

## Appendix - 1 Panel Member Biographies

**Philip E. Coyle III** is a Senior Advisor to the President of the Center for Defense Information and defense consultant. He is a recognized expert on U.S. and worldwide military research, development and testing, on operational military matters, and on national security policy and defense spending.

From September 29, 1994, through January 20, 2001, Mr. Coyle was Assistant Secretary of Defense and Director, Operational Test and Evaluation, in the Department of Defense, and is the longest serving Director in the 20 year history of the Office.

Mr. Coyle has 40 years experience in research, development, and testing matters. From 1959 to 1979, and again from 1981 to 1993, Mr. Coyle worked at the Lawrence Livermore National Laboratory in Livermore, California. From 1987 to 1993, he served as Laboratory Associate Director and Deputy to the Laboratory Director. In recognition of his 33 years service to the Laboratory and to the University of California, the University named Mr. Coyle Laboratory Associate Director Emeritus.

During the Carter Administration, Mr. Coyle served as Principal Deputy Assistant Secretary for Defense Programs in the Department of Energy (DOE). In this capacity he had oversight responsibility for the nuclear weapons testing programs of the Department.

Mr. Coyle graduated from Dartmouth College with an MS in Mechanical Engineering (1957) and a BA (1956) and has received numerous accolades including the Defense Distinguished Service Medal by Secretary Perry and the Bronze Palm of the Defense Distinguished Service Medal by Secretary Cohen.

**Charles A. Fowler** has a BS in Engineering Physics from the University of Illinois. His work has been primarily in electronics and military systems. He has held management positions at AIL Systems, the Defense Department (DOD), Raytheon and Mitre. He is currently a consultant to government and industry.

He is a former member and past Chairman of the Defense Science Board and of the Defense Intelligence Agency (DIA) Advisory Board and a former

member of the Air Force Scientific Advisory Board. He is a member of the National Academy of Engineering and a Fellow of the Institute of Electrical and Electronic Engineers (IEEE), the American Institute of Aeronautics and Astronautics (AIAA) and the American Association for the Advancement of Science (AAAS).

Among his awards are: the US Electronic Warfare Joint Service Award (1980); the DOD Medal for Distinguished Public Service (1987 and 1997); the DIA Exceptional Civilian Service Medal (1982) and the Director's Award (2001); the 1998 IEEE Pioneer Award (with Entzminger and Kenneally) for early work leading to the US JointSTARS system; and the 2001 Eugene G. Fubini Award for "providing significant contributions to DOD and National Security through outstanding scientific and technical advice."

**Robert A. Frosch** earned a BA from Columbia College in 1947, and a PhD in Physics from Columbia University in 1952. In 1956 he was appointed Director of Hudson Laboratories at Columbia University. In 1963 he became Director for Nuclear Test Detection in the Defense Department's Advanced Research Projects Agency (ARPA). In 1965 he was appointed Deputy Director of ARPA. In 1966 Dr. Frosch was appointed Assistant Secretary of the Navy (Research and Development).

In 1973 he became the first Assistant Executive Director for Program of the U.N. Environment Program. In 1975 he became Associate Director for Applied Oceanography at the Woods Hole Oceanographic Institution.

From 1977-1981 Dr. Frosch was Administrator of NASA. During this period, the first space shuttle was built and ground-tested, and spacecraft projects were begun to investigate Venus with radar imaging, and the universe with x-rays and gamma rays.

In 1981 Dr. Frosch became the first President of the American Association of Engineering Societies. From 1982-1993 he was Vice President of the General Motors Corporation in charge of Research Laboratories. In 1993 he joined the John F. Kennedy School of Government at Harvard University. Dr. Frosch is a fellow or member of a number of engineering and scientific societies. He has been awarded the Navy Distinguished Public Service

Award, and the NASA Distinguished Service Medal. He has served as President of Sigma Xi, and is an Honorary Member of Eta Kappa Nu.

**Ivan Kaminow** retired from Bell Labs in 1996 after a 42-year career. He did seminal studies on electrooptic modulators and materials, Raman scattering in ferroelectrics, integrated optics, semiconductor lasers, birefringent optical fibers, and WDM lightwave networks. Later, as Head of the Photonic Networks and Components Department, he led research on WDM components, and on WDM local and wide area networks. Earlier (1952-1954), he did research on microwave antenna arrays at Hughes Aircraft Company.

After retiring from Bell Labs, he served as IEEE Congressional Fellow. He also established Kaminow Lightwave Technology to provide consulting services to technology companies and to law firms. In 1999, he served as Senior Science Advisor to the OSA. He received degrees from Union College (BSEE), UCLA (MSE) and Harvard (AM, Ph.D). He has been Visiting Professor at Princeton, Berkeley, Columbia, University of Tokyo, and Kwangju University (Korea). He has written or co-edited 5 books, the most recent being *Optical Fiber Telecommunications IV A&B*.

Kaminow is a Life Fellow of IEEE, and Fellow of APS and OSA. He is the recipient of the Bell Labs Distinguished MTS Award, IEEE Quantum Electronics Award, OSA Townes Award, IEEE/LEOS/OSA Tyndall Award and IEEE Third Millennium Medal. He is a member of the National Academy of Engineering, Diplomate of the American Board of Laser Surgery, and Fellow of the New York Academy of Medicine.

**C. Kumar N. Patel** is Professor of Physics and Astronomy, Chemistry, and Electrical Engineering at UCLA. From 1993 to 2000 he was the Vice Chancellor of Research at UCLA. Until March 1993, he was Executive Director, Research, Materials Science, Engineering and Academic Affairs Division at AT&T Bell Laboratories, Murray Hill, New Jersey. He is a member of the National Academy of Sciences (1974) and the National Academy of Engineering (1978). He is a fellow of the American Academy of Arts and Sciences.

For his seminal contributions to lasers and quantum electronics (including his invention of the carbon dioxide laser), he has received many awards

including the highest awards of the Institute of Electrical and Electronic Engineers and the Optical Society of America. He received the National Medal of Science from President of the United States in July 1996. He is the Past President of the American Physical Society (1995) and the Sigma Xi, The Scientific Research Society (1993-1995). He co-chaired (with N. Bloembergen) the American Physical Society Study of the Science and Technology of Directed Energy Weapons. Dr. Patel is a founder and Chairman of the Board of Pranalytica, a sensor instrumentation company. He is a Director of the Newport Corporation.

**John L. Remo** has been the principal investigator on numerous research projects involving Quantum Optics as applied to laser resonators (Ph.D. dissertation), optical interferometry and systems design, detectors, materials sciences, high energy density continuous and pulsed (infra-red and visible laser, X-ray, neutron, and very high speed mechanical) interactions with matter, nuclear isomers, space physics, astronomy, planetary physics, meteoritics, risk management, biophysics, alternate energy utilization, and science policy issues. He holds over ten patents in laser design, sensors, and material properties and has also published over 100 refereed papers and book chapters, from successful technology corporations and consulted to many others as well as to the National Laboratories, components of the Departments of Energy and Defense and NASA. In addition he has worked with the United Nations Office of Outer Space Affairs and has addressed the U.N. General Assembly Committee on the Peaceful Uses of Outer Space (COPUOUS) on the issue of hazards from Near-Earth objects. He has taught several undergraduate and graduate course and has supervised several graduate dissertations. Dr. Remo has received numerous honors and awards in recognition of his achievements.

**Ian Roxborough** is Professor of Sociology and History at Stony Brook University. He has a Ph.D. in sociology from the University of Wisconsin-Madison, and has taught at the University of Glasgow and the London School of Economics. In 1997-98 he was Senior Research Fellow at the Institute for National Strategic Studies, National Defense University. His current research, "Diagnosing New Dangers: a sociology of military strategy and threat assessment," is funded by the Carnegie Corporation of New York. It focuses on the organizational and conceptual underpinnings of U.S. military strategy and doctrine. The author of three books and numerous articles, he has published his work on military strategy

in Joint Force Quarterly, the Army War College's Strategic Studies Institute monograph series, International Sociology, and elsewhere. Professor Roxborough is currently writing a book on U.S. military strategy since the end of the Cold War.

**Lawrence Scheinman** is Distinguished Professor of International Policy at the Monterey Institute of International Studies, Adjunct Professor at Georgetown University, and retired professor from Cornell University where he also served as Director of the Program on Science, Technology and Society and as Assistant Director and Director of the Peace Studies Program. He was the Assistant Director of the U.S. Arms Control and Disarmament Agency during the Clinton Administration, responsible for NonProliferation and Regional Arms Control and during the Carter Administration was Principal Deputy to the Deputy UnderSecretary of State for International Security, Science and Technology. In the mid 1980s he served as Senior Advisor on proliferation and arms control to the Director General of the International Atomic Energy Agency. He has written extensively on non-proliferation, arms control and international aspects of technology. Dr. Scheinman is a member of the Council on Foreign Relations and is admitted to practice before the Bar of the State of New York.

**Leonard Weiss**, Chair, is a private consultant specializing in analysis and development of public policy issues involving technology and national security. He is a former staff director of the U.S. Senate Committee on Governmental Affairs, where, for more than two decades, he crafted and directed legislative and oversight activities involving nuclear nonproliferation, energy policy, government management, and science and technology. He has held tenured professorships in Applied Mathematics and Engineering at Brown University and the University of Maryland, and has a Ph.D. from Johns Hopkins University.

**Ray A. Williamson** is Research Professor of Space Policy and International Affairs in the Space Policy Institute of The George Washington University, where, among other research, he currently directs the Project on Socioeconomic Benefits of Earth Science Research. He is co-investigator of the project, "Transatlantic Defense Relations: Is There a C4ISR Technology Gap?" Previously he was a Senior Associate in the Office of Technology Assessment of the U.S. Congress, where he was project director for more than a dozen major reports on space transportation

development and management policies, Earth observations, and space exploration. He is editor, with John C. Baker and Kevin O'Connell, of *Commercial Observation Satellites: At the Leading Edge of Global Transparency* (Washington, DC: RAND and ASPRS, April 2001), editor of *Dual-Purpose Space Technologies: Opportunities and Challenges for U.S. Policymaking* (Washington, DC: Space Policy Institute, July 2001), and co-editor of *Space and Military Power in East Asia* (Washington, DC: Space Policy Institute, December 2001). He is also the author or editor of seven books on archaeology, historic preservation, and American Indian astronomy, culture, including *Living the Sky: The Cosmos of the American Indian*.

**Jill Wittels** is Corporate Vice President, Business Development for L-3 Communications, a leading merchant supplier of Intelligence, Surveillance and Reconnaissance systems and products, secure communications systems and products, avionics and ocean products, training devices and services, microwave components and telemetry, instrumentations, space and navigation products. Dr. Wittels has over 25 years of management, engineering and leadership experience. She worked for 21 years with BAE Systems and its predecessor companies, including Lockheed Martin, Loral and Honeywell. Most recently, she served as vice president and general manager of BAE Systems' Information and Electronic Warfare Systems/Infrared and Imaging Systems division. Dr. Wittels began her career as a systems engineer and has also served as a Congressional Fellow for the American Physical Society, a research associate at Massachusetts Institute of Technology and a senior visiting scientist for the National Academy of Sciences. Dr. Wittels received a Bachelor of Science degree in Physics from MIT in 1970 and received a PhD in Physics from MIT in 1975. She serves on the Board of Overseers for the Department of Energy's Fermi National Accelerator Lab, is a member of the American Physical Society and a member of the American Astronomical Society. Dr. Wittels presently serves on the Boards of Directors of Innovative Micro Technology Inc and eMargin Inc.

## Staff Biographies

**Subrata Ghoshroy** served as the Executive Director of the FAS Space Weapons Project while also serving as a Senior Research Associate at Harvard University's John F. Kennedy School of Government. Mr. Ghoshroy's research involves missile defense, space weaponization, and security issues in South Asia.

Previously, he was a Congressional Science and Engineering Fellow with the House International Relations Committee. Later he served as a Professional Staff Member of the House Armed Services Committee.

Before moving to the policy and legislative world, Mr. Ghoshroy had worked for nearly twenty years in defense research and development specializing among others in high power lasers, pulse power systems, and alternative energy resources. Ghoshroy holds B.S. and M.S. degrees in electrical engineering and an MS in Public Policy. He has published technical articles in his discipline, arms control and on South Asia.

He is a Senior Defense Analyst at the United States General Accounting Office and worked on the space weapons project during a yearlong sabbatical. Prior to that, he served as the technical leader of the GAO team that investigated the results of a flight test in the National Missile Defense program, which found that the infrared sensor had malfunctioned.

**Josh Kellar** is a research associate with the Federation of American Scientists. He has a B.S. from Georgetown University where he majored in physics and English, an MA in creative writing from Boston University, and will be a PhD candidate in materials science & engineering at Northwestern University in the fall where he will study nanotechnology.

**Heidi La Bash** received a B.S. in Journalism from the University of Kansas and now works in the Security Studies Program at the Massachusetts Institute of Technology. Research interests include Post Traumatic Stress Disorder in women, and especially women in the military. Building on her experience working abroad in Japan and as a media analyst, she plans to continue her studies and pursue her research interests in a clinical psychology graduate program.

## Appendix - 2      Summary of Briefings

December 18, 2002:

Dick Garwin, Council on Foreign Relations, Direct Space Weapons; Bob Preston, RAND, Summary of Space Weapons, Earth Wars; Peter Hays, Joint Forces Quarterly, Overview of Space Weaponization Stances; Michael Krepon, Stimson Center, International Ramifications; Jeffrey Lewis, University of Maryland,

Budgetary Information on Space Weapons; Laura Grego, Union of Concerned Scientists, Tracking Satellites; Richard DalBello, Satellite Industry Association, Industry View on Space Weaponization.

February 20, 2003:

Randy Correll, SAIC, Space Weapons and National Security Strategies; Dan Hastings, former Chief Scientist USAF, MIT, USAF Perspective; John Remo, Harvard Center for Astrophysics, Preliminary Debris Findings.

April 17, 2003:

John Remo, Harvard Center for Astrophysics, Continuation of Debris Findings; Qiu Young, MIT, ASAT capabilities of Brilliant Pebbles-Type System; Pavel Podvig, Princeton, Capabilities of Small Satellites.

July 10, 2003, Boston MA:

Bob Naka, former director NRO, Reconnaissance Issues in Space John Remo, Harvard Center for Astrophysics, Orbital Debris; Dennis Papadopoulos, University of Maryland, Effects of HANE; David Wright, Union of Concerned Scientists, North Korean Missile Capabilities; Pavel Podvig, Princeton University, Russian ASAT capabilities; Geoffrey Forden, MIT, GPS Coverage and Robustness.

January 27, 2004

Review of Preliminary Draft - Comments from Panelists