

## PUBLICATIONS

- F. J. Adrian, "Surface Enhanced Raman Scattering by Surface Plasmon Enhancement of Electromagnetic Fields near Spheroidal Particles on a Roughened Metal Surface," *Chem. Phys. Lett.* **78**, 45-49 (1981).
- S. N. Antoniadis and B. F. Hochheimer, "Developing Films for High Speed, High Resolution and High Gamma," *J. Biol. Photogr.* **48**, 167-173 (1980).
- W. H. Avery, "Grazing OTEC Plantships Technical Status, Potential Products, and Costs," *Proc., National Conf. on Renewable Energy Technologies*, Honolulu (1980).
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- J. F. Bird, "Theory of Magnetic Levitation for Biaxial Systems," *J. Appl. Phys.* **52**, 578-588 (1981).
- H. D. Black, "Satellites for Earth Surveying and Ocean Navigating," *Johns Hopkins APL Tech. Dig.* **2**, 3-13 (1981).
- B. I. Blum (APL), R. E. Lenhard, Jr. (JHMI), and E. McColligan (JHU), "Protocol Directed Patient Care Using a Computer," *Proc., 4th Symp. on Computer Applications in Medical Care*, 753-761 (1980).
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- J. L. Calkins (JHMI) and B. F. Hochheimer (APL), "Retinal Light Exposure from Ophthalmoscopes, Slip Lamps, and Overhead Surgical Lamps: An Analysis of Potential Hazards," *Invest. Ophthalmol. Vis. Sci.* **19**, 1009-1015 (1980).
- R. E. Gibson, "The Hillebrand Award: The Early Years," *The Capitol Chemist*, 6-9 (Mar 1981).
- C. Greifinger and P. S. Greifinger (R&D Assoc.) and L. W. Hart (APL), "Shielding of ELF Magnetic-Dipole Fields by Ferromagnetic Cylindrical Shells," *IEEE Trans. Electromagn. Compat.* **EMC-23**, 2-12 (1981).
- W. H. Guier and G. C. Weiffenbach, "The Early Days of Sputnik," *Johns Hopkins APL Tech. Dig.* **2**, 14-15 (1981).
- B. F. Hochheimer, "A Possible Cause of Chronic Cystic Maculopathy: The Operating Microscopé," *Ann. Ophthalmol.* **13**, 153-155 (1981).
- S. A. Kahn, R. L. Stewart, S. G. Tolchin, and S. J. Healy, "Functional and Logical Description of a New Fiber-Optic Contention Bus Network," *Proc., COMPCONFALL*, 268-272 (1980).
- R. B. Kershner, "The Arcane Art of Research and Development Management," *Johns Hopkins APL Tech. Dig.* **2**, 45-49 (1981).
- E. Kirsch (Max-Planck Inst. Aeronomy) and S. M. Krimigis, J. W. Kohl, and E. P. Keath (APL), "Upper Limits for X-Ray and Energetic Neutral Particle Emission from Jupiter: Voyager-1 Results," *Geophys. Res. Lett.* **8**, 169-172 (1981).
- L. C. Kohlenstein, "On the Proportion of the Chesapeake Bay Stock of Striped Bass that Migrates into the Coastal Fishery," *Trans. Am. Fish. Soc.* **110**, 168-179 (1981).
- J. A. Krill and R. H. Andreo, "Vector Stochastic Variational Principles for Electromagnetic Wave Scattering," *IEEE Trans. Antennas Propag.* **AP28**, 770-776 (1980).
- S. M. Krimigis (APL), T. P. Armstrong (Univ. Kansas), W. I. Axford (Max-Planck Inst. Aeronomy), C. O. Bostrom (APL), G. Gloeckler (Univ. Maryland), E. P. Keath (APL), L. J. Lanzerotti (Bell Labs), J. F. Carbary (APL), D. C. Hamilton (Univ. Maryland), and E. C. Roelof (APL), "Low-Energy Charged Particles in Saturn's Magnetosphere: Results from Voyager 1," *Science* **212**, 225-231 (1981).
- L. J. Lanzerotti and C. G. MacLennan (Bell Labs), R. P. Lepping (NASA-Goddard), and S. M. Krimigis (APL), "Intensity Variations in Plasma Flow at the Dawn Magnetopause," *Planet. Space Sci.* **28**, 1163-1169 (1980).
- D. K. Larson, "Computer + Plotter = Direct-to-Art Design," *Microwaves* **20**, 91-97 (1981).
- C.-I. Meng, "Polar Cap Arcs and the Plasma Sheet," *Geophys. Res. Lett.* **8**, 273-276 (1981).
- D. G. Mitchell and E. C. Roelof (APL) and J. H. Wolfe (NASA-Ames), "Latitude Dependence of Solar Wind Velocity Observed  $\geq 1$  AU," *J. Geophys. Res.* **86** (A1), 165-179 (1981).
- L. Monchick (APL) and J. Schaefer (Max-Planck Inst. Physics and Astrophysics), "Theoretical Studies of H<sub>2</sub>-H<sub>2</sub> Collisions. II. Scattering and Transport Cross Sections of Hydrogen at Low Energies: Tests of a New *ab initio* Vibrator Potential," *J. Chem. Phys.* **73**, 6153-6161 (1980).
- J. C. Murphy and L. C. Aamodt, "Optically Detected Photothermal Imaging," *Appl. Phys. Lett.* **38**, 196-198 (1981).
- R. R. Newton, "Comments on 'Was Ptolemy a Fraud?' by Owen Gingerich," *Q. J. R. Astron. Soc.* **21**, 388-399 (1980).
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- R. R. Newton, "The Sources of Eratosthenes' Measurement of the Earth," *Q. J. R. Astron. Soc.* **21**, 379-387 (1980).
- V. L. Pisacane and S. C. Dillon, "Determining Coordinates of the Rotational Pole Using Satellite Data from Four Sites," *J. Geophys. Res.* **86** (B2), 899-902 (1981).
- W. R. Powell, "An Analytical Expression for the Average Output Power of a Wind Machine," *Solar Energy* **26**, 77-80 (1981).
- L. L. Pryor, "Developing and Managing a Large Computer Program," *Johns Hopkins APL Tech. Dig.* **2**, 39-44 (1981).
- W. Schneider (APL), G. Schmeisser (JHMI), and W. Seamone (APL), "A Computer-Aided Robotic Arm/Worktable System for the High-Level Quadruplegic," *Computer*, 41-47 (Jan 1981).
- D. M. Silver and N. deHaas, "Temperature Dependence of the Reaction Rate for H + CF<sub>3</sub>Br," *J. Chem. Phys.* **74**, 1745-1749 (1981).
- R. L. Stewart and S. G. Tolchin, "A Distributed Processing/Fiber-Optic Hospital Information System," *Proc., 4th Symp. on Computer Applications in Medical Care*, 1519-1524 (1980).
- S. G. Tolchin, B. I. Blum, and M. A. Butterfield, "A System Analysis Methodology for a Decentralized Health Care Information System," *Proc., 4th Symp. on Computer Applications in Medical Care*, 1479-1484 (1980).
- R. L. Trapp, "Automated Intrapulse RF Data Acquisition," *Proc., IEEE SOUTHEASTCON*, 508-512 (1981).
- R. Turner, "The Glow-to-Arc Transition in a Pulsed High-Pressure Gas Discharge," *J. Appl. Phys.* **52**, 681-692 (1981).
- T. Wyatt, "The Gestation of Transit as Perceived by One Participant," *Johns Hopkins APL Tech. Dig.* **2**, 32-38 (1981).

## PRESENTATIONS

- F. J. Adrian, "Surface Enhanced Raman Scattering (SERS): A Review and an Electrodynamic Mechanism," Howard

- Univ. Chemistry Dept. Seminar, Washington, D.C. (6 Mar 1981).
- C. B. Barger, R. A. Farrell, and R. L. McCally (APL) and W. R. Green (JHMI), "CO<sub>2</sub> Laser Multiple Pulse Damage Thresholds in the Rabbit Cornea," Assoc. for Research in Vision and Ophthalmology, Sarasota (27 Apr-1 May 1981).
- R. W. Blevins, H. L. Donnelly, J. T. Stadter, R. O. Weiss, and L. Perez y Perez, "At-Sea Test of a Large Diameter Steel Cold Water Pipe," ASME Energy Sources Technology Conf., New Orleans (3-7 Feb 1980).
- H. Bouver (APL) and R. E. Bargmann (Univ. Georgia) "A Comparison of Frequency Curves of Karl Pearson and Norman L. Johnson Using the Minimum  $\chi^2$ ," American Statistical Assoc., Houston (11-15 Aug 1980).
- G. L. Dugger, D. Richards, J. F. George, and W. H. Avery, "Ocean Thermal Energy Conversion," AEO-81-13, Seminar on Energy Options for Developing Countries, Madras (23-27 Feb 1981).
- G. L. Dugger, R. W. Henderson, E. J. Francis, and W. H. Avery, "Projected Costs for Electricity and Products from OTEC Facilities and Plantships," IECEC Conf., Seattle (Aug 1980).
- E. J. Francis and G. L. Dugger, "Promising Applications of OTEC," 7th Energy Technology Conf., Washington, D.C. (24-26 Mar 1980).
- F. K. Hill, P. P. Pandolfini, G. L. Dugger, and W. H. Avery, "Biofouling Removed by Ultrasonic Radiation," Corrosion Conf., Toronto (6-10 Apr 1981).
- M. D. Lasky, "Math and Engineering," Math and Science Career Symp. for Gifted Girls, The Johns Hopkins Univ. (27 Mar 1981).
- R. L. McCally and R. A. Farrell, "Corneal Structure Deduced from Small Angle Light Scattering and Birefringence Properties," Meeting, Assoc. for Research in Vision and Ophthalmology, Sarasota (27 Apr-1 May 1981).
- L. Monchick, "Anisotropic Molecular Forces and Their Influence on Transport Properties, Kinetic Coefficients and Other Molecular Cross Sections," Natuurkunde Colloq., Katholieke Univ. Nijmegen, The Netherlands (24 Nov 1980).
- L. Monchick, "Modern Kinetic Theory of Polyatomic Molecules and Non-Spherical Molecular Forces," Theoretical Physics Sem., Univ. Utrecht, The Netherlands (5 Nov 1980).
- L. Monchick, "Molecular Collisions and Their Correlation with Molecular Forces," Werkbespreking Groep Moleculfysica, Univ. Leiden, The Netherlands (4 Nov 1980).
- L. Monchick, "New Developments in the Theory of Diffusion Controlled Reactions," Seminar der Statische Physik, Univ. Erlangen-Nürnberg, West Germany (20 Nov 1980).
- L. Monchick, "Transport Properties of Anisotropic Molecules," 3rd European Conf. on Low Energy Molecular Collisions, Oxford Univ. (4 Sep 1980).
- V. O'Brien, "Physics and Chemistry," Math and Science Career Symp. for Gifted Girls, The Johns Hopkins Univ. (27 Mar 1981).
- J. S. O'Connor, "Development Testing of a Concrete Cold Water Pipe for Ocean Thermal Energy Conversion Systems," 3rd International Conf. on Alternate Energy Systems, Bal Harbour, Fla. (17 Dec 1980).
- J. S. O'Connor, "Scale Model Structural Testing of a Lightweight Concrete Cold Water Pipe for OTEC Systems," 5th International Symp. on Concrete Technology, Univ. Nuevo Leon, Monterrey, Mexico (25 Mar 1981).
- J. S. O'Connor, "The Development of a Lightweight Concrete for Ocean Thermal Energy Conversion (OTEC) Systems," International Conf. on the Performance of Concrete in the Marine Environment, St. Andrews, New Brunswick (19 Aug 1980).
- P. P. Pandolfini, J. L. Keirse, G. L. Dugger, and W. H. Avery (APL) and H. D. Foust (Trane Co.), "Alclad-Aluminum, Folded-Tube Heat Exchangers for Ocean Thermal Energy Conversion," 3rd Miami International Conf. on Alternative Energy Sources, Miami Beach (15-17 Dec 1980).
- P. P. Pandolfini, J. L. Keirse, J. Funk, and R. T. Cusick, "Tests of the APL/JHU Folded Tube OTEC Heat Exchanger Core Unit," ASME Meeting, Chicago (16-18 Nov 1980).
- R. S. Potember, "Electrical Switching and Memory Phenomena in Organic Charge Transfer Salts," Chemistry Dept. Colloq., Princeton Univ. (4 Feb 1981).
- D. Richards, J. F. George, and J. S. Seward, "Design of 40-MW Grazing and Moored OTEC Pilot/Demonstration Plants," IECEC Conf., Seattle (Aug 1980).
- J. C. W. Rogers, "Downstream Boundary Conditions for Incompressible Flow," Applied Mathematics Colloq., Univ. Wisconsin, Madison (24 Mar 1981).
- The following papers were presented at the American Physical Society Meeting, Phoenix, 16-20 Mar 1981:
- N. A. Blum, J. W. Leight, K. Moorjani, and F. G. Satkiewicz, "Mössbauer Study of Ferromagnetic Amorphous Fe<sub>B</sub> and Fe<sub>2</sub>B;"
- R. L. McCally and R. A. Farrell, "Structural Implications of the Small Angle Light Scattering and Birefringence Properties of the Cornea;"
- T. E. Phillips, K. Moorjani, J. C. Murphy, and T. O. Poehler "TiO<sub>2</sub>-VO<sub>2</sub> Alloys -Reduced Bandgap Effects in the Photoelectrolysis of Water;"
- T. O. Poehler (APL) and F. Wudl and D. Nalewajek (JHU), "Microwave Conductivity of Solid Solutions [(TMTSF)<sub>1-x</sub>(TMDTF)<sub>x</sub>]<sub>2</sub>PF<sub>6</sub>."
- R. S. Potember and T. O. Poehler (APL) and D. O. Cowan and A. N. Bloch (JHU), "Spectroscopic and Electrochemical Properties of Semiconducting Cu-TCNQ Films;"
- R. S. Potember (APL), D. O. Cowan (JHU), and T. O. Poehler (APL), "Properties of a New Polyaromatic Conductor."

## APL COLLOQUIA

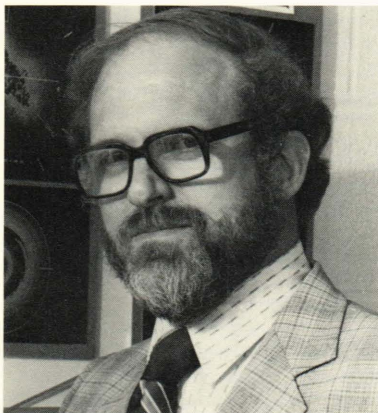
- Mar. 6, 1981 - "Some Serious Problems that Hinder Productivity," W. E. Deming, APL consultant.
- Mar. 13 - "Volcanism in Island Arcs," B. D. Marsh, The Johns Hopkins Univ.
- Mar. 20 - "The Magnetosphere of the Planets," J. A. Van Allen, Univ. Iowa and Smithsonian Inst.
- Mar. 27 - "The Biodynamics of Running," P. R. Greene, The Johns Hopkins Univ.
- Apr. 3 - "The Perplexing Planet Pluto," P. K. Seidelman, U.S. Naval Observ.
- Apr. 10 - "Scopes Revisited? Must Public Schools That Teach Evolution Give Equal Time to Creationism in Science Classes?" S. G. Brush, Univ. Maryland.
- Apr. 17 - "Environmental Microbiology of the Chesapeake Bay and the Atlantic Ocean," R. R. Colwell, Univ. Maryland.
- Apr. 24 - "Observation of Fractional Charge 1/2 on Matter," W. M. Fairbank, Stanford Univ.
- May 1 - "Some Cosmological Consequences of Massive Neutrinos," D. N. Schramm, Univ. Chicago.
- May 8 - "Gravitational Wave Detection Confronts the Uncertainty Principle," C. M. Caves, California Inst. Technology.
- May 15 - "A Two-Year-Life Refrigerator in Space," C. S. Leffel, Jr., APL.
- May 22 - "Drugs, Neurotransmitters, and the Brain," S. H. Snyder, The Johns Hopkins Univ.
- May 29 - "Enhanced Raman Scattering of Molecules Absorbed on Small Particles," M. Kerker, Clarkson College.
- Jun. 5 - "The Ecological Impact of Energy," D. M. Gates, Univ. Michigan.

## THE AUTHORS



**JAMES CARBARY** is a post-doctoral research associate with the Space Physics and Instrumentation Group. He obtained his undergraduate degree in physics from the University of Illinois in 1973 and his Ph.D. in space physics from Rice University in 1977. His thesis work involved numerical simulations of Jupiter's magnetosphere. Since joining APL in 1978, Dr. Carbary has worked with data from the IMP and Voyager spacecraft. He is currently investigating the magnetospheres of Jupiter and Saturn. In addition to being a mountain climber and a devoted bicyclist, he is a fanatical runner.

**BRUCE L. GOTWOLS** was born in Philadelphia in 1941. He received a B.S. in physics from Drexel University in 1963 and did his graduate work at the University of Maryland, receiving an M.S. in physics and astronomy in 1970. Mr. Gotwols joined APL in 1966 as a member of the Space Physics and Instrumentation Group, where he engaged in research in radio astronomy. He was principal investigator for the Solar Radio Astronomy Project, and co-investigator on a program to predict solar particle events using interplanetary scintillation radio observations. He also worked part-time on sever-



al techniques for remote sensing of the ocean. In 1977, this became a full-time endeavor when he joined the Surface Effects Group, where he is engaged in remote sensing of the ocean using optical techniques. He enjoys bicycling, canoeing, and fishing.

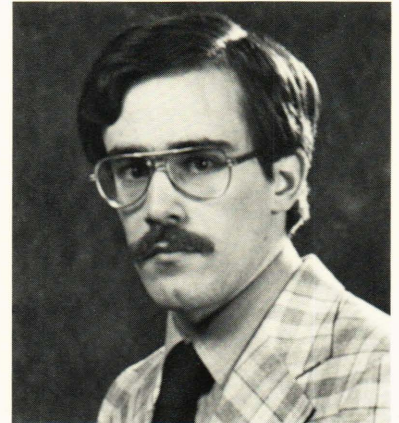
**STEPHEN J. HEALY** is a member of the Computer Systems Group of the Fleet Systems Department. He was born in Medford, Mass. in 1956 and received a B.S. degree in electrical engineering from the University of Maryland (1977), where he has completed a year of graduate school. Technical interests include distributed processing, local computer networking, and microprocessor design. He received the George Corcoran Memorial Award for teaching from the University of Maryland. Hobbies include scuba, skiing, and softball.

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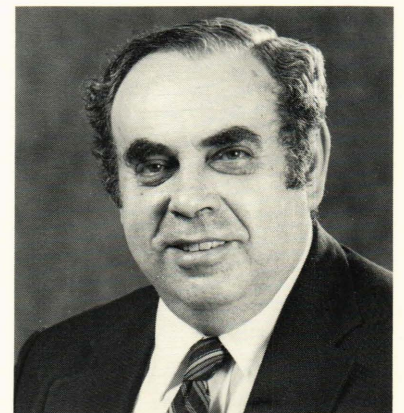
**GEOFFREY B. IRANI** was born in Ohio in 1943, but grew up in Chevy Chase, Md. He received a B.S. in 1964 from the University of Maryland. His M.S. (1966) and Ph.D. (1970) were earned from the University of California, Davis, extension at the Lawrence Livermore Laboratory where, as an employee and then as a Hertz Fellow, he researched the mechanical shock properties of various materials and the electronic band structures of several alloys.

In 1970, Dr. Irani joined APL to work on topics related to SSBN submarine security. Specializing in measurement and analysis of ocean surface waves and in optical sensing of ocean surface features, he has been Assistant Supervisor of the Surface Effects Group since 1979. His efforts include conducting two major oceanographic experiments. Since 1979 he has also been Optical Radiance Project Leader.



**STEVEN A. KAHN** was born in Chicago in 1955, and received the B.S. and M.S. degrees in electrical engineering from Washington University in St. Louis in 1976 and 1978, respectively. His thesis work involved a multiprocessor interconnection network. Mr. Kahn joined APL in 1978 and has worked in distributed processing, computer graphics, local communication networks, and microprocessor design. He is a member of the Computer Systems Group of the Fleet Systems Department. Outside interests include sailing and opera.

**SAMUEL KOSLOV** was born in Brooklyn in 1927. He received the A.B., M.A., and Ph.D. (1957, nuclear physics) from Columbia University. During the period from 1954 to 1964, four years of which he spent as Associate Professor of Physics at Stevens Institute of Technology, his primary research areas were controlled fusion, plasmas, nuclear weapons effects. He joined the Office of the Secretary of Defense in 1964 and was Special Assistant for National Intelligence when he left in 1967 to join RAND Corporation's Research Council. He became Special Assistant for Science to the Assistant Secretary of the Navy in 1972, receiving



the Navy Superior Civilian Service Award in 1977.

Dr. Koslov joined APL in 1978. As Assistant to the Director for Technical Assessment, he advises on the technical performance of various programs, and develops and encourages interaction of the various laboratory divisions in developing new interdisciplinary approaches to problems of national interest. He is Executive Secretary of the Program Review Board.

When not hunting for and cataloging his collection of early books on the history of science and medicine, he indulges in his other hobbies of photography and microscopy.

STAMATIOS M. KRIMIGIS was born in Chios, Greece in 1938. He was educated at the University of Minnesota (B. Physics, 1961) and the University of Iowa (M.S. 1963, Ph.D. 1965, both in physics). He remained at Iowa as Research Associate (1965-66) and Assistant Professor of Physics (1966-68) before joining APL in 1968.

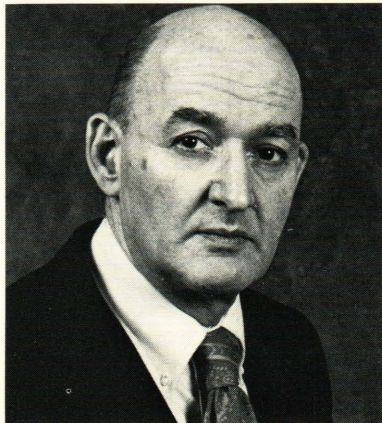


He is currently Chief Scientist of the Space Department and Supervisor of the Space Physics and Instrumentation Group. Dr. Krimigis' research interests include the earth's magnetosphere, the sun, the interplanetary medium, and the magnetospheres of the planets. He has been the Principal Investigator or Co-Investigator on several NASA spacecraft, and has published 120 papers. Most recently he has served as the Principal Investigator of the Low Energy Charged Particle (LECP) experiment on Voyagers 1 and 2, designed and built at APL, and has been awarded the NASA Medal for Exceptional Scientific Achievement for that work.

CLAUDE S. LEFFEL, JR. was born in Pearisburg, Va. in 1921 but spent most of his youth in Howard County, Md. He did his undergraduate work at St. Johns College, where he taught physics and mathe-

matics during 1946-50 after service in the Air Force. He received the Ph.D. in physics from The Johns Hopkins University in 1960.

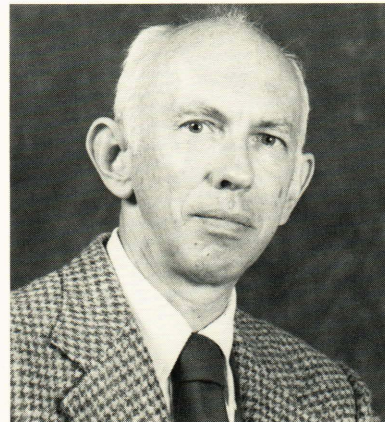
Dr. Leffel was employed by APL in 1960 as a member of the Plasma Dynamics Group. Since 1974, he has been in the Advanced Research Programs Office. At APL, he has worked in the fields of thermonuclear fusion, weapons effects, gamma ray spectroscopy, atmospheric electricity, space cryogenics, small-scale hydroelectric power, and geothermal energy. He serves as the Sunday Superintendent of the Hunting Ridge Presbyterian Church.



MATTHEW C. LUCAS was born in Stevenson, Md. in 1930. He attended Loyola College in Baltimore, where he earned a B.S. in physics in 1952. He was employed by ACF Electronics, Riverdale, Md., from 1952 to 1960, where he assisted in the development of aircraft flight simulators, and was also field engineering supervisor of the Pacific area. He was

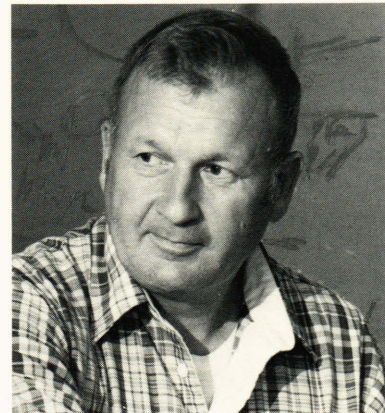


senior field engineer for display systems for LTV Electronics at the Pentagon from 1960 to 1962. In 1962 he joined APL, where he has coordinated test and evaluation programs for TALOS Missile Systems and electronic warfare systems. As a system engineer, he has worked on the Guided Projectile Program and the MK 92 Fire Control System.



WILLIAM B. MCCLOSKEY, JR., was born in Baltimore in 1928, received his B.S. degree from Columbia University in 1951, and served until 1953 with the U.S. Coast Guard in Alaska. After working for the Baltimore *Sun*, the U.S. Information Agency in Madras, and in industrial public relations, he joined APL's External Relations Group in 1962, where his responsibilities include Federal liaison in Washington. Since 1975, he has spent vacations and leaves of absence in Alaska inspecting foreign fishing ships as a member of Coast Guard groups, and working as a commercial fisherman. A result of his experiences was the book *Highliners* (McGraw-Hill, 1979), a documentary novel about Alaskan fishermen. A previous novel, *The Mallore Affair* (Heinemann/Bantam, 1966), dealt with Americans in India. Since 1979, Mr. McCloskey has participated in the fisheries of Canada, Norway, and Japan at the invitation of their governments. His articles and photographs appear in various newspapers and magazines, including professional fishing publications.

JOHN G. PARKER was born in Providence, R.I. in 1926. He received the Sc.B. in electrical engineering (1947) and the Sc.M. (1956) and Ph.D. (1952) in physics, all from Brown University. After a brief stay at the Johns Hopkins Institute for Cooperative Research, he joined the Naval Research Laboratory in 1952. There he conducted research on sound



propagation in oceanic isothermal layers and the related problem of reflection from irregular surfaces.

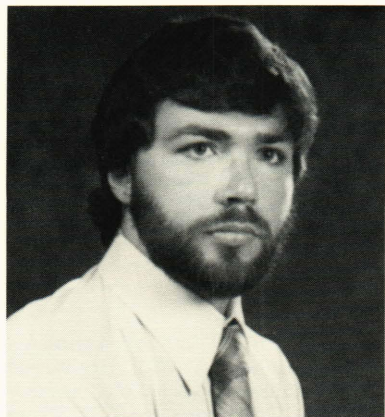
Dr. Parker joined APL in 1956. His research efforts and interests at the Eisenhower Research Center have revolved mainly around the problem of molecular energy transfer. He has investigated the dynamical physical and chemical events accompanying pulsed laser generation of various molecular species, the effectiveness of laser-excited singlet oxygen in water sterilization, and, most recently, the capabilities of a system for detecting underground pipeline leaks based on the use of an acoustic diagnostic.



LINDA GREEN PHILLIPS is an engineer in the Power Plant Site Evaluation Group. Born in Schenectady in 1953, she received the B.A. in physics at the State University College of New York at Potsdam in 1975 and the M.S. in engineering science at the State University of New York at Buffalo in 1980. On joining APL in 1978, she participated in the geothermal and low head hydroelectric programs. Since 1979, she has concentrated on studies concerning the recovery of methane from landfills and has been project engineer for landfill field testing programs at the Laboratory. Her hobbies include swimming, camping, and fishing.

KARL E. SHADE was born in Kansas City, Mo. in 1928. He earned a B.S. at William Jewell College, and an M.S. in physics from The Johns Hopkins University. During the Korean War, Mr. Shade served in the U.S. Army Ordnance Corps at Redstone Arsenal. In 1955, he joined APL and worked in the TERRIER and TARTAR Missile programs in the areas of system engineering, test, and evaluation. Since the inception of the MK 92 Fire Control System Program at APL in

1973, he has been the project engineer. At present, Mr. Shade is project engineer for the Guided Projectile Weapon System.



STEVEN L. SHADEL was born in rural Pennsylvania in 1957. He came to APL in 1979 after graduating from Shipensburg State College with a B.A. (summa cum laude) in physics. Following his completion of the Associate Staff Training Program, he joined the Environmental Assessment Group, where he has been involved primarily with landfill methane testing and utilization programs. Mr. Shadel is responsible for the operation of equipment and instrumentation used for extracting and analyzing landfill gas in the field and is currently working to develop new testing techniques to improve field procedures. He is working toward an M.S. degree in computer science at The Johns Hopkins University Evening College. He enjoys camping, growing house plants, and playing basketball, softball, and golf.

ROBERT L. STEWART is a member of the Computer Systems Group of the Fleet Systems Department. Born in Wilm-

ington, Del. in 1939, he enlisted in the Navy in 1957 where he served as a computer specialist and surface warfare officer until his retirement in 1977. He received the M.S. in mathematics from the University of Utah in 1968. Mr. Stewart joined APL in 1977. His work has been in Navy command, control and communications systems planning, hospital information systems analysis, and computer systems engineering.



STEPHEN G. TOLCHIN supervises the Software Engineering Section of the Fleet Systems Department's Computer Systems Group. Born in 1944 in New York City, he received M.S. (1967) and Ph.D. (1973) degrees in physics from New York University. He has taught at N.Y.U., the State University of New York (Fort Schuyler), New York Institute of Technology, and the JHU/APL Evening College. Prior to joining APL in 1978, Dr. Tolchin worked for Analytic Services, Inc. and for Blue Cross and Blue Shield of Greater New York on the analysis, design and implementation of large information systems. His interests at APL include distributed systems, medical information systems, and automated tools for software engineering.