OUT OF THE BOX AND INTO THE FUTURE

A Dialogue Between Warfighters and Scientists on Far-Future Warfare (2025)

26-27 June 2000

Armed Forces Journal
conference & exhibition group

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Why You Should Attend and Key Participants

"... This unique event was developed from discussions between Congress, the defense policy community, and research scientists in order to promote the sharing of ideas between the civilian R&D community and the uniformed military on critical issues of national defense. ... This worthwhile effort will bring together the U.S. military, the science and engineering research communities, and members of Congress to explore the impact of rapid advances in science and technology on far-future warfare. It will promote a better understanding for all parties involved of the interplay between the scientific and the warfighting communities, and the critical impact of research on future military operations. Upon conclusion of the conference and preparation of a summary report, we request a formal briefing on your recommendations and future plans. We are particularly anxious to hear your informed opinions on the scientific and technical areas that will impact future military operations and thus, require additional S&T investment from Congress and the Department of Defense, as well as recommendations on methods for improving communications between scientists and the military."

Senator Joseph Lieberman, Senator Pat Roberts, and Senator Jeff Bingaman

22 March 2000, Letter to the Potomac Institute for Policy Studies, U.S. Joint Forces Command and CNSR

"Transformed military forces are needed because the strategic environment is changing. Technology, vastly changing the civilian world, is changing the military sphere as well. Exploited effectively, through innovative operational concepts and new organizational arrangements, new information systems and other technologies will allow U.S. forces to be smaller, faster, more agile, more precise and better protected."

The Honorable William S. Cohen, Secretary of Defense

2000 Annual Report to the President and the Congress

Conference Co-Chairs

Congress

Representative Curt Weldon (R-PA)

Chairman, Military Research & Development Subcommittee, House Armed Services Committee

Defense

Admiral Harold Gehman, USN

Commander in Chief, U.S. Joint Forces Command

Science & Engineering

Dr. Charles Vest

President, Massachusetts Institute of Technology

Conference Steering Committee

Dr. Joseph Bordogna
Deputy Director, National Science Foundation

Major General George Close, USA (Ret.)
Former Director, Operational Plans and Interoperability (J-7)

Dr. Craig Dorman
Chief Scientist, Office of Naval Research

Dr. Ted Gold
Director, Joint Advanced Warfighting Program, IDA

General Al Gray, USMC (Ret.)
Former Commandant Marine Corps

Dr. Joe Janni
Director, Air Force Office of Scientific Research

Major General John R. Landry, USA (Ret.)
NIO for Conventional Military Issues, National Intelligence Council

Mr. Andy Marshall
Director, Net Assessment, OSD

Mr. Walter Morrow
Director Emeritus, MIT Lincoln Laboratory

Major General Tim Peppe, USAF
Director, Joint Experimentation, USJFCOM

Dr. Richard Powell
Vice President, Optical Society of America
Vice President for Research and Graduate Studies, University of Arizona

Program Objectives and Key Issues

The incredible pace of scientific and technological change, combined with the uncertainty of future threats, makes forecasting the nature of far-future military operational areas both difficult and crucial as we enter the 21st century. If we are to ensure U.S. technological superiority in far-future conflicts, we must promote a technology-driven revolution in military affairs. However, the current structure for achieving technological progress in the military is grounded in organizational structures, priorities, and funding distributions that have changed little since the Cold War era. Moreover, commercial industry and universities dominate most areas of science and technology, rather than the defense community.

The influence of science on military affairs is already profound and will surely grow during the next 25 years. But understanding the direction of that growth is an extremely complex undertaking and, for many areas of science, is understood by only a few experts. Similarly, the warfighter faces an increasingly complex far-future landscape, with ill-defined enemy operations and both allied and threat weapons technologies. Yet, military doctrine must be developed for far-future battles.

The purpose of *Out of the Box and Into the Future: A Dialogue Between Warfighters and Scientists on Far-Future Warfare,* the focal point of a larger effort being conducted at the request of congressional members, is to test current perspectives and generate new ideas on how science will change the nature of far-future (Year 2025) military operations. These goals will be pursued through a dialogue among leading science researchers, uniformed military strategists, and the congressional members and staffs who must fund the efforts to prepare for the future. The project will enhance our ability to understand and plan for the diverse spectrum of possible battlefield scenarios in the new century.

Conference Goals

- Test current perspectives and generate new ideas on how science will change the nature of far-future operational areas
  - Primary Focus: How is science likely to affect far-future conflict?
  - Subsidiary Issues: What threats and doctrine will emerge?
- Help to prepare the U.S. for the diverse spectrum of possible warfighting scenarios in the new century
  - R&D budgets
  - Leveraging academia and industry

Some Key Issues To Be Addressed By Noted Warfare and Science Experts

Far-Future Conflict Characteristics

- Will U.S. forces face "high tech" soldiers or unsophisticated warriors? If "both," which do we emphasize?
- Will we continue to exploit our information superiority, or are we vulnerable to information warfare?
- Can we expect increasing incidents of urban warfare and, if so, how do we win in the cities?
- How do we protect our forces in the face of expected weapons proliferation?
- How do we transport forces with those increased levels of protection?
- Does the emphasis on combined forces mean dramatic role-changes for the Services?
- What should be our weapons priorities?
  - Heavy armor vs. light systems with distributed capabilities
  - Balance of Hider vs. Finder
  - Maneuver vs. Firepower
  - Surface ships vs. Undersea Vessels

Science and Technology Trends

- The importance of current and predicted science and technology trends and how they might affect conflict.
- Priorities of these science and technology trends will be suggested along with possible changes in who might develop and build them (e.g., federal laboratories, defense or commercial industry, or academia).
- Capabilities derived from today's genetics and neuroscience research and the impact on U.S. forces.
- Impacts of new forms of energy and power research on military operations.
- Protection benefits derived from nanotechnologies and advanced materials research.
- Where is the information revolution going in the next 30 years - what is the role of defense R&D?

Program - Monday, 26 June

0700-0800 Registration

0800-0850 Sponsor and Co-Chair Introductory Remarks
Mr. Michael Swetnam, President and Chairman, Potomac Institute for Policy Studies
Representative Curt Weldon (R-PA), Chair, Subcommittee on Military R&D, House Armed Services Committee
Admiral Harold Gehman, Commander in Chief, U.S. Joint Forces Command
Dr. Charles Vest, President, Massachusetts Institute of Technology

0900-0930 Joint Vision 2010 and Beyond
Major General George Close, USA (Ret.), Former Director, Operational Plans and Interoperability (J-7)

0930-0940 Introduction of Senator Lieberman
Dr. Joseph Bordogna, Deputy Director, National Science Foundation

0950-1040 Senator Joseph Lieberman, Senate Armed Services Committee

1040-1120 Future Technology Investments
Dr. Frank Fernandez, Director, Defense Advanced Research Projects Agency

1140-1230 Asymmetrics
Mr. Ralph Peters, Author, *Fighting for the Future?* and *The War in 2020*

1230-1350 Luncheon - Future Combat
Dr. Dennis Bushnell, Chief Scientist, NASA Langley Research Center

1400-1800 Fundamental Warfighting Parameters - Introduction - MG Robert Scales, Jr., Commandant, Army War College

- **Intelligence/Threat**
  Changes in the threat will dictate much of our doctrine, rules of engagement, and the technologies we incorporate. The past few years have shown that our military operations cannot be insulated from global and national politics. Operations involving civil strife and peacekeeping will continue to bring complexities to intelligence-gathering. Understanding the enemy's next move will be increasingly difficult and crucial.
  Lieutenant General Pat Hughes, USA (Ret.), Former Director, Defense Intelligence Agency

- **Maneuver/Power Projection/Protection**
  Robotics on the battlefield may change current concepts of maneuver. Power projection could be a much more complex undertaking, given advancements in precision weaponry. Will adequately equipped forces be lighter or heavier? Urban warfare may become more necessary, with maneuver constrained by civilian populations and admonitions against large-scale destruction. Troops and civilian populations must be protected against the diverse set of weapons and tactics they are likely to encounter in far-future conflicts. Threats will include advanced munitions; chemical, biological and nuclear weapons of mass destruction; and asymmetric threat weapons and tactics.
  General Al Gray, USMC (Ret.), 29th Commandant, United States Marine Corps

- **Firepower/Precision Targeting**
  Beam weapon advancements may bring new dimensions to the firepower equation. Extreme accuracy, target identification, and selectivity (from increasingly remote and sophisticated platforms) may change the balance between firepower and maneuver.
  General Paul Gorman, USA (Ret.), Former Commander in Chief, United States Southern Command

- **Space Warfare**
  Space will certainly play a larger part in tomorrow's battles, even if it only an expanded intelligence-gathering role. There is also the potential for space planes and orbital-trajectory munitions.
  General John Piotrowski, USAF (Ret.), Former Commander in Chief, United States Space Command

- **Air Warfare**
  Recent US experiences in conflict have stressed air-to-ground warfare under conditions of near-complete air dominance. Will we see increased threats to this superiority? Will technology make finding and hitting ground targets more or less difficult? Will stealth continue to be effective? What are the expected trends in air transport?
  General Ronald Fogleman, USAF (Ret.), Former Chief of Staff of the Air Force

- **Information/Networking**
  C^4I Advancements, principally from the commercial sector, will be largely available to our opponents. But the U.S. is likely to remain more advanced than our enemies, in terms of its computers, sensors, and communications networks. We will also be more dependent on these technologies, making them a prime target for our foes.
  Admiral Arthur Cebrowski, USN, President, Naval War College

1830-2100 Dinner
Dr. David Brin, Author, *Earth*, *Startide Rising*, *The Postman*

Program - Tuesday, 27 June

0800-0840 Opening Remarks

Dr. Delores Etter, Deputy Under Secretary of Defense (Science and Technology) and Deputy Director of Defense Research and Engineering

0850-1150 Panels on Science and Technology Trends (Break-out Session #1)

- **Energy**

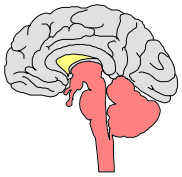
Three germane areas of energy projection: Macro-energy issues (e.g., availability of fossil fuels, growth of renewable energy) are critical to defense production and affordability. Energy consumption and conversion (e.g., hybrid propulsion, large consumption of electrical power for electronics and weapons) during military operations include projecting effects on logistics, power consumption, and stealth operations. Finally, micro-power technologies are emerging to improve batteries and unconventional sources of power to satisfy small power requirements.

Dr. Robert Nowak, Program Manager, Defense Sciences Office, Defense Advanced Research Projects Agency

Dr. Terry Surles, Associate Director, Energy Programs, Lawrence Livermore National Laboratory

- **Human Factors/Neuroscience**

Studies of the brain are enhancing our understanding of neural mechanisms. Neuroscience may affect tomorrow's military operations through this understanding and resultant "precision drugs."



Dr. Dan Alkon, Chief, Laboratory of Adaptive Systems, National Institutes of Health

Dr. William Calvin, Neurophysiologist, Affiliate Professor, School of Medicine, University of Washington

Dr. Dennis McBride, Professor, Departments of Psychology and Engineering, University of Central Florida

- **Nanotechnologies**

The possibility of realizing orders of magnitude of improvement in strength for structural materials and to reduce MEMS devices to molecular levels is awesome. Future roles as diverse as medical "tool kits"and super light armor could be emerging within this time frame.

Dr. Ken Gabriel, Professor of Electrical and Computer Engineering and Robotics, Carnegie Mellon University

Dr. Ralph Merkle, Principal, Zyvez and Former Researcher, Xerox Palo Alto Research Center

Dr. Paul J. McWhorter, Deputy Director of Microsystems Center, Sandia National Laboratory

Dr. Richard Smalley, Gene and Norman Hackerman Professor of Chemistry and Professor of Physics, Rice University

1320-1400 Keynote Speech

Dr. Hans Mark, Director, Defense Research and Engineering

1400-1700 Panels on Science and Technology Trends (Break-out Session #2)

- **Advanced Materials**

Some have suggested that the days of exponential advancements in conventional structural materials have ended. Even if this is true, electronics materials may bring about dramatic improvements in computing speed, sensor sensitivities, and other capabilities.

Dr. Merrilea Mayo, Associate Professor of Materials Science and Engineering, Pennsylvania State University

Dr. Steve Wax, Program Manager, Defense Sciences Offices, Defense Advanced Research Projects Agency

Dr. George Whitesides, Professor of Bioorganic/Physical Organic Chemistry and Materials Science, Harvard University

- **Biomedical**

The rapid and profound changes in biological sciences and medicine will be discussed during this session. Some important issues are the effectiveness of emerging biological warfare agents versus protective and curative systems, the potential to develop "Biobots," integrating organic and computational and electronics components, and the diverse applications of the tools and products of genetic research.

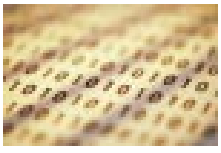
Dr. Millie Donlon, Program Manager, Defense Sciences Offices, Defense Advanced Research Projects Agency

Dr. Stuart Kauffman, Founding General Partner and Chief Scientific Officer, Bios Group LLP

Dr. Harold P. Smith, Jr., Former Assistant to the Secretary of Defense for Nuclear, Chemical, and Biological Defense Programs

- **Information and Knowledge**

Systems of computers, information networks, and imbedded sensors may be the most important weapon in our arsenal. It is difficult to predict with any certainty how these sciences and technologies may change over the next twenty-five years, but clearly this is a commercial sector investment area to watch closely.



Dr. Steve Cross, Director, Software Engineering Institute, Carnegie Mellon University

Dr. Paul Messina, Director, ASCI Program, Department of Energy and CalTech

Dr. Irving Wladawsky-Berger, Vice President, IBM Corporation and Co-Chair, PITAC

1700 Conference Adjourns

General Information

Conference Registration Fees

	Early	Late (After 5/30/00 and On-Site)
Academia	$ 200 USD	$ 300 USD ***(Limited to first 100 applicants at degree granting universities only.)***
U.S. Government/Non-Profit	$ 500 USD	$ 600 USD
Industry/Foreign Government	$ 750 USD	$ 850 USD

Early Registration ends on Tuesday, 30 May 2000, 5:00pm EST. ALL registrations received after 30 May, or on-site registrations will be charged the LATE registration fee. The conference registration fee includes admittance to all plenary sessions, two break-out sessions, coffee breaks, lunch, and dinner. In addition, all attendees will receive the final project report (mailed after the Congressional Briefing) as part of their registration fee. Registration for the Science and Technology break-out sessions is on a first come, first served basis. Please complete the attached registration form, and mail or fax with payment, to: Potomac Institute for Policy Studies, *ATTN: Out of the Box Conference*, 1600 Wilson Boulevard, Suite 1200, Arlington, VA 22201, tel 703.525.0770, fax 703.525.6616. Once registration has been processed, written confirmation will be sent to the registrant.

Cancellations and Refund Policy

If registration must be cancelled prior to the event, **a written request for cancellation must be submitted no later than Friday, 2 June 2000 to the Institute.** There is a $75 fee for all cancellations made by the deadline. **Absolutely NO REFUNDS will be made for cancellations received after 5:00 pm EST, Friday, 2 June; however, written substitutions are welcome until Friday, 9 June, 5:00 pm EST. Please note that no substitutions will be permitted at the door.** All approved refunds will be issued **after** the conference. Conference sessions and speakers are subject to change without prior notice. Please fax your cancellation or substitution request to the attention of Stephanie Tennyson, at 703.525.6616.

Identification Badges

Each attendee will be provided an identification badge. This badge must be worn while attending all conference functions.

Attendee Roster

An attendee roster will be included in the registration materials distributed at the conference. In order to appear on the roster, you must be registered by Friday, 2 June 2000.

Attire

All conference events are business attire or military duty uniform.

Hotel Accommodations

The Potomac Institute for Policy Studies has reserved guest rooms at the **Loews L'Enfant Plaza Hotel**, 400 L'Enfant Plaza, SW, Washington, D.C. 20024, for 25-28 June 2000. The Metrorail stop is L'Enfant Plaza stop (orange/blue/yellow/green lines), only two metro stops from the conference venue at the International Trade Center and four stops from Reagan National Airport. Rooms have been reserved at a discounted rate of $169.00 per night. For those with a valid U.S. Government identification, rooms have also been reserved at the current Federal Government Per Diem of $118.00 per night. **Reservations can be made by calling 800.635.5065 or 202.484.1000 x5000. Please identify yourself as a part of the *Potomac Institute for Policy Studies conference*. These rooms are available until Tuesday, 30 May 2000, so please make your reservation early.**

Location and Parking

The conference is being held at the International Trade Center at The Ronald Reagan Building (www.itcdc.com), located at 1300 Pennsylvania Avenue, NW, Washington, D.C. 20004. The ITC is easily accessible by Metrorail via the Federal Triangle stop (orange/blue lines). Parking is available at the building from 6:00 am – 2:00 am for $15.00 per day.

Conference Inquiries or Questions?

Chair, Organizing Committee: Stephanie Tennyson, Potomac Institute for Policy Studies, 1600 Wilson Boulevard, Suite 1200, Arlington, VA 22209, tennyson@potomacinstitute.org, tel 703.525.0770 x225, fax 703.525.6616.

For the most current conference information see www.potomacinstitute.org/wsconf.htm.

We support the American with Disabilities Act of 1990. Attendees with special needs should call 703.525.0770 prior to 9 June 2000.

26-27 June 2000
The International Trade Center
at the Ronald Reagan Building
Washington, D.C.
www.potomacinstitute.org/wsconf.htm

Registration Form

PLEASE PRINT

MAIL TO:
Potomac Institute for Policy Studies, *ATTN: Out of the Box Registration*, 1600 Wilson Boulevard, Suite 1200, Arlington, VA 22209
FAX to: 703.525.6616

PART 1: ATTENDEE INFORMATION

Prefix/Rank (Mr./Ms./Dr./CAPT/etc.): _____ Military Affiliation: _____

First Name: _____ Initial: _____ Last Name: _____

Nickname for Badge: _____

Title: _____

Organization: _____

Address: _____

City: _____ State: _____ Zip Code: _____ Country: _____

Business Phone: _____ Fax: _____

E-mail Address: _____

Please list any special needs: _____

PART 2: CHOICE OF BREAK-OUT SESSIONS #1 AND #2

Please indicate your preferences for attendance at the second day AM and PM break-out sessions. Registration for the break-outs is on a first come, first served basis. You will be placed in the sessions by your order of preference until each session is filled. Please indicate your preference below by using numbers 1-3, with 1 being your first preference for that session. Please complete for both the AM and PM sessions.

Break-Out Session #1
Tuesday, 27 June, AM

_____ Energy
_____ Human Factors/Neuroscience
_____ Nanotechnologies

Break-Out Session #2
Tuesday, 27 June, PM

_____ Biomedical
_____ Advanced Materials
_____ Information & Knowledge

PART 3: TYPE OF REGISTRATION

Registration Fees:	Regular	Late (After 5/30/00 and On-Site)
Academia	❑ $200 USD	❑ $300 USD *(Limited to first 100 applicants - degree granting universities only)*
U.S. Government/Non-Profit	❑ $500 USD	❑ $600 USD *(Please attach Government ID to registration form.)*
Industry/Foreign Government	❑ $750 USD	❑ $850 USD

NO REFUNDS FOR CANCELLATIONS RECEIVED AFTER Friday, June 2nd.
Written Substitutions are Welcome! (Prior to 9 June, 5:00PM, EST)

PART 4: METHOD OF PAYMENT

Payment ONLY by: _____ Check _____ Visa _____ MasterCard

Credit Card Number: _____ Expiraton Date: _____/_____ (MO / YR)

Name as It Appears on Card: _____

Signature: _____

(I agree to pay the above amount according to card issuer agreement. I understand that my credit card will be charged as soon as the *Out of the Box* registration request is processed.)

Enclose check or bank draft payable in U.S. Dollars to the Potomac Institute for Policy Studies. If payment is made from outside the United States, the bank must be instructed that it must bear all bank charges. Furthermore, if payment is made by check, payment must be drawn on a U.S. bank.

Potomac Institute for Policy Studies
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www.potomacinstitute.org

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Don't miss your chance to attend this prestigious two-day conference!

Join us June 26-27, 2000
For what promises to be the
Out of the Box Conference of the year!

Being Held at:

THE RONALD REAGAN BUILDING
The International Trade Center
WASHINGTON D.C.

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