg'(z) / g(z)$), then f (respectively g) is α-convex (respectively α-starlike of order ϱ in E.) Some known results for $P^k(\mu, t)$ are surveyed and applied to a method for finding bounds on the radius of starlikeness of the class of regular functions h satisfying $\mathrm{Re}\{h(z) / z\} \in P^k(\mu, t)$, $\varrho > 0$, z in E.

Using Computer Graphics As An Aid to the Teaching of Mathematics

RESEARCHER: ASSOCIATE PROFESSOR HOWARD L. PENN

The purpose of this project is to produce computer graphics presentations which will serve as an aid to the learning of various mathematical topics. These topics include the heat equation, the vibrating string equation, and polar coordinates. Three video tapes have been completed in this project and are used in the classroom for courses in differential equations and engineering mathematics. Work is progressing on a fourth topic. The research involves using different computers such as the TERAK 8600, the ATARI 800, and the TEKTRONICS terminals connected to the Naval Academy Time-Sharing System. The facilities of the Educational Resources Center are used frequently.

On a Problem of Lucas

RESEARCHER: ASSISTANT PROFESSOR MICHAEL L. ROBINSON

In 1885 Lucas asked when the sum of the first n squares is also a square. This is the same as solving the Diophantine equation

$$6y^2 = x(x + 1)(2x + 1).$$

The only positive solutions are given by x = 1 and 24. This was first solved by Watson in 1918 using elliptic functions. A new proof was given in 1952 by Ljunggren using a Pell *equation in a quadratic field*. The investigator has constructed a proof based on a result of Schinzel concerning differences between powers.

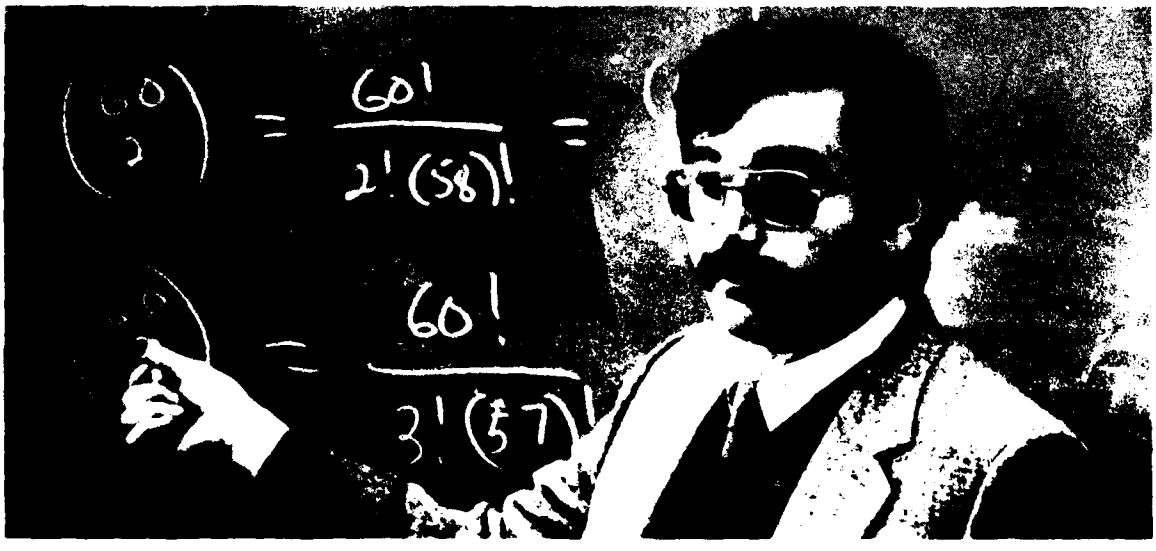
Products of Sums of Squares

RESEARCHER: ASSISTANT PROFESSOR JOANN S. TURISCO

The main objective of this project is the classification of triples (p,q,r) for which one can find formulas of the type:

$(X_1^2 + \ldots + X_p^2)(Y_1^2 + \ldots + Y_q^2) = Z_1^2 + \ldots + Z_r^2$ where the X_i's and Y_j's are indeterminants, and each Z_k is a bilinear form in the X_i's and Y_j's. By the well-known theorem of Hurwitz, the formula exists for p = q = r only when p = 1,2,4, or 8. The *Radon-Hurwitz Theorem* provides a solution when p = r or q = r. This study deals with the case where p ≠ r and q ≠ r.

There are two aspects to this project. First there is the problem of obtaining triples (p,q,r) for which the above formula holds. (These triples are called "admissible.") The second, and more difficult problem is that of determining, for fixed p and q, the smallest r for which such a formula exists. The methods used for determing the existence of admissible triples involve explicit constructions. An infinite sequence of examples is obtained by using certain "special" Clifford algebra representations. It is shown that these examples do give the minimal r for small values of p or q. (The "best" example is the admissible triple (10,10,16)). The investigation of the minimal r is done using various number theoretic considerations. For example, it is known that $\binom{r}{k}$ must be even whenever r − p < k < q. Results such as this arise from a study of the geometric aspects of the problem (the methods and results of intersection theory play a part).



Optical Properties of Coastal Waters

RESEARCHER: PROFESSOR JEROME WILLIAMS AND ASSOCIATE PROFESSOR JOHN W. FOERSTER
SPONSOR: DEFENSE MAPPING AGENCY

ay-wide cruises sampling water from 26 ations, ranging from the very northern ortion to the Chesapeake Bay entrance, ere continued. This sampling program ıcluded making water clarity measure- ıents at all depths where possible. This as done twice a year, once during the ummer growing season, and once during ıe winter quiescent season. For some time ıe researchers believed that water clarity is related not only to the suspended sediments but also to the living organisms growing in the water, in particular the algae or phytoplankton. Data were analyzed with the objective of determining relationships between meteorological and topographic parameters and the suspended sediments and plankton. Relationships appear to exist but more data are required.

Underwater Visibility of the Patuxent River

RESEARCHERS: PROFESSOR JEROME WILLIAMS AND ASSOCIATE PROFESSOR JOHN W. FOERSTER
SPONSOR: NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CEN

ı data gathering program was initiated in vhich the Patuxent River was studied in ome detail. A total of five stations in the atuxent River were sampled starting in une at bi-monthly periods. In addition, a 6-hour station was occupied to measure he variations in water clarity as a function of tide. These data will be used in an ıttempt to develop a mathematical model or prediction of water clarity in estuarine ystems. The area chosen to develop this model is the Patuxent River, selected because it has been modeled for other purposes, and the river is more or less within "commuting" distance of the Naval Academy. The Patuxent is small enough and well enough known so that it should be possible to develop a meaningful model in a reasonably short period of time. Preliminary efforts have been made in this direction and a box model is now being prepared.

Analysis of the Effect of Controlled Pressure Changes on the Stimulation of Bioluminescence in *Pyrocystis Lunula*

RESEARCHER: MIDSHIPMAN 1/C KRISTINE HOLDERIED, USN
ADVISER: ASSOCIATE PROFESSOR JOHN W. FOERSTER
SPONSOR: TRIDENT SCHOLAR PROGRAM

he researcher's project was directed oward one particular area of biolum- nescence: determination of the minimum evel of stimulation necessary to induce ght emission by an organism. Specifically, n attempt was made to determine the ffect of pressure changes on the timulation of light in the dinoflagellate *loctiluca marina*, an organism commonly ound throughout the world. The investigator concentrated on collecting data on the minimum levels of excitation necessary to induce light emission by these organisms. The impact of controlled variations in experimental conditions, including the magnitude and rate of pressure changes, ambient pressure, and temperature were evaluated. These data were then applied to a streamline model that simulates vessel movement.

Field Investigation of the Longuet-Higgins Equation for Longshore Current Velocity Prediction

RESEARCHERS: PROFESSOR JOHN F. HOFFMAN AND LIEUTENANT COMMANDER FRED ZEILE, USN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

Longshore current predictions used by the U.S. Navy and U.S. Army are based on the Longuet-Higgins equation:

$$V = 20.7\ m\ (gH_b)^{1/2} \sin a_b$$

Where:

- m = beach slope, ft/ft.
- g = gravity constant, ft/sec^2
- H_b = height of breakers, ft.
- a_b = angle between crest of waves and the beach, degrees

This formula appears to give erroneous results.

An optical grid was devised to enable measurements of the breaker height (H_b) from the beach. Distance measurements required were made by utilizing aerial photos. Four-foot plywood squares, painted black, placed at measured intervals along the beach, served as the baseline reference in these photos.

Breaker height (H_b) was measured from the shore utilizing the optical grid. Some measurements in the breakers were made using a hand-held Philadelphia rod.

The angle between the crest of breakers and the shore ($_b$) was determined from aerial photos as well as by using a surveyors transit on the beach.

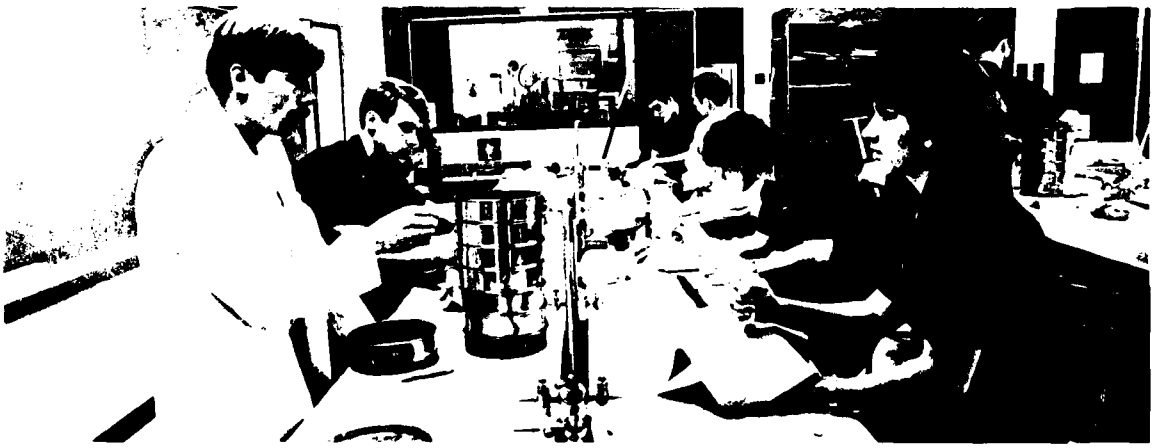
The beach slope (m) was determined utilizing surveying procedures with a Dumpy level and a Philadelphia rod.

Longshore currents (V) were measured using floats to which packets of dye were attached. Extensive testing of drogues and various types of bottle floats was made. A plastic bottle weighted so that it floated at a depth of four feet with a slender rod extending to the surface was selected to monitor longshore currents. A packet of dye attached to the top of the rod served as a tracer. Two dyes were tested as tracers — Fluoroscein and Rhodamine. Fluoroscein was found to be more suitable.

The processing of field measurements and aerial photos is not complete. Preliminary results are as follows:

breaker height (H_b)	: 2 ft to 3 ft
breaker angle (a_b)	: 4 to 15 degrees
beach slope	: .093 ft/ft to 0.151 ft/ft
Longshore current velocity (observed)	: 0.25 ft/sec to 1.1 ft/sec

Conclusions concerning longshore currents based only on shore observations may be in error unless supported by aerial observations. This was evident during the beach work in the 1983 summer when both aerial photos and beach observations were compared.



Ship Evaluation Assessment of Tributyl Tin Oxide Antifoulant Paint

RESEARCHER: ASSOCIATE PROFESSOR JOHN W. FOERSTER
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

An environmental assessment of the use of tributyl tin oxide antifoulant paints on selected ship hulls was prepared.

Aircraft Icing Conditions in Wintertime, Low Ceiling Clouds

RESEARCHERS: VISITING PROFESSOR NATHANIEL B. GUTTMAN, MIDSHIPMAN 1/C MICHAEL MUELLER, AND MIDSHIPMAN 2/C MARK R. HENDERSON
SPONSOR: NAVAL AIR SYSTEMS COMMAND

Twelve cold, low ceiling events during the winter of 1981-1982 in the Washington, D.C. area were examined to identify patterns that may lead to improved forecasts. Surface weather observations and synoptic conditions as well as radiosonde data were analyzed. State-of-the-art forecasts of aircraft icing below 10,000 ft. were made and verified by pilot reports of icing occurrences. Results show the importance of both regional weather systems and local topographic features in the generation of very low cloud ceilings. Aircraft icing situations are often mitigated by frontal inversions that lead to cold surface temperatures but warm temperatures aloft.

Sponsored Research

Factors Influencing the Maritime Development of Cold Air Stratocumulus

RESEARCHERS: LIEUTENANT COMMANDER ROBERT L. CLARK, USN, RESEARCH PROFESSOR RICHARD K. JECK, AND MIDSHIPMAN 1/C THOMAS J. CUFF
SPONSOR: OFFICE OF NAVAL RESEARCH

An attempt was made to forecast empirically the maritime development of cold air stratocumulus (Sc) off the east coast of the United States, a result of continental polar air advecting across the warmer waters of the Atlantic Ocean during the winter months. Parameters such as air temperature, wind speed, sea surface temperatures, and vorticity were evaluated in the Cape Hatteras area for nine Sc cases in 1978, in order to develop a forecast for Sc formation and dissipation time, and cloud free distance (CFD). Results of this research indicate that actual wind speeds have minimal relationship to the CFD, although minimum winds required for development are indicated. A temperature difference of 6.9°C is noted as a minimum for cloud development, as measured between the air at Cape Hatteras and the sea surface where clouds begin to form. Clouds will tend to increase in coverage as areas of positive vorticity move over the cloud region, and decrease in coverage in areas of negative reltive vorticity. Precipitation occasionally occurs with this phenomenon, but seems to be associated with short-wave troughs at 500 mb. Further research is needed to confirm these results.

Predicting the Formation of Stratocumulus Clouds Over the Western Atlantic During Cold Air Outbreaks

RESEARCHERS: LIEUTENANT COMMANDER ROBERT L. CLARK, USN, AND RESEARCH PROFESSOR RICHARD K. JECK
SPONSOR: OFFICE OF NAVAL RESEARCH

Stratocumulus clouds (Sc) that form in the winter months over the western North Atlantic Ocean during cold air advection appear to be related to the air-sea temperature difference, T. A four-month comparison (November, 1981 - February, 1982) of the air-sea Ts from four selected buoys in the Atlantic Ocean with Sc consisting of both open and closed cells showed some correlation between the formation of Sc and air-sea T. Other observations during the study revealed the probable involvement of several other additional factors as well in the formation of Sc clouds. These factors include vorticity advection, the lifted index, vertical velocity, the surface wind speed, and the relative humidity. Each of these parameters is computed daily by computer models for most coastal stations along the Atlantic seaboard. As this analysis was a limited study of four months, the prediction model based on the air-sea T relationship remains to be tested further.

DEPARTMENT OF

Oceanography

COMMANDER JOHN P. SIMPSON, III, USN
CHAIRMAN

During the 1983-1984 Academic Year, faculty research (in a broad range of atmospheric and oceanographic areas) was regularly undertaken by both civilian and military members of the Oceanography Department. Not only does this research provide the opportunity for the faculty to keep abreast of current technology and theory, but it also serves as a basis for qualified midshipmen to undertake related research projects, particularly those dealing with the Chesapeake Bay, where their work can be supported by the Departmental research vessel.

Funding for these research activities has been available from a number of sources, including grants from or contracts with the Office of Naval Research, Defense Mapping Agency, Naval Air Systems Command, Naval Sea Systems Command, Naval Explosive Ordnance Disposal Technology Center, and the Naval Academy Research Council.

Specific areas of research activity within the Department included but were not limited to sedimentation processes and properties, light attenuation, bioluminescence, estuarine ecology, marine biofouling, dredging, environmental effects on electro-optic systems, climatology, statistical weather forecasting, and remote sensing.

SCHWENK, Allen J., Associate Professor, **"How Many Rinds Can a Finite Sequence of Pairs Have?"** Fifth Quadrennial Graph Theory Conference, Kalamazoo, Michigan, 4 - 8 June 1984.

SCHWENK, Allen J., Associate Professor, **"The Group Reduced Chromatic Polynomial of a Graph,"** George Washington University, Washington, D.C., 7 December 1983.

SCHWENK, Allen J., Associate Professor, **"How to Minimize the Largest Shadow of a Finite Set,"** Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, 7 September 1983.

STORMES, James M., Assistant Professor, **"Dynamics of Robot Manipulators,"** Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, 30 November 1983.

TURISCO, JoAnn S., Assistant Professor, **"A Family of Quadratic Forms Associated to Quadratic Mappings of Spheres,"** Annual Meeting of the American Mathematical Society, Louisville, Kentucky, 27 January 1984.

TURNER, John C., Associate Professor, **"Nonparametric Validation of Parametric Statistics,"** 1983 National Meeting of the American Statistical Association, Toronto, Canada, August 1983.

TURNER, John C., Associate Professor, **"SPRT Applied to Triangle Testing,"** Annual Probability and Statistics Day, U. S. Naval Academy, Annapolis, Maryland, 14 April 1984.

WARDLAW, William P., Assistant Professor, **"Slicing d-Spaces,"** Regional Meeting of the Mathematical Association of America, Virginia Commonwealth University, Richmond, Virginia, 14 April 1984.

WARDLAW, William P., Assistant Professor, **"Computer-Aided Intuition in Abstract Algebra,"** Mathematical Association of America Workshop *Math via APL*, Salisbury, Maryland, June 1984.

WELCHER, Peter J., Associate Professor, **"What's Ada All ABout?"** Regional Meeting of the Mathematical Association of America, Richmond, Virginia, 14 April 1984.

KAPLAN, Harold M., Professor, "**Non-Parametric Inference of the Mean,**" Regional Probability and Statistics Day, Newark, Delaware, 29 October 1983.

KAPLAN, Harold M., Professor, "**Pessimist Treatment of Missing Data,**" Regional Probability and Statistics Day, U. S. Naval Academy, Annapolis, Maryland, 14 April 1984.

KARWATH, Arthur A., Associate Professor, "**A Four Processor Sensitivity Analysis,**" Anti-Submarine Systems Project Office, Crystal City, Virginia, April 1984.

LEE, Rebecca, Assistant Professor, "**Boolean-like Rings,**" Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, May 1984.

LERNER, Bao-Ting, Assistant Professor, "**Fuzzy Sets and Computer Vision,**" Regional Meeting of the Mathematical Association of America, Washington, D.C., November 1983.

MALEK-MADANI, Reza, Assistant Professor, "**Formation of Singularities for a Conservation Law with Memory,**" Meeting of the American Mathematical Society, Evanston, Illinois, 12 November 1983.

MASSELL, Paul B., Assistant Professor, "**The Logistic and Other Population Growth Models,**" Regional Meeting of the Mathematical Association of America, Washington, D.C., 19 November 1983.

MASSELL, Paul B., Assistant Professor, "**Cycles of 1- and 2-Dimensional Dynamical Systems,**" Mathematics Colloquium, U.S. Naval Academy, Annapolis, Maryland, 11 January 1984.

MASSELL, Paul B., Assistant Professor, "**The Dynamics of Iterates of Maps on the Unit Interval,**" Regional Meeting of the Mathematical Association of America, Richmond, Virginia, 14 April 1984.

MCCOY, Peter A., Associate Professor, "**Harmonic Functions on the Unit Sphere,**" Special Session on Topics in Contemporary Complex Analysis, American Mathematical Society, Fairfield, Connecticut, October 1983.

MCCOY, Peter A., Associate Professor, "**Interpolation and Approximation of Solutions to Systems of Elliptic Partial Differential Equations,**" Special Session on Partial Differential Equations, American Mathematical Society, San Luis Obispo, California, November 1983.

MCCOY, Peter A., Associate Professor, "**A Function Theoretic Approach to Compact Operator Approximation,**" Special Session on Partial Differential Operators, American Mathematical Society, Louisville, Kentucky, January 1984.

MOEN, Courtney, Assistant Professor, "**Cryptography and Number Theory,**" Rutgers University, Newark, New Jersey, April 1984.

PENN, Howard L., Associate Professor, "**Graphs of the Solutions to the Vibrating String Problem,**" Regional Meeting of the Mathematical Association of America, Washington, D.C., 19 November 1983.

PENN, Howard L., Associate Professor, "**Computer Generated Polar Coordinate Graphs,**" Regional Meeting of the Mathematical Association of America, Richmond, Virginia, 14 April 1984.

PRICE, Geoffrey L., Assistant Professor, "**Extremal Traces on Some C*-Algebras,**" Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, November 1983.

PRICE, Geoffrey L., Assistant Professor, "**Extending Traces on Fixed-point Algebras,**" University of Pennsylvania, Philadelphia, Pennsylvania, December 1983.

ROBINSON, Michael L., Assistant Professor, "**Pade Approximations and Irrational Numbers,**" University of Michigan Number Theory Seminar, Ann Arbor, Michigan, 10 October 1983.

ROBINSON, Michael L., Assistant Professor, "**New Results in Diophantine Approximation,**" City University of New York Graduate Number Theory Seminar, New York City, 6 March 1984.

Presentations

ANDRE, Peter P., Associate Professor, **"Optimal Mode Selection for the Proteus Processor,"** Briefing, Anti-Submarine Systems Project Office, Crystal City, Virginia, 17 April 1984.

BAILEY, Craig K., Assistant Professor, **"Generating Functions,"** Washington and Lee Mathematics Colloquium, Lexington, Virginia, 9 March 1983.

BAILEY, Craig K., Assistant Professor, **"Geometric Mean of Automorphism Group Orders for Trees of Maximum Degree 3 and 4,"** Michigan State University Graph Theory Seminar, Lansing, Michigan, 12 October 1983.

BAILEY, Craig K., Assistant Professor, **"Playing the Game of Even,"** Washington and Lee University Mathematics Colloquium, Lexington, Virginia, 17 November 1983.

BREMSER, Priscilla S., Assistant Professor, **"Character Sums Associated to Certain Linear Tranformations,"** Special Session on Number Theory, American Mathematics Society Meeting, Louisville, Kentucky, 27 January 1984.

BUCHANAN, James L., Assistant Professor, **"Riemann-Hilbert Problem for Pascali System,"** Special Session on Partial Differential Equations, American Mathematical Society Meeting, San Luis Obispo, California, 11-12 November 1983.

BUTCHER, Ralph S., Assistant Professor, co-author, **"Uncountable Subfields of the Real Numbers,"** Regional Meeting of the Mathematical Association of America, Richmond, Virginia, 14 April 1984.

CRAWFORD, Carol G., Assistant Professor, **"Applications of Graph Theory to Robot Vision System Design,"** Regional Meeting of the Mathematical Association of America, Washington, D.C., 19 November 1983.

CRAWFORD, Carol G., Assistant Professor, **"Designing and Implementing Adult Math Programs,"** Annual Meeting of the American Mathematical Association of Two-Year Colleges, Orlando, Florida, 13 November 1983.

CRAWFORD, Carol G., Assistant Professor, **"Faculty Development,"** Daytona Beach Community College, Daytona Beach, Florida, 20-22 February 1984.

CRAWFORD, Carol G., and Joann S. TURISCO, Assistant Professors, **"Women and Mathematics,"** Equity in Career Education Seminar, Board of Education of Frederick County, Frederick, Maryland, 15 December 1983.

FOWLER, Gary O., Assistant Professor, **"Survival Analysis and Censoring,"** Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, 28 March 1984.

GAGLIONE, Anthony M., Associate Professor, co-author, **"Are Some Groups More Discriminating Than Others?"** Special Session on Combinatorial Group Theory (Infinite Groups), American Mathematical Society Meeting, Fairfield, Connecticut, 29 October 1983.

GAGLIONE, Anthony M., Associate Professor, co-author, **"A Conjecture of Tarski in Group Theory,"** Philadelphia Logic Colloquium, Bryn Mawr, Pennsylvania, 9 November 1983.

GAGLIONE, Anthony M., Associate Professor, **"A Theorem in the Commutator Calculus,"** Mathematics Colloquium, U. S. Naval Academy, Annapolis, Maryland, 21 September 1983.

HERRMANN, Robert A., Associate Professor, **"Nature: The Supreme Logician,"** Essex Community College, Baltimore, Maryland, 9 June 1984.

This article treats certain associativity properties of groupoids and algebras. A groupoid G is said to be n-*associative* if every product of n factors in G is independent of the way in which the factors are associated. This investigation is motivated by the following natural generalization of the generalized associative law: for $n \geq 3$, n-associativity implies (n + 1)-associativity. After obtaining several structural results and giving examples of groupoids which are n-associative but are not (n – 1)-associative, the possible cardinalities of such groupoids are investigated and it is shown that a groupoid with k elements is either $(2^{k-2} + 1)$-associative or it is not n-associative for any integer $n > 2$. The paper concludes with a similar treatment of an algebra of finite dimension d.

WOLFE, Carvel S., Associate Professor, **"Cutting Plane and Branch and Bound for Solving a Class of Scheduling Problems,"** *Transactions of the American Institute of Industrial Engineers,* 16(1984), 50-58.

Two general purpose integer programming algorithms, one a fractional cutting plane algorithm and the other a branch and bound algorithm, were investigated. The cutting plane algorithm easily solves an important class of integer problems, a class of scheduling problems for the assigning of personnel to work shifts over a fixed period of time. Scheduling problems were constructed with 14 to 189 integer variables and with 14 to 21 constraints. The general branch and bound search was not effective on this class of scheduling problems, but it was effective on the classical test problems found in the literature of integer programming, many of which were not handled by the cutting plane algorithm.

Over 200 scientists were contacted. It was found that the use of computers is increasing greatly and that those scientists who do not have access to the latest equipment are at a disadvantage. Two areas of particular concern are access to super-computers and high quality computer graphics and image processing equipment. The recommendations of this report are being used to help plan long range allocation policies.

PRICE, Geoffrey L., Assistant Professor, **"Extensions of Quasi-free Derivations on the CAR Algebra,"** *Publications of the Research Institute of Mathematical Sciences, Kyoto University*, 19 (1983), 345-354.

A densely-defined linear operator on an operator algebra is said to be a derivation if it satisfies the Liebniz rule. A derivation on the canonical anti-commutation relations algebra is quasi-free if it maps the creation and annihilation operators into themselves. We prove that there exist quasi-free derivations, all of whose generator extensions are quasi-free.

PRICE, Geoffrey, L., Assistant Professor, **"Pure States on Some Group-invariant C -algebras,"** *Transactions of the American Mathematical Society* 283(May 1984), 533-562.

In quantum mechanics one considers an operator algebra acted on by a group of symmetries of the physical system. The fixed point algebra is the set of physical observables of the system. In this paper, restrictions of pure product states to the fixed point algebra are considered, and conditions are given for the restriced states to remain pure. For example, in the case of the Ising model, pure product states corresponding to the situation where particles may be either spin up or spin down are found to restrict to pure states on the fixed point algebra.

STORMES, James M., Assistant Professor, **"Open-Loop Control and Motion Simulation of a Robot Manipulator,"** David Taylor Naval Ship Research and Development Center Report, Carderock, Maryland, October 1983.

Many robot control systems consist of two distinct subsystems: an open-loop control system which synthesizes the nominal force or torque at each joint, and a feedback control system which synthesizes error-correcting forces or torques which are added to the nominal forces or torques. Control systems in which the open-loop control subsystem is absent, and all forces or torques are "error"-correcting, are common in industrial robots. Such pure-feedback control systems have performed adequately, but their performance under at-sea conditions must be evaluated, and new control systems may have to be designed.

This paper presents the mathematical analysis underlying the computer-based implementation of an open-loop control subsystem which takes into account base motions and end-effector forces and torques, and motion simulation of a robot manipulator. When implemented, these could be used for the design and evaluation of feedback control subsystems.

TURNER, John C., Assistant Professor, **"Nonparametric Validation of Nonparametric Statistics,"** Social Statistics Section of the American Statistical Association, (1983) 293-295.

A method is given for resolving the conflict between the statistician's desire to use non-parametric statistics for validity and the user's desire for parametric statistics for ease of understanding. In the example given, the Mann-Whitney statistic is used to test for differences. The corresponding t statistics are plotted in two groups - those similar and those different. The t statistics are shown to lead to the same conclusions as the Mann-Whitney statistics, proving the validity of the parametric approach.

WARDLAW, William P., Assistant Professor, **"Problem 1179,"** *Mathematics Magazine*, 56(November 1983), 326.

Let A be a square matrix of rank r. It is shown that the minimum polynomial of A has degree at most r + 1.

WARDLAW, William P., Assistant Professor, **"Finitely Associative Groupoids and Algebras,"** *Houston Journal of Mathematics*, 9(1983), 587-598.

LERNER, Bao-Ting, Assistant Professor, **"A Report on the State of the Art of the Applications of Fuzzy Set Theory to Computer Vision,"** David Taylor Naval Ship Research and Development Center Technical Report, August 1983.

This paper constitutes a report on progress being made by various researchers in the application of fuzzy set theory to the problem of computer vision. Giardina's imaging operators (translation, erosion, threshold and counting and covariance functions) are described. Also detailed are various researchers' results on the perimeter of a fuzzy set, fuzzy degree of monotony for a region, and models for image description and primitive extraction. The application of fuzzy logic to the decision-making processes involved in computer vision systems is described.

McCOY, Peter A., Associate Professor, co-author **"Temperature Profiles Generated By a Source Term in Motion: A Non-linear Heat Equation,"** *Transactions of the Illinois Academy of Science,* 76(1983), 141-152.

Applications in welding engineering require precise analytic models for temperature transmission through planar work pieces in order to treat weldments for exotic materials such as titanium. The current state-of-the-art views linear quasistationary problems for planar heat flow in work-pieces whose physical parameters, such as thermal conductivity, are functions of position only. This investigation is an analytic approach to the solution of a nonlinear planar heat flow problem generated from a distributional heat source moving along a smooth curve at constant speed. The quasistationary condition is not required and the thermal properties of the workpiece are functions of position and temperature. Thus, the problem is non-linear and time dependent. The solution follows by applying D'Alembert's transformation to the heat equation to generate a formally hyperbolic partial differential equation in the complex plane that is solved in equivalent form as a non-linear Volterra's integral equation. This produces an analytic solution in the form of a rapidly converging series.

PENN, Howard L., Associate Professor, **"Using Computer Graphics to Aid in the Teaching of the Heat Equation with a Radiating End,"** *National Consortium of Users of Computers in Mathematical Sciences Education Newsletter,* 2(June 1983), 9.

In engineering mathematics courses, the topic of the heat equation with a radiating boundary condition at one end is studied as an application of generalized orthogonal functions. The solutions may be expressed as a series of terms which are products of an exponential in time and a trignometric function in position. The terms contain eigenvalues which are the points of intersection of the tangent function with another function. Students have difficulty understanding these solutions. Therefore a video tape was produced containing the graphs of the solutions to five such problems.

PENN, Howard L., Associate Professor, **"Computer Drawn Polar Coordinate Graphs,"** *Collegiate Microcomputer,* (August 1984).

When students learn to draw graphs using polar coordinate graphs, they often have difficulty "seeing" the graphs from their polar equations. Therefore, after the basic skill of drawing polar coordinate graphs is mastered, it is enlightening to produce a computer program to draw polar graphs. The program forces the student to think about the maximum value of the radial coordinate, a suitable range for the angular coordinate, and the number of points needed to produce a good graph. This paper presents 19 pictures of unusual computer generated graphs, listings of the program written for the TERAK 8600, the ATARI 800 and the APPLE IIe.

PENN, Howard L., Associate Professor, **"Usage and Need for Computers in Astronomy and the Geosciences,"** National Science Foundation Report, August 1983.

A survey was conducted among scientists in the fields of astronomy, atmospheric science, earth science, and ocean science to determine the current level of usage and the future needs for computer equipment.

in Maryland. Unique in combining the resources of a service academy faculty to work with a community educational system, the program provides courses taught by the Naval Academy faculty to reach and inspire local gifted and talented junior high school students. Students in these courses have achieved a great deal of success in working with abstract ideas and discovering underlying mathematical relationships. Much of this success can be attributed to both the approach and presentation of the material together with appropriate selections of thought provoking concepts and problems. This paper provides some of the methods and techniques found to be particularly successfully in the presentation of both courses.

D'ARCHANGELO, James M., Associate Professor, co-author, "**Acoustic High Frequency Scattering by Elastic Cylindrical Shells,**" *Journal of Acoustical Society of America,* 74 (1983), 294-304.

Acoustical scattering resulting from a high frequency plane wave incident upon an infinite aluminum circular cylindrical shell immersed in and filled with water is determined by applying the Sommerfeld-Watson transformation to the classical Rayleigh normal mode series solution. The resulting contour integrals are computed by both the saddle point method and by summing residues over poles which correspond to the zeros of a 6x6 determinant which results by imposing the necessary boundary conditions. The Bessel functions and their derivatives which appear in the 6x6 determinant are evaluated using asymptotic representations of both the Airy and Debye type depending upon the region of the complex plane. Emphasis is placed on the transitions in the scattering characteristics as the object goes from a solid cylinder to a thin-walled shell. This dual behavior is discussed in terms of the number and trajectories of allowed modes of the scatterer, the dispersion curves of various modes, and the contributions of the various modes to the scattered pressure field.

HANNA, Charles C., Associate Professor, co-author "**Noetherian Subsets of Prime Spectra,**" *Proceedings* of the American Mathematical Society, 88(July 1983), 397-398.

The spectrum of a commutative ring with identity is the set of prime ideals of that ring endowed with the Zariski topology in which the closed sets are the sets of the form V(I), the set of all prime ideals containing the ideal I. A topological space is noetherian if it satisfies the ascending chain condition on open sets. The main result shows that if A is a noetherian subset of the spectrum of a ring R, if T is a finitely-generated R-algebra, and if B is the set of prime ideals of T lying over elements of A, then B is noetherian. This leads to substantial simplifications in previous work of Ohm and Pendleton and of Heinzer.

HANNA, Charles C., Associate Professor, co-author, "**Homogenization and Dimension in T-graded Rings,**" *Communications in Algebra,* 12(February 1984), 259-269.

If T is a torsionless, cancellative monoid, a T-graded ring R is a direct sum of abelian groups R_γ, indexed by T, such that $R_\gamma R_\delta \leq R_{\gamma + \delta}$. This paper is an investigation of the relationships between the spectrum of such a ring and its graded spectrum. The notion of homogenization is generalized to relate Spec R and grSpec R to Spec R[S] for suitable extensions R[S] of R. A number of results are obtained relating the combinatorial dimensions of Spec R and grSpec R, the rational rank of T, and the rational rank of a maximal subgroup of T.

LERNER, Bao-Ting, Assistant Professor, "**An Amenability Property of Algebras of Functions on Semidirect Products of Semigroups,**" *International Journal of Mathematics and Mathematical Sciences,* 6(1983), 297-306.

Let S and T be semitopological semigroups and $S \textcircled{T} T$ a semidirect product of S and T. An amenability property is established for algebras of functions on $S \textcircled{T} T$. This result is used to decompose the kernel of the weakly, almost periodic compactification of $S \textcircled{T} T$ into a semidirect product.

Publications

ANDRE, Peter P., Associate Professor, **"Optimal Mode Selection for the Proteus Processor,"** Report to Anti-Submarine Systems Project Office (PM-4), December 1983

This report describes a computer software package which will aid the operator of a Proteus processor. It accepts as input information about the tactical situation in the form of means, variances, and correlations of the source levels of the possible targets at individual frequencies. It also uses information about the environment such as ambient noise measurements.

The software package produces a list of the best modes to use with the Proteus processor when searching for a target under the given conditions. This list allows an operator who is searching for an underwater target with the Proteus processor to pick the best setting for his electronic equipment.

BAILEY, Craig K., Assistant Professor, co-author, **"Points by Degree and Orbit Size in Chemical Trees, II,"** *Discrete Applied Mathematics*, 5 (1983), 157-164.

An asymptotic analysis is performed on the distribution of points by degree and orbit size in trees whose points have maximum degree $d \geq 3$. When $d = 4$, these trees represent the carbon skeleton of alkanes. Tables are provided for $d = 3$ and $d = 4$. These results are readily converted to corresponding conclusions for $(1,d)$ – trees, whose points have only degree 1 or d. The paper concludes with a discussion on the expected order of the automorphism group of a tree.

CRAWFORD, Carol G., Assistant Professor, **"From Solid Model to Robot Vision,"** *Proceedings* of the IEEE First International Conference on Robotics, March 1984, 90-93.

At the National Bureau of Standards, a *a method is being developed for transferring* sufficient information directly from the *solid modeling system* to the *robot vision* system to enable the robot to recognize a part. Information is encoded in the form of an aspect graph together with functions associated with each vertex of the graph. Aspect graphs were developed by J. J. Koenderink of the Netherlands as part of an attempt to understand how shape information is represented by the human vision system. This paper presents the theory and algorithms developed to use with parts designed on the PADL2 Solid Modeling System at the National Bureau of Standards.

CRAWFORD, Carol G., Assistant Professor, **"Determining the Structure of Finite Manuals From Event Structures,"** *Congressus Numerantium*, 39 (1984), 247-263.

Empirical Logic is a mathematical theory relating to experiments in an abstract setting. This field generalizes the conventional notion of sample spaces by allowing for the simultaneous representation of the outcomes of a set of related random experiments. Associated with the generalized sample space is a graph representing the manual of operations involved and a graph indicating the structure of events for the sample space. A natural graph theoretic question would be to ask whether it is possible to determine the structure of corresponding manuals given unlabeled event structures. This paper presents an algorithm to determine the structure of the desired manuals. Further details and explanations of the algorithm are developed through the use of specific examples, and the paper concludes with a table of event structures and their reconstructed manuals.

CRAWFORD, Carol G. and Bao-Ting LERNER, Assistant Professors, **"Great Expectations - Challenging the Interests of the Gifted Junior High School Student,"** *Math Teacher*, 77 (1984), 21-26.

"Graphs, Games and Puzzles" and "Strange Algebras" are two of the courses making up the Advanced Study Program sponsored by the Anne Arundel Public School system

Factors Affecting the Carbon Dioxide Exchange Between the Atmosphere and the Ocean in the Atlantic Ocean Region

RESEARCHER: MIDSHIPMAN 1/C BRUCE LIPPHARDT
ADVISER: PROFESSOR JEROME WILLIAMS
SPONSOR: TRIDENT SCHOLAR PROGRAM

Increasing levels of atmospheric carbon dioxide have been hypothesized to cause future global warming as a result of an enhanced "greenhouse effect." Man is responsible for the addition of carbon dioxide to the atmosphere through the burning of fossil fuels and the removal of vegetation from the continents. Future climatic changes caused by a global warming are of governmental concern because of their economic impact, and possible future restrictions on the use of fossil fuels are a likely result.

It has been suggested that the carbonate system in the oceans may act as a carbon dioxide sink by converting excessive atmospheric carbon dioxide to dissolved ions. The role of the oceans as a carbon dioxide sink has not been clearly established, however.

A study of time variations of surface ocean carbon dioxide levels is necessary to determine whether or not the oceans absorb significant quantities of atmospheric carbon dioxide. Three existing data sets are used to construct time variation studies covering 9- and 15-year intervals.

The resulting comparisons show that oceanic carbon dioxide levels do not consistently increase with time, although some significant increases are noted. One comparison suggests that the geographic location of local carbon dioxide sources and sinks may be changing with time. Studies covering a larger time interval are necessary to establish more clearly the response of the oceanic surface layer to increasing atmospheric carbon dioxide levels.

Independent Research

Feeding Ground Dynamics in the Denmark Strait

RESEARCHER: ASSOCIATE PROFESSOR JOHN W. FOERSTER

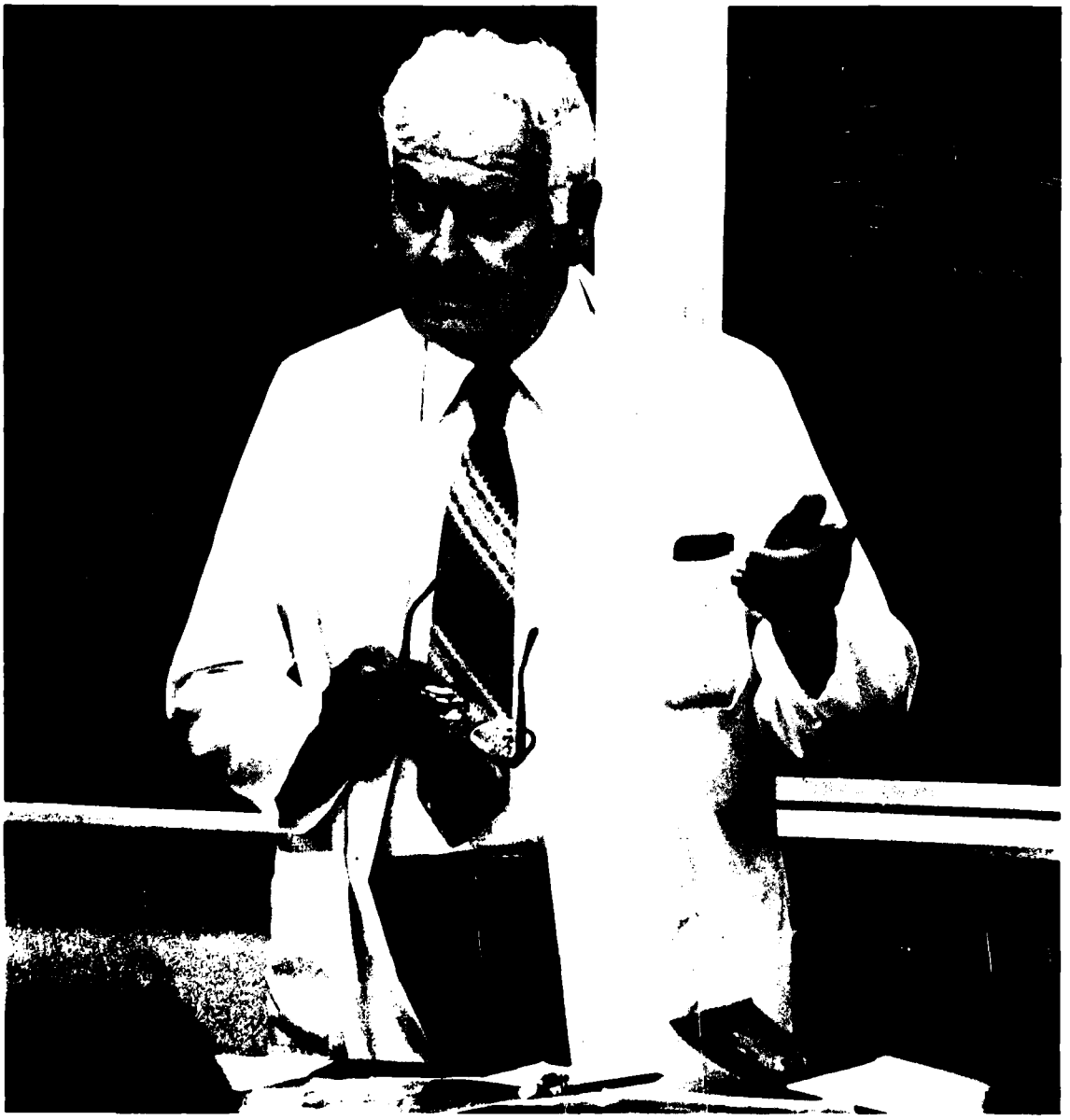
Between longitude 28°W to 32°W and latitude 62°N to 66°N an intense feeding ground system frequented by several species of large whales has been located. The area on the eastern side of the Denmark Strait is influenced by the Irminger Current. Data on Phytoplankton and Zooplankton is presented. In addition, studies on the meteorology of the area, mass transport of the water, ocean stability dynamics, and nutrient concentrations have been compiled. Satellite data will be used to augment the analyses. All data researched and to be presented will be used to demonstrate the dynamics of a feeding ground able to support the polar summer feeding of apex predator populations of fin, sei, minke, and sperm whales. Investigations to date have revealed an intermittent upwelling system believed to be caused by the arctic storms moving through the Denmark Strait every 5-7 days.

Research Course Projects

Marine Biofouling

RESEARCHERS: MIDSHIPMEN 1/C KEITH WAGONER AND CLIFF MAURER
ADVISER: LIEUTENANT COMMANDER ROBERT L. CLARK, USN

Specially constructed panels were submerged in the Severn River at varying depths and at different locations. They were then periodically monitored for marine growth rates and community identification.



Publications

FOERSTER, John W., Associate Professor, **"Habitat Dynamics and Anadromous Clupeids in the Northern Chesapeake Bay,"** *American Fisheries Society-Potomac Chapter,* 9(1984), 51-89.

The northern Chesapeake Bay has been undergoing accelerated change since the seventeenth-century when non-natives began colonizing the Susquehanna River Valley. Anadromous clupeids (*Alosa sapidissima*—American shad, *A. pseudoharengus*—alewife, *A. aestivalis*—blueback herring) are discussed in relation to environmental changes and predation by commercial fisherman.

The northern Chesapeake Bay and the Susquehanna River in Maryland are nursery areas and spawning grounds. Only the lower sixteen kilometers in the Susquehanna River are available for spawning. The Conowingo Dam blocks the river to upstream migration.

Environmental changes, recruitment over fishing, and emergence of a possible landlocked race of alewifes are discussed. A suggestion for increasing the success of the spawning through spawning bed improvement is offered.

FOERSTER, John W., Associate Professor, **"Environmental Assessment of Tributyl Tin Containing Antifoulant Paints for Ship Evaluations by the U.S. Navy,"** David W. Taylor Naval Ship Research and Development Center Report, 1983.

The U. S. Navy proposes to implement the application of commercially available tributyltin containing anti-foulant paints to the hulls of the USS *Nimitz, Barney, Spruance, Omaha, Sampson,* and *Birmingham.* The procedure involves the coating of some hulls in the Norfolk Naval Shipyard and subsequent deployment of two vessels to the Norfolk Naval Operating Base. No adverse environmental impact is apparent from the deployment of these ships to the Norfolk Naval Operating Base. A monitoring procedure for these vessels is necessary to determine whether there will be any short term or long term adverse environmental impacts. There is a discussion of alternative methods, mitigation procedures to reduce any adverse environmental impacts, and development of a water quality criterion.

GUTTMAN, Nathaniel B., Visiting Associate Professor, co-author, **"Tennessee Valley Extreme Wind Speed Climatology,"** *Journal of Hydraulic Engineering,* 109(August 1983).

The hydrologic design of dams and determining flood levels for nuclear plant siting requires postulating windwave occurrence concurrent with maximum flood levels. Practical postulations of windwave magnitudes require knowledge of wind probabilities by direction and time of year. Probability estimates of daily extreme 30-minute and 60-minute wind speeds are presented for each direction for the months of March, April, and June through September for the Tennessee Valley. Some broad guidelines concerning generalized regions of homogeneous wind speeds are also presented. The methods used are applicable to a wide variety of applied problems requiring analyses of wind extremes and comparisons between frequency distributions.

HOFFMAN, John F., Professor, **"Ocean Pollution."** *Knight's Modern Seamanship,* 17th edition. New York: Van Nostrand-Reinhold Publishing Co., Inc. 1983.

Discussed in the subject chapter are the basics of pollution and the effects of hydrology and ecology on pollution in the ocean. Special topics discussed are oil spills, acid rain, dredging and waste disposal.

WILLIAMS, Jerome, Professor, Frederick SKOVE, Assistant Professor, and John FOERSTER, Associate Professor, **"The Effect of Suspensoids on Optical Parameters in a Typical Estuary,"** USNA Oceanography Department Technical Report OCTR-84-01, May 1984.

As a first step in optical modeling of coastal area, the effects of various suspensoids on optical parameters were studied in the Patuxent River, a subestuary of Chesapeake Bay. Particle populations were measured using a Coulter Counter, while both inherent and apparent optical properties were being monitored. Results are presented indicating strong relationships between beam attenuance and total suspensoids, including both suspended sediments (particle diameters between 1 and 5 $x10^{-6}$m) and phytoplankton (particle diameters between 15 and 35 $x10^{+6}$m). Relationships of natural phenomena such as tidal currents and daylight period with sediment and plankton populations are also demonstrated. As expected, efforts at predicting inherent optical properties from apparent optical properties, and *vice versa*, were not very successful.

From these studies it appears possible to develop models capable of predicting, within reasonable limits, optical properties of coastal waters when local conditions such as weather, input stream characteristics, and local topographic conditions are known.

Presentations

FOERSTER, John W., Associate Professor, **"From Here to Where: Future Think Conceptualizing Regional Survival,"** Maryland Department of State Planning's Futures Conference, Baltimore, Maryland, 30 October 1983.

FOERSTER, John W., Associate Professor, **"Whale Studies in the Denmark Strait,"** Sigma Xi, Towson State University, Towson, Maryland, 14 April 1984.

WILLIAMS, Jerome, Professor, **"Estuarine Research in the People's Republic of China,"** Seventh International Estuarine Research Conference, Virginia Beach, Virginia, 23 October 1983.

WILLIAMS, Jerome, Professor, **"The New Salinity Scale and What It Means to Estuarine Oceanography,"** Seventh International Estuarine Research Conference, Virginia Beach, Virginia, 25 October 1983.

WILLIAMS, Jerome, Professor, **"Navy Needs in Optical Oceanography,"** Mapping, Charting, and Geodesy Base Technology Review, Bay St. Louis, Mississippi, 15 November 1983.

WILLIAMS, Jerome, Professor, **"Progress Report on Coastal Optical Studies,"** Mapping, Charting, and Geodesy Base Technology Review, Bay St. Louis, Missippi, 15 November 1983.

DEPARTMENT OF

Physics

PROFESSOR FRANK L. MILLER
CHAIRMAN

The modern Navy has become increasingly dependent on technology. In addition to the continued importance of sonar and nuclear power, the Navy's use of electro-optics and computers has increased many fold in recent years. The Department's goal is to ensure maximum coverage in the basic physics courses of those concepts upon which these modern devices are based. In order to do so, it is imperative that the Department maintain a state-of-the-art expertise in these several areas. This is most effectively done by active involvement in current research. In addition, it is most beneficial to involve midshipmen in this research wherever and whenever possible and appropriate. Current faculty research activity areas include non-linear acoustics, ship acoustic signatures, electromagnetic properties of materials, laser optics applications, radiation effects, solar systems and galactic astronomy, solid state physics, radiation effects, solar systems and galactic astronomy, solid state physics, polymer physics, and nuclear physics.

Support of this year's research included the Office of Naval Research, the David W. Taylor Naval Ship Research and Development Center, the Naval Research Laboratory, the National Aeronautics and Space Administration, the Naval Sea Systems Command, and the Naval Academy Research Council.

Midshipmen (particularly the physics majors) are encouraged to participate in research programs, either through the SP400 course series or through the Trident Scholar Program.

Sponsored Research

Positronium Formation from $e^+ + H^-$

RESEARCHER: PROFESSOR RUTHERFORD H. ADKINS
SPONSOR: NAVAL AERONAUTICS AND SPACE ADMINISTRATION AND AMERICAN SOCIETY FOR ENGINEERING EDUCATION FACULTY FELLOWSHIP PROGRAM

It is hypothesized that low energy positrons (e^+) incident on H^- ions in the ground state yield positronium in one or more of several low-lying stationary states. The cross section (matrix element) for this process is calculated using the distorted wave Born approximation (DWBA) with Coulomb wave functions representing the incident positron.

In first approximation, the ground state wave function of H^- is taken to be the helium-like. Cross sections are being calculated for positronium states from 1S to 3d inclusive.

FORTRAN programs have been developed for these calculations for positron partial waves from $L = 0$ to $L = 4$. Gaussian-type analytical approximations to the Fourier transforms of the wave functions have also been utilized to estimate the cross sections. Comparisons have not yet given consistent results.

A Servo-Controlled Cold Infrared Spectrometer

RESEARCHER: ASSISTANT PROFESSOR C. ELISE ALBERT
SPONSOR: NAVAL RESEARCH LABORATORY

The goal of this project is the completion of the last stage of a cooled, moderate resolution Cassegrain Fabry-Perot spectrometer, initially designed for observations in the near-infrared wavelength range. A unique feature of this instrument is its fully servo-controlled operation, which allows for self-alignment, variable resolution, stop-and-integrate detection, continuous scanning, and automation under microprocessor control.

During this year, the instrument has been tested in two observing runs with the Kitt Peak National Observatory 50" telescope: the first run, from 25-31 May 1983, tested the stability of the system using infrared etalons and successfully implemented the microprocessor control; while the second run, 7-14 January 1984, tested its sensitivity on astronomical objects. Additional refinements will be implemented during observing runs scheduled for the remainder of 1984-1985, and the system will begin to be used for routine infrared research projects.

Acoustic Resonance Scattering by an Elastic Cylinder

RESEARCHER: PROFESSOR DONALD W. BRILL
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The following is the index of an informal review of work done during the summer of 1983 at the David W. Taylor Naval Ship Research and Development Center, Annapolis Laboratory: (1) acoustic scattering from an elastic cylinder in a liquid (resonance scattering theory approach); (2) acoustic scattering from an elastic cylindrical shell in a liquid (resonance scattering theory approach); and, (3) a classified feasibility study.

Laser Vulnerability Studies

RESEARCHER: LIEUTENANT COLONEL JAMES R. BUCKMELTER, USAF
SPONSOR: LOS ALAMOS NATIONAL LABORATORY

The purpose of this ongoing study is to determine laser vulnerability of various rocket materials to several different wavelength lasers. This project is in initial stages, and work was done as part of the Service Academy Research Associates Program (SARA) during the summer of 1983.

Computer Modeling of Unstable Optical Resonators

RESEARCHER: PROFESSOR GERALD P. CALAME
SPONSOR: NAVAL RESEARCH LABORATORY

Lasers constructed with unstable optical resonators are of current interest because their relatively large active volumes permit the generation of intense beams. Very little can be done analytically with regard to predicting the mode structure of such devices, so computations of intensity in the laser, and more importantly in the far-field in order to permit study of the focusing properties of the beams, must be performed numerically. Accordingly, a group of modular programs has been written in order to study the propagation of electromagnetic waves in those devices in strip geometry. Being modular, the programs are very flexible and have been combined in different orders to study mode structure, transient behavior, far-field patterns, and phase-configuration problems.

One useful result found is that for a given (large) Fresnel number, beam divergence increases only very gradually in the higher modes, which explains why the output from unstable resonators is easily focusable with minimal attempt to achieve mode purity. A number of modes may well be present, but if the combination of modes is focusable, one does not care whether one is operating in a single mode or not.

Sputtering and Carburization of Ion-Implanted Iron

RESEARCHER: ASSISTANT PROFESSOR FRANCIS D. CORRELL
SPONSOR: NAVAL RESEARCH LABORATORY

This new project is part of a large Naval Research Laboratory effort to better understand the basic physical processes that occur during ion implantation of metals, so that efficient implantation techniques can be developed to improve such metal properties as resistance to wear, fatigue, and oxidation. One motivation for the present research is an earlier discovery that the wear resistance of several steels can be significantly improved by implantation with high doses ($\simeq 10^{17}$ cm^{-2}) of Ta (and other) ions. Carburization of the surfaces, possibly due in part to cracking of residual hydrocarbons and complexing with the highly-reactive implanted Ta ions, has been suggested as an important factor in the process. Sputtering is also important in high-dose implantations, especially when non-normal incidence is required, because it can limit the maximum attainable concentration of implanted species. In order to more fully understand the improved wear resistance of implanted steels and to properly design implantation procedures for treating complex workpieces such as bearings, more information is needed on the approach to saturation conditions during implantation and on the variation of sputtering yields with the angle of incidence and the chemical nature of the implanted ions.

To obtain this information, thin films of pure Fe deposited on Si substrata will be implanted with 150-keV Ta or Au ions at incident angles from 0° to 50° and to fluences between 0.5×10^{16} cm^{-2} and 20×10^{16} cm^{-2}. Implantations will be carried out either under UHV conditions or in the presence of controlled amounts of C, so that carburization of the samples can be controlled. Rutherford backscattering of ^{4}He ions will be used to measure the amount of sputtered Fe, the retained dose of the implanted species, and the concentration of C near the sample surface. Results obtained using Ta and Au ions will be compared to assess the importance of chemical effects, and data will be analyzed using theoretical models being developed at Naval Research Laboratory. Considerable progress has been made on the conceptual development of the project, as well as on the design and fabrication of a special sample holder and a new laser mount for use in positioning the samples and measuring implantation angles.

Experimental and Theoretical Study of Underwater Tone Generation over a Slot: Phase III

RESEARCHER: PROFESSOR SAMUEL ELDER
SPONSOR: NAVAL SEA SYSTEMS COMMAND

The prevention of vibration and acoustic radiation generated by flow over slots or cavities in hulls is a recurrent problem in ship performance. Currently, studies are being directed toward understanding the coupling between sheartone oscillation and structural vibration modes and the effects of finite boundary layer thickness. In the present series of Tow-Tank tests, it is planned to extend the speed and frequency scales so as to permit flyby radiation measurements above the tank cutoff frequency. A comprehensive sheartone theory is being developed taking into account nonlinear shear layer oscillation, turbulence, and structural mode coupling, in a form suitable for direct application to naval problems. Recently, a breakthrough was made in understanding how the threshold for nonlinear orifice impedence depends on linear acoustic cavity resistance, making it possible to estimate the threshold of nonlinear effects underwater. This has been used to check the internal consistency of the air-resonator model as applied to underwater problems. It is clear that the observed strong breathing modes of the underwater cavity generate sound in a manner very similar to air-resonant cavities. However, the radiation characteristic is probably dominated by quadrupole or octupole effects. A proposal has been submitted for further investigation of nonlinear orifice effects.

Cometary Ion Tail Narrow Band Imagery Dynamical Planetary Magnetospheric Field Modeling

RESEARCHER: ASSOCIATE PROFESSOR IRENE M. ENGLE
SPONSOR: U.S. NAVY AND AMERICAN SOCIETY FOR ENGINEERING EDUCATION FACULTY FELLOWSHIP PROGRAM

The researcher spent the summer of 1983 working independently in a program sponsored by American Society of Engineering Education in cooperation with the Naval Research Laboratory involving work on the calculation of intensity profiles of cometary ion tail images as produced via the solar luminescence mechanism. The researcher formulated an alternative mechanism for the particular observation of Comet Kohoutek which was the original reason for the study and continues work on self-consistent modeling of planetary magnetospheric fields with particular attention to the extremely variable Jovian magnetosphere.

An Investigation into the RMS-Track Radius for Electron-Hole Pairs Created by Ionizing Particles or Radiation in MOS/CMOS Memory Cells

RESEARCHER: ASSISTANT PROFESSOR JOHN P. ERTEL
SPONSOR: NAVAL RESEARCH LABORATORY

Preliminary studies have been made into the numerical modeling of the RMS-track radius created by ionizing particles incident upon MOS memory structures. While there exists a few singular results, the method is in reasonable agreement with results of other investigators. The code used for this calculation will continue to be refined as the basis for a model of single event upset characteristics due to the diffusion of charge carriers towards the depletion layer where binary information is stored.

Degaussing Range Studies

RESEARCHER: ASSOCIATE PROFESSOR WILLIAM E. FASNACHT
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

The researcher determined position on ship and analyzed data for degaussing range runs.

Electrical and Thermal Properties of Ion Conducting Polymers

RESEARCHER: ASSOCIATE PROFESSOR JOHN J. FONTANELLA AND
ASSISTANT PROFESSOR MARY C. WINTERSGILL
SPONSOR: OFFICE OF NAVAL RESEARCH

The primary objective of the work is to measure the electrical and thermal properties of ion conducting polymers over a wide range of temperatures and pressures.

The electrical measurements are performed in vacuum from 5.5 to 400K and at high pressures of several kilobars over the temperature range 100-400K. Thus, electrical transport and electrical relaxation are studied, along with the associated activation volumes.

Some of the polymers studies include PEO, PAN, PVF_2, and PVA_c. In the case of the PEO, an effort is being made to ascertain the effects of water and pressure on the glass transition and electrical relaxations. Also, it has become apparent that poly (vinyl acetate) (PVA) can be transformed into a good conductor by complexing with alkali metal salts. This particular polymer also appears to have attractive mechanical properties and promises to be an interesting candidate for study. The properties of both conducting PVA and its copolymers with PEO will be studied.

Concurrently, DSC studies have been performed on all samples, and work has begun on a molecular mechanics approach to polymers. Specifically, an attempt is being made to adapt a computer program which has been used to model ionic crystals to the problem of ions in PVF_2 and PEO.

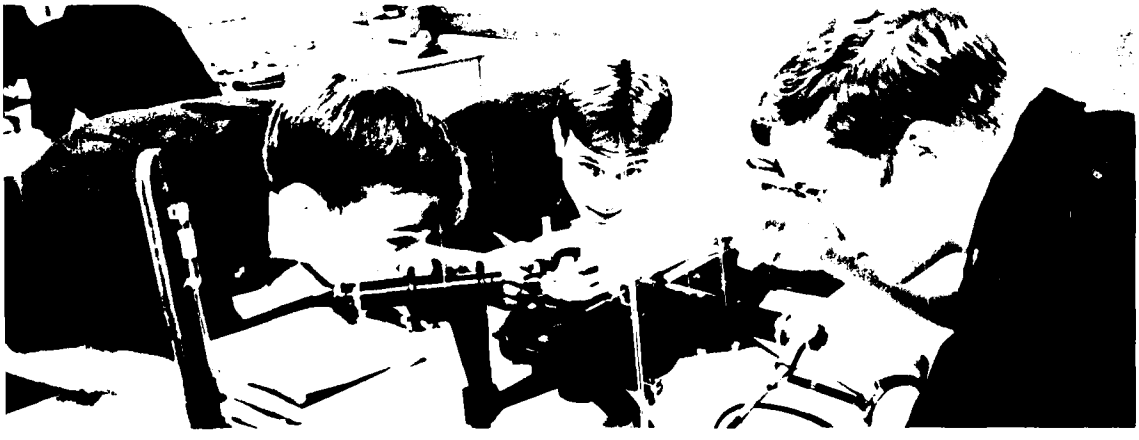
Merchant Vessel Source Levels

RESEARCHER: VISITING RESEARCH PROFESSOR ROBERT L. JENNETTE
SPONSOR: NAVAL SEA SYSTEMS COMMAND

The acoustic emanations of transiting merchant vessels tend to degrade anti-submarine warfare capabilities by masking the presence of a target, or by mimicking a target. Thus, the amount of radiated acoustic noise and the signature of this noise is of current Navy interest.

The Physics Department is engaged in a measurement program for the gathering of narrow-band source levels of numerous ships. A sonar laboratory (including a digital signal processing facility, plus two research vessels) has been developed.

To date, the feasibility of the methodology has been proven with the obtaining of the first set of final results — a small data base of calibrated narrow-band source levels of representative merchant vessels.



An Experimental Investigation on the Nonlinear Scattering of Crossed Ultrasonic Beams in the Presence of Turbulence in Water

RESEARCHER: ASSISTANT PROFESSOR MURRAY S. KORMAN
SPONSOR: NAVAL RESEARCH COUNCIL

uring the past two years, an experimental vestigation and a theoretical analysis have en carried out on the nonlinear scattering oblem involving the interaction of two ossed sound beams interacting in the esence of turbulence.

Experiments, which originally involved ntinuous beams of sound, are now rformed using pulse techniques. Pulses ovide more accuracy and allow many fferent types of measurements that are itable for computer analysis.

Theoretical predictions are in good agreement with experimental results involving the Doppler shift and spectral broadening of the scattered "Sum" frequency wave component. Agreement is somewhat less for the more difficult prediction involving the scattering cross section.

During the academic year (1984-1985), the apparatus will be operated to gather more data for analysis. Midshipmen involved in SP411 (Sonar) will be encouraged to participate in the project.

Experiments on the Nonlinear Scattering of Crossed Sound Beams in the Presence of Turbulence

RESEARCHER: ASSISTANT PROFESSOR MURRAY S. KORMAN
SPONSOR: NAVAL RESEARCH LABORATORY

/hen sound waves propagate through turbulent region, one observes:) excess sound absorption; (2) scattering om the spatial fluctuations of the turbuence, and; (3) a frequency broadening of ne acoustic spectrum due to interactions /ith a turbulent field that fluctuates with me.

An experimental apparatus has been constructed at the U.S. Naval Academy hydrodynamics tow-tank facility to measure the nonlinear scattering of two mutually perpendicular crossed sound beams (f_1 = 2.1, f_2 = 1.9 MHz) interacting in the presence of turbulence (from a submerged waterjet). A transducer receiver, placed 2m from the interaction region, measures the scattered radiation.

Ultrasonic Wear Particle Sensors

RESEARCHER: ASSOCIATE PROFESSOR DAVID A. NORDLING
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Vork was on the ultrasonic wear particle ensors in which software was written or experimental tests. A history of data nd a formulation of a failure prediction nodel for various particle detection ystems was initiated. A comparison among data systems will also be made. The software written will control monitoring and storage of various data collected in the bearing failure test. The actual test will probably begin near the end of this year.

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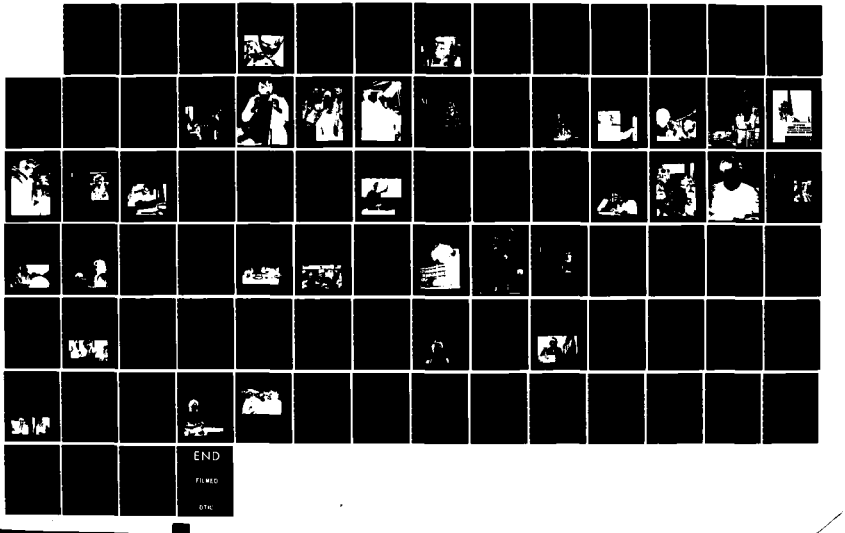
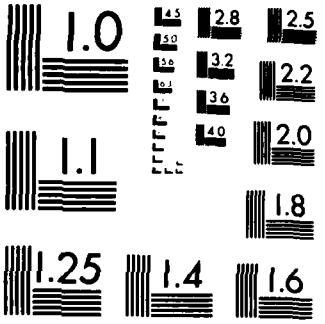




Laser Damage Effects

RESEARCHER: PROFESSOR CHARLES W. RECTOR
SPONSOR: NAVAL RESEARCH LABORATORY

The investigator continued work on a Laser Damage and Effects Bibliography incorporated into a computer data base. This data base is now included in the "Directory of DoD Sponsored Data Bases." The researcher also served as a consultant on special projects to the Naval Research Laboratory Laser Project Manager.

Investigation of the DC Potential Drop Technique for High-Rate J_1-R-Curve Testing of Structural Alloys

RESEARCHER: PROFESSOR CARL S. SCHNEIDER
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

Fracture initiation in structural steels has been successfully studied at high rates (1 – 2 m/s) by removing the magnetoelastic signals generated in steel samples by stress in the presence of non-zero magnetic fields or residual magnetization. This technique required longitudinal magnetic saturation of the sample during the fracture test. Alternatively, the potential drop was eliminated, and the sample magnetization reduced to reversible rotations by elastic prestressing in smaller magnetic fields. The voltage versus time signature shows excellent correlation with the fracture process and may itself become a new fracture test parameter.

Closed-Loop Feedback Degaussing

RESEARCHER: PROFESSOR CARL S. SCHNEIDER
SPONSOR: DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, ANNAPOLIS LABORATORY

An algorithm has been developed to relate hull, keel, and far-field magnetostatic signatures and determine the onboard degaussing coil current necessary to eliminate the off-hull signature of ships. The algorithm uses "coil functions" as a nearly orthonormal set of basis functions in which to linearly expand observed signatures. The iterative nature of the feedback loop allows time dependence of signatures, and the number of onboard coils allows spatial inhomogenity within one shil diameter as well as nonlinear or permanent magnetization degaussing.

Magnetoelastic Processes in Steel

RESEARCHER: PROFESSOR CARL S. SCHNEIDER
SPONSOR: ADMIRALTY RESEARCH ESTABLISHMENT (JH4)

The effect of stress on magnetization and magnetic susceptibility has been modelled mathematically through effective field, domain symmetry, and magnetic amisotropy. The individual effects have been combined in a FORTRAN program which can predict magnetization at any point in any magnetoelastic ($H - \sigma$) process of any complexity up to the coercive field or coercive stress. Final representation of magnetic amisotropy, which occurs at large magnetizations, fields, or stress is underway. A representation of the initial susceptible has been found in terms of that from the major hysteris or saturated loop, exploiting internal demagnetization.

III-IV Semiconductor Properties and Soft Upset Events in Josephson Junction

RESEARCHER: PROFESSOR ROBERT N. SHELBY
SPONSOR: NAVAL RESEARCH LABORATORY

The study of electronic traps in III-IV semiconductors was continued with emphasis on traps in neutron irradiate GaAs. The goal of this work is to identify and determine the annealing properties of the important EL-2 trap in GaAs.

The work on soft upset events in Josephson Junction devices induced by alpha particles was continued. Currently, measurements on smaller area Nb-Si-N6 and Pb-Pb0-Pb junctions are being made. The goal is to establish a relationship between upset rate and junction area and properties.

Nonlinear Optics

RESEARCHER: ASSOCIATE PROFESSOR LAWRENCE L. TANKERSLEY
SPONSOR: NAVAL RESEARCH LABORATORY

The nonlinear conversion of laser radiation is the most promising source of coherent light in the extreme ultraviolet. The nonlinear optics group at the Naval Research Laboratory has continued its study of the harmonic conversion of Xenon Fluoride Laser radiation using differentially-pumped and phase-matched conversion cells. A systematic study of optical cavity configurations has substantially increased the energy available for harmonic conversion. The system has reached the performance levels required for a study of semiconductor materials to be completed in cooperation with solid state physicists at the Naval Research Laboratory. This development gives a novel optical probe of solids.

Structure of Chalcogenide Glasses

RESEARCHER: PROFESSOR DONALD J. TREACY
SPONSOR: NAVAL RESEARCH LABORATORY

Chalcogenide glasses have further potential applications for the Navy. This project was designed to increase the understanding of the structure of this type of material so it could be decided how to modify this structure to apply devices made from this class of materials.

The primary tool for the investigation was Nuclear Quadrupole Resonance of mixed chalcogenide systems. This tool was chosen because it is extremely sensitive to short range order in the structure. The final results have not been obtained.

Investigation of AN/SQR-19 Tactical Towed Array Performance Characteristics

RESEARCHER: LIEUTENANT COMMANDER MICHAEL H. TRENT, USN
SPONSOR: NAVAL SURFACE WEAPONS CENTER, WHITE OAK

This project consists of analysis of acoustic data gathered with passive linear array to include experimentation with techniques to enhance system signal-to-noise ration, development of an efficient and accurate target motion analysis algorithm for use with the array, and refinement of acoustic classification cues.

Independent Research

Orbital Elements of Eclipsing Binaries

RESEARCHERS: ENSIGN ROBERT M. CAMPBELL, USN, AND PROFESSOR GRAHAM D. GUTSCHE

The object of this research is determination of the light curves for two Ursa Majoris type binary star systems (AZ Virginis and SAO 77615) and the calculation of their orbital elements using a fully computerized analysis method first developed by Horak.

Studies of Nuclear Forces and Reaction Mechanisms Using Multiparticle Breakup Reactions

RESEARCHER: ASSISTANT PROFESSOR FRANCIS D. CORRELL

Systems containing a small number of interacting nucleons provide an interesting "laboratory" in which to study nuclear forces and theoretical descriptions of nuclear reaction mechanisms. The interaction of three nucleons can be treated exactly by solving the Faddeev equations numerically, and some progress has been made toward extending this method to the four-nucleon system. For systems containing 5 to 7 (or so) nucleons, a different approach has been used with some success: Certain processes appear to be described quite well in terms of the interaction of three composite bodies, whose actual nucleon structure need not be fully taken into account, but can often be adequately represented by specifying phenomenological interaction potentials. The interactions of these three objects can then be calculated "exactly" using the Faddeev formalism.

The object of the present research has been to obtain experimental data under conditions that are thought to provide stringent tests of the three-body model itself and of the interaction potentials employed. In particular, the data sought consists of cross sections and polarization analyzing powers for kinematically-complete break up reactions. These data are compared to the predictions of simple two-body reaction models and of a three-body Faddeev code which uses realistic input forces.

Data on the 5- and 7-nucleon systems were obtained at the Los Alamos National Laboratory during the period 5 July - 2 August 1983. Cross sections for the ^{2}]H (t, pt)n and ^{4}He(t,pα)n reactions were measured for incident triton energies of 18 and 24 MeV and for several kinematic conditions chosen to enhance the sensitivity of the calculated cross sections to the details of the input p-t, p-n, p-α, and n-α forces. These data are still being analyzed.

Additional data on the 6-nucleon system were measured at the Indiana University Cyclotron Facility during the period 2-8 January 1984. Cross sections and analyzing powers for the ^{4}He(d, αp)n reaction, initiated by polarized deuterons of 69 NeV incident energy, were measured for two different kinematic configurations. These data complement the results obtained earlier at Los Alamos for the same reaction initiated by 12- and 17-MeV deuterons. The new data are still in a preliminary stage of analysis.

Sound and Shape in the Platonic Solids

RESEARCHER: PROFESSOR SAMUEL A. ELDER

Since ancient times it has been known that there are exactly five regular polyhedra that can be inscribed in a sphere. A number of important relationships among these polyhedra and their internal structure involve lengths connected by simple integer ratios or harmonics. When a solid shell of this configuration is ensonified by means of acoustic random (or "white") noise, characteristic modal spectra are produced. The most familiar of the regular polyhedra is the cube, for which there are standard solutions to the wave equation. This has some harmonic modes and some inharmonic, so that when ensonified with white noise there should be a pleasant, almost musical response. On the other hand, the tetrahedron or pyramid shape, has no parallel walls and would not be expected to support the kind of simple standing wave pattern that gives rise to musical tone. There are, however, characteristic modes, even for this body, though the solution cannot be obtained by the standard method of separation of variables. By probing the inside of the ensonified solid shell with a microacoustic detector, the investigator has been able to study the geometrical structure of the nodal surfaces for both calculable and noncalculable modes, identifying the precise acoustic mode. In effect, his approach is an analog method for solving the wave equation for strange boundary conditions, and gives invaluable insights into difficult cases, such as the pyramid. An immediate practical application is architectural acoustics, where it is often (erroneously) assumed that a room without parallel walls has no acoustic modes.

Optical Measurement of Liquid Magnetic Susceptibility

RESEARCHERS: PROFESSOR CARL S. SCHNEIDER AND ASSISTANT PROFESSOR JOHN P. ERTEL

The distortion of a liquid surface in a magnetic field has been theoretically studied and is found to be simply related to its specific susceptibility of the sample, the gradient of the field energy density, and the local gravitational field. The surface profiles of several liquids will be measured using a LASER reflection technique and compared with that predicted from the magnetic field and field gradient at the liquid surface. The experimental apparatus has been designed, and fabrication is underway to allow experimental verification of this new and powerful technique for measuring magnetic susceptibility.

EFPEBFP (Ertel's Fool-Proof Eye-Ball Fitting Package)

RESEARCHER: ASSISTANT PROFESSOR JOHN P. ERTEL

A real-time interactive program has been developed for use in fitting multi-variate functions to experimental observations. The fit is generated by any real-time (time sharing or dedicated) computer linked to any graphics terminal with two or more memory planes and cursor control keys by plotting the data, error bars, and labeled axes in one plane which is saved while the curve which corresponds to the current fit-parameter values is dynamically plotted in the second plane. The interactive user then adjusts the fit-parameters independently to obtain the curve which gives the "most optically pleasing" fit. This fit then represents, at the very least, a good set of "seed-parameters" for a more rigorous statistical regression.

Research Course Projects

Investigation of Dust Associated with Shell Stars

RESEARCHER: MIDSHIPMAN 2/C MARK S. BOEHLE
ADVISER: ASSISTANT PROFESSOR C. ELISE ALBERT

The goal of this project was to provide an independent study course in basic astronomy and to develop a proposal, designed for the Naval Academy's 16" telescope for the Trident Scholar Program. The proposal, which was accepted by the Trident Program, is to investigate the role of dust in shell stars. The first phase of the project will be a detailed photometric study of two selected shell stars (in addition, six other stars have been chosen for observation if weather and time permits). The data collection will be with the Academy's 16" reflecting telescope and broad-band photoelectric photometer plus an additional and compatible photometric head equipped with narrow band filters. At the same time, calibration of the equipment will be accomplished by observing stars which have been measured precisely with standard equipment. The last part of this phase will be the reduction of the data to the standard astronomical form of magnitudes and colors.

The second phase of the project will be the analysis of the data. The broad band data will demonstrate if dust exists and if it is physically associated with the star. The narrow band data will indicate stellar characteristics and if the star itself is intrinsically varying. If venebility due to dust is observed, two different models for the role of the dust can be investigated.

Trapped Ions in Space (TRIS)

RESEARCHERS: MIDSHIPMEN 1/C JEFFREY N. ZAUN AND MICHAEL GERHARDT
ADVISER: ASSISTANT PROFESSOR FRANCIS D. CORRELL

The Trapped Ions in Space (TRIS) project is a joint effort of the Academy's ΣΠΣ Physics Honor Society and the Naval Research Laboratory's E. O. Hulburt Center for Space Research. Its purpose is to measure the fluence, composition, energy spectra, and pitch-angle distribution of low-energy (3 MeV/u to 200 MeV/u), heavy ($Z > 2$) ions located in the inner magnetosphere, at altitudes between 150 and 250 nautical miles and at orbital inclinations of 57° and 28.5°. To obtain this information, a "track detector" consisting of interleaved sheets of thin plastic and aluminum will be carried aboard Space Shuttle flights in August 1984 (STS-41G) and, possible, November 1984 (STS-51B). As the ions pass through the detector stack, they will leave microscopic damage trails which can be analyzed after the payload returns to earth in order to determine the properties of the ions encountered during the flight. The results of the experiment will be used to improve theoretical models of the near-earth particle radiation environment and more reliably predict the effects of this radiation on space-borne microelectronics.

Efforts this year have centered on the fabrication, assembly, and testing of payload components. Much of the payload was constructed in the Academy's Technical Services Department shops from plans developed last year. Certain components were tested in the Physics Department laboratories and delivered to Naval Research Laboratory in early May for installation of the track detectors and batteries and for final assembly and testing. It is expected that the completed payload will be turned over to NASA in early July for integration into the Space Shuttle and its eventual launch on 30 August 1984. Data analysis will commence shortly after the return of the apparatus to Naval Research Laboratory in mid-September.

Experimental Hydrodynamic Studies on Various Keel Design

RESEARCHER: MIDSHIPMAN 2/C MARGARET MENZIES
ADVISER: ASSISTANT PROFESSOR MURRAY S. KORMAN

The design of individual keels has been investigaged to optimize the experimental study of Drag and other Reynold's Number effects. Two standard keels, a winged keel and a bulbed keel, have been completed. This summer the Rickover Hall shop will build them. A model hull previously built will be used with the keels, and towing tests are expected to start in the Fall of 1984. The final investigation will include a design analysis, an experimental analysis, a performance analysis, and some mention of the scaling problems one usually finds.

Publications

ALBERT, C. Elise, Assistant Professor, **"Neutral Interstellar Gas in the Lower Galactic Halo,"** *The Astrophysical Journal*, 272 (15 September 1983), 509-539.

Optical interstellar absorption lines of TiII, CaII and NaI, and the 21cm emission line of HI have been observed at high resolution and high detection sensitivity toward nine pairs of nearly aligned distant halo stars and foreground disk stars with well-determined distances. Analysis of the column densities, velocities, and the directly determined variation of the titanium abundances with z-distance leads to a general picture of the neutral interstellar material in the lower galactic halo. Two types of gas with distinct distribution, kinematics, and abundances are found: a thick, low-velocity disk (Type A) extending from the plane to well beyond the thin disk of OB stars; and a high-velocity, much less strongly depleted gas (Type B) observed only at high z-distances, which constitutes at least 24% of the mass of the halo gas. The observed velocity distribution does not agree well with that predicted by a model corotating halo. The possible origins of the observed gas and its connection with QSO absorption lines are discussed.

ALBERT, C. Elise, Assistant Professor, co-author, **"Do Blue Stragglers Mimic Normal (Population I) OB Stars?"** *Bulletin of the American Astronomical Society*, 15 (1983), 969.

Crucial to investigations of the galactic halo is whether low luminosity, low mass field stars analogous to UV-bright stars in globular clusters can produce spectra so similar to those of luminous massive Population I OB stars that the two types of objects could be systematically confused. Classification spectra for five UV-bright stars, whose globular cluster membership has been determined by proper motion studies, were obtained with the Garrison prime focus spectrograph at the 3.8 meter Canada-France-Hawaii Telescope. Spectra of the OB standard stars were taken with the same system at the 72" telescope of the David Dunlop Observatory. Of the three UV-bright stars which have well-exposed spectra, none can be confused with normal Population I stars.

BRILL, Donald, Professor, co-author, **"Mechanical Eigenfrequencies of Axisymmetric Fluid Objects; Acoustic Spectroscopy,"** *Acustica*, 53(1983), 11-18.

Echoes of acoustic waves reflected from elastic targets carry within them certain resonances features caused by the excitation of the eigenvibrations of the target. By means of a suitable background subtraction it is possible to isolate the target's spectrum of resonances. This resonance spectrum characterizes the target just as an optical spectrum characterizes the chemical element or compound that emits it. Extracting the resonance information from the echo allows the possibility of identifying the target as to its size, shape, and composition. This is illustrated here by studying the dependence of the resonance spectra of fluid targets in vacuo upon changes of target shape. The target shapes are varied here from spheres to prolate spheroids and infinite-length cylinders. The resulting "acoustic spectroscopy" generates the same type of level scheme as in optics, and it may thus be used for solving some aspects of the "inverse scattering problem" (i.e., the problem of an identification of target shapes from the returned echoes).

BRILL, Donald, Professor, co-author, **"Interior and Exterior Resonances in Acoustic Scattering.I - Spherical Targets,"** *Nuovo Cimento B*, 76 (11 August 1983), 153-175.

In acoustic scattering from elastic objects, resonance features appear in the returned echo at frequencies at which the object's eigenfrequencies are located, which are explained by the excitation of interior creeping waves. Corresponding resonance terms may be split off from the total scattering amplitude, leaving behind an

apparently nonresonant background amplitude. This is demonstrated here for scatterers of spherical geometry and in a companion paper also for scatterers of arbitrary geometry, by using the T-matrix approach. For the case of near-impenetrable spheres, it is subsequently shown that the background amplitude can be split further into specularly reflected contributions, plus highly attenuated resonance terms which are explained by the excitation of exterior (Franz-type) creeping waves. The singularity structure of the scattering function is shown mathematically, by using the R-matrix approach of the nuclear-scattering theory, as that of a meromorphic function without any additional entire function (as had been postulated by the singularity expansion method).

BRILL, Donald, Professor, **"Feasibility Analysis of a Noise Control System,"** Report, David W. Taylor Naval Ship Research and Development Center/CSME—83/93, December 1983, (U).

Classified report.

BRILL, Donald, Professor, co-author, **"Electromagnetics and Acoustic Resonance Scattering Theory,"** *Wave Motion*, 5 (1983), 307-329.

The excitation of the eigenfrequencies of finite radar or sonar of inhomogeneities in elastic materials, of geological strata or of the entire earth by the impact of propagating waves (of electromagnetic or acoustic nature, or of ultrasonic, elastic, or seismic character, respectively) manifests itself in the appearance of poles in the resulting wave amplitudes, as described by the Resonance Scattering Theory (RST). In the complex frequency plane, these poles relate to the ringing of the scattering resonance. In the complex mode number plane, corresponding poles are connected with circumferential or creeping waves. An analytic relation between these two descriptions is indicated here, and a number of examples from the above-mentioned fields will be discussed. The researchers introduce the concepts of 'Acoustic Spectroscopy' and of 'Radar Spectroscopy', respectively, by exhibiting the target's resonance frequency spectrum in a form familiar from atomic spectroscopy, in order to study the shifting and splitting of resonances 'levels' under changes of target shape, and to provide possible solutions for the 'inverse problem' (i.e., determination of target properties from echo-properties — here resonant echoes).

BURT, Patricia E., Assistant Professor, co-author, **"Low Multipolarity Magnetic Transitions in ^{32}S Excited by Electron Scattering,"** *Physical Review*, C29 (March 1984), 713-721.

Electron scattering cross section measurements on ^{32}S have been made at incident electron energies between 34 and 74 MeV and at scattering angles of 162.4° and 180°. Form factors were deduced for transitions to states at 8.11, 9.68, 10.05, 10.78, 11.12, and 11.63 MeV. Additional peaks at 7.12, 12.02, and 13.36 MeV were observed in some spectra. Comparisons of cross sections at different angles show that the above six transitions are transverse. Comparison of the experimental form factors with those calculated using an oscillator shell model indicate that the 8.11, 9.68, 11.12, and 11.63 MeV transitions are M1. Transition probabilities B(M1) ↑ = 1.14 ± 0.18, 0.69 ± 0.20, 2.40 ± 0.22, and 1.26 ± 0.20 μ^2, respectively, were determined for these four transitions. The M1 form factors and transition probabilities are also compared with other theoretical shell model calculations. The transition at 10.78 MeV is probably M2, or a mixture of M2 and transverse E2 transitions to unresolved states at about that energy.

CORRELL, Francis D., Assistant Professor, co-author, **"Nuclear Moments of ^{9}Li,"** *Physical Review*, C28 (1983), 862.

The ground-state magnetic dipole and electric quadrupole moments of the β emitter ^{9}Li ($J^{\pi} = 3/2^{-}$, $T_{1/2} = 0.176$ s) have been measured for the first time. Polarized ^{9}Li nuclei were produced in the ^{7}Li(t,p) reaction,

using 5-6 MeV polarized tritons. The recoiling ^{9}Li nuclei were stopped either in Au foils or in $LiNbO_3$ single crystals, and their polarization was detected by measuring the β-decay asymmetry. Nuclear magnetic resonance techniques were used to depolarize the nuclei, and the resonant frequencies were deduced from changes in the asymmetry. The ^{9}Li dipole moment was deduced from the measured Larmor frequency in Au; the result, including corrections for diamagmetic shielding and the Knight shift, is $|\mu| = 3.4391(6)\ \mu_N$. The ratio of the ^{9}Li quadrupole moment to that of ^{7}Li was derived from their respective quadrupole couplings in $LiNbO_3$ the value is $|Q(^9Li)/Q(^7Li)| = 0.88 \pm 0.18$. Both results are in agreement with shell model predictions.

ELDER, Samuel A., Professor, **"Water-Flow-Induced Tones Associated with Resonant Fluctuations of a Free Flooding Cavity,"** *Journal of the Acoustical Society of America* 74 (1983), S113.

A towed-model apparatus designed to study nonresonant water-flow-induced cavity tones was found to exhibit strong fixed-frequency oscillation at certain speeds. Stationary ensonification of the model by means of a J9 projector disclosed six apparent resonances in the range 0-200 Hz, five of which could be excited by flow over the cavity. Accelerometer measurements of the cavity wall vibration are consistent with the hypothesis that the acoustic oscillation is due to fluctuations in the chamber cross section. The strongest mode was found to occur at a Sroubal number predictable by a formula previously derived for air pipetones.

ENGLE, Irene M., Associate Professor, **"UV Image of Comet Kohoutek Ion Tail,"** Naval Research Laboratory Report, September 1983.

On 25.9 December, 1973, a 1250-1600 A image of Comet Kohoutek was taken using the Naval Research Laboratory S-201 ultraviolet camera from Skylab 4. That image, taken in daylight, is believed to be that of an ion tail and, with the comet nucleus about 0.1818 AU from the sun, the nearest to the sun ion tail that had been this far observed. The investigators believed that the ion source was probably singly-ionized carbon. No specific spectroscopic data were available, but the various possible alternative ion species were considered and ruled out, either because of their spectra or their very short lifetimes. The singly-ionized carbon is fairly long-lived when produced and has two prominent emission lines in the solar spectrum, at 1334.5 and 1335.7 A°, respectively. Intensity profiles, calculated assuming scattering solar radiation as the source of the photons, have been calculated, using the observed image brightness contours and geometry of the comet orbit as control parameters. The results do not compare well with observations unless one assumes that the carbon ions, on the average, were nearly at rest with respect to the sun, which would mean a tailwind drift velocity of only about 36 km/sec, or, even more improbable, an absorption of solar photons emitted at the smaller wavelength but Doppler red-shifted by 265 km/sec are absorbed by the comet ions. This latter mechanism would require a precise tailwind drift velocity of 265-36 = 229 km/sec throughout the approximately 10^7 km extent of the tail.

FASNACHT, William E., Associate Professor, **"Prolate Spheroidac Harmonic Analysis on the Magnetic Field of a Trident Model Submarine,"** Report, David W. Taylor Naval Ship Research and Development Center, (U).

Paper is classified.

FONTANELLA, John J., Associate Professor, Mary C. WINTERSGILL, Assistant Professor, G. C. KOLODZIEJCZAK, Ensign, USN, and D. R. FIGUEROA, Visiting Professor, **"Radiation Induced Electrical Relaxation in Rare Earth Doped Calcium Fluoride,"** *Nuclear Instruments and Methods in Physics Research*, B1 (1984), 431-435.

The complex dielectric constant has been measured over the temperature range 5.5-39K at several audio frequencies for several different rare earths in calcium fluoride both before and after irradiation with ϒ-rays from a Co-60 source. The dose was about 10 rads. The observed effects depend strongly upon the nature and concentration of the rare earths. For 0.01 mol-% Sm, for example, the relaxation associated with the reorientation of a nearest neighbor charge compensator is eliminated by the radiation, and two new relaxations are found at lower temperatures. For 0.1 mol-% Sm, the results are different and can be attributed to rare earth clusters. In general, strong relaxations are induced in the regions where stable RII and RIII relaxations exist for small rare-earths in calcium fluoride. In addition, RIV is significantly diminished by the ϒ-rays. All of the effects are unstable, however, and measurements were made of the change in the radiation-induced effects with time. Some of the data are correlated with the results of thermoluminescence studies performed on similar materials.

FONTANELLA, John J., Associate Professor, Mary C. WINTERSGILL, Assistant Professor, and D. R. FIGUEROA, Visiting Professor, **"Anomalous Pressure Dependence of Dipolar Relaxation Times in Rare Earth Doped Lead Fluoride,"** *Physical Review Letters*, 51 (1983), 1892-1895; ONR Technical Report No. 13.

Electrical relaxation measurements at high pressure have been carried out on lead fluoride doped with lanthanum and cerium. A single, strong relaxation peak is observed and the relaxation time decreased with increasing pressure. This is contrary to the behavior exhibited by all known relaxations and can be explained by attributing the relaxation to a substantial trivalent rare-earth ion compensated either by an intersitial fluorine ion with a soft attempt mode or by an electron.

FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, **"Electrical Relaxation in Pure and Alkali Metal Thiocyanate Complexed Poly(ethylene oxide),"** *Solid State Ionics*, 8 (1983), 333-339; ONR Technical Report No. 6.

Audio frequency complex admittance and DSC studies have been performed on pure poly(ethylene oxide) (PEO) and PEO complexed with alkali metal thiocyantes over the temperature range 5.5-380K. The dielectric constant of the complexed materials is found to be greater than for pure PEO. A discontinuity in the conductivity is found which increases in temperature as the size of the cation increases. In every case, the discontinuity is associated with a feature in the DSC results. Next, some evidence is given that water may enhance the formation of amorphous complexed PEO. In pure PEO, α_a and ϒ relaxations are observed in good agreement with previous work. A thermal anomaly is found corresponding to α_a. In addition, α_c is identified in pure PEO. Very little difference is found for the ϒ relaxation between pure PEO and PEO-LiSCN and PEO-NaSCN. For PEO-KSCN, three distinct peaks are found in the ϒ relaxation region. These results are consistent with a $tg^{+}t \rightarrow tg^{-}t$ transition interpretation for ϒ where the cations reside within the helical channels at low temperatures.

FONTANELLA, John J., Associate Professor, Mary C. WINTERSGILL, Assistant Professor,

F. P. PURSEL, Ensign, USN, D. R. FIGUEROA, Visiting Professor, **"Effect of Pressure of Conductivity in Poly(ethylene oxide) Complexed with Alkali Metal Salts,"** *Solid State Ionic,* 9 & 10 (1983), 1139-1146; ONR Technical Report No. 7.

Audio frequency complex admittance measurement at a number of temperatures have been performed on PEO complexed with various alkali metal perchlorates and thiocyantes at pressures up to 0.3 GPa. In general, the activation volumes tend to increase with the size of both the cation and the anion. The trend is best explained if the ion transport mechanism involves both anions and cations. The results are in good agreement with the predictions of a dynamical diffusion theory with an attempt mode Gruneisen parameter appropriate for interchain vibrations. This implies that diffusion takes place via interstice-interstice hopping of the ions. Next, it is shown that free volume consideration lead to unreasonable results if T_0 is interpreted as the glass transition temperature. Finally, the effect of pressure on the activation volume is determined.

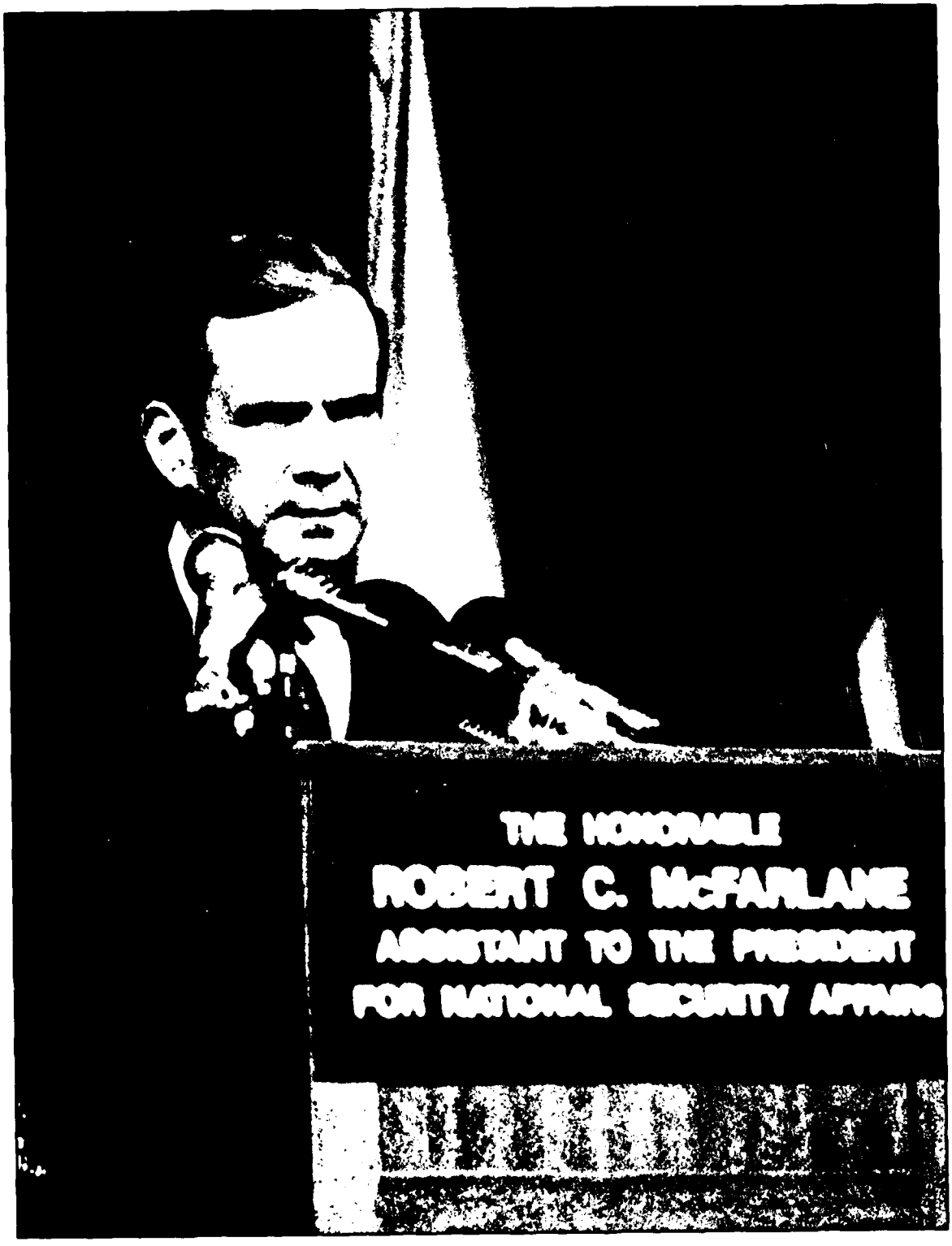
KORMAN, Murray S., Assistant Professor, **"Experimental Investigation of Nonlinear Crossed Beam Scattering in the Presence of Turbulence,"** *Journal of the Acoustical Society of America,* 71 (1983), 5301(A).

An experimental apparatus has been constructed to measure the nonlinear scattering of two mutually perpendicular crossed sound beams in the presence of turbulence (from a submerged water jet). Results are used to measure and characterize the turbulent flow. The pulsed beams (1.90 and 2.10 MHz) are generated from 1-in-diameter transducers, suspended from perpendicular radius arms that are free to rotate 360° in a horizontal plane. The transmitters and 4-MHz receiver are located 1 and 2 m from the interaction region, respectively. One experimental difficulty is the inability to distinguish between scattering from the interaction region and other nonlinear processes. As part of the calibration procedure the nonlinear scattering of a cylinder is investigated. Measurements show that scattering at angles near the main primary lobes are extremely difficult to measure due to the inability to separate out the scattered field of (a) one primary beam interacting with (b) the scattered linear field of the other primary beam from the cylinder. Preliminary results from the scattering by turbulence and by a cylinder will be presented.

RECTOR, Charles W., Professor, *Laser Damage and Effects Bibliography, Part I.* Journal Literature through 1982. 15 June 1984.

A listing is given of a computer-based bibliography on laser-induced damage and effects covered in the open journal literature through 1982. Although the computer entries are content-reyed in a detailed fashion, the listing here is only broken down into seven categories: I. General laser damage and energy/momentum coupling; II. Damage to optical materials; III. Laser plasma formation and characteristics; IV. Transmission and optical phenomena; V. Material testing/processing and applications; VI. Laser fusion; and VII. Bibliographies, background material, and books.

Division of U.S. and International Studies

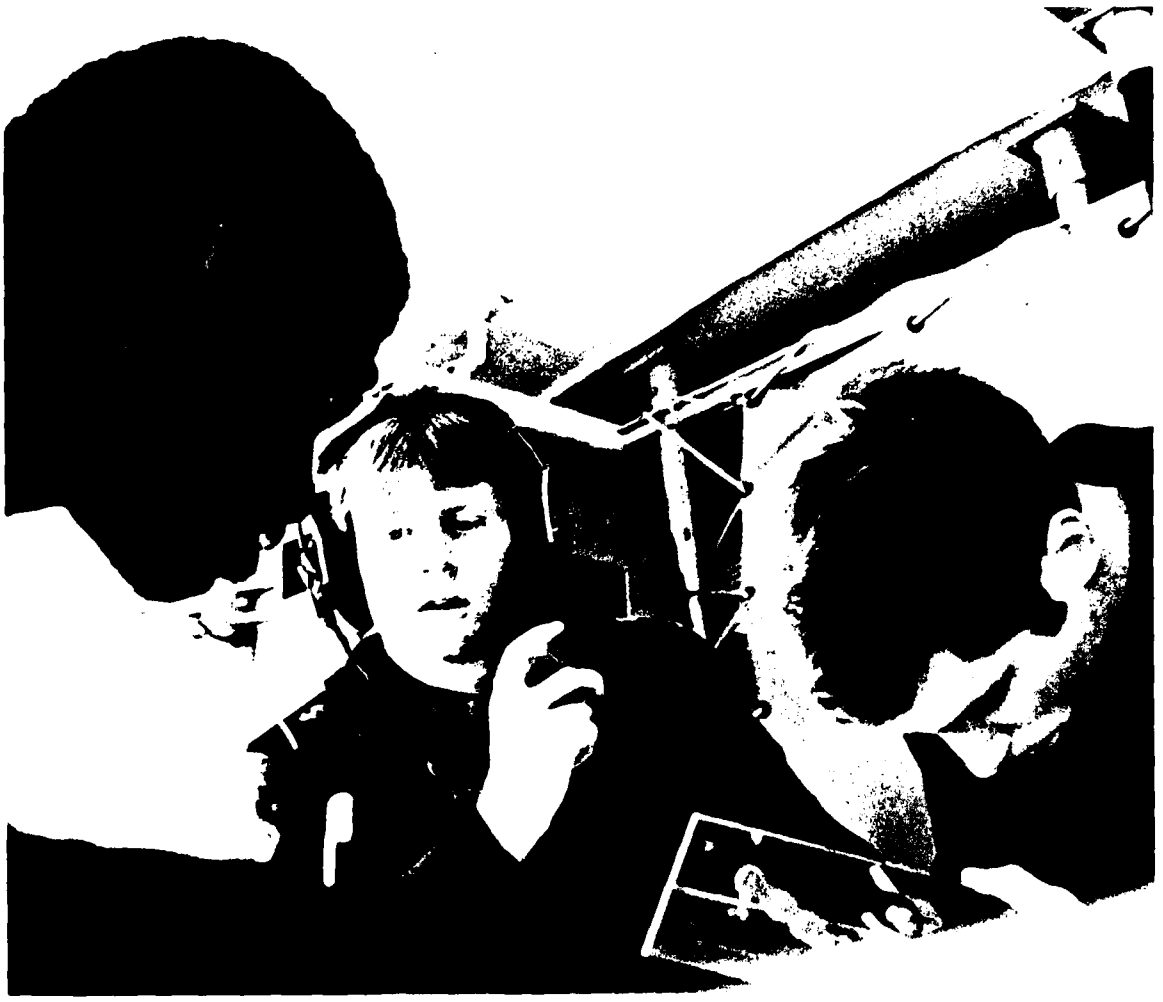


Presentations

MONTOR, Karel, Associate Professor, **"Methodology and Results of Using Engineering Equipment in the Analysis of Brain Waves,"** 20th Annual Meeting of Society of Engineering Science, Inc., University of Delaware, Newark, Delaware, 24 August 1983.

MONTOR, Karel, Associate Professor, **"Personality and Motivational Factors of U. S. Naval Academy Graduates as Indicators of Aviation Mishap Potential,"** 27th Annual Meeting of the Human Factors Society, Norfolk, Virginia, 13 October 1983.

SLATER, Charles B., Commander, MSC, USN, **"Psychology of Cancer"** and **"Death and Dying,"** Experimental Course in Understanding Cancer, sponsored by American Cancer Society and James Madison University, Harrisburg, Virginia, 16 April 1984.



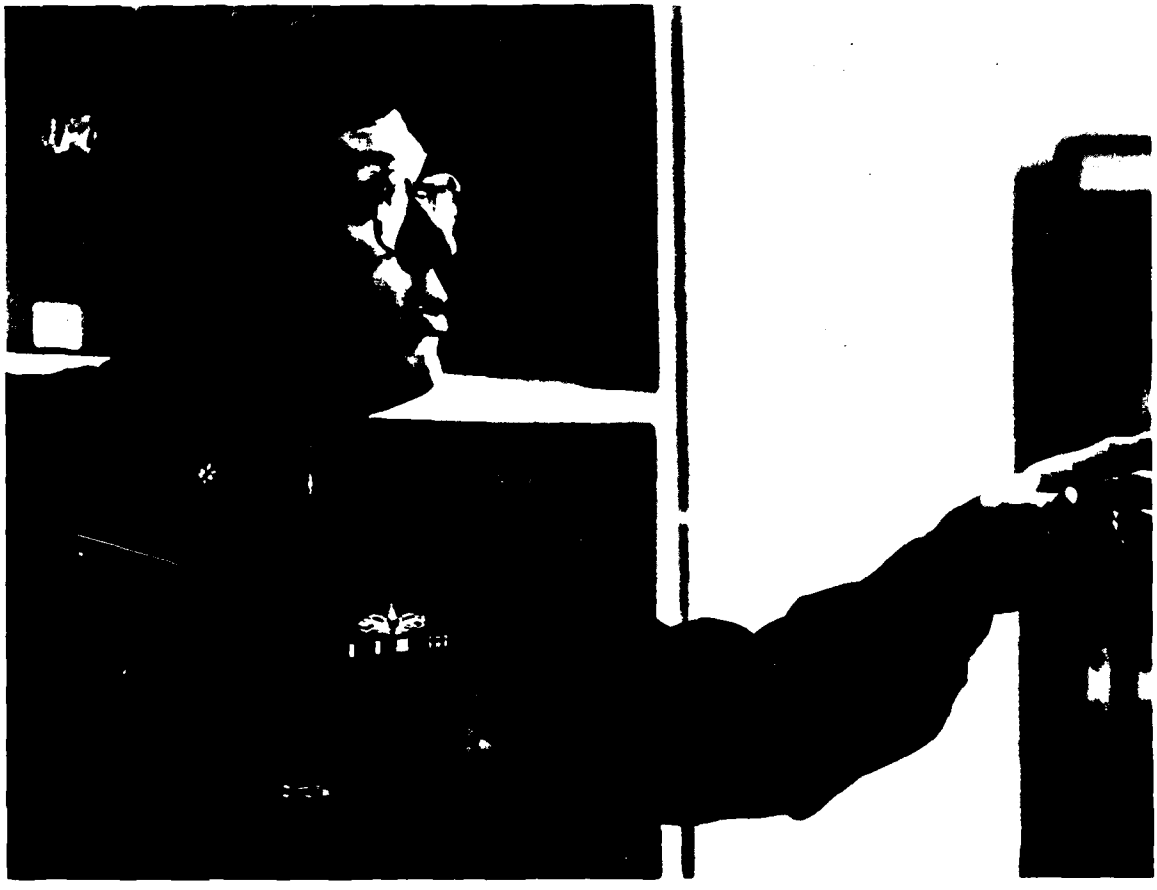
Publications

MONTOR, Karel, Associate Professor, and Anthony CIOTTI, Major, USMC, *Naval Leadership.* 3rd ed. Annapolis: Defense Printing Plant, 1983.

Midshipmen are presented with materials designed to inculcate them with an understanding and ability to use concepts related to the study of human behavior, motivation and learning, and reaction to conflict and frustration. Also included are materials related to moral leadership, the role of the naval officer, the personal qualities for effective leadership, the dynamic qualities of leadership, counseling and interviewing, discipline and morale, training, organization and administration, and the Code of Conduct for members of the Armed Forces of the United States.

BORRO, Ronald, Lieutenant Commander, USN, Harvey HOPSON, Major, USMC, Kevin McMAHON, Lieutenant Commander, USN, David MYERS, Lieutenant, USN, and Clayton SANDERS, Lieutenant, USN, *Law for the Junior Officer.* Annapolis: Defense Printing Plant, 1983.

Law for the Junior Officer presents the major aspects of military justice, administrative law, and the law of Armed Conflict as applicable to the newly commissioned officer. It strives to develop an awareness in the individual to develop professionalism and a high degree of self-accountability. The text includes sections on non-punitive measures, non-judicial punishment, courts-martial, substantive offenses and defenses, and U.S. Constitutional rights.



Developing a Video-Visual Means for the Layman to Recognize and Understand Heart/Artery Blockage

RESEARCHER: ASSOCIATE PROFESSOR KAREL MONTOR

Thirty-five millimeter artery/heart catheterization films were converted into various speed video tapes that graphically demonstrate to both doctors and laymen alike the extent and effect of heart/artery blockage along with an easily observed demonstration of the ejection fraction.

Demonstration of Classical Leadership Approaches Using Video

RESEARCHER: ASSOCIATE PROFESSOR KAREL MONTOR

The researcher developed electronic and visual means and techniques for using commercial films to teach midshipmen how a leader should act under various circumstances. The concept, recognized and tested, that today's college student's 15,000-18,000 hours of pre-college television viewing significantly affects their ability to learn and understand complex social interactions. By using films such as *Command Decision, Hell Cats of the Navy,* and *The Bedford Incident,* and others, midshipmen could see and understand what a leader should and shouldn't do.

Independent Research

Perceptual Processing

RESEARCHER: LIEUTENANT SUSAN C. COLLIGAN, MSC, USN

This research attempts to expand on previous research. The Rorschach is presented tachistoscopically with exposure times of 200 MS, 400 MS, and 600 MS. Initial research used three groups of 36 subjects, two of non-psychiatric subjects, and one of first-admission schizophrenics. Differences in exposure times did not produce significant results within any of the groups. Research is ongoing with a group of high functioning subjects (midshipmen) to further assess and explicate the processes involved in this complex perceptual task.

Developing a Myopia-Avoidance Protocol and Research Program

RESEARCHER: ASSOCIATE PROFESSOR KAREL MONTOR

The purpose of this research is to establish a procedure and techniques with the Johns Hopkins Medical School for the prevention of myopia in college students. This is a continuing program which has been in development for the past several years and will be coordinated with the USNA Medical Officer, other members of the Navy medical community, and ultimately the Surgeon General.

Developing a Nutritional Approach to Weight Loss

RESEARCHER: ASSOCIATE PROFESSOR KAREL MONTOR

There are literally hundreds of books on the market that provide approaches to weight loss but that do not provide sufficient information so that anyone can prepare a nutritional diet with the proper ratio of carbohydrates (60%), protein (30%), and fat (10%). During the reporting period, an approach was prepared that can easily be learned by others. It provides a method for an individual to insure that he not only obtains the necessary C-P-F ratio, but also ingests adequate amounts of vitamins, minerals, and amino acids along with an emphasis on salt reduction in the diet.

DEPARTMENT OF

Leadership and Law

COMMANDER THOMAS H. BERNS, USN
CHAIRMAN

Members of the Leadership and Law Department conduct various kinds of applied research in support of institutional objectives. To this end, research is directed toward the professional development of midshipmen to effectively and efficiently become tomorrow's leaders of the fleet and Marine Corps.

While not reported in detail, the Department's ongoing efforts to determine the best way for counseling midshipmen and providing them with improved study materials continued, and saw the development of video instructions prepared by both the Naval Systems Engineering Department for studying EN100 (Introduction to Naval Engineering), and the Mathematics Department for studying mathematics.

Division of Professional Development

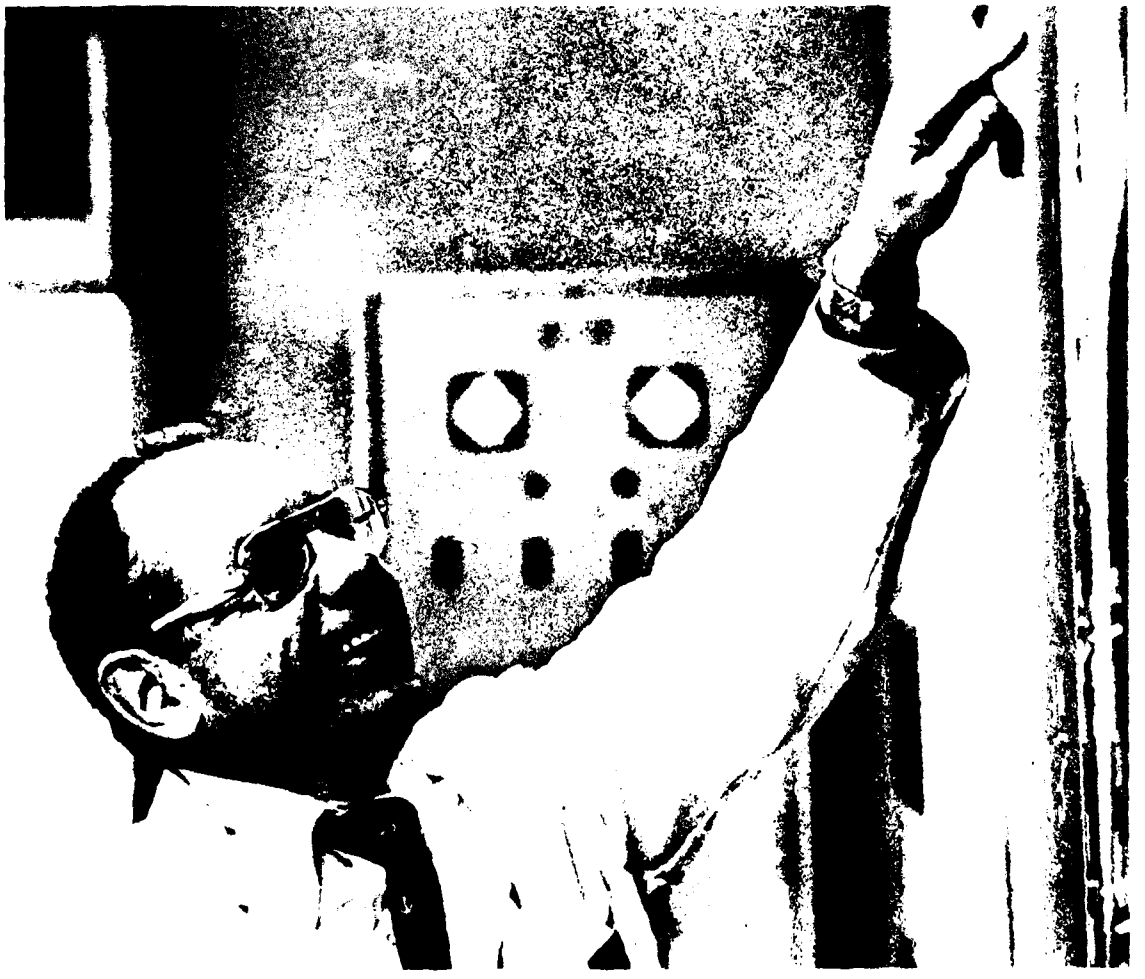
KORMAN, Murray S., Assistant Professor, **"Report on the Distribution of Educational Films and Other Audio-Visual Aids in Secondary Schools Across the USA,"** Technical Committee on Education in Acoustics, Acoustical Society of America, Norfolk, Virginia, 6-10 May 1984.

TANKERSLEY, Lawrence L., Associate Professor, co-author, **"Limitations on the Third-Harmonic Conversion of Xenon Fluoride Laser Radiation,"** Optical Society of American Annual Meeting, New Orleans, Louisiana, 20 October 1983.

TANKERSLEY, Lawrence L., Associate Professor, co-author, **"High Energy VUV Pulse Generation by Frequency Conversion,"** Second Topical Meeting on Laser Techniques in the Extreme Ultraviolet, Boulder, Colorado, March 1984.

TREACY, Donald J., Professor, co-author, **"Structure and Bonding in the Mixed Chalcogenide System $As_2S_xSe_{3-x}$,"** Tenth International Conference on Amorphous and Liquid Semiconductors, Tokyo, Japan, 22-26 August 1983.

TREACY, Donald J., Professor, co-author, **"Raman Scattering of the Mixed Chalcogenide Glass System $As_2S_xSe_{3-x}$,"** Tenth International Conference on Amorphous and Liquid Semiconductors, Tokyo, Japan, 22-26 August 1983.



Presentations

ALBERT, C. Elise, Assistant Professor, co-author, **"Do Blue Stragglers Mimic Normal (Population I) OB Stars?"**, American Astronomical Society, Las Vegas, Nevada, 10 January 1984.

BRILL, Donald W., Professor, co-author, **"Acoustic Resonance Scattering by an Elastic Cylinder — Theory and Calculations Behind a Recent Experiment,"** 11th International Congress on Acoustics, Paris, France, 19-27 July 1983.

BRILL, Donald W., Professor, co-author, **"Acoustic Resonance Scattering by a Cylindrical Shell,"** 106th Meeting of the Acoustical Society of America, San Diego, California, 11 November 1983.

BRILL, Donald W., Professor, co-author, **"Exterior Surface Acoustic Waves Scattered by Impenetrable Cylinders,"** 107th Meeting of the Acoustical Society of America, Norfolk, Virginia, 9 May 1984.

BRILL, Donald W., Professor, co-author, **"Resonance Scattering by an Elastic Cylinder in Water — Theory and Experiment,"** 105th Meeting of the Acoustical Society of America, Cincinnati, Ohio, 13 May 1983.

CORRELL, Francis D., Assistant Professor, co-author, **"The Sensitivity of the d*α Breakup to n-p Forces,"** Tenth International Conference on Few-Body Problems in Physics, Karlsruhe, Federal Republic of Germany, 21-27 August 1983.

CORRELL, Francis D., Assistant Professor, co-author, **"Some Quasifree and Final-State Interactions in ^{12}H(t,pt)n Reactions at 18 and 24 MeV,"** Meeting of the American Physical Society, Washington, D.C., 23-26 April 1984.

ELDER, Samuel A., Professor, **"Science and the Bible,"** Towson State University New Life Club, Towson, Maryland, 3 May 1984.

ENGLE, Irene M., Associate Professor, **"The Committee on the Status of Women in Physics,"** Symposium of the American Chemical Society, Washington, D.C., 1 September 1983.

FONTANELLA, John J., Associate Professor, and Mary C. WINTERSGILL, Assistant Professor, F. P. PURSEL, Ensign, USN, and D. R. FIGUEROA, Visiting Professor, **"Effect of Pressure on Conductivity in Poly(ethylene oxide) Complexed with Alkali Metal Salts,"** Fourth International Conference on Solid State Ionics, Grenoble, France, 4-8 July 1983.

JENNETTE, Robert L., Research Professor, **"Low Frequency Transmission Loss in the Chesapeake Bay,"** United States Naval Academy, Annapolis, Maryland, 10 December 1983.

KORMAN, Murray S., Assistant Professor, **"Scattering from Crossed Ultrasonic Beams in the Presence of Turbulence,"** Acoustics Division, Naval Research Laboratory, Washington, D.C., 15 May 1983.

Group II materials tend to degrade. In basic research, interest has centered on Group I materials and of these polyethylene has been studied most intensively. Applied materials research has investigated a variety of polymers, particularly those used in cable insulation, and those used in ion beam lithography of etch masks. Currently there is also great interest in enhancing the conducting properties of polymers, and these uses would tend to involve the doping capabilities of ion implantation, rather than energy deposition.

WINTERSGILL, Mary C., Assistant Professor, FONTANELLA, Associate Professor, and D. R. FIGUEROA, Visiting Professor, **"Dielectric Relaxation in Poly(ethylene oxide) Complexed with Alkali Metal Perchlorates,"** *Solid State Ionics,* 11 (1983), 151-155; ONR Technical Report No. 8.

Audio frequency complex admittance measurements over the temperature range 5.5-350K have been performed on *poly(ethylene oxide) (PEO)* complexed with lithium and sodium perchlorates. No evidence of an α_a relaxation was seen in any sample. In the Li-complexed material, the Υ relaxation occurs at about 174K and 1000 Hz which is the same as for pure PEO. In the Na-complexed materials, there appear to be more than one peak in this region, and the relative peak heights are concentration dependent. The result is that at the 8:1 doping level, there is a broad, skewed relaxation whose peak occurs at about 203K and 1000 Hz, while at 4.5:1 $NaClO_4$ the relaxation appears much closer to a normal peak with a maximum at 185K for the 1000 Hz data. Combined with previous results for thiocyanate complexed PEO, these results show that distortions in the polymer chain depend on both the cation and anion. Next, two new relaxations are observed at low temperatures. The first, occurring at 60-100K, is very weak and is common to all PEO samples. The second occurring at very low temperatures is only found for perchlorate complexed PEO and is attributed to the localized motion of perchlorate-induced defects on the exterior of the chains. The high temperature electrical conductivity for PEO_8: $NaClO_4$ is found to be larger than PEO4.5:$NACIO_4$ in agreement with the trend observed by other workers for PEO complexed with different alkali metal salts.

WINTERSGILL, Mary C., Assistant Professor, John J. FONTANELLA, Associate Professor, and F. P. PURSEL, Ensign, USN, **"Electrical Relaxation in Rare Earth Doped Cubic Lead Fluoride,"** *Radiation Effects,* 75 (1983), 263-266; ONR Technical Report No. 5.

Audio frequency complex impedance measurements are performed over the temperature range 5.5-380K on lead fluoride doped with eleven rare earths, yttrium and lanthanum at various concentrations. It is found that the complexity of the relaxation spectrum increases as the size of the trivalent ion decreases. Specifically, for the largest rare earths, only one relaxation is found. That relaxation is different from the cases in the alkaline earth fluoride where only one relaxation is observed in that the reorientation enthalphy depends strongly upon ion size. Double-doped samples are studied to determine whether the relaxation is due to a simple site or a cluster. For the smallest rare earths, however, at least nine relaxations are found. The concentration studies indicate multiple relaxations for certain sites. Both simple sites and clusters are observed for small rare earths.

TREACY, Donald J., Professor, co-author, **"Structure and Bonding in the Mixed Chalcogenide System $As_2 S_x Se_{3-x}$"**, *Journal of Non-Chrystalline Solids*, 59 & 60 (1983), 847-850.

There exists considerable controversy in relating the optical and electronic properties of chalcogenide glasses to specific structural models. ^{75}AS Nuclear Quadrupole Resonance (NQR) lineshape measurements have been performed on the mixed amorphous chalcogenide system $AS_2S_xSe_{3-x}$. The data were obtained at 77K utilizing a spin-echo technique. The NQR lineshapes are asymmetric and approximately 8 MHz in width (full width at half maximum). The resonance frequencies corresponding to both the intensity maximum and the "center of gravity" of the line increase monotonically with increasing *x*. The experimental lineshapes cannot be described in terms of a linear superposition of the spectral features attributable to pure As_2S_3 and AS_2Se_3. A mixed chalcogenide system exhibiting phase separation on a scale of more than several atomic sites would presumably *display such a superposition due to the short* range nature of the nuclear electric quadrupole interaction. The NQR results are thus consistent with the presence of structural units in the mixed chalcogenides t' at are absent in the pure "parent" compounds. Structural models consistent with the observed shift in NQR frequency (as a function of composition) will be discussed. NQR for annealed samples will be presented as well.

TREACY, Donald J., Professor, co-author, **"Raman Scattering of the Mixed Chalcogenide Glass System $AS_2 S_x Se_{3-x}$"** *Journal of Non-Crystalline Solids*, 59 & 60 (1983), 975-878.

Polarized room temperature Raman spectra of glassy $As_2Se_xS_{3-x}$ for $0 \leq x \leq 3$ have been measured using the near infrared 7525 and 7993 A° lines of a Krypton laser. The phonon bands measured in the alloys are near those observed in glassy As_2S_3 (~ 340 cm^{-1}) and As_2Se_3 (~ 240 cm^{-1}). However, the alloy bands exhibit unexpected intensity and shape dependences on light polarization and sample composition. For $0.5 \leq x \leq 2.0$ the band at 240 cm^{-1} is split into two peaks at 235 and 255 cm^{-1} which depend differently on light polarization and sample composition. The reported results cannot be described in terms of a simple linear combination of the Raman scattering intensity associated with glassy As_2S_3 and AS_2Se_3. This observation contrasts previous infrared reflectivity studies by Felty, Lucovsky and Myers (1967) of the same glassy systems which could be interpreted in terms of a linear combination of the end member compounds. Structural models consistent with the observed Raman spectra will be presented. Measurements of the compositional dependence of the polarized low frequency (< 50 cm^{-1}) Raman spectra are also reported and the observations to proposed models for intermediate range order are related.

WINTERSGILL, Mary C., Assistant Professor, **"Ion Implantation in Polymers,"** *Nuclear Instruments and Methods in Physics Research*, B1 (1984), 595-598; ONR Technical Report No. 9.

An introductory overview will be given of the effects of ion implantation on polymers, and certain areas will be examined in more detail. Radiation effects in general and ion implantation in particular, in the field of polymers, present a number of contrasts with those in ionic crystals. The most obvious difference is that the chemical effects of both the implanted species and the energy transfer to the host may profoundly change the nature of the target material. Common effects include crosslinking and scission of polymer chains, gas evolution, double bond formation and the formation of additional free radicals.

Research has spanned the chemical processes involved, including polymerization reactions achievable only with the use of radiation, to applied research dealing both with the effects of radiation on polymers already in commercial use and the tailoring of new materials to specific applications. Polymers are commonly divided into two groups, in describing their behavior under irradiation. Group I includes materials which form crosslinks between molecules, whereas

DEPARTMENT OF

Economics

PROFESSOR ROGER D. LITTLE
CHAIRMAN

The consuming research-related activity of the Department during the past year was a conference co-sponsored with the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics) on "The All-Volunteer Force After a Decade: Retrospect and Prospect." The conference, and the forthcoming book of edited conference proceedings, is in keeping with the Department's goal of encouraging defense-related research. Both in terms of contacts with researchers in the military manpower area and future financial support for manpower research, the conference will have significant long-run benefits to the Department. An abstract of a paper by Professor Little and Major Wolf summarizing the conference proceedings is contained under "Publications" in this section.

The six publications this year devoted to defense-related research are clearly evidence of the Department's contributions to this general area of inquiry. Research projects currently in progress, one sponsored and one independent, as well as two midshipmen projects, also address defense-related questions. In addition, the Department's growing research capability is apparent in the areas of monetary economics, environmental issues, labor studies, and development economics.

Although the project summaries are not included in this volume, all First Class midshipmen in the Department are required to produce during their last semester a research paper requiring extensive data collection and manipulation. This year our research seminar sections were devoted to (1) analysis of

data from the National Longitudinal Survey (labor economics), (2) efficiency of non-profit institutions, (3) modeling the behavior of firms, and (4) analysis of the defense acquisition process. Successful completion of this course prepares midshipmen well for understanding the process of research that goes into studies comparable to a masters degree thesis.

Sponsored Research

Delinquency Behavior of Servicemen and Potential Recruits

RESEARCHERS: PROFESSORS J. ERIC FREDLAND, ROGER D. LITTLE, AND JOHN A. FITZGERALD (POLITICAL SCIENCE)

SPONSOR: DEPARTMENT OF DEFENSE

The objective of the work is to compare delinquent behavior of those in the military and those interested in joining it with delinquent behavior of peers who are not in the military and are not interested in joining. The data-set used is the National Longitudinal Survey New Youth Cohort. Various univariate and multivariate statistical techniques are being used to explore the question. Specific objectives are to identify important delinquency variables and to determine what kind of delinquent behavior is "average" for the youth population in general and to compare that with the delinquent behavior by those in the military and with those not serving but interested in joining. These comparisons are being made controlling various socioeconomic characteristics which may also be associated with delinquent behavior. Preliminary statistical work has been completed. The remainder will be completed in the summer of 1984.

Independent Research

Socioeconomic Status of World War II Veterans: An Empirical Test of the Bridging Hypothesis

RESEARCHERS: PROFESSORS J. ERIC FREDLAND, AND ROGER D. LITTLE

This manuscript, which is the first-ever test of a socioeconomic hypothesis concerning experiences of veterans that might contribute to future income or status, was revised for the *Social Science Quarterly*. The revision extended the analysis to include data from both 1966 and 1969. Additionally, a summary table was developed which identifies more clearly those socioeconomic experiences of veterans which enhance income and status. The researchers conclude that the bridging hypothesis is too broad. What really matters is education and training.

Rural Informal Sector Employment Generation

RESEARCHER: ASSOCIATE PROFESSOR ARTHUR GIBB, JR.

The Equity Policy Center (EPOC), an international research organization concerned with women's employment and livelihood in developing countries, has a program of research into food preparation and marketing activities. The work involves designing a regional research framework within which the next stage of Equity Policy Center's field research will be undertaken. This stage will extend the purview of the program beyond secondary cities (of 100-500,000 population) to the hierarchy of tertiary urban areas found in agricultural regions. It will attempt to establish the precise place of food preparation and marketing activities in regional development, using the researcher's "rural informal sector" model. The proposed field research will be in the Philippines.

Flat-Rate Tax Proposals and Impact on Housing Demand

RESEARCHER: ASSOCIATE PROFESSOR RAE JEAN B. GOODMAN

This research is investigating the impact on housing and other related industries of the flat-rate tax proposals currently in Congress. The impact on housing and housing-related industries of proposals such as the elimination of the mortgage interest deduction should be severe.

The Federal Reserve System's Role in Electronic Funds Transfer Clearing Provision

RESEARCHERS: ASSOCIATE PROFESSOR RAE JEAN B. GOODMAN,
ASSISTANT PROFESSOR THOMAS A. ZAK, *ET AL*

This study, establishing a framework for discussing public provision of services generally with especial attention to the Federal Reserve System's current electronic funds transfer (EFT) payments clearing activity, consists of four sections.

Section I reviews the history and evolution of the Federal Reserve System's (FED) participation in the provisions of payments mechanisms for interbank settlement and describes institutional features that have shaped the supply and marketing of these services by both the FED and private consortia.

Section II discusses the general theory of public provision of services. Especial attention is paid to the role of the FED in the EFT market and the issue of cross-subsidization and generalized subsidy of services used by firms subject to regulation. The model presented presumes the regulator/provider maximizes bureaucratic or organization slack. Such an enterprise has an independent, internal, incentive to enter an otherwise competitive market and, potentially, supply services at *less than* marginal cost. This conclusion, without relying on typical voting or public choice related arguments, holds that political forces induce redistribution to favored supporters by altering relative prices. Apparent commercial bank resistance to the FED EFT provision is examined in the context of alleged service subsidization by the FED.

This section also examines the public goods character of payments mechanisms generally. Efficient usage of the system depends on either (1) homogeneous transactors and their banks or (2) interbank post-transaction settlements.

Section III sets out various alternative explanations for the FED's present role as both a regulator and supplier of EFT (and check clearing) services. These motives include (1) system security, (2) minimization of commercial risk of system failure, (3) economies of scale, (4) promotional pricing, and (5) the connection between payments mechanisms and the proper control of monetary aggregates. Section IV concludes the study by summarizing results.

Estimating Forest Recreation Values Using Existing Data: A Case Study of the White Mountain National Forest

RESEARCHER: ASSOCIATE PROFESSOR F. REED JOHNSON

This study was to determine whether defensible use and value estimates could be made from data that is routinely collected and reported by the Forest Services. It was found that the widest coverage across recreation settings can be obtained from the Law Enforcement Management and Reporting System (LEMARS) data. By merging visitor data from LEMARS with site-characteristic data from the Recreation Information Management data, it is possible to estimate satisfactory willingness to pay values. The results have been issued as a technical report and two manuscripts have been submitted to journals for publication.

Research Course Projects

Navy ACOL Retention Model for USNA Computer System (NATS)

RESEARCHER: MIDSHIPMAN 1/C THOMAS S. LEACH
ADVISER: ASSOCIATE PROFESSOR WILLIAM R. BOWMAN

The Annualized Cost of Leaving (ACOL) model is an aggregate model of retention behavior. It was originally written in APL for the IBM 370 series and was converted by Paul Van Langren to Fortran IV in the spring of 1983 for use on the IBM 3033 computer at the Naval Postgraduate School in Monterey, California. The goal of this independent study was to convert the ACOL model to the USNA computer system so that future students can utilize ACOL in their Defense Management classes.

As ACOL is presently set up, students who need to use ACOL must have their storage increased to 200K in order to successfully create the files in their catalogs that can accommodate ACOL and the data. It would be desirable for NATS to store ACOL permanently and the data sources so that anyone can utilize ACOL by using OLD format.

Incentive Contracting in DOD

RESEARCHER: MIDSHIPMAN 1/C MICHAEL M. WILSON
ADVISER: ASSOCIATE PROFESSOR WILLIAM R. BOWMAN

The major purpose of this study was to investigate various economic aspects of the major types of defense contracting. While most contracts are assumed to focus primarily on profit maximization, this is not always the case. In a majority of cases, it has been proven that contractors will optimize, not maximize, profits.

Some of the difficulties with incentive contracting are documented, and selected supplements to increase incentive contracting efficiency are proposed. These include choosing a contract based individually on the project that will minimize costs and maximize benefits to both contractor and the government; implementing a solid second source program whenever applicable; placing heavy emphasis on extra-contractual incentives; placing Cost Plus Incentive Fee contracts up and above original contract to increase communication; continually updating contract as major project changes occur; and focusing incentive contracts, where applicable, on profit optimization as distinct from profit maximization.

An Economic Analysis of the Unification, Industrialization, and Recovery from Destruction of the German Nation

RESEARCHER: MIDSHIPMAN 1/C MARK V. CANNICE
ADVISER: PROFESSOR CLAIR E. MORRIS

The intent of this project was to investigate the role of economic forces in the emergence of Germany as a world industrial power, 1840-1960. The "stages of development" model proposed by Walt W. Rostow was used as the basis for organizing, analyzing, and testing the data relating to Germany's growth. Evidence was collected on population changes, rural-urban changes, capital-output ratios, trade structure changes, and changes in labor force pattern and the involvement of government in economic affairs.

The conclusions were not entirely unanticipated but were nevertheless revealing. Some of the evidence, like changes in population and trade structure, fit the model very nicely, but other series could not be easily interpreted as following a "stages" trend of development. Problems of timing and stage-overlap led to the ultimate conclusion that Rostow's model could not be confirmed by the evidence.

Publications

BOWMAN, William R., Associate Professor, **"Crucible Steel Approach,"** *The Dislocated Worker*, W. H. Kolberg, ed., Washington, D.C.: Seven Locks Press, 1983.

The Crucible Steel Plant in Midland, Pennsylvania, was the first steel plant to use Quality Circles, the Japanese labor-management tool, as well as the first to develop and operate a labor-management outplacement program for its displaced hourly workers. The program is described in detail, noting both successes achieved and problems incurred. Today the Crucible Plant has begun a more extensive retraining program to supplement the outplacement activities that still form the basis for all its reemployment efforts.

BOWMAN, William R., Associate Professor, **"Grant Applications Guide for JTPA,"** Private Sector Initiative Program Technical Report, August 1983.

This technical report provides a "how to" procedure for firms and labor groups to apply for state and federal financial assistance through the Job Training-Partnership Act Program for Dislocated Workers. The objective of the report is to explain clearly the necessary steps that must be taken in filing for the government grants, including a step-by-step sample proposal.

BOWMAN, William R., Associate Professor, **"Worker Assistance Center Guide for JTPA Title III Programs,"** Private Sector Initiative Program Technical Report, August 1983.

This technical report describes in detail how firms and labor groups, in conjunction with local government employment agencies, can set up a complete, "one-stop" worker assistance center for displaced workers. Included in the description are step-by-step procedures necessary to plan, implement, operate, and close such a facility.

FREDLAND, J. Eric, and Roger D. LITTLE, Professors, **"Job Satisfaction Determinants: Differences Between Servicemen and Civilians,"** *Journal of Political and Military Sociology*, 11 (Fall 1983), 265-280.

Univariate analysis indicates that job satisfaction in the military is lower than in the civilian sector. Multivariate analysis demonstrates that military service itself, or the personal characteristics of servicemen, exert little independent influence. Rather, differences in specific elements of satisfaction which have policy implications — feelings that the experience will be valuable later, for example—account for most of the difference. Racial differences and the likelihood of being married also suggest some policy alternatives. A small segment of each service who report being very satisfied with their military job appear to be influenced by different job satisfaction factors than the majority.

FREDLAND, J. Eric, and Roger D. LITTLE, Professors, **"Educational Levels, Aspirations, and Expectations, of Military and Civilian Males, Ages 18-22,"** *Armed Forces and Society*, 10 (Winter 1984), 211-228.

Differences between servicemen aged 18-22 and males of the same age who have never served are examined with respect to three dimensions of manpower quality: educational levels, aspirations, and expectations. The analysis is disaggregated by racial/ethnic group and by branch of service. Among whites, those in the military are found to have less education than their civilian counterparts while among blacks and Hispanics, those in the military have more education than those in the civilian sector. Service members of all three racial/ethnic groups have higher educational aspirations than their civilian counterparts. Further, service members in all three groups expect to get more education than do those in the civilian sector.

GOODMAN, Rae Jean B., Associate Professor, **"An Assessment of Recent Changes and Proposals in S&L Taxation,"** Research Working Paper No. 43, Federal Home Loan Bank Board, September 1983.

This paper reports on an analysis of the effects of the Tax Equity and Fiscal Responsibility Act of 1982, the Garn St. Germain Depository Institutions Act of 1982, the President's Commission on Housing proposed mortgage interest tax credit, and the experience method for savings and loan associations for 1983 and 1984. The analysis utilized data which are projections from the Federal Home Loan Bank Board's Savings and Loan Industry Model (SLIM).

The primary results are: (1) The Tax Equity and Fiscal Responsibility Act changes will increase S&L tax liability by 10 to 40 percent relative to the pre-1983 tax system. (2) The Garn St. Germain Depository Institutions Act could increase S&L taxes slightly if S&Ls took advantage of extended asset powers to the point of acting as savings banks. (3) The mortgage interest tax credit would increase S&L tax liability by 35 to 81 percent if S&Ls did not change their portfolio composition in response to the new tax system. (4) Given the experience factors investigated, S&L taxation under the experience method could increase by up to 40 percent of the current tax liability.

GOODMAN, Rae Jean B., Associate Professor, **"Analysis of the President's Commission on Housing's Proposal of a Mortgage Interest Tax Credit,"** Research Working Paper No. 46, Federal Home Loan Bank Board, August 1983.

This paper presents the results of an investigation of the effect on savings and loan associations for the 1975-80 period of the mortgage interest tax credit proposed by the President's Commission on Housing. The tax proposal is a mortgage interest tax credit available to final investors (holders) of mortgages or mortgage-backed securities, computed as a percentage of the mortgage interest earned. Eligibility for the tax credit would be based on net new mortgage flows; the level of the tax credit would depend on the interest income from mortgage assets. The report of the President's Commission discussed both a fixed-rate tax credit and a graduated tax credit.

The conclusions of the study are: (1) A constant-rate tax credit of 2 percent for S&Ls investing 40 percent or more of all net new funds in mortgages would provide, in general, a break-even point with the current tax system. (2) A step-graduated tax credit ranging from 1.0 to 2.5 percent with a 40 percent or greater investment of net new funds in mortgages would provide a tax-neutral situation. (3) A graduated tax would supply additional incentives for mortgage investment relative to a constant-rate tax credit. (4) A tax credit covering a much greater range in portfolio investment in mortgages would provide incentives for new entrants into the market. (5) There should be some form of eligibility requirement linking to annual mortgage flows to prevent any windfall gain to one-time mortgage issuers (holders). (6) There are significant arguments to support a mortgage interest tax credit relative to the current tax system.

JOHNSON, F. Reed, Associate Professor, co-author, **"Estimating the Impacts of Forest Management on Recreation Benefits: Application with Reference to the White Mountain National Forest,"** Resources for the Future, Discussion Paper No. D-115, December 1983.

This paper reports the results of a study of recreation values on the White Mountain National Forest. Travel cost models are used to estimate use and willingness to pay for forest recreation as a function of natural and managed site characteristics. Law enforcement data is used to obtain origin and destination data on visitors. Biases in the sample are corrected in specifying the regression equations. The study concludes that it is possible to obtain accurate values using data that is routinely collected and reported throughout the National Forest system.

JOHNSON, F. Reed, Associate Professor, **"A Prospectus for Environmental Benefits Research at EPA,"** EPA Office of Policy Analysis, January 1984.

This report surveys past and current environmental benefits research funded by EPA in view of several published research agendas and the economic theory of information. The impact of funded research on EPA policy and regulatory activities is discussed. Based on a projection of likely future regulatory actions, the paper identifies areas of high priority research and outlines specific research objectives and tasks. Despite progress that has been made in several areas of nonmarket value estimation, there are serious deficiencies in both data and methodology, particularly in the area of health effects. Since EPA's regulatory mandate stresses reduction in health risks, this study recommends a greater research emphasis on estimating the incidence and costs of environmentally-related mortality and morbidity.

LITTLE, Roger D., Professor, and Robert L. WOLF, Major, USMC, **"Ten Years of Volunteers,"** U.S. Naval Institute *Proceedings*, (August 1984).

This manuscript summarizes and integrates the papers and discussion of a conference held at the Naval Academy, 2-4 November 1983. Contained are comments addressing the four major sessions of the conference: the Gates Commission Report Projections and the Realities to Date; the Impact of Technology, Weapons Systems and Force Size on Future Demand; the Economy, Budget and Supply in the 1980's; and Alternate Manpower Procurement Policies for the 1980's. Also included are brief excerpts from the major conference speeches by Secretary Caspar W. Weinberger, Assistant Secretary Lawrence J. Korb, Professor Charles C. Moskos, Jr., and Dr. Martin Anderson, former advisor to President Nixon.

WOLF, Robert L., Major, USMC, **"Anticipating Trouble,"** *Marine Corps Gazette*, 68 (February 1984), 18-20.

This paper outlines the international terrorism threat and goes on to identify the elements of a crisis management plan which is designed to minimize vulnerability for fanatical acts faced by Marine personnel. Included are recommendations for dealing with crisis situations along with the appropriate chain of command, command post location, operational logs, emergency aid stations, and press and information centers. Additionally, specific suggestions for different types of terrorist activity — bomb threat, captor/hostage situations, civil disturbance, and skyjacking — are included.

ZAK, Thomas A., Assistant Professor, co-author, **"Canonical Estimation of Joint Educational Production Functions,"** *Economics of Education Review*, 3 (Spring 1984), 37-43.

It is argued here that in the presence of joint educational production, a simultaneous equations system is not the most appropriate way to view the production of learning and attitude. Instead, an alternative estimation procedure based on canonical correlation is used to estimate the parameters of a joint educational production function. The technique utilizes the canonical variables to yield parameter estimates in terms of the original economic variables. Marginal products and marginal rates of substitution are calculated and gender-related differences are discussed.

Presentations

GIBB, Arthur Jr., Associate Professor, **"Placing Small-Scale Enterprise Assistance in a Macroeconomic Context,"** Annual Conference of the Washington Chapter of the Society of International Development, 15 March 1984.

GOODMAN, Rae Jean B., Associate Professor, Thomas A. ZAK, Assistant Professor, *et al.*, **"The Federal Reserve System's Role in Electronic Funds Transfer Clearing Provision,"** FTC Conference on **"The Political Economy of Regulation: Private Interests in the Regulatory Process,"** Washington, D.C., March 1984.

JOHNSON, F. Reed, Associate Professor, **"Estimating the Impacts of Forest Management on Recreation Benefits,"** USDA Forest Service, Washington, D.C., 9 December 1983.

JOHNSON, F. Reed, Associate Professor, **"Estimating the Impacts of Forest Management on Recreation Benefits,"** Eastern Economic Association Meetings, New York City, 15 March 1984.

JOHNSON, F. Reed, Associate Professor, **"Estimating the Impacts of Forest Management on Recreation Benefits,"** Environmental Protection Agency/Environmental Law Institute Benefits Seminar Series, Washington, D.C., 22 March 1984.

ZAK, Thomas A., Assistant Professor, **"Defense Industry Diversification and Monopsony Power,"** Southern Economic Association Meetings, Washington, D.C., November 1983.

ZAK, Thomas A., Assistant Professor, co-author, **"Monopoly and Competition in Public Agencies: 'The Implications of Dual Enforcement for Antitrust Output and Costs',"** Southern Economic Association Meetings, Washington, D.C., November 1983.

DEPARTMENT OF

Language Studies

PROFESSOR JOHN D. YARBRO
CHAIRMAN

Faculty members in Language Studies have engaged in a notable variety of scholarly and professional activities this year. Assistant Professor Corredor's studies have centered on contemporary literature, criticism, philosophy, the role of intellectuals, and the forms of autobiography. Assistant Professor Dahlgren has moved into a new phase of her semiotic analysis of dramas by Calderón and his followers. She has also worked with computers and video, using foreign programs via the new satellite TV station.

Associate Professor Halbig has prepared the first of two volumes on Jacob Masen's seventeenth-century Latin plays. Associate Professor Lee has extended his massive computerized collection of biographies of Chinese leaders. Associate Professor Tolstoy has added name and topic indexes, with brief biographies, to his book manuscript on the Russian Church in 1917-1918. Assistant Professor Rivera-La Scala has completed the manuscript of her second book on didactic poetry in fifteenth-century Spain. Commander Battke, FGN, has published his study of women in the naval service. Faculty presentations have dealt with critical theory, the role of intellectuals, existentialism, semiotics, computer-assisted instruction, and aspects of international education.

Overall, with four articles published, three book manuscripts prepared for publication, two major sponsored projects in progress,

and several independent studies underway, research has been very much a part of professional life in this Department of eight civilians and three exchange officers.

Cooperative Solutions to Southeast Asian Security Problems: ASEAN, Australia, Japan and the United States

RESEARCHER: PROFESSOR ROBERT L. RAU
SPONSOR: EARHART FELLOWSHIP

This research project investigates, describes, nd outlines past, current and future ecurity problems, relations, pacts, lignments, and agreements. Field and locumentary research was carried out in Asia (Philippines, Japan, People's Republic of China, Thailand, Singapore, Australia, and Fiji) in the spring of 1983. The writing phase will be completed in September 1984.

International Political Behavior in Arms Control Issues

RESEARCHER: ASSOCIATE PROFESSOR RODNEY G. TOMLINSON
SPONSOR: JOINT STAFF/DEFENSE COMMUNICATIONS AGENCY/STATE DEPARTMENT

This project aims at developing a mainframe-nicro interface that permits exchanging rms control information with the analysis group at the Joint Staff. Positions of various nations will be developed and cast into a structure useful on a microcomputer.

This project is part of a larger project of studying United Nations votes for the purpose of publishing a large compendium of UN Roll Calls for the period 1946-present.

Biographic Analysis of Chinese Leadership

RESEARCHER: ASSOCIATE PROFESSORS RODNEY G. TOMLINSON AND DANIEL T. Y. LEE
SPONSOR: DEFENSE INTELLIGENCE AGENCY

This study is an analysis of eighteen biographic characteristics of the leaders of he People's Republic of China. English-text summaries are prepared according to strict syntactical rules, with imbedded computer flags affixed to proper names and locations, permitting researchers to link biographical names with names and locations, in the biographical text.

Research includes automated linkages of "who knows whom," identifying rising stars in the Chinese hierarchy. Research is on a continuing basis and includes the development of a public appearance file that will be linked to the biography file. When complete, it will be possible to develop seniority lists and study patterns of behavior of Chinese leaders.

The Role of Perception in the U.S.-Japanese Security Relationship

RESEARCHER: CAPTAIN KEVIN P. O'KEEFE, USMC
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This research will focus on the critical role perception plays in the evolving U.S.-Japanese security relationship, and the resulting gap it has produced between policy makers in Washington and Tokyo. With the steady drawdown of U.S. military presence coupled with the dramatic increase in Soviet military power in East Asia, the question of an increased security role for Japan in the region has been a topic of keen discussion between the two nations with very little tangible success. The major stumbling block has been a sharp perceptual divergence over the seriousness of the threat being faced, and what role Japan should and is capable of playing in meeting that threat. This research will attempt to isolate those perceptions held both in Tokyo and Washington, and to indicate a more coherent U.S. policy approach towards Japan.

The basic approach to this research will be twofold. Initial investigation will center around detailed analysis of the evolution of U.S. security policy in East Asia over the past five years. This will be accomplished primarily through access to documents at the Departments of Defense and State, and interviews with current key individuals in the policy-formulation process. Additionally, discussions will be held with Japanese Embassy officials. The objective of this portion of the research will be to establish Japan's role in East Asia as seen by the United States.

The second phase of research will involve on-scene interviews with both U.S. military and civilian officials at HQ, U.S. Forces, Japan, and the American Embassy; and with Japanese military officers and civilians at the Japan Defense Agency and the Ministry of Foreign Affairs. This trip will take place in July 1984.

Based on this research, the "perception gap" will be examined at two levels. First, the "gap" between those officials who formulate policy in Washington and those who carry it out in Tokyo will be defined. Secondly, the on-scene U.S.-Japanese military-to-military "gap" (i.e., Joint Staff Office, Japanese Self Defense Forces; and HQ, U.S. Forces, Japan), and the "gap" between those on the higher political-military level (i.e., Japan Defense Agency/ Ministry of Foreign Affairs, and Department of Defense/State) will be investigated.

An Experimental Study of Cognitive Processes and Information on Political Problem Solving

RESEARCHER: ASSOCIATE PROFESSOR HELEN E. PURKITT
SPONSOR: NATIONAL SCIENCE FOUNDATION

This is an experimental study of how people use prior beliefs, problem information and mental heuristics in making judgments and decisions about political problems. The study relies heavily on recent insights on human information processing and problem-solving behavior generally in developing a complex experimental design to investigate political problem solving. The study is placed in the context of small groups because of the extensive presence of groups in political decision making and as a method to elicit as data as the cognitive operations of choosers. Status: This is an 18-month study, currently in the data collection phase. Analysis and a final report will be completed by the beginning of 1985.

Delinquency Behavior of Servicemen and Potential Recruits

RESEARCHER: PROFESSORS JOHN A. FITZGERALD, J. ERIC FREDLAND, AND ROGER D. LITTLE
SPONSOR: DEPARTMENT OF DEFENSE

The objective of this work is to compare delinquent behavior of those in the military and those who are interested in joining the military with delinquent behavior of peers who are not in the military and are not interested in joining. The data set used is the national Longitudinal Survey New Youth Cohort. Various univariate and multivariate statistical techniques are being used to explore the question. Specific objectives are to identify important delinquency variables and to determine what kind of delinquent behavior is "average" for the youth population in general and to compare that with delinquent behavior by those in the military and with those not serving but interested in joining. These comparisons are being made controlling for various socioeconomic characteristics which may also be associated with delinquent behavior. Preliminary statistical work has been completed. The remainder will be completed in the summer of 1984.

Maneuver Warfare and the Marine Corps

RESEARCHER: CAPTAIN RICHARD S. MOORE, USMC
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This research consisted of two phases: historical analysis, particularly focusing of German combat operations during World War I and II, and study and observation of current Marine Corps doctrine. The intent of this study was to attempt to determine historically successful combat tactics and techniques and then mesh these with current doctrine in order to synthesize new concepts. Preliminary doctrinal theories were further explored while observing a Marine Corps combined arms exercise held at 29 Palms, California, 8-23 July 1983.

The combination of maneuver warfare theory, historical analysis, and practical experience and observation has resulted in the development of new doctrinal concepts that, while not revolutionary, will offer the Marines a tactical means to overcome possible future numerical or technological disadvantages.

Sponsored Research

Argentina's Foreign Policies

RESEARCHER: PROFESSOR G. POPE ATKINS
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

This research project is the writing of a book-length manuscript analyzing the foreign policies of Argentina. It is coauthored by a leading West German Latin Americanist.

Argentina has always been an important and ambitious yet puzzling state. From the turn of the century until about 1930, it was the leading nation of Latin America, highly important and effective in several arenas of international relations, and on the threshold of great power status. Since about 1955, however, Argentina's role in the international political system has been a case of foreign policy failure and international decline. Understanding Argentina's foreign policy is complicated by the fact that its orientations have not conformed to standard analytic models, such as theories of isolationism, alliance, development, and dependency. Analysis must acknowledge the dearth of guiding frameworks and develop a set of definitions and concepts applicable to the Argentine case.

Within an "ecological" approach, stressing foreign policy decision-making as a function of the environments in which policies operate, analysis of the Argentine case is organized around six networks of relations and the linkages among them. These networks involve relations (1) within the Argentine national system, (2) with European nations and organizations, (3) in the South American southern cone, South Atlantic, and Antarctic regions, (4) with the United States and in the Inter-American System, (5) with the Third World outside the Americas, and (6) with the communist bloc. Each of these environments has presented distinct situational considerations for Argentine policy makers. The result has been the evolution of a complex set of policy characteristics that provides the keys to understanding Argentina's international behavior.

United States Naval Academy 1982 Follow-Up Survey of 1978 Entering Plebe Midshipmen

RESEARCHER: PROFESSOR CHARLES L. COCHRAN
SPONSOR: NAVAL PERSONNEL RESEARCH AND DEVELOPMENT CENTER

This study analyzed the results of a 1982 Follow-Up Survey of Midshipmen who entered the Naval Academy as plebes in the Fall of 1978. The data are based on the annual freshman and follow-up surveys of American college students conducted by the Cooperative Institutional Research Program (CIRP) at the University of California, Los Angeles.

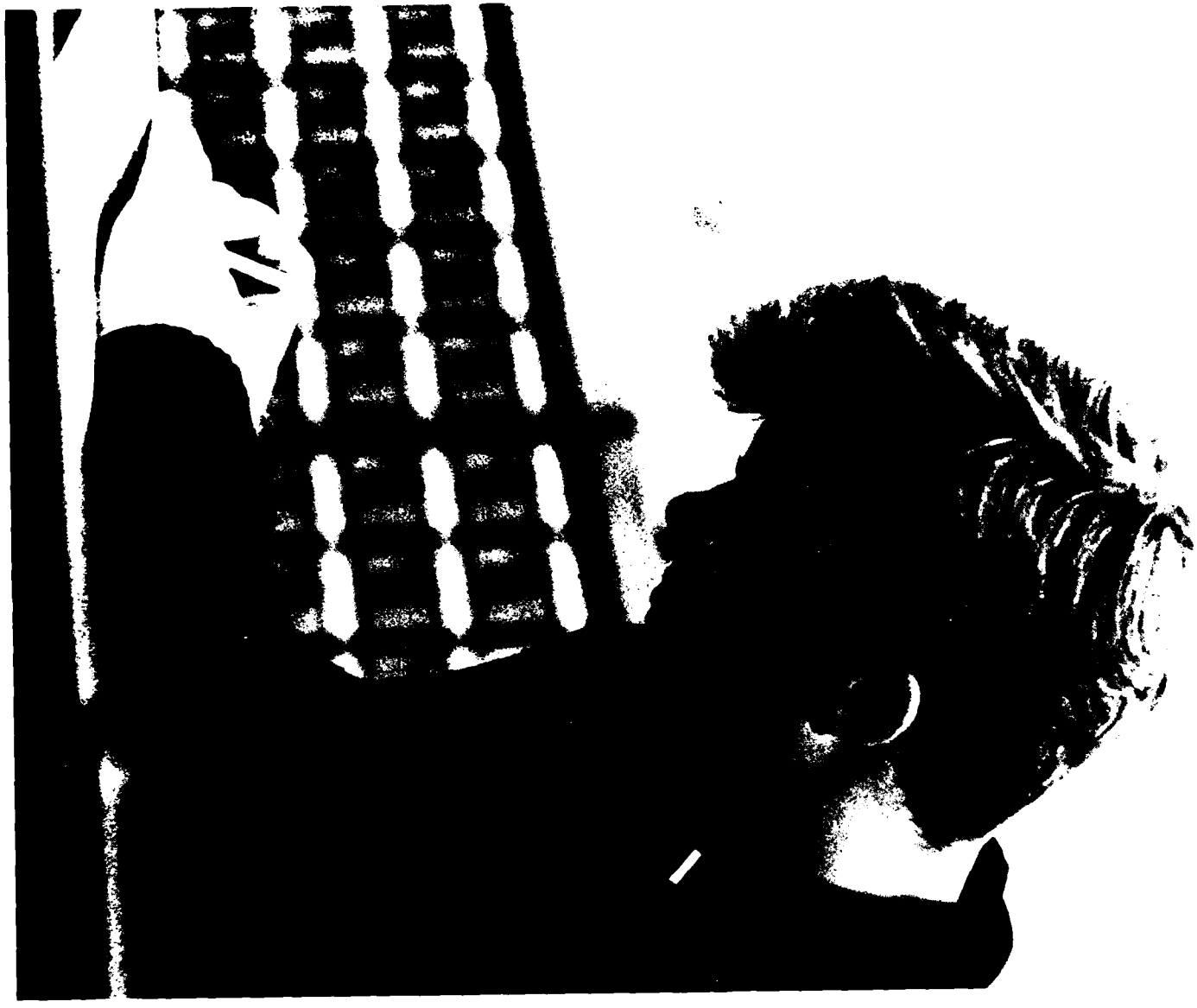
The study determined several factors predicting degree completion, academic performance, and overall satisfaction with the Naval Academy experience. Most demographic variables were not significant predictors of degree completion. High school science preparation and church attendance predicted completion. Experimental variables which predicted degree completed included satisfaction with opportunities to talk with professors and with courses in the major, and self-assessed gain in leadership ability and in analytic skills.

DEPARTMENT OF

Political Science

PROFESSOR ROBERT L. RAU
CHAIRMAN

The Political Science Department continued its significant volume of faculty research, publication, and travel for research purposes in 1983-1984. Extensive research and writing for publication were accomplished by the faculty and midshipmen research and published on a wide range of topics dealing with functional areas of Political Science to analysis of sensitive regional issues, as well as Cognitive Process and Information in Political Problem Solving. One book was published. Three additional book-length manuscripts are under contract. Eight chapters were contributed to other books. Sixteen journal articles were written and have been or will be published in various forms in the United States and abroad. The faculty was very active in the lecture arena, especially overseas. Research activity in the Department continues strongly in the fields of foreign and national security policy as well as having a strong regional orientation (Asia, Eastern Europe, and Latin America). The Department has enjoyed funding support from the Naval Academy Research Council, Defense Intelligence Agency, Department of State, Department of Defense, National Science Foundation and the Earhart Foundation. It is interesting to note that only nine of thirty-five research efforts are funded and useful to remember that much of the follow-on research began as Naval Academy Research Council projects. Midshipmen research projects (sixteen in number) were significant not only because of the volume but because of the sophistication of the topics. Of the sixteen papers written by midshipmen, four were eligible for entry in national student research project competitions in various sub-fields in Political Science. In 1984-1985, selected midshipmen research papers will be entered in these competitions.



Presentations

CORREDOR, Eva L., Assistant Professor, Organizer and Moderator, Session on **"Critical Theory: In the Margins of Deconstruction,"** Philological Association of the Pacific Coast, Santa Barbara, California, 11-13 November 1983.

CORREDOR, Eva L., Assistant Professor, Organizer and Moderator, Special Session on **"The Role of the Intellectual Today,"** Modern Language Association, New York, New York, 27-30 December 1983.

CORREDOR, Eva L., Assistant Professor, Panelist, Session on **"Desert, Retraite, Engagement,"** Sixteenth Annual Conference of North American Society for Seventeenth-Century French Literature, University of Arizona, Tucson, Arizona, 15-17 March 1984.

DAHLGREN, Sharon G., Assistant Professor, **"Interactive Video Programs and Teaching Foreign Language,"** Conference on Computers and the Humanities, U.S. Naval Academy, Annapolis, Maryland, 27 October 1983.

DAHLGREN, Sharon G., Assistant Professor, **"Mundo y Muerte: la semiotica de lo social en dos figuras alegoricas de Calderón,"** Spanish Golden Age Drama Symposium, University of Texas, El Paso, Texas, 7 March 1984.

HALBIG, Michael C., Associate Professor, **"Internationalizing the Undergraduate Curriculum,"** National Assembly, Global Crossroads: Educating Americans for Responsible Choices, Washington, D.C., 17 May 1984.

Publications

BATTKE, Winfried A., Commander, Federal German Navy, **"Frauen in der Marine — Erfahrungen der U. S. Navy,"** *Truppenpraxis,* 4 (April 1984), 287-293.

This is a study of women in the naval service, taking the United States Navy as an example for integrating women. Starting with a description of the present German Navy and its shortage of personnel in the forthcoming years which will create the necessity of introducing women into the armed forces, the article describes reservations and scruples against such plans and depicts how the U.S. Navy has dealt with problems and has overcome many of them.

CORBEDOR, Eva L., Assistant Professor, **"The Fantastic and the Problem of Re-presentation in Hélène Cixous's Feminist Fiction,"** *Papers in Romance,* 4 (Autumn 1982), 173-179.

This is a characterization and critique of the French feminist Hélène Cixous's novels through Z. Todorov's newly developed concept of the "fantastic." The writer of the article expresses sympathy for Cixous's "fantastic" explorations of her "self," her linguistic determinants, her role in society, relationships to mother/father/society, but disagrees with the novelist's escapist, non-realistic solutions for women.

HALBIG, Michael C., Associate Professor, **"NAFAC '83,"** *Shipmate,* 46 (July-August 1983), 11.

This article is a summary of the 1983 Naval Academy Foreign Affairs Conference, "The Western Alliance in Transition." The article reviews the speakers, round-table topics, and student conclusions. It includes several photographs of the conference and lists the major financial supporters of this annual event.

Juan de Mena's Coplas de los Siete Pecados Mortales: Second and Third Continuations

RESEARCHER: ASSISTANT PROFESSOR GLADYS M. RIVERA-LA SCALA

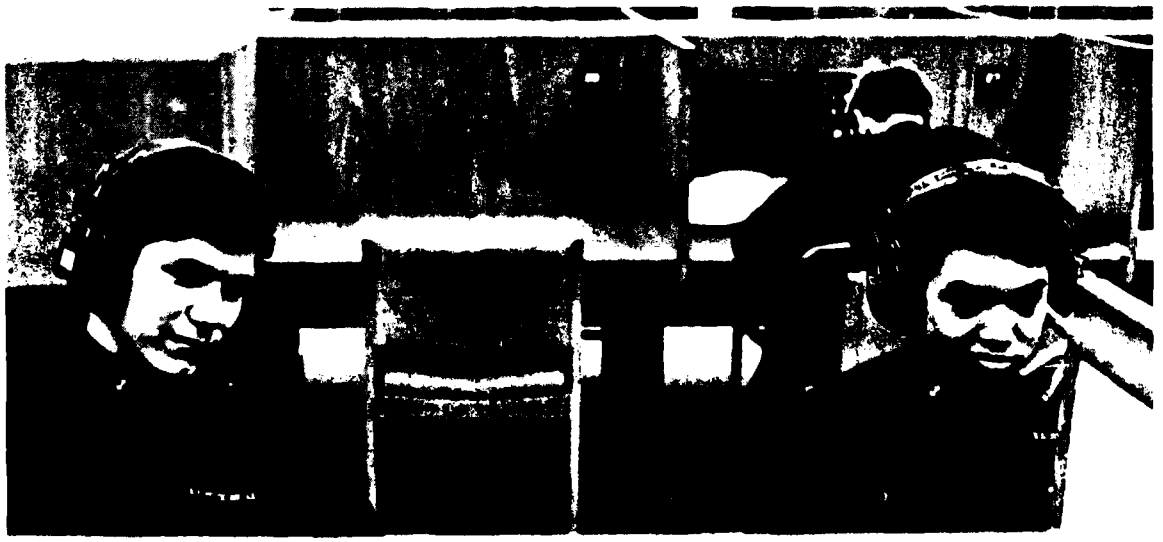
During the past year, the researcher has completed the first critical edition of two major continuations of Juan de Mena's poems on the seven deadly sins. An intertextual analysis of the main work and all three of its continuations was made. This material is now ready for publication as Volume II of the long study of Juan de Mena and his followers.

The first chapter offers a comparative study of the four discrete works, analyzing themes, imagery, meter, and rhyme. In the second chapter, the researcher gives a detailed description of the manuscripts, and of the sixteenth-century printings used in establishing the base text, and then discusses the interrelationships between the many versions of the works. A corrected version of the continuations in modern script follows. Editorial, literary, and linguistic notes comprise the next section, which ends with glossaries of medieval Spanish terms and proper names. Also included is an extensive bibliography of primary and secondary source materials on fifteenth-century Spanish and European didactic poetry.

The Sacred Council of the Russian Orthodox Church, Moscow, 1917-1918

RESEARCHER: ASSISTANT PROFESSOR VLADIMIR S. TOLSTOY

This book-length study provides a history of the Russian Orthodox Church during the communist revolution, with emphasis on the Church Council in 1917-1918. It is based on analysis of documents in the Library of Congress and libraries in Rome, Paris, and at St. Vladimir's Seminary, Tuckahoe, New York. During the past year, the researcher has added a name index, with short biographies, and a subject index. The manuscript is now complete.



Autobiography: Its Form and Development from the Renaissance to the Twentieth-Century

RESEARCHER: ASSISTANT PROFESSOR EVA L. CORREDOR

Since 1982, after teaching a course on the topic, the researcher has been studying the historical development of the form of autobiography. A paper was presented in March 1983 entitled "Autobiography as Sign and Symptom: Roland Barthes by Roland Barthes." The researcher expects to turn the studies on autobiography into a monograph and possibly also into fictional writing.

Jacob Masen's *Rusticus Imperans:* Facsimile Edition with Translation and Introduction

RESEARCHER: ASSOCIATE PROFESSOR MICHAEL C. HALBIG

This edition is the first volume of a two-volume set on Jacob Masen's theater. It includes an enlargement to quarto format of the 1662 Latin original on the verso page and an English translation on the recto. Critical footnotes are provided on each page to correct typographical errors in the original and to identify obscure references in the text. The introduction includes a discussion of the orthography, the translation criteria, a description of the Latin original and a brief overview of Masen's career, as drawn from the editor's research in the Jesuit archives in Rome.

The Image of the Partridge in Fifteenth-Century Spanish Literature

RESEARCHER: ASSISTANT PROFESSOR GLADYS M. RIVERA-LA SCALA

The researcher is studying the use and significance of imagery of the partridge in communicating moralistic teaching through literary works to the general public in fifteenth and sixteenth-century Spain.

Independent Research

The Modernisms of György Lukács: A Study of his Literary Criticism

RESEARCHER: ASSISTANT PROFESSOR EVA L. CORREDOR

Over the last two decades, the work of the Hungarian philosopher and critic György Lukács (1885-1971) has attracted considerable attention in all disciplines concerned with the study of Western thought, such as literature, philosophy, history, sociology, and politics. Yet, according to this researcher's recent survey no comprehensive study of his literary criticism has been published. The aim of the present study is to fill this gap.

Lukács's relationship to literature is very complex and interesting, since he integrates the work of literature into a much broader context where it becomes but one of the voices of human expression. From his early work on modern drama to his later works on the novel, contemporary literature, and philosophy, Lukács's foremost preoccupation is with the historically and socially mimetic function of the text. His epistemological and ontological questions are those of a twentieth-century intellectual attempting to find himself through the study of literature. As a human "subject" he seeks objective knowledge of himself and his surroundings, while he is also aware of, and denounces, the danger inherent in a complete objectification or "reification" of man. Such complex subject-object dichotomies are at the heart of his literary theories, as they seem to have dictated most of his theoretical and personal writings. Constantly, Lukács seems to battle with the concept and the experience of "modernism" as a phenomenon of recent history, which, according to the researcher, is the most characteristic aspect of his work. Preliminary work for this project has been going on for several years.

The Role of the Intellectual

RESEARCHER: ASSISTANT PROFESSOR EVA L. CORREDOR

The researcher has studied twentieth-century theories of the intellectual by authors and philosophers such as Carl Mannheim, György Lukács, Jean-Paul Sartre, and Michel Foucault. In 1981 she organized an international conference at Mills College on Sartre's concept of "engagement." In 1982, she participated in a conference on and with the noted French philosopher, Michel Foucault, at the University of Southern California. A published monograph on this theme is expected.

Automated Biographic Analysis of the Chinese Military Leadership

RESEARCHER: ASSOCIATE PROFESSOR DANIEL T. Y. LEE
SPONSOR: DEFENSE INTELLIGENCE AGENCY

The purpose of this multiyear project is to study biographic characteristics and career patterns of the significant military leaders in the People's Republic of China (PRC). During the past year, the researcher has again traveled to Taiwan, Hong Kong, and Mainland China to seek new data. Computer entries were structured according to firm syntactical rules, thus making possible outputs of single or multiple biographies according to the characteristics desired: name, travels, career achievements, hobbies, specialties, acquaintances, associations, writings, and the like. Biographies may be linked in order to group individuals by chronological, geographic, educational or other factors, according to investigative needs. The researcher has pursued further the technique of hierarchical clustering, as a means of finding patterns in the evolving structure of the PRC leadership. This technique allows clearer analysis of the traits and backgrounds of the key decision makers. Automation with microcomputers, which could give easier access to the biographic files, is also being studied.

Since May 1983, the researcher has added 122 new biographies and updated or augmented some 540 existing ones. The total number of leaders included now stands at 768. The overall design of the project is being expanded to include non-military leaders — an emerging class of great importance in post-Mao China.

Associate Professor Rodney G. Tomlinson, Political Science Department, serves as research associate for this project.

Sponsored Research

A Semiotic Approach to the Allegorical Drama of Pedro Calderón and his Contemporaries (1682-1700)

RESEARCHER: ASSISTANT PROFESSOR SHARON G. DAHLGREN
SPONSOR: NAVAL ACADEMY RESEARCH COUNCIL

The objective of this research centers on the development of a critical analytical system for the theater, based on two semiotic theories: Algirdas Greimas's constitutional model for the analysis of diverse cultural artifacts, and Charles S. Pierce's typology of signs, the icon, index, and symbol. As a means of testing hypotheses on the relationships between verbal and non-verbal signs, the researcher has sought to extend her concepts of syntax as an ordering device. Archival research in Madrid in the summer of 1983 led to the identification of a neglected period in Calderonian studies, that of the works actually performed after the death of Calderón in 1681 up to the end of the Hapsburg reign in 1700. From unpublished documents, including plays by Manuel Vidal, Antonio de Zamora, Jacinto Yáñez, Bances de Candamo, and Andrés de Villamayor, the researcher was able to establish that the allegorical plays, vigorously cultivated in this period, were even performed in public arenas — a fact that attests to their effectiveness as theater. Using the techniques of semiotic analysis, the researcher proposes to establish this period as significant to the history of allegorical drama, since these specific works, actually performed on stage, provide additional information on Calderón's contemporaries, who were, in essence, his viewing audience. In combining archival research and the methodology of semiotics, the investigator is now preparing a book-length study of Calderón and his contemporaries.

Independent Research

Changing United States–Latin American Relations

RESEARCHER: PROFESSOR G. POPE ATKINS

This study analyzes United States-Latin American relations, the context within which Iberian activities in Latin America take place. The treatment is not a critique of or prescription for U.S. policies, but an examination of the distribution of international power and influence in Latin America. The first part of the chapter explores the general bases for U.S. policy, with reference to historical antecedents and to some considerations for nonhemispheric activities and Latin American responses. The second part is organized around the concept of a still important but diminishing U.S. hemispheric role over the past two decades. The third and final part evaluates present trends. Distinctions are made among different "policy arenas" within Latin America: the Inter-American System, Mexico, the Caribbean Basin, Brazil, and the Southern Cone of South America.

Micro-Computer Decision-Making Simulations

RESEARCHER: ASSOCIATE PROFESSOR STEPHEN E. FRANTZICH

This project is the development of a series of decision-making simulations for micro-computers to be used in American Government courses. Students will be given the opportunity to "play" legislators, candidates, and bureaucrats and be given feedback on the consequences of their decisions.

Write Your Congressman

RESEARCHER: ASSOCIATE PROFESSOR STEPHEN E. FRANTZICH

This book-length manuscript analyzes communications patterns between members of Congress and their constituents. While the dictum "Write Your Congressman" has been a long-standing aspect of the American system, it has taken on new meaning with the dramatic increase in two-day communications and the application of modern information technology. The research confronts all aspects of the communications and the implications of current trends for the future.

U.S. Foreign Policy Toward Southern Africa During the Carter and Reagan Administrations: An Information Processing Perspective

RESEARCHER: ASSOCIATE PROFESSOR HELEN E. PURKITT

This study examines the problem-solving logic employed by top foreign policy officials during the Carter and Reagan administrations toward Southern Africa. Data on foreign policy toward the region was collected using both content analytic and events data methods. Major similarities and differences in the foreign policies toward the region across the two administrations were identified and discussed. While there were important commonalities across the two administrations, there were also important differences. For example, while the Carter administration stressed a variety of old and new themes in articulating U.S. foreign policy priorities, Reagan officials stressed a few, common themes related to containing Soviet expansion and promoting free enterprise. The study concludes that these sorts of differences across the two administrations may have been an important factor in shaping the attitudes of the attentive public, especially in terms of the Carter administration's image of maintaining an inconsistent and confusing policy toward the region.

Polish Socialism

RESEARCHER: ASSISTANT PROFESSOR ARTHUR RACHWALD

This is a study of the basic socioeconomic *characteristics of the contemporary system* in Poland. Special attention is given to the differences between the Soviet model and the political trends prevailing within the Polish society. As for the emerging trends in the political system, Poland is moving in a Communist-Fascist direction. Indeed, the Poland of General Jaruzelski has distinguished itself by a narrow and arrogant nationalism promoting "national unity," anti-intellectualism, a contempt for human values, the use of violence, occasional anti-Semitism, and the militarization of public life.

Research Course Projects

A Campaign for the U.S. Senate

RESEARCHER: MIDSHIPMAN 1/C TOMAS J. AGUILAR
ADVISER: ASSOCIATE PROFESSOR STEPHEN FRANTZICH

Running a campaign entails the coordination of thousands of individuals as a team to handle fund raising, traveling, advertising, and the assessment of the campaign's resources. The resources of the campaign are the life of the candidate's hopes to be elected. They include contributions, volunteer activity, independent expenditures, the candidate's personal funds, party and popular support, and legal and accounting services.

The most important aspect of any campaign is its finances. The money in a campaign must be checked continuously from the start. This is important not only to help the candidate win the election, but also for records required by the Federal Election Campaign Act and the Federal Election Commission. Also a very important aspect of a campaign is the strategy behind that campaign. Its development, planning and execution can spell success or failure for a campaign. These aspects are accomplished by the campaign organization comprised of two divisions, each with its own span of control and further divided into independent subdivisions. This paper develops a management strategy for a modern political campaign.

The Soviet Factor in U.S.-China Relations

RESEARCHER: MIDSHIPMAN 2/C JAMES R. COCHRANE
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

This research project explores the interrelationship between U.S.-PRC cooperation and Soviet foreign policy. Using the theory of the balance of power and the strategic triangle, the history of Sino-Soviet and Sino-American relations are analyzed. Relevant to this study are the American policy errors during and immediately after World War II, and the Russian blunders during the 1950s and 1960s. Since the opening of relations between the U.S. and China in 1972, the U.S. has held a slight advantage in the strategic triangle at the expense of the Russians. However, throughout the 1970s and the early 1980s, the Chinese have exhibited an unsteady and vacillating attitude toward both superpowers.

If the U.S. is to capitalize on the recent overtures from China to build better relations, many areas should be carefully investigated. The relationship is not only hindered from an ideological point of view; there are pragmatic areas which also must be considered. National security, economic questions, and external threats to the relationship could inhibit U.S.-PRC cooperation. The final conclusions state that the largest obstacle facing the relationship is the Soviet Union. In all cases, the reactions by the Soviets must be considered.

Political Culture in Russia

RESEARCHER: MIDSHIPMAN 1/C DOUGLAS CONKEY
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The Russian people can be characterized as hard-nosed and faithful to the motherland, which is exploited by the ruling regime in the form of political culture. Centuries of strict leadership and terror mechanisms have served to numb the people's attitudes toward the leadership. Their loyalties are distinctly to the land and not so much the leadership. Working within this atmosphere, the Bolsheviks used tradition to their advantage to develop a culture from above that they knew would be followed. Because the majority of the population is middle-of-the-line and not radical, the Bolsheviks had a relatively easy time in implementing their new culture, especially at a time when the people were grasping for new leadership, but old values. Even today, the population revolves around traditional thinking; thus, the Bolsheviks worked within the system as the leadership does today. This new culture is used by the leadership to subjugate the people realizing their devotion to societal values. Unlike some cultures that exist, the Soviet culture is rather basic with clear directions for the people. The overriding theme of this new culture is a driving subordination of the individual's will to the Bolsheviks and the Communist ideology. This new culture has various applications to reach all levels of society, including party members. This culture, which reflects Russian history and tradition, is a concept that needs to be understood if the people and their associated thinking are to be properly integrated into the world community. The Soviet people are prisoners more of their minds than of an unwillingness to understand the world community. This project is concerned with identifying, quantifying, and defining this political culture that plays such a big role in Soviet life.

Soviet-Polish Relations During the Brezhnev Era

RESEARCHER: MIDSHIPMAN 1/C PAUL D. HULLINGER
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

This research project dealt with the so-called Brezhnev Era in Poland. It is interesting to note that while Brezhnev took control in October 1964, his "Era" did not begin until the Czechoslovakian Spring of 1968. There is a lengthy explanation for this. The Soviet Union has viewed Eastern Europe in any combination of four ways. Through the idea of using Eastern Europe as a buffer zone against attack comes the Military Security factor. Second is the proposed Springboard into Eastern Europe by Soviet forces during attack. Third is the so-called "Communist Internationalist" factor developed by Kruschev to forward communism through a vanguard of communist countries. And finally, there is a fourth factor, "Ideological Security." Pursued by Brezhnev, this has been the most visible policy regarding Eastern Europe during the last twenty years.

Brezhnev saw Eastern Europe as an ideological buffer zone to Western ideas and influence. However, he did not seek to change things in Eastern Europe until it became necessary. By following that conservative maxim, he did not change Soviet policy in the region until the Czechoslovakian crisis in 1968. In a very real sense then, the Brezhnev Era in Poland begins in Czechoslovakia.

The Soviet War Fighting Strategy for Western Europe

RESEARCHER: MIDSHIPMAN 1/C BRENT JENKINS
ADVISER: ASSISTANT PROFESSOR GALE A. MATTOX

Political confrontation, as a rule, does not result solely from objective factors; it is instead dependent upon how each actor perceives or interprets these objective factors. Embracing such an outlook, this study is an attempt to marry the objective with the perceived. It is a thesis addressing the Soviet strategy for war in Western Europe. On that basis, it is an attempt to look from the inside out, to place the objective factors surrounding the possibility of war in Western Europe in a typically Soviet perspective. This study focused on the extent to which Soviet perceptions of various external objective factors affect their strategy for war in the European theater.

The first chapter outlines the very elements of the Soviet strategy for war in Europe. The second chapter focuses on current economic, social and political problems which face the Soviet leadership. The third chapter treats the use of dissent in the Eastern bloc. It focuses on what economic, social, and political factors in recent years have strengthened East European dissent and how this dissent has affected Soviet strategy for war in Europe. The final chapter addresses the Soviet approach to Western Europe and the USSR's response to the North Atlantic Treaty Organization's (NATO) decision to deploy Pershing II and Ground Launch Cruise Missiles (GLCM) in Europe. The chapter presents the Soviet interpretation of the decision and traces how this interpretation has led to a walk-out at the talks in Geneva. Then, certain actions that the Soviets may take in response to the deployment are presented, as well as how these actions may affect the overall Soviet strategy.

Roots of the Sino-Soviet Conflict

RESEARCHER: MIDSHIPMAN 1/C JOHN M. JORGENSEN
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The Chinese Revolution put another major actor on the game board of international politics, a new Communist giant in the early stages of development. Having a common political ideology with the Soviet Union seemingly made the Chinese and the Soviets natural allies, but each expected different things of the other partner and the alliance foundered after a scant decade had passed.

An historical examination of the two nations' relations would indicate that they have traditionally never gotten on well together. Past disagreements were primarily due to territorial disputes, which continued to serve as an irritant during the short period of their alliance. But issues deeper than territory troubled the Sino-Soviet alliance; national interests, ideology, historical attitudes and cultural influences, disagreements over Bloc leadership and nuclear weapons procurement, and economics all served to irritate the bonds of their treaty. As both sought to pursue their own best national interests, friction developed and mutual criticism grew. Polemics flew back and forth as the Chinese eventually chose to pursue a policy of self-reliance, and both charged the other with ideological heresy for their divergent domestic and international views. The Soviets did not trust the Chinese to act rationally, and the Chinese resented Soviet stinginess with aid. The final break came as a direct result of the propaganda war between them, which had been caused by differing and mutually unrecognized national objectives.

The Role of Cuba in Global Affairs: Is Cuba a Proxy of the Soviet Union?

RESEARCHER: MIDSHIPMAN 1/C BRUCE D. KOCHER
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The post World War II world has witnessed several examples of Soviet expansionism. One of the many ways that the Soviets have expanded their global influence is through the use of proxies. A proxy, strictly defined is a person, or in this case a friendly government or group willing to act as a deputy or substitute for another. The Soviets' use of proxies has ranged from influencing local politics through supporting and financing local communist parties, to subversive violent action, to limited war.

This study of Cuba and its relationship with the Soviet Union as a proxy nation involves an analysis of the Soviets' relationship with Latin America and Cuba since the 1950s up to the late 1970s and early 1980s. It examines the specific events that have shaped Cuba's position toward Moscow and how these events have molded Cuba's domestic and foreign policy.

The goal of this study is to determine to what extent the Soviet Union dictates Cuban policies and if this influence has really given Moscow enough leverage over Havana for Cuba to be considered a tool of Soviet foreign policy.

Turkish Politics: The Transition

RESEARCHER: MIDSHIPMAN 1/C FEZA KOPRUCU
ADVISER: ASSOCIATE PROFESSOR RODNEY TOMLINSON

During the years 1974 to 1975, Turkish politics were in a constant state of change. The recent past held two military coups by the armed forces in order to maintain Turkey's unity and prevent anarchy. With no party able to achieve a majority in the National Assembly, Turkish politics were overrun with splinter parties. At the same time, major foreign issues, such as the Cyprus invasion, Arab Oil Embargo, and NATO commitments, preoccupied the time and resources of Turkish authorities.

The major historic fault in Turkish politics has been the failure to achieve a single party majority. The numerous coalitions formed all ended up on the ash heaps of history. No party ever emerged victorious. In September 1980, the military forces found it necessary to intervene and prevent total anarchy. Turkey's western orientation coupled with an Islamic, Middle Eastern past has produced culture shock in Turkey. Sociological problems rank high on Turkey's list of major problems. In the future, the government in power will not, most likely, be one that is westernly inclined. Turkey's ties with NATO and the U.S. bind her to western life. Eventually a stable government will come into being there. The major task of this government will be, however, to provide transition of the people to a western way of life.

Law and Justice in the Soviet Union

RESEARCHER: MIDSHIPMAN 1/C DAVID L. LIHANI
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

It may seem strange to raise the question of law and justice in Soviet Marxism since the disregard of law seems, after all, to be an outstanding feature of the Soviet exercise of power both in internal and external affairs. Karl Marx considered law and the state as phenomena of the class-ridden society which are doomed to disappear. However, the establishment and maintenance of a lasting political order in the Soviet Union led to the resurrection of the system of law and theory of law. This research paper analyzed the doctrine of Marx on the function and significance of law in modern capitalist societies, and in the post-revolutionary stage. Furthermore, the paper examined the profound changes which Marx's doctrine has undergone in Post-Stalinist Soviet Union.

In the Soviet Union, there is no other freedom than freedom to consider the sole truth expressed by the Communist Party. On the road to realization of absolute justice, a state of total injustice has been achieved. Individual consciences have been handed over to a supreme political-ideological instance which rules over the individuals. Whatever justification there might be for offering a Marxist critique of the legal order in Western Society, it is beyond doubt that Soviet Marxists are certainly not justified in making such criticisms in the name of Marx.

The Soviet Economy: Strengths and Weaknesses

RESEARCHER: MIDSHIPMAN 1/C GREGORY P. MARVIL
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The purpose of this paper was to examine the strengths and weaknesses of the Soviet economy. The paper is divided into three parts. The first part analyzes the problems and prospects of a centrally planned economy. The second part observed the problems of Soviet agriculture. The last part investigated the prospects and performance of the Soviet industry.

The basic characteristic of the Soviet economy is that it is controlled, in conjunction with Soviet politics, by the Communist Party. Furthermore, the party tends to allocate the economy's resources according to political considerations rather than economic considerations. The conservative leadership and the structure of the centrally planned economy fosters economic growth, achieved through increasing the amount of inputs rather than by increasing efficiency and productivity.

The strengths of the economy are historical high rates of growth; an ability to marshal resources according to priorities; vast natural resources; and captive markets, all of which in combination create a basically solid economy. The weaknesses of the Soviet economy are stifling bureaucracy; inadequate information flow; absent and disfunctioning incentives; barriers to innovation; unfavorable change in demographics; wide geographic dispersion of resources; and poor quality of life — which in combination create a declining productivity and growth rate.

United States Ballistic Missile Defense: Implications for Strategic Nuclear Policy

RESEARCHER: MIDSHIPMAN 1/C MICHAEL L. MOORE
ADVISER: COMMANDER E. A. MCKENNEY, USN

This project included extensive research from August through December 1983. While temporarily assigned to the Nuclear Negotiations Division of the Joint Chiefs of Staff (J-5), the researcher utilized the Pentagon Library, the United States Air Force Research Service, and the special collection of publications within the Division. In addition, interviews were conducted with senior and flag officers concerning such issues as arms control, arms negotiations, BMD weapons development, and strategic nuclear policies. Interviews were conducted with strategy experts from the Atlantic Council and the Brookings Institution.

The primary goals were familiarization with BMD development and major national security concerns and writing a balanced paper summarizing the pertinent elements of current United States BMD development.

United States' Policy in the Persian Gulf

RESEARCHER: MIDSHIPMAN 1/C MICHAEL MURRAY
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

This research project concentrated on United States policy in the Persian Gulf from 1972 to the present. The paper began with an analysis of the strategic needs and objectives within the region, going on to examine each of the major problems and actors of the region. The paper then went on to explain the policies that the United States pursued in order to meet these needs. This is followed by an analysis of the effectiveness of the policies and the reasons behind their success or failure. The paper ends with suggestions for future policy along with the probable future course of action in the Persian Gulf.

Siberian Development

RESEARCHER: MIDSHIPMAN 1/C GERALD PETERS
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

This research project deals with the Soviet development of Siberia. The project covers the various resources and their locations, presented with various maps, charts, and graphs, and interpretation of the data.

The research includes analysis of the impact this development could have for the Soviet Union in the sphere of international relations. The trade that would evolve would generate an enormous amount of hard currency which the Soviet Union badly needs. The increased trade could increase Soviet influence abroad as well. It could also help them purchase more advanced technology and certainly help finance a greater buildup of their military arsenal.

The Soviets have run into several problems in their efforts to develop Siberia: transportation, climate, demography, and demand. Some of these problems are unique to the Soviet Union while others are related to or caused by other nations. The biggest problem seems to be the need for technology advanced enough to solve some of the difficulties created by the adverse climate and territory. This leads to obtaining technology from foreign sources.

The Soviet Union has increased efforts towards improving relations with Japan, Western Europe, and the United States in an effort to arrange joint ventures to develop the Siberian region. There has been some success using these tactics but there continue to be barriers. Additionally, there are concerns of China that must be considered. The Soviets have increased both their military presence and activity in the region to demonstrate their resolve and concern for the defense of Siberia. The project makes an effort to cover both sides of trade relations with potential investors by analyzing some of the agreements that have taken place to date.

Soviet Succession: Structure and Process

RESEARCHER: MIDSHIPMAN 1/C ROSS M. WILHELM
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The past year and a half has seen the death of Leonid Brezhnev and his replacement by Yuri Andropov, followed shortly thereafter by the death of that leader and his succession by Konstantin Chernenko. This period has resulted in speculation by the western press as a crisis in leadership, characterized by secrecy and mystery. It is commonly accepted that there is little set procedure within the Soviet Union for replacement of the upper echelons of leadership. However, this is not an entirely accurate perception. This study showed that while there is little written in the USSR on the subject, and little precedent to follow, the forms and precedent nonetheless exist. Although it is difficult to determine exactly what is happening today within the Politburo and Central Committee, it is possible to examine what forms have been followed in the past. This study used the case of the career of Nikita Segereivich Khrushchev to examine how the Soviets effect a transition in leadership. The reasons for this are obvious. First, it is the best documented case, especially considering the existence of Khrushchev's memoirs. Secondly, in his career one finds all forms of Soviet succession: the case of succession after the death of a General Secretary, the case of an unsuccessful attempted deposition, and the case of a successfully enforced retirement. Because of its relevance to the situation which exists today, this paper focused primarily on the succession following the death of Stalin, touched briefly on the other cases, and then attempted to extrapolate from this the forms which must be followed for succession. It drew conclusions for the possible paths of future succession within the Soviet Union.

Ideology and the Sino-Soviet Conflict

RESEARCHER: MIDSHIPMAN 1/C EDWARD P. WILSON
ADVISER: ASSISTANT PROFESSOR ARTHUR RACHWALD

The Sino-Soviet conflict has long since passed the ideological stage when Moscow and Beijing accused each other of being revisionists. Rather, developments in the relationship now are based on the security interests of the two countries with each state seeking to reduce the threat that it perceives is directed at it.

Considering the general warming trend of the Sino-American relations and the collapse of detente in the late 1970's, the Soviet Union has been eager to mend fences with the Peoples' Republic of China. The Soviet Union fears the rise of a Sino-NATO coalition against them in any future conflict and despises having to spread its forces in peacetime between a western NATO front and an eastern China front. Thus, the Soviets have been more than eager to improve relations provided that they do not have to give up too much in the process.

The Chinese too, have an interest in improving relations with Moscow. Beijing needs peace to modernize China. If bettering relations with the Soviets would reduce the Soviet threat enough that China could divert the military resources elsewhere, then that would be ideal. Additionally, the Chinese fear a Soviet encirclement in East Asia. If the PRC is ever to be a great power, it must prevent this encirclement.

Thus, the three main points of conflict as articulated by the Chinese are: (1) the Soviet support of Vietnam in Cambodia; (2) Soviet forces stationed along the Chinese border; and (3) the Soviet presence in Afghanistan.

However, the Chinese are clever enough to use the Soviet-U.S. conflict of the 1980's to play each superpower off each other as both come courting at China's door. By making each aware of its relations with the other, China may acquire economic help from the U.S. and a lessening of the Soviet military threat. So the real question becomes: Does China hold the "cards"?

Publications

ATKINS, G. Pope, Professor, **"Conflict Resolution in the Southern Cone,"** *Bulletin of of Latin American Research* 3 (May 1984), 42-46.

The Southern Cone of South America is an international political subsystem with characteristics that present special problems for conflict resolution. International relations there involve not only states located entirely in the region (Argentina, Chile, Bolivia, Paraguay, and Uruguay), but ultimately include Brazil and often draw in Peru. Some of the states extend their geopolitical concerns to the South Atlantic and Antarctica. This short interpretative article seeks to identify the major current problems of conflict resolution in the Southern Cone. It emphasizes the region's isolation from established third-party mechanisms and suggests that the future course of disputes depends on *ad hoc* arrangements among the states involved; special importance is placed on the role of Argentina.

ATKINS, G. Pope, Professor, **"Diplomacy in the South Atlantic Crisis,"** in J. W. Hopkins (ed.), *Latin America and Caribbean Contemporary Record*, New York: Holmes & Meier, 1984, pp. 99-128.

On 2 April 1982, Argentina invaded and took military control of the inhabited portions of the United Kingdom's Falkland Islands colony in the South Atlantic Ocean. Argentina asserted it was enforcing its rightful sovereignty over the Islas Malvinas, the name it applied to the disputed territory. Costly naval, air, and land warfare ensued, effectively ending on 14 June with Argentina's defeat at the hands of British armed forces. The United States, the United Nations, the European Community, and the Inter-American System made considerable diplomatic efforts, first to avoid warfare, then to end it, and finally to repair postwar relations. Other actors, such as the Soviet Union, the Vatican, the Non-aligned Movement, and many more, were involved to some degree. However, this essay emphasizes the roles played by the disputants and the principal third parties mentioned above. While the crisis seemed to begin as an isolated series of events in a remote corner of the globe, it ended with important consequences for international politics of several levels.

ATKINS, G. Pope, Professor, **"'Trouble in the U. S. 'Back Yard,'"** *Chronicle*, 4 (January 1984), 15-18.

The U. S. intervention in Grenada and continuing conflict in Central America refocuses attention on important questions about U. S. policies in the Caribbean region. When Ronald Reagan became President of the United States in 1981, he sought to bring basic changes to U. S. policies in Latin America, although his approach has been part of a continuing U. S. view of the Caribbean at a fundamental level of calculation. Despite considerable effort, the Reagan administration has accomplished little towards mitigating the Caribbean problems it set out to deal with; if anything, they are more intractable. This experience indicates the need for the United Stated to consider alternative policies to those presently pursued.

FRANTZICH, Stephen E., Associate Professor, **"Congress in the Classroom,"** *C-SPAN Update*, (April 1984).

This is a bi-monthly column for educators which discusses the strengths, weaknesses, and options for using C-SPAN (The Cable-Satellite Public Affairs Network) programming in college and high school classrooms. The bulk of C-SPAN programming is live, "gavel to gavel" coverage of the U. S. House of Representatives, and most of the techniques focus on teaching about the U. S. Congress. The column originated after a series of interactive video-tapes were created at the Naval Academy and eventually were exported to other institutions. Other methods discussed include casually "pick up viewing" and the creation of original programming.

FRANTZICH, Stephen E., Associate Professor, *Congressional Window: Instructor's Guide,* Private, 1984.

This fifty-page document serves as a guide to the *Congressional Window* series, a four-segment video-tape supplement to courses dealing with the U.S. Congress. Each tape is approximately 20 minutes long and uses liberal insertions of actual floor debates taped from C-SPAN (the Cable-Satellite Public Affairs Network) coverage. The program includes Congressional Norms, Rules, Styles of Debate, and Congressional Reporting. Each program comes with a script, suggestions for usage, and a test bank. Included in the instructor's guide are also a history of televising Congress and further suggestions for using C-SPAN coverage in class.

FRANTZICH, Stephen E., Associate Professor, *Congress, We the People: Test Bank,* Washington, D.C.: American Political Science Association, 1984.

This test bank covers the twenty-six programs of "Congress, We the People" a self-contained course on the U.S. Congress developed by the American Political Science Association and WETA under a major grant from the Annenberg Foundation. The program was designed to provide remote learners with high quality college level course material in an exciting manner. The test bank was keyed to the major texts in the field and includes both objective and essay questions.

LIMBERT, John W., FSO-2, **"Indigenous Revolution,"** *Foreign Service Journal,* 10 (October 1983), 31-38.

Despite numerous books on the Iranian revolution, the nature and course of that upheaval remain largely unexplained. Although outside forces could influence events in Iran to some extent, the revolution has been essentially an Iranian event shaped by that nation's rich historical and religious traditions. With all of its difficulties, chaos, and brutalities, the Islamic Republic has endured. It has drawn strength by presenting itself as an Iranian-Islamic alternative to the Shah's system, which was alien to the traditions of most Iranians.

MATTOX, Gale A., Assistant Professor, **"The INF Experience: Lessons for the Conventional Force Debate,"** *Conventional Deterrence in NATO: Alternatives for European Defense,* ed. by James Golden, Lexington, Massachusetts: Lexington Books, 1984, Chapter 7, pp. 66-71.

This chapter reviews the numerous debates in progress both within the North Atlantic Treaty Organization (NATO) and between NATO allies on various aspects of NATO strategy. These debates span the tenets of prevailing NATO strategy from the nuclear guarantee to theater nuclear modernization to short-range nuclear weapons use to the structure and objectives of the Western conventional force posture. These are taking place at the expert level in a predominantly military context with insufficient regard for political implications and in the public with often alarmingly little awareness of military requirements. The present direction of those discussions is disparate and undisciplined and the result could be less than satisfactory or even disruptive to the alliance.

The objective of the chapter is to focus attention specifically on the conventional force debate with respect to the possible lessons of the NATO 1979 decision to modernize intermediate-range nuclear forces (INF). It concludes that the heightened public involvement in the INF debate dictates that future decisions and implementation of conventional force modernization will have to give even more careful consideration to political and financial constraints than has been true in the past.

IATTOX, Gale A., Assistant Professor, o-author, **"From Kiel to Port Stanley: 'he Arms Sales Debate,"** Naval Institute *roceedings*, 23 (March 1984), 179-182.

he Federal Republic of Germany (West ermany) is the world's fifth largest arms xporting country. As a leading industrial ation, the fact that West Germany has eveloped an armaments industry is hardly urprising. What is striking is that significant ortions of those exports, especially in the hird World, are naval arms. Three events old potential significance for this export arket and indicate a rethinking of the West erman arms policy: (1) in April 1982, the chmidt Government announced a revision f the 1971 arms export guidelines; 2) simultaneous with that announcement, the alkland Islands Conflict between Argentina nd Great Britain erupted and brought into uestion some long-held assumptions in erman arms export policy with the Third Vorld about the probability of naval conflict n the nuclear age; and (3) in October 1982, Christian Democratic coalition government eaded by Helmut Kohl replaced the Social Democratic government of Helmut Schmidt. hese events have underlined the difficulties f constructing a coherent policy that nswers both the historical constraints on Vest Germany's arms policy as well as the eeds of the maritime and defense industries. o address these issues adequately, the article utlines the development of the postwar aval exports industry and discusses the olitical debate that continues to accompany rms export decisions.

IATTOX, Gale A., Assistant Professor, **"U.S. icherheitsolitik Unter Besonderer eruecksichtigung Europas,"** *Information ur die Truppe*, (Winter 1983/1984), 4-9.

U.S. Security Policy with Regard o Europe" was published in the West erman *Armed Forces Journal*. It reviews he important and common security interests f the United States and Western Europe istorically and the more specific policies ursued under the current Reagan adminis- ration. The article addresses the areas of debate over those policies and inevitable differences in the U.S. and West European approaches to many security issues given the historical, perceptual, and political divergences of the members of the Atlantic Alliance. Areas covered include U.S. and European security policies, perceptions of the Soviet threat, strengthening of defense, and security interests out-of-NATO territory.

MATTOX, Gale A., Assistant Professor, **"West German Perspectives on Nuclear Armament and Arms Control,"** *Annals of the American Academy of Political and Social Sciences*, 469 (September 1983), 104-116.

The NATO decision of 1979 to modernize its nuclear arsenal has prompted an intense and divisive political debate over security policy in the Federal Republic of Germany. The divergence of public opinion reflects uncertainty over the U.S. commitment to European security; uneasiness over the possibility of limited war in Europe and the continuing Soviet deployment of the SS-20; and dissatisfaction with the progress of arms control. These concerns have heightened public attention to all aspects of NATO doctrine, conventional strategy, and arms control. However, despite a shift by the Social Democratic Party in the 1983 electoral campaign on the question of intermediate-range nuclear force modernization and some success by the Green candidates on an antinuclear platform, the prospects for reforging the consensus are encouraging. Chancellor Kohl recognizes the need to reestablish broader public support and will attempt to avoid further deterioration of the consensus, even if U.S.-German relations suffer in the short term. The discussion will probably increase support for a NATO strategy that is less dependent on the nuclear threat but does not forfeit the U.S. nuclear guarantee.

MATTOX, Gale A., Assistant Professor, co-author, **"New Directions in West German Arms Sales Policy?"** *Washington Essays*, 11 (1983-1984), 59-73.

resident Reagan has been widely quoted hoping to achieve more support from ıropeans for Western defense objectives in ıe Persian Gulf. However, despite the more sible role played by the Federal Republic Germany in the international arena in cent years, it has become clear that ıy military involvement outside NATO ould be constrained by constitutional and istorical limitations which reflect Germany's etermination in the post-World War II era) avoid becoming member to any future onflict situation. The only areas in which ıere could be some kind of latitude for ıture German involvement in the Gulf, r other regions, has been its previously *estrictive arms transfer* policy. After eviewing the arms sales of the Federal lepublic, however, the article concludes that, s exemplified by the decision not to sell he Leopard II tank to Saudi Arabia, FRG nvolvement outside NATO can be expected o remain relatively limited be it in arms ales or in any direct Gulf presence.

URKITT, Helen E., Associate Professor, **'Dealing with Terrorism: Deterrence nd the Search for an Alternative Iodel,"** in M. Banks, ed., *Conflict in World Society: A New Perspective on International Relations*. Brighton, Sussex, 1984, pp. 161-173.

This chapter surveys recent empirical esearch on international terrorism and con- ludes that deterrence alone is inadequate or coping with political terrorism. A more ophisticated strategy dealing with the olitical dimensions in addition to the ecurity aspects of counter-terrorism is resented and discussed in detail.

ACHWALD, Arthur R., Assistant Professor, **"The Soviet Approach to Western Europe,"** *Current History*, (October 1983), 97-110.

After the collapse of detente, the chaotic state of the Western alliance has offered Moscow fresh opportunities for diplomatic activism to project Soviet influence. The Soviet leaders in recent years have concentrated their attention on accentuating the contradictions between the United States and Western Europe to achieve their long-standing goal of breaking the Western alliance.

The security ties that bind West Europe and the United States are similar social structures and a common cultural heritage. In the Leninist perspective, these are subjective factors, not immune to alteration. The objective reality, in this case reality conditioned by geography, is asymmetric American and European security needs. A threat to Europe is not necessarily a threat to the United States, and vice versa. Since World War II, the Soviet Union has sought political and military measures to accentuate this asymmetry. In recent years, the Soviet leaders have focused their attention on three basic contradictions between the United States and West Europe: (1) the fact that the European members of NATO do not have a monopoly on American security commitments, since the United States has dual status of a global power and a self-appointed European power; (2) the fact that West European governments regard as highly impolitic the American demand that the Soviet Union be punished (sanctioned) for every transgression anywhere in the world; and (3) and the difference over the issue of proper Western response to Soviet SS-20 deployments. A large part of the West European public has adopted a "better red than dead" attitude, while the mood in the United States has shown itself to be more assertive and nationalistic.

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RACHWALD, Arthur R., Assistant Professor, **"Poland '83,"** *Yearbook on International Communist Affairs.* Hoover Institution, Stanford University, 1984, pp. 239-249.

This profile of Poland in 1983 focuses on the major organized forces — the party, the church, the military and the unions — and how they behaved in the context of their aims and ideologies and in reaction to social and economic developments. Unlike some preceding years, 1983 was not a particularly dramatic period. Its importance should be measured by actions taken to overcome the crisis and redesign the political superstructure of the Polish state.

During 1983, the primary concern of the military oligarchy in Poland was restoration of the leading role of the Communist Party. Involved in this was an attempt to develop a new ideological profile. The purpose of the ideological debate was to regain the initiative and reestablish the legitimacy destroyed by Solidarity and martial law.

Church policy in 1983 was to allow the authorities to win more popular trust and self-confidence in hope that added political security would make the regime more amenable to the tangible concessions required for stability.

The national economy continues to experience structural crisis and the country now finds itself in a *sui generis* New Economic Policy (NEP). The private sector is in the process of expansion and state-owned enterprises are experimenting with free-market levers to overcome stagnation if not decline.

In conclusion, Poland continues to be ruled by minority government incapable of governing by consensus, yet unwilling to open a real national dialogue.

RAU, Robert L., Professor, **"The Role of the Armed Forces and Police in Malaysia,"** E. C. Olsen, ed., *The Armed Forces in Contemporary Asian Society,* Durham, North Carolina: Duke University Press, 1984.

This monograph investigates the Armed Forces and Royal Malaysian Police in the security of Malaysia. The evolution of the Malaysian army, especially the Royal Malay Regiment, is covered in detail and the interrelationship of the Royal Malaysian Police and the other ground units of the army is explored in depth. A major portion of the study is devoted to the discussion of Malaysia's security situation in Southeast Asia. Central threats are identified and cooperation solutions which have existed since 1970 with the United Kingdom, Australia, and New Zealand are outlined. Other issues covered in the monograph include ethnic relations within the Malaysian Armed Forces; changes in tactics and strategy; political implications of evolutionary development; and the recent movement to form an integrated security scheme within ASEAN.

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This annual report summarizes the research work of the Naval Academy faculty and midshipmen for the period July 1983 through June 1984. 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.

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