Space Science and the International Traffic in Arms Regulations: Summary of a Workshop

DETAILS

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SPACE SCIENCE AND THE INTERNATIONAL TRAFFIC IN ARMS REGULATIONS

Summary of a Workshop

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Joseph K. Alexander, Rapporteur

Space Studies Board

Division on Engineering and Physical Sciences

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PLANNING COMMITTEE FOR SPACE SCIENCE ACTIVITIES AND ITAR: A WORKSHOP TO PROMOTE DIALOGUE

RAPPORTEUR

STAFF

Preface

The International Traffic in Arms Regulations (ITAR) control defense trade as called for by 22 USC 2788 of the Arms Export Control Act[1] and by Executive Order 11958 as amended. ITAR includes the U.S. Munitions List (USML), which specifies categories of defense articles and services that are to be regulated. The Strom Thurmond National Defense Authorization Act of FY 1999[2] placed all space satellites on the USML; Category XV, "Spacecraft Systems and Associated Equipment," explicitly designates scientific satellites, and other types of satellites, as defense articles and also includes ground control stations for satellite telemetry, radiation-hardened microelectronic circuits, and other components of spacecraft systems.

ITAR covers not only hardware of the types noted above but also technical data[3] and defense services (for example, furnishing of technical data or training). Under ITAR, an "export" includes a defense article taken out of the United States as well as the act of "disclosing (including oral or visual disclosure) or transferring technical data to a foreign person, whether in the United States or abroad." It also includes a defense service performed "on behalf of, or for the benefit of, a foreign person, whether in the United States or abroad." Except in a few instances as defined in ITAR, all transfers of U.S. defense articles or services to foreign persons require a case-by-case review and preauthorization by the Department of State.

In 2002, after expressions of concern by the space-science and university communities, the State Department amended ITAR so that accredited U.S. institutions of higher learning were excluded from having to obtain ITAR licenses for interacting with persons in some other countries and with some non-U.S. persons in this country for the purpose of conducting fundamental research. ITAR defines *fundamental research* as "basic and applied research in science and engineering where the resulting information is ordinarily published and shared broadly within the scientific community."[4] Significantly, the licensing exclusion in ITAR is applicable only to fundamental research conducted by "accredited institutions of higher learning."

However, it has not been clear whether the 2002 amendments are providing academic institutions involved in

[1]The Arms Export Control Act, 22 USC § 2778 (1979), Priv. L. No. 96-72, 93 Stat 503 (September 29, 1979), 22 CFR §§ 120-130 (2002), available at http://www.access.gpo.gov/nara/cfr/waisidx_01/22cfr121_01.html (April 1, 2001).

[2]U.S. Congress, Public Law 105-261, Section 1513, 105th Congress, 1998.

[3]Section 120.10 of ITAR (U.S. Congress, International Traffic in Arms Regulations, Section 120.10, April 1, 2007, Washington, D.C.) describes technical data as information that is necessary for the design, development, production, manufacture, assembly, operation, repair, testing, maintenance, or modification of defense articles.

[4]U.S. Congress, International Traffic in Arms Regulations, Section 120.11 (8), April 1, 2007, Washington, D.C.

space science activities with substantial relief from the effects of ITAR regulations. Uncertainty about the definition of *fundamental research*, especially as it pertains to space projects or proposals, has been cited as a cause of problems or concerns in the space science community. There is confusion about whether results need to have been published or can simply be intended to be published. Many space science activities conducted through academic institutions involve collaboration with private companies and other parties that are not "accredited institutions of higher learning" and thus do not appear to be covered under the fundamental-research exclusion in ITAR. That the regulations apply differently to universities, national laboratories, government, and industry has led to confusion as to what institutions must do to comply with ITAR. There is also much uncertainty about what types of space-project-related information can be provided to non-U.S. project participants without a license and what types can be transmitted to foreign students in an academic setting. Furthermore, for aspects of space research that do not meet the fundamental-research exclusion or do not involve U.S. institutions of higher learning (such as activities performed by industry contractors and federal laboratories working on space science satellites), institutions must obtain export licenses or technical-assistance agreements from the Department of State to work with non-U.S. partners on cooperative space science missions or to discuss mission plans with foreign nationals. The process for obtaining licenses and technical-assistance agreements and the administrative work necessary to ensure ITAR compliance in project implementation can introduce substantial additional costs and time requirements for space projects. It is especially notable, moreover, that some violations of ITAR are punishable criminal offenses. Because of the many uncertainties noted above about the applicability of ITAR, institutions tend to interpret the regulations conservatively to be on the safe side of potential legal difficulties and thus often impose upon themselves burdens that might not be necessary.

In recognition of concerns in the space research community regarding these issues, the NASA associate administrator for science, Mary Cleave, wrote to Space Studies Board (SSB) chair Lennard Fisk on November 27, 2006, to request that the SSB organize a workshop on the implications of ITAR for space science. The purpose of the workshop was to reopen a discussion among State Department regulators and policymakers, academic researchers and faculty, ITAR officials, NASA officials, and other interested parties to explore concerns about ITAR's effects on space science activities.

The workshop was convened at the National Academies' Constitution Avenue Building in Washington, D.C., on September 12-13, 2007, with the following goals:

- Identify concrete problems that academic, government, and industry space science researchers, faculty, managers, and institutions face as a result of ITAR regulations.
- Determine the extent to which those problems are the result of implementation of the regulations or of misunderstanding of what is required by various parties.
- Identify possible steps for addressing or further examining the problems.

The workshop was organized by an appointed planning committee (Appendix A) that developed an agenda and invited speakers and other participants (see Appendix B for the list of workshop participants). More than 60 people attended the workshop. They were drawn from the space science community; export-control officials in academe, national laboratories, industry, and government, including the State Department, NASA, and the Department of Commerce; NASA program representatives; congressional and Office of Science and Technology Policy staff; representatives of professional societies; and the relevant policy community.

The workshop began with brief comments that covered recent developments, current status, and likely future directions from the perspectives of the various stakeholder sectors noted above. In three sessions that followed, participants discussed a collection of case studies that focused on ITAR issues relevant to activities within the United States, interactions with parties outside the United States, and requirements for obtaining technical-assistance agreements and licenses. The fourth and fifth workshop sessions were devoted, respectively, to splinter-group discussions of key issues in more detail and to a general summary and synthesis of the major ideas that emerged from the workshop. The complete agenda of the workshop is presented in Appendix C.

This report presents a summary of the workshop discussions. It is not intended to represent a consensus of the views of the workshop participants.

Acknowledgments

This report has been reviewed in draft form by persons chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Research Council's Report Review Committee. The purpose of the independent review is to provide candid and critical comments that will assist the institution in making its published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We thank the following for their review of this report:

David L. Chenette, Lockheed Martin Advanced Technology Center,
Richard P. Seligman, California Institute of Technology,
Debbie Shaffer, Southwest Research Institute,
Gregory M. Suchan, Commonwealth Consulting Corporation, and
Roy B. Torbert, University of New Hampshire.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the statements presented in the report, nor did they see the final draft of the report before its release. The review of the report was overseen by Jack D. Fellows, University Corporation for Atmospheric Research. Appointed by the National Research Council, he was responsible for making certain that an independent examination of the report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of the report rests entirely with the authors and the institution.

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APPENDIXES

Summary

The United States seeks to protect its security and foreign-policy interests, in part, by actively controlling the export of goods, technologies, and services that are or may be useful for military development in other nations. "Export" is defined not simply as the sending abroad of hardware but also as the communication of related technology and know-how to foreigners in the United States and overseas. The U.S. government mechanism for controlling dual-use items—items in commerce that have potential military use—is the Export Administration Regulations (EAR) administered by the Department of Commerce; items defined in law as defense articles fall under the jurisdiction of the Department of State and the International Traffic in Arms Regulations (ITAR). Because of the potential military implications of the export of defense articles, the ITAR regime imposes much greater burdens (on both the applicant and the government) than does the EAR regime during the process of applying for, and implementing the provisions of, licenses and technical-assistance agreements.

Until the early 1990s export control activity related to all space satellites (commercial and scientific) was handled under ITAR. Between 1992 and 1996 the George H.W. Bush and the Clinton administrations transferred jurisdiction over the licensing of civilian communications satellites to the Commerce Department under EAR. In 1999, however, in response to broad concerns about Chinese attempts to acquire U.S. high technology, the U.S. House of Representatives convened the Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, also known as the Cox Committee. One of the many consequences of the Cox Committee's report[1] was Congress's mandate that jurisdiction over export and licensing of satellites and related equipment and services, irrespective of military utility, be transferred from the Department of Commerce to the State Department and that such equipment and services be covered as defense articles under ITAR. Scientific satellites were explicitly included despite their use for decades in peaceful internationally conducted cooperative scientific research. It is widely recognized that the shift in regulatory regime from EAR to ITAR has had major deleterious effects on international scientific research activities that depend on satellites, spaceflight hardware, and other items that are now controlled by ITAR. Furthermore, contravening U.S. interests in attracting foreign students to U.S. universities, the capture of space technology by ITAR has caused serious problems in the teaching of university space science and engineering classes, virtually all of which include non-U.S. students.

[1]U.S. House of Representatives, *U.S. National Security and Military/Commercial Concerns with the People's Republic of China*, Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, U.S. Government Printing Office, January 1999.

This report is a summary of a September 2007 workshop in which participants from the space research communities and the export-control administration and policy communities came together to discuss problems, effects, and potential solutions regarding the application of ITAR to space science. The principal themes and ideas that emerged from the discussions are summarized below.

UNINTENDED CONSEQUENCES OF A NET CAST TOO BROADLY

The space science community acknowledges the sensitivity of much hardware and technology related to space activity, but they also argue that controlling "everything that flies in space" casts too broad a net. The current administration has actually recognized the mismatch between the ITAR control regime and the low levels of risk inherent in the bulk of international space science activity. A variety of White House policy statements have been made and regulatory adjustments tried over the years, but the unfortunate net result of such changes has been the introduction of ambiguity and uncertainty. As a result, and because the criminal sanctions for failure to comply with ITAR are personal and great, university officials and researchers tend to err on the side of conservatism in seeking licenses and thus impose on themselves financial, administrative, and time-delay burdens that might not even be necessary.

No one in the policy or political community contends that observed deleterious effects on U.S. leadership in scientific research and on U.S. academic excellence in science and engineering were intended by the use of ITAR as the regulatory regime for scientific-satellite exports. Nonetheless, the unintended consequences continue to plague the space community.

EFFECTS ON SCIENTIFIC RESEARCH

Science, perhaps more than most fields of endeavor, depends on a full and open discussion and exchange of ideas among researchers who are addressing a given problem. If researchers are constrained by security classification or proprietary interests, communication is necessarily limited. Because most of the results of space science research are placed in the public domain, most space research activity qualifies as "fundamental research," which is excluded from ITAR controls as long as the research is conducted by "accredited institutions of higher learning." However, the bulk of government-sponsored fundamental space research at universities is conducted by consortia, including government research laboratories and private companies, and ITAR requires licensing when persons from other countries are involved—and they usually are. Since the dawn of the space age, other nations have invested in developing their own capabilities and have thereby made themselves desirable partners of the United States. Furthermore, many space-based scientific efforts focus on the science of Earth, and so international collaboration is necessary if global perspectives are to be drawn. The costs and delays imposed by ITAR processing requirements, coupled with other nations' reluctance to be made subject to restrictions derived from U.S. law and regulations, are making the United States less and less desirable as a partner to its foreign collaborators. The implications for continued international collaboration are grave.

EFFECTS ON ACADEMIC OPERATIONS

Ambiguities about what constitutes fundamental research that can thus be excluded from ITAR controls, about what information can be placed in the public domain, and about what specific kinds of involvement with non-U.S. persons require licensing have led to great uncertainties in the university community about the participation of foreign students and researchers in projects involving potentially controlled hardware or technology. Universities must choose between either going through the burdensome licensing or technical-assistance agreement process to involve their students and researchers from other countries or consciously excluding any non-U.S. nationals from space-related research. The latter approach is injurious to the quality of research and to the educational value inherent in diversity. It is especially damaging when the non-U.S. participants could contribute critical and unique knowledge and skills to a project, as is often the case. According to workshop participants, the same uncertainties are leading some professors to "dumb down" course content rather than risk ITAR violations by discussing their

research in the classroom setting. Although they believe that the vitality of education in the U.S. university system depends on its links to state-of-the-art research, many cite fears of breaking the law inadvertently.

THE OUTLOOK

In the short term, fundamental changes to the law or regulations are unlikely, especially in a political environment in which almost any provisions related to national security are taken as givens and attempts to modify them are viewed as being politically risky, regardless of the potential practical impacts. Over the next year or so, the State Department is committed to incremental improvements in efficiency and to better communication with the space community to clarify and harmonize key definitions and concepts where confusion exists. Similarly, members of the university community are committed to participating actively in that communication to make their actions more effective and to document their problems with ITAR to facilitate favorable change.

Over the long term, however, many believe that a clean-slate approach is needed to fix the fundamental disconnect between ITAR as it is being applied to space science research and the needs of the U.S. space science community as it endeavors to maintain world leadership. The United States has many space-related policy priorities in addition to national security, including space leadership, university excellence, and international partnerships. As emphasized at the workshop, all these national goals need to be considered jointly in the development of a system for controlling the export of space-related hardware and technology that is effective at protecting national security, but that does not inadvertently harm the other policy priorities.

1

Background

INTERNATIONAL TRAFFIC IN ARMS REGULATIONS

The International Traffic in Arms Regulations (ITAR) are administered by the Directorate of Defense Trade Controls (DDTC) at the Department of State; its objective is to ensure that U.S. defense trade does not injure the national-security and foreign-policy interests of the United States. ITAR is intended to prevent the proliferation of sensitive technologies and weapons of mass destruction by controlling the export and temporary import and re-export of items that have been defined in law as defense-related. Such items appear on the U.S. Munitions List (USML), which is a list of equipment and related technical data that are designated as defense articles and defense services[1] according to the Arms Export Control Act (AECA). A second mechanism by which the U.S. government controls export activity is the Export Administration Regulations (EAR) administered by the Department of Commerce (DOC). The intent of EAR is to regulate the export of dual-use commodities, software, and technology—items that have predominantly commercial uses but also have military applications.

The two systems are both aimed at protecting U.S. interests, but they are based on fundamentally different policy premises. ITAR protects goods, technologies, and services that are declared to be military items; EAR addresses items that are common in commercial trade and is consistent with DOC's charter to promote and regulate U.S. trade. In the mid-1990s, because of the importance of commercial communication satellite ("comsat") trade in the commercial sector, such satellites were considered dual-use items and controlled by DOC. In 1999, in response to the report of the U.S. House of Representatives Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China (also known as the Cox Committee), Congress mandated that export-licensing jurisdiction over all satellites and related equipment and services, irrespective of military utility, be returned from DOC (under EAR) to the State Department (under ITAR). That shift has had a major effect on international satellite activity—not just commercial trade but also international scientific research activity involving satellites, notwithstanding the fact that all satellites other than comsats were *always* subject to ITAR.

Export of "experimental, scientific, and research" satellite hardware, technical data, or assistance judged to be defense-related is not permitted with non-U.S. persons without approval or exemption by the State Department. A non-U.S. person is defined as a person who is neither a citizen of the United States nor a "protected individual"

[1]Defense services are defined as including "the furnishing of assistance (including training) to foreign persons, whether in the United States or abroad in the design, development, engineering, manufacture, production, assembly, testing, repair, maintenance, modification, operation, demilitarization, destruction, processing or use of defense articles."

under the Immigration and Naturalization Act, such as a foreign national who is a legal permanent resident.[2] Under ITAR, an export is defined as

- Any oral, written, electronic, or visual disclosure, shipment, transfer, or transmission outside the United States to anyone, including a U.S. citizen, of any commodity, technology (information, technical data, or assistance), or software or codes.
- Any oral, written, electronic, or visual disclosure, transfer, or transmission to any person or entity of a controlled commodity, technology, or software or codes with intent to transfer it to a non-U.S. entity or person, wherever located.
- Any transfer of those items or information to a foreign embassy or affiliate.

Any U.S. or non-U.S. person planning to exchange ITAR-controlled articles with foreign nationals must obtain an export authorization from the Office of Defense Trade Controls Licensing (DTCL). Licenses are reviewed case by case, so for multiple defense-controlled activities responsible parties may find that they must apply for and obtain multiple licenses. License approval for space-related activities can take from several weeks to several months. It may also be necessary for responsible parties to obtain technical-assistance agreements (TAAs), which are required for the performance of defense-related services or disclosure of technical data when a foreign national is involved.

THE FUNDAMENTAL-RESEARCH EXCLUSION AND NATIONAL SECURITY DECISION DIRECTIVE 189

In 1985, President Reagan signed National Security Decision Directive (NSDD) 189, which established "national policy for controlling the flow of science, technology, and engineering information produced in federally-funded fundamental research at colleges, universities, and laboratories."[3] NSDD 189 defines fundamental research as

> basic and applied research in science and engineering, the results of which ordinarily are published and shared broadly within the scientific community, as distinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons.

It describes the policy for control of fundamental research as follows:

> It is the policy of this Administration that, to the maximum extent possible, the products of fundamental research remain unrestricted. It is also the policy of this Administration that, where the national security requires control, the mechanism for control of information generated during federally-funded fundamental research in science, technology and engineering at colleges, universities and laboratories is classification. . . . No restrictions may be placed upon the conduct or reporting of federally-funded fundamental research that has not received national security classification, except as provided in applicable U.S. Statutes.

The policy, which formally recognizes the open nature of fundamental research, was reaffirmed by the national-security adviser to the president, Condoleezza Rice, in 2001.[4]

In March 2002, DDTC revised ITAR's treatment of scientific satellite activities at U.S. universities when they are intended solely for fundamental research purposes. The State Department declared that, in being consistent with NSDD 189, it did not intend to regulate fundamental research. Consequently, ITAR provided exclusions for

[2]Non-U.S. persons also include foreign corporations, business associations, partnerships, trusts, societies, and any other entities or groups that are not incorporated or organized to do business in the United States, and they include international organizations, foreign governments, and agencies and subdivisions of foreign governments.

[3]National Security Division Directive 189, "National Policy on the Transfer of Scientific, Technical and Engineering Information," September 21, 1985, reaffirmed on November 1, 2001, Washington, D.C.

[4]Letter, November 1, 2001, to Harold Brown, cochair of the Center for Strategic and International Studies, from Condoleezza Rice, national-security adviser to President George W. Bush.

"persons who engage only in the fabrication of articles for experimental or scientific purpose, including research and development." ITAR licenses were explicitly not required for fundamental research involving international cooperative activity with foreign universities or research institutions in the North Atlantic Treaty Organization and some other U.S.-allied countries, as long as a number of conditions were met:

- *All* the information about the article, including its design, and all the resulting information is "published and . . . generally accessible and available to the public" or is the kind of information "ordinarily published and shared broadly in the scientific community."
- The U.S. entity involved in the research is an accredited institution of higher learning.
- The U.S. university engaged in the research accepts no "restrictions on [the] publication of [the] scientific and technical information resulting from the project or activity" (including U.S. government-imposed access and dissemination controls that protect information resulting from U.S. government-funded research).

ISSUES MOTIVATING THE WORKSHOP

Because universities often collaborate with foreign partners in research and teach or employ foreign graduate students and other researchers, ITAR has a substantial effect on university activities in the space sector. Many university activities are considered to be fundamental research and thus are excluded from ITAR control; however, academic regulatory-compliance administrators and researchers alike still encounter problems with space-related activities because of the narrow and somewhat ambiguous conditions that enable research to be considered "fundamental" and therefore excluded from licensing under ITAR.

Several recent meetings and reports have indicated that some issues concerning university compliance with ITAR are still unresolved. Universities have been concerned about the 2002 revision of ITAR, which appeared to narrow the definition of *public domain* and *fundamental research*.[5] They are also concerned about the costs of compliance with ITAR and ITAR's chilling effect on research. Because of uncertainty as to what research efforts are ITAR-controlled, many university researchers are now working only with students or partners who are U.S. citizens. Universities have voiced their concerns to the State Department and the Office of Science and Technology Policy through the American Association of Universities and the Council on Governmental Relations, and the government has responded by hosting explanatory workshops and investigative studies.

DDTC held a meeting on November 13, 2003, at the National Academies' Constitution Avenue Building in Washington, D.C., to discuss AECA and its regulatory impact on the conduct of university-based research. As a result of discussions that included representatives of DDTC and various universities, the participants identified key issues: the definition of a "full-time" employee, whether research that is intended to be in the public domain but is not yet published because it is not finished is considered to be in the public domain, work under a contract with a company (specifically, Defense Federal Acquisition Regulation Supplement clause 252.204-7000[6]), how controls of biological and chemical agents intersect with ITAR, and whether foreign students can access equipment at universities. In collaboration with Johns Hopkins University and the Federal Demonstration Partnership, the State Department presented a symposium on export controls in May 2007; the symposium was intended to help bring universities up to date about ITAR registration, licensing, and various exemptions and exceptions.

The U.S. Government Accountability Office (GAO) has published several reports that have touched on university compliance with ITAR and the regulations' effect on university research. A 2006 GAO report stated that most of the research that occurs at universities is fundamental research; however, when there might be a need for a license many universities are taking the conservative approach of limiting engagement of foreign partners and students to those who would qualify to work under an ITAR exclusion, so that the universities can avoid the paperwork and cost of obtaining a license. The report recommended that the State Department and DOC assess vulnerabilities in the conduct and publication of university research and "improve guidance and outreach to ensure that universities

[5]See http://www.aau.edu/research/Ltr7.11.02.html.

[6]See http://206.151.87.67/docs/DFARSExportControlRevisedComments.doc.

understand when to apply export controls."[7] A separate GAO report in 2006 found that "the enforcement of export control laws and regulations is inherently complex" and recommended "that the enforcement agencies take several actions aimed at improving coordination and remedying other weaknesses in export control enforcement";[8] the agencies generally agreed with the recommendation.

At the September 12-13, 2007, National Research Council workshop, researchers voiced their concerns about the lasting effects of ITAR on the quality of space-related research and education at U.S. institutions of higher education. A number of participants also expressed concerns about the effect of ITAR on American competitiveness in the satellite sector. The lack of comprehensive guidance in the ITAR application process, lack of clarity in the ITAR language itself, and delays and administrative costs associated with obtaining an ITAR license have caused many U.S. and foreign researchers to turn away from international partnerships. Those issues, which were deliberated at the workshop, are discussed in greater detail in the following chapters.

[7]GAO, *Export Controls: Agencies Should Assess Vulnerabilities and Improve Guidance for Protecting Export-Controlled Information at Universities*, GAO, Washington, D.C., December 2006.

[8]GAO, *Export Controls: Challenges Exist in Enforcement of an Inherently Complex System*, GAO, Washington, D.C., December 2006.

2

Perspectives on Recent Developments and Current Implementation of International Traffic in Arms Regulations

The first workshop session provided an opportunity for all participants to hear perspectives of a variety of stakeholders—universities, government agencies, and Congress—regarding the status of the implementation of the International Traffic in Arms Regulations (ITAR) and thereby provided a context for more focused discussions. Planning Committee Chair Norman P. Neureiter and Session Moderator Spence M. (Sam) Armstrong opened the session with comments about the importance of the workshop topic. There is widespread agreement about the national-security importance of controlling the export of munitions and munitions technology, but as subsequent speakers often repeated, the implementation of such controls via ITAR has had many unintended consequences and created serious problems and concerns. Those concerns have prompted many to call for a careful assessment of ITAR from a cost-benefit perspective.

The first speaker was Claude R. Canizares (vice president for research, associate provost, and professor at the Massachusetts Institute of Technology). He summarized key aspects of a meeting between university representatives and Department of State officials in November 2003 that was intended to open a discussion of issues involving universities, fundamental research, and the Arms Export Control Act. Dr. Canizares believes that State Department officials recognize that the impact of ITAR on universities is important and that universities have various degrees of expertise for dealing with ITAR, that the State Department does not seek to control fundamental research, that the State Department believed that the process of issuing licenses had been expedited, and that the State Department wanted to find ways to communicate with universities. From the university perspective, Dr. Canizares noted that participants at the 2003 meeting had emphasized that universities play a major beneficial role in space research and are inherently open and increasingly global. However, for a number of reasons, ITAR is ill suited to the realities of university research. Dr. Canizares said that the earlier meeting highlighted two specific problems: the application of the fundamental-research exclusion from ITAR controls was ambiguous in several ways, and interactions between universities and industry and federal laboratories posed a number of ITAR compliance problems.

Dr. Canizares observed that the 2003 meeting succeeded in opening up communication channels and identifying specific follow-up actions. He did not believe that the latter were ever finalized, and follow-up had been difficult partly because of changes in personnel at the State Department, the press of other external events, and reactions to General Accounting Office (now Government Accountability Office [GAO]) and agency inspector-general reviews of the implementation of ITAR.

Anne K. Ganzer (director of defense trade controls policy in the State Department Directorate of Defense Trade Controls [DDTC]) provided a perspective from the State Department. She emphasized that in spite of concerns that

have been expressed about aspects of ITAR, everyone must recognize that it reflects action by Congress in response to the Cox Committee report[1] in 1999 and that the inclusion of space technology in the U.S. Munitions List is the law. Consequently, not much has changed since the 2003 meeting that Dr. Canizares summarized; although there have been discussions of revisions in a few items,[2] one should not expect sweeping changes in the near future.

Ms. Ganzer noted that DDTC is eager to reach out more to the university community, and she cited three examples of how that outreach could be accomplished. First, DDTC partnered with Johns Hopkins University (JHU) and the Federal Demonstration Partnership to hold an information-exchange conference with university representatives in May 2007, and she hopes that such a cosponsored conference will become an annual event; to that end, DDTC is interested in finding a cosponsor for the 2008 conference to provide the kinds of assistance that JHU did in 2007. Second, DDTC's Defense Trade Advisory Group[3] (DTAG) comprises outside persons who provide the Bureau of Political-Military Affairs with a formal channel for regular consultation and coordination with U.S. private-sector defense exporters and defense trade specialists on issues involving U.S. laws, policies, and regulations for munitions export. Ms. Ganzer noted that DTAG is dominated by industry and has no university representatives. She invited the university community to provide members who can lend university perspectives to DTAG activities. Third, DDTC has always had a university-based science fellow serving in the office, and she looked forward to continuing that practice.

A workshop participant asked whether an export license is needed when an employee of a company or other entity wishes to place information in the public domain and thereby satisfy a requirement that excludes fundamental research from export controls. Ms. Ganzer said that the State Department could not license the placement of something in the public domain and that the pertinent question is whether information intended for publication is eligible to be placed in the public domain, that is, is not linked to information with prior controls or in some other way restricted.

John F. Hall (director of the Export Control and Interagency Liaison Division of the National Aeronautics and Space Administration [NASA]) summarized NASA's experience with ITAR and challenges for the future. He indicated that NASA's export-control policy is centralized in a single office at NASA headquarters and implemented agencywide by 21 officials who are in place at each NASA center. The agency uses an active training program, standardized documentation requirements, and internal and independent external audits to ensure export-control compliance. Mr. Hall noted that NASA has enjoyed a long, cooperative, and productive relationship with the State Department, the Department of Defense (DOD), and the Department of Commerce (DOC), the results of which included prompt turnaround of critical NASA licenses when requested.

However, Mr. Hall described the following important challenges that NASA still faces:

- Foreign governments' reluctance to sign required technical-assistance agreements (TAAs), especially when NASA already has concluded government-to-government agreements with those international partners for the activities covered by the TAAs.
- Problematic TAA provisos or conditions regarding resolution of space-mission anomalies, involvement of persons who have third-country or dual nationality, and nondisclosure agreements.
- Delays in processing NASA contractors' licenses and TAAs, especially when mission-critical or safety issues arise or when TAA amendments are required, even for simple changes in programs with major partners, such as the European Space Agency (ESA) and the Canadian Space Agency (CSA).

Mr. Hall also offered several ideas for potential solutions to the problems above. First, he suggested that there be a tightly circumscribed NASA ITAR exemption, similar to DOD's foreign military sales exemption, that will ensure that DDTC is regularly apprised of any contractor exports or services authorized or directed by NASA

[1]U.S. House of Representatives, *U.S. National Security and Military/Commercial Concerns with the People's Republic of China*, Select Committee on U.S. National Security and Military/Commercial Concerns with the People's Republic of China, U.S. Government Printing Office, Washington, D.C., January 1999.

[2]One such change that is now in the works is an increase in the radiation-tolerance threshold at which radiation-hardened microchips would be subject to ITAR export licensing.

[3]See http://www.pmddtc.state.gov/dtag_index.htm.

and that adheres to specific criteria that limit the types of activities covered and the parties that can be involved. Second, he suggested that the government could eliminate unduly restrictive provisos in TAAs for U.S. government contractors implementing NASA international programs. He argued that there is a fundamental difference between supporting a government cooperative activity and making a foreign sale of controlled goods or technology. Finally, he noted that DDTC, NASA, ESA, and CSA had been exploring approaches to provide limited relief and that DDTC had also agreed to revise some provisos for resolution of anomalies on a case-by-case resubmission basis.

In answer to a question, Mr. Hall indicated that all NASA contractors and grantees are permitted to publish their research results after review by NASA. He pointed out that it is NASA's mandate to provide "the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

Bernard Kritzer (director of the DOC Office of National Security and Technology Transfer Controls) summarized activities of DOC's Deemed Export Advisory Committee, which was established in 2006 to address the complex issues surrounding technology transfers involving the release of controlled dual-use technology to foreign nationals in the United States. The committee has traveled throughout the country, visited national laboratories and major research universities, and heard from representatives of leading U.S. high-technology companies and industry associations on how current deemed-export policy affects them and how it can be improved. He indicated that the committee's report was due to go to the secretary of commerce in late 2007 and to be made publicly available soon after.[4] Mr. Kritzer noted that the challenge has been about how to find the tipping point between America's need for vigilant security and its equally great desire to sustain and enhance scientific and commercial innovation. He also noted that his office had been evaluating the health of the U.S. space industry; preliminary conclusions are that export controls have slowed the increase of U.S. competitiveness in the international marketplace.

Robie Samanta-Roy (assistant director for space and aeronautics in the Office of Science and Technology Policy [OSTP]), provided a perspective from the Executive Office of the President. He noted that OSTP has been interested in the impact of ITAR on the space community but added that there is a distinct lack of quantification of that impact. He made the point that there needs to be a balance among the goals of national security, foreign policy, economic security, and academic freedom but that to ensure the balance there has to be a quantification of the issues. He noted several opportunities for improving DDTC's capacity to respond to ITAR license requests, all of which can be accomplished without legislative change, including

- Providing adequate resources for the office.
- Using modern information technology to speed processing and streamline the process.
- Adopting best practices from other agencies, such as DOD.
- Use of detailees from DOD and NASA.
- Explaining DDTC's processes to outside entities more clearly.
- Regularly reviewing the items on the Military Critical Technologies List to remove items that are state of the art but globally available commercially, as opposed to items that need to be protected.

Dr. Samanta-Roy offered two observations about the future: that there is no appetite for fundamental reform of ITAR either in the administration or in Congress, and that because ITAR is prescribed by law, any changes will have to come from Congress.

John P. Hutton (director of acquisition and sourcing management at GAO) noted that ensuring the effective protection of technologies critical to U.S. national interests has recently been added to GAO's list of federal-government high-risk areas,[5] and he summarized a recent GAO review of export controls at U.S. universities. GAO found that the U.S. export-control system places the onus on universities and other exporters to understand and comply with export-control regulations. However, universities reported to GAO that training provided by the DOC and the State Department is too general or focuses on industry issues, rather than those related to

[4]The committee's report, *The Deemed Export Rule in the Era of Globalization*, was delivered to the Department of Commerce on December 20, 2007.

[5]GAO defines high-risk areas, in part, as "areas associated with broad-based transformations needed to achieve greater economy, efficiency, effectiveness, accountability, and sustainability of selected key government programs and operations." See GAO, *High-Risk Series:An Update,* GAO-07-310, GAO, Washington, D.C., January 2007.

universities; that Web sites are unclear or provide only general introductions to topics; and that help desks can provide useful information, but getting immediate help can be difficult. He said that the State Department and DOC officials had indicated that their top priority is to process license applications—the vast majority of which are from industry—and that effort left few resources for guidance and outreach to exporters. GAO noted agencies' concerns that export-control regulations and guidance may be misinterpreted.

GAO made two recommendations to improve federal oversight of export-controlled information at universities. First, the agencies should strategically assess potential vulnerabilities in the conduct and publication of academic research by becoming more knowledgeable about research being conducted on university campuses and, in consultation with other agencies, make use of available information on technology development and foreign-student populations to assess the extent to which research at universities may be subject to export controls. Second, on the basis of the strategic assessment, the agencies should improve interagency coordination, conduct additional outreach, and improve guidance to ensure that universities understand when to apply export controls.

David Fite (senior member of the professional staff of the House Committee on Foreign Affairs) provided a congressional perspective. He noted that the Committee on Foreign Affairs had not focused on the issue of ITAR's impacts on science and is unfamiliar with them. He encouraged members of the space research community to talk to the relevant congressional committees about this issue. He added that it is important for the space research community to distinguish facts from "hysteria," because proposals for regulatory changes need to be substantiated by specific arguments.

Mr. Fite said that in general members of Congress are supportive of science and technology and of the importance of U.S. progress in space research. However, he cautioned that if proposed actions were seen as having any potential to jeopardize national security, national security would always prevail. In the post-Cox-Committee-report era, there is great consciousness of Chinese espionage efforts to gain technology from the United States, so legislative actions to expedite technology transfer abroad could be viewed by members of Congress as unsafe votes. In the post-9/11 environment, anything that can be represented, or even misrepresented, as abetting terrorism is a tough vote for members.

In concluding his assessment of the near-term outlook, Mr. Fite noted that although there probably is no longer time for a reasoned debate on ITAR reform in the current administration, the executive branch has a great deal of authority to make regulatory changes without legislation.

Robert Hardy (director of contracts and intellectual-property management at the Council on Governmental Relations) concluded the session with an overview of current export-control issues of concern to universities. He indicated that ITAR is outside the scope of most university activities, but when ITAR is applicable, it may affect

- The ability of foreign students or researchers to participate in research involving controlled technology.
- The ability to provide training for foreign nationals where access to controlled technical data is required.
- The ability to send controlled equipment to foreign countries.
- Disclosures for patent applications and licenses when controlled technology is involved.

He added that universities do not necessarily all share the same views or concerns, nor are they affected to the same extent by ITAR (that is, the ones that do substantial space or defense research are affected more heavily).

Mr. Hardy said that ITAR's treatment of the limitations on the definition of "fundamental research" is critically important to universities because fundamental research, as defined in the regulations, is not subject to ITAR controls. Mr. Hardy noted that the fundamental-research exclusion (FRE) from ITAR restrictions is invalidated if a university accepts any award or agreement clause that forbids or requires approval of the participation of foreign nationals, gives the sponsor a right to approve publications resulting from the research,[6] or otherwise operates to restrict participation in research or access to and disclosure of research results (for example, through a nondisclosure agreement with an industry sponsor). One particularly troublesome publication-restriction problem

[6]The presumption is that a short (30-90 days) period for prepublication review (not approval) for patent protection or to permit a sponsor to remove inadvertently included sponsor-proprietary information does not destroy exclusion.

for universities is related to inclusion of the Defense Federal Acquisition Regulation Supplement 252.204-7000 clause in contracts with universities.[7]

Mr. Hardy said that universities seek to protect their coverage under the FRE by eliminating whenever possible any contractual clauses that destroy the ability to claim the exclusion. When that is not possible and export licenses are needed, the process may require substantial faculty and administration staff time and effort. The process of obtaining a license can take months and may result in limitations or conditions that are unacceptable to the university.

Another key issue for universities is the potential government distinction between the conduct and the products of research. National Security Decision Directive (NSDD) 189 provides that "no restriction may be placed upon the *conduct* [emphasis added] or reporting of federally funded fundamental research that has not received national security classification, except as provided in applicable U.S. statutes."[8] DOC has reiterated the distinction between products of fundamental research and conduct of fundamental research; conduct is subject to regulation where access to controlled technical data is required. The university community believes that the DOC interpretation of the scope of the FRE is inconsistent with NSDD 189 and has resulted in considerable confusion at the operating level. At the State Department, DDTC has not expressed a view in the debate.

A third key issue cited by Mr. Hardy revolves around ambiguities in an ITAR license exemption for university export of scientific, research, or experimental satellite components fabricated for fundamental-research purposes.[9] Such exports must be to universities or research centers in NATO countries (and centers of some other U.S. allies), and information about the articles must be in the public domain. However, license requirements to export exempted public-domain information beyond the specified recipients appear to conflict with other ITAR provisions and impose special conditions on satellite and space-based research at universities. Because of ambiguity, universities tend to err on the side of caution and apply for licenses for any exports of technology or information related to satellite research. Furthermore, universities may be reluctant to use this exemption also because of the need to pass U.S. access restrictions through to foreign university partners. Mr. Hardy questioned whether this is good public policy.

A fourth key problem area for universities pertains to the ITAR defense-services concept and related need for TAAs. Implementation of the TAA requirements is often burdensome (see Chapter 4) and the requirements unclear. Mr. Hardy noted that ITAR implies that providing foreign nationals with public-domain information may require a license or a TAA if providing the information falls within the definition of performing a defense service (furnishing of assistance in the design, development, engineering, manufacture, production, assembly, testing, repair, maintenance, modification, operation, demilitarization, destruction, processing, or use of a defense article). He posed a question about the possibility that such an activity would occur in the course of fundamental research, and he noted that as a consequence of the ambiguity universities have tended to be cautious in interpreting the requirement.

Mr. Hardy concluded by commenting that universities now are devoting much time and effort to ITAR (and overall export-control) compliance, especially because of the wide scope of ITAR-related issues that may arise and the lack of clarity about them. The chapters that follow in this report summarize workshop discussions of those and related matters as they apply to space-research activities at universities, national laboratories, and industry.

[7]This section of the Defense Federal Acquisition Regulation Supplement is often passed on in contracts from federal sponsors of research at universities. It restricts the release of unclassified information without prior government approval even when the information is about the results of fundamental research.

[8]National Security Division Directive 189, "National Policy on the Transfer of Scientific, Technical and Engineering Information," September 21, 1985, reaffirmed on November 1, 2001, Washington, D.C.

[9]U.S. Congress, International Traffic in Arms Regulations, Section 123.16(b)(10), April 1, 2007, Washington, D.C.

3

Overarching Issues

The second, third, and fourth workshop sessions (see Appendix C) each began with and expanded on a panel discussion that drew on a set of case-study summaries of space science community experiences with the implementation of the International Traffic in Arms Regulations (ITAR). The discussions elicited four major themes that were later developed during splinter-group discussions and that are summarized in Chapters 4 and 5. This chapter summarizes several broader themes that spanned the specific topics of the case-study sessions and the splinter groups' topics.

CONTRASTING INSTITUTIONAL PERSPECTIVES

An important point that emerged from the discussions was that the federal agencies (especially the Department of State), industry, and universities have different primary charters and perspectives and that everyone needs to understand the genuine differences. For the State Department, the highest priorities clearly are attached to protecting and advancing foreign-policy and national-security interests. Universities, on the other hand, are charged to conduct fundamental research in science and technology. Because of the globalized nature of such research, universities strive to promote full and open exchanges of research information without regard to the nationalities of university personnel or of the members of the broader scientific community. And while industry often does include fundamental research as part of its business, its primary goal is to protect and enhance competitive position, including proprietary solutions to government and commercial customer requirements.

A problem, some workshop participants observed, is that different stakeholders establish institutional policies, decisions, and protocols in relative isolation and thereby affect the conduct and output of space science. Communication between the legal (regulatory) communities and technical (scientific) communities is strained when the former view the latter as "just trying to bend the rules" and the latter think that the former "don't understand what is significant and what is not."

One of the crucial consequences of this lack of mutual understanding, workshop participants argued, is the promulgation of unclear regulations that are implemented in ways that lead to consequences unintended by the regulators, such as restrictions on individuals' and institutions' participation in international projects; confusion and inaction; or highly polarized, restrictive positions on the part of government regulators and institutional administrators.

FUNDAMENTAL QUESTIONS ABOUT INTERNATIONAL TRAFFIC IN ARMS REGULATIONS

Many workshop participants from both the policy and the scientific communities voiced questions about the basis of ITAR. Many argued that ITAR is the wrong export control regime for space research. According to that point of view, there is a divergence between current national-security rules and the existence of an increasingly global economy. Current export-control laws seek to limit interactions with international partners. "The military fights the last war," but the future strength of the country relies on its intellectual vigor. Thus when the use of ITAR to regulate space exports ignores other significant national goals—such as leadership in space, preeminence of university education and research, international cooperation—it actually compromises serving the one national policy goal (national security) that it seeks to optimize.

Some participants suggested that ITAR is a "quasi classification system" but is missing key elements of Department of Defense or other national security systems. Application of ITAR controls is based on the context of the technologic application (satellites) rather than on technologic content even when application is unrelated to armaments. Covering specific implementations of standard practices that are not relevant to arms or other defense articles has the effect of having ITAR exert control over nonthreatening elements of spaceflight hardware, which detracts from the authority of ITAR in other technical areas. There is a degree of conservatism in implementation of the regulations that appears to be meant to satisfy the (unknown future) auditor and thereby to keep things clearly on the safe side of the line. Some participants opined that there is no evident contribution of ITAR to U.S. commercial competitiveness and that there are no evident cases in which ITAR controls of space science activities contributed materially to the management of a national-security threat.

One participant summarized that point of view by saying, "ITAR is simply the wrong tool."

GENERIC PROBLEMS AND UNINTENDED CONSEQUENCES

Many participants cited a set of common recurring problems with the requirements and implementation of ITAR. Speakers seemed to agree that the consequences of those problems drive the cost and compromise the value of controlled activities and undermine the fundamental intent of the regulations.

Some speakers argued that the ITAR controls themselves are often counterproductive and inappropriate. That point of view was based on the idea that placing controls on "everything that flies in space" is too broad an approach. Many spaceflight devices are less technically advanced than their nonspace equivalents, but the former are controlled and the latter are not. Speakers argued that just as ITAR does not seek to control information about the results of fundamental research, so also placing controls on information about instruments built for fundamental research is inappropriate, especially given the integral relationships between research results and the instruments that produce the results.

A second generic problem that was cited repeatedly regarding the current implementation of ITAR was lack of clarity. Speakers noted that each licensing decision is based on the merits of a single case and that there is no publically available statement of overall standards that would provide the space science community the insight to make its own determinations as to whether other, potentially comparable cases need to be submitted to the State Department or not. There also appears to be frequent confusion regarding whether an exclusion from ITAR controls applies to both the *results* of fundamental research and the *conduct* of fundamental research. The idea that some fundamental research activities are free of ITAR controls when they occur at universities but not when they occur in industry or at federal laboratories was viewed as indicating the particular lack of clarity and consistency associated with application of ITAR.

OUTLOOK

In spite of frequently mentioned misgivings about ITAR as described above, there appeared to be widespread agreement at the workshop that some space hardware and technology are indeed sensitive and that their export could pose a national-security threat. For such hardware and technology, export controls are appropriate. Speakers

often reminded their colleagues that ITAR is a reality to be reckoned with and that one should not expect fundamental changes in the near term.

Some speakers suggested that incremental changes and improvements could be made, for example, by modifying procedures (see Chapter 5) and by providing more resources at the State Department to administer ITAR. Steps along these lines, which could eliminate some of the ambiguity and burden felt by the regulated community and also improve efficiency in processing applications, appeared to be widely supported and encouraged.[1]

However, a second school of thought among the participants was that ITAR cannot be fixed incrementally and that what is needed instead is a fresh start with a clean-slate approach to develop a regulatory regime that will simultaneously address the full array of policy goals that involve national security, technology transfer, space activities, and university teaching and research. All participants appeared to share the view that such a sweeping, fundamental revision of ITAR is, at best, a long-term prospect.

[1]On January 22, 2008, the Bush Administration announced a new export controls directive to reform U.S. defense trade policies and practices, but details were not available when this report went to press. See http://www.state.gov/r/pa/prs/ps/2008/jan/99562.htm.

4

Problems Arising from the Implementation of International Traffic in Arms Regulations

Before the workshop, the National Research Council staff solicited brief case-study summaries that were intended to illustrate a wide array of space scientists' and scientific institutions' experiences with the implementation of the International Traffic in Arms Regulations (ITAR) and to highlight problems or concerns that might be explored during the workshop. The planning committee selected 24 cases and provided them to workshop participants in advance, and the cases then served as starting points to look at ITAR from three, often interrelated perspectives: activities inside the United States, interactions with parties outside the United States, and policies and processes for obtaining licenses and technical-assistance agreements (TAAs).

Three case-study sessions and four later splinter-group sessions drew out a number of key themes and ideas. Two of the themes were the effects of the implementation of ITAR on international scientific cooperation and on the roles of universities, and this chapter summarizes views from those two perspectives. Other themes concerned potential near-term actions for the government and for the scientific community that offered the promise of mediating identified problems, and those ideas are summarized in Chapter 5.

EFFECTS ON INTERNATIONAL SCIENCE

One splinter group drew on the discussions during earlier sessions of the workshop to synopsize the effects of ITAR on international scientific cooperation and science as a global endeavor. Those effects generally were in three categories, as summarized below.

Controls at Odds with International Character of Science

An important premise that was mentioned often during the workshop was that science is intrinsically an international enterprise, whether conducted by private-sector organizations or by academic institutions.[1] Unlike industry, universities are inherently open in their operations. Participants noted that advances in space science benefit substantially from the diversity and expertise of foreign researchers at universities and national laboratories and from academe's open environment for the exchange of information. However, ITAR requirements pose obstacles for

[1]The point is also emphasized in a new National Research Council report, *Science and Security in a Post 9/11 World: A Report Based on Regional Discussions Between the Science and Security Communities* (The National Academies Press, Washington, D.C., 2007).

international participation in research at U.S. institutions. An important side effect of the obstacles is that international interest is diverted away from the United States as a research partner to alternative foreign providers, such as China, Russia, and India. The experiences of other space agencies (such as the European Space Agency and the Japan Aerospace Exploration Agency) in dealing with the United States on ITAR have led to concerns abroad over collaboration with the United States and have stimulated policies that encourage foreign industry to avoid collaboration and to become autonomous in space projects to avoid the burdens imposed by ITAR.

Diminishing U.S. Access to Foreign Expertise

Participants argued that the current ITAR regime, contrary to the intent of export-control regulations, serves as a detriment to U.S. national interests in at least two ways. First, there is a "reverse brain drain" effect in which talented U.S.-trained scientists and engineers are avoiding what they perceive as an overregulated U.S. science market. Scientific and technical professionals are reluctant to become engaged in space research, because they find the effort to deal with ITAR frustrating or even insurmountable. Second, the administrative burden, cost, and unpredictable delays leading to loss of contracts to international competitors adversely affect the entrepreneurial small-business base of U.S. third-tier suppliers that are important elements of the U.S. aerospace industry. During the workshop, some participants noted that ITAR is having a serious effect on foreign cooperation with U.S. scientists, especially because of lack of clarity in the regulations, inconsistency in their application, and delays associated with approval of TAAs. Those problems are expected to worsen as projects, such as the James Webb Space Telescope and the Mars Surface Lander, become more ambitious and complex. International participants in the workshop went so far as to speculate that without high-level U.S. government relief on ITAR, the development of highly integrated infrastructure programs, such as those envisioned for human space exploration, will be impossible.

Handicaps on Effective Space-Mission Designs

In addition to concerns about effects of ITAR on science and technology in the broad sense, speakers noted more specific effects on individual projects. Participants believe that ITAR constraints compromise the capabilities and scientific return of individual space missions by making it difficult for mission science teams to take advantage of the best skills and resources in participating partners' countries. For example, teams involved in international projects often devise less-than-optimal spacecraft test plans that minimize the exchange of information rather than maximize the chances of mission success, thereby compromising instrument development and testing. ITAR requirements also increase mission cost, technical risk, and schedule uncertainties by restricting the flow of critical but routine technical data required to implement scientific investigations.[2]

EFFECTS ON FUNDAMENTAL ROLES OF UNIVERSITIES

A second splinter group considered the prior discussions during the workshop to synopsize the effects of ITAR on universities' fundamental roles in education, development of the national workforce, and nurturing of scientific and technologic innovation and advancement. Those effects are generally in four categories, as summarized below.

[2]An example of the consequences of such a policy is the failure of a National Aeronautics and Space Administration (NASA) science instrument on the Japanese Suzaku (formerly Astro-E2) mission. According to the NASA inspector general's review of risk mitigation associated with international agreements, "NASA's policy was unclear about early collaboration to identify data to be shared with a foreign partner and the international agreements we reviewed did not require joint participation in reviews, integration, and testing related to mission success. . . . NASA science projects lacked adequate assurance that sufficient information was available to properly integrate instrument components or an instrument with the spacecraft." (NASA, *NASA Can Improve Its Mitigation of Risks Associated with International Agreements with Japan for Science Projects*, Audit Report No. IG-06-020, Office of the Inspector General, NASA, Washington, D.C., September 12, 2006, page ii.)

Compromising the Quality of Student Experience

Workshop participants indicated that ITAR has the potential to change the character of space studies at universities. Actions to implement ITAR can compromise a university's ability to educate all its students simply because of the many foreign students at the institution, and that effect is seriously at odds with other U.S. government policies for encouraging foreign students at U.S. universities. It can also create a move toward insularity in science at universities. University representatives were especially concerned about the effects of discrimination against foreign students because of their nationality and about the effects of situations in which U.S. students would be unable to interact with their non-U.S. colleagues, which would deprive all students of their opportunity for a full education and for development of a richly international network of future colleagues.

Effects of Regulatory Uncertainties on Faculty and Staff

University representatives also called attention to the many ambiguities in ITAR and in requirements for how the regulations are implemented. An effect of the lack of clarity is confusion and uncertainty about when and how ITAR is applicable. The situation is exacerbated by the fact that the Department of State makes decisions on the applicability of ITAR case by case, avoiding any explanations that are generalizations that might facilitate the research community's ability to extrapolate the results of one case to another. Examples of uncertainty included not knowing whether a university must be the lead institution in a collaborative partnership in order to use its fundamental-research exclusion, not knowing whether use of space-project-specific materials to teach a class that includes non-U.S. students qualifies for an exemption or is controlled as a defense service, and not knowing how broadly to interpret the terms "ordinarily publishable" or "is published" when applying to scientific and technical information the criterion for broad public availability. Those examples and others like them might appear to involve arcane details, but they are significant when a university and its faculty members are trying to understand whether to incur the burden of applying for licenses or TAAs and whether their actions might be vulnerable to criminal or civil prosecution under ITAR.

Participants cited several examples of the personal effects of uncertainties like those cited above. Many participants cited high levels of frustration among their colleagues with the complexities and delays inherent in ITAR—a situation that they claim is discouraging careers in teaching and research in space-related fields.

As a result of ambiguities inherent in ITAR and the serious penalties for failure to comply, universities and individual researchers tend to be extremely conservative in their interpretations of ITAR requirements and thus in their actions. That has led to the "creep" of ITAR and its chilling effects on public-domain information and non-cutting-edge technologies. Such conservatism may be desirable from the perspective of regulators, but it leads to unintended consequences when self-imposed restrictions might sometimes be more constraining than those the regulations themselves would impose.

Costs and Administrative Burdens

University representatives noted that the cost of ensuring compliance with ITAR is high. That requirement creates a significant unfunded mandate for universities, because they operate with capped overhead costs and must cover the added cost of administering ITAR requirements within an already-tight envelope. Elements of the cost at universities include programs to educate contracting and grants officers and faculty members about ITAR requirements and processes, satisfactorily documenting situations in which a university seeks to operate within the fundamental-research exclusion, supporting negotiations with State Department officials for approvals for exports and interactions with non-U.S. persons, and the substantial costs of delays in securing approval for activities that fall under ITAR. Although ITAR costs that come with a university's participating in space research are large, university representatives noted that the long-term effects of simply abandoning university participation in such activities probably would be greater. Major research universities see participation in the space program as an important component of their overall national responsibilities for training and research.

Universities Do Not Act in Isolation

A fourth kind of effect on universities stems from the fact that contemporary space science projects are rarely, if ever, conducted solely on university campuses. Even when a faculty member leads a project and carries out major elements of the work at a university, there are also partners in industry and national laboratories and often abroad. A typical spaceflight project might have a science team led from a university, collaborating team members in other U.S. and foreign institutions, an aerospace-industry partner, and a national-laboratory partner or overseer (such as the California Institute of Technology Jet Propulsion Laboratory or the Johns Hopkins University Applied Physics Laboratory). However, the project would not be permitted by ITAR to extend the fundamental-research exclusion, for which the university might qualify, to its industry and national-laboratory partners. That limitation becomes a serious impediment to the efficient conduct of the partnership as a whole.

5

Opportunities for Near-Term Actions and Improvements

The third and fourth key themes evident in workshop discussions concerned opportunities for near-term actions by the government and by the scientific community, respectively. This chapter summarizes the ideas that emerged from splinter-group deliberations and from related discussions that occurred earlier in the workshop.

GOVERNMENT ACTIONS AND IMPROVEMENTS

The ideas for government actions reflect a general conclusion that considerable confusion now pervades the space-research community and that a major cause of the confusion is ambiguities in the International Traffic in Arms Regulations (ITAR). Participants suggested that short-term actions focus on steps that could lead to clarification of the regulations, including a set of specific action items, as outlined below.

More Information and Training for the Regulated Community

Participants saw opportunities to enhance and expand the flow of information about ITAR to the scientific community and thereby help the community to understand ITAR requirements and processes better. First, the Department of State Directorate of Defense Trade Controls (DDTC) has a Web site[1] that provides a great deal of information about the directorate and how to interact with it. There was support for having DDTC post all commodity-jurisdiction (CJ) rulings on the Web site. CJ determinations are issued in response to inquiries from potential license applicants to establish whether an item or service is covered by the U.S. Munitions List (USML) and therefore subject to export controls under ITAR. They may also be used for consideration of redesignation of an item or service covered by the USML, which could result in movement of the item or service to the licensing jurisdiction of the Department of Commerce (DOC). Workshop participants felt that creating an element of transparency by posting all CJ determinations would afford the research community a much better understanding of what is likely to be subject to ITAR constraints. The DDTC Web site provides answers to a small sample of frequently asked questions, but workshop participants felt that the list should be expanded to provide greater, more generalized guidance to the outside community. There also was enthusiasm for engaging representatives of the research community in identifying key subjects to be covered by new questions and answers (see below).

[1]See http://pmddtc.state.gov/.

Second, participants argued that training programs are important and that the existing array of training opportunities should be expanded and improved. Members of the splinter group were particularly interested in the idea of training programs for both scientists and institutional officials that would be hosted by the National Aeronautics and Space Administration (NASA) and conducted on a state or regional basis.

Clarification and Harmonization of Key Definitions and Concepts

As already noted, many workshop participants felt that a lack of clarity in the language of the regulations, particularly with respect to the definitions of key terms and concepts, was a serious problem. The splinter group highlighted several subjects on which explicit clarification is needed. Among them are the definition of *defense services* and its nexus to the sharing of data already in the public domain, whether information is in the public domain only if it has already been published or if it is in the public domain if there is an intent to publish, and ITAR's limitation of the definition of fundamental research such that it only covers work conducted at a university.

Workshop participants called attention to the fact that there are important differences in some key definitions between ITAR (under the State Department) and the Export Administration Regulations (EAR; under DOC) and urged that definitions in the two sets of regulations be harmonized. Examples of the differences are the following:

- Under EAR, research at federally funded research and development centers and research conducted by scientists or engineers working for a business entity can be considered fundamental research if the other conditions for fundamental research are met. However, ITAR refers to research conducted only at "accredited institutions of higher learning."
- The language of ITAR indicates that the fundamental-research exclusion applies to information "which is published" and is generally accessible or available to the public. However, EAR exempts information that is publicly available, that is already published or will be published, or that arises during or results from fundamental research.
- EAR explains that no license is needed for classroom or laboratory teaching of foreign nationals in U.S. universities if the information is in the public domain. ITAR handles teaching by saying that "information concerning general scientific, mathematical, or engineering principles commonly taught in schools, colleges, and universities, or information in the public domain" is excluded from the kinds of technical data that are subject to controls.
- An EAR exclusion is not lost when a university accepts a temporary delay of publication for prepublication review for proprietary or patent-protection purposes, but ITAR does not contain such language, and so whether this safe haven is available under ITAR is ambiguous.
- An EAR exclusion is not lost in a federally funded project when a university accepts specific national-security controls if controls are not violated in exporting the controlled information, but under ITAR the exclusion is lost in a federally funded project if such controls are accepted.
- A supplement to EAR provides extensive explanatory questions and answers regarding what is not subject to EAR in the context of university and research laboratory activities. There is no such elaboration in ITAR documents.

In general, many participants seemed to find the EAR treatment of those issues not only clearer but also more consistent with recognition of the needs of scientific research.

Streamlining and Simplification of Regulatory Requirements

Workshop participants called attention to the need for streamlining and simplification of ITAR or ITAR procedures. Examples of revisions worthy of consideration are the following:

- For activities conducted for the Department of Defense, there is a foreign military-sales exemption whereby commercial exports are exempt from the licensing requirements of ITAR if they are in furtherance of a program

between a U.S. government agency and a foreign government (a government-to-government program). Workshop participants argued that a similar exemption should be granted to NASA so that exports by U.S. entities that are in support of an international collaborative space project that is being conducted under a formal government-to-government agreement can be excluded from ITAR licensing requirements.

- Participants cited numerous examples of cases in which a scientific research instrument or instrument subsystem was designed and built by a foreign partner, delivered to the United States for testing or integration into a scientific satellite, and later returned ("exported") to the foreign instrument team for calibration or repairs before launch. Export licenses were required in such cases even though the equipment being "exported" originally came into the United States from the overseas partner. Participants argued that such a requirement defied logic and added delays and administrative burdens without serving the fundamental purpose of export controls, and they argued for approval of exemptions for such cases. Likewise, participants supported a repair-and-return exemption that would allow a U.S. company that purchases and imports an item from a foreign entity to return ("export") an unmodified imported item to the original manufacturer for repair or recalibration without having to get a license.
- Several participants called attention to problems that have stemmed from misconceptions among foreign collaborators about the purpose of a technical-assistance agreement (TAA). In particular, many foreign collaborators try to restructure the agreements into funding agreements and thereby cause unnecessary delays in completing the approval process. Participants proposed standardization of the TAA format to use a DDTC-approved template and educational program that could alleviate some of the problems.

SCIENTIFIC COMMUNITY ACTIONS AND IMPROVEMENTS

Workshop participants agreed that the space-research community—including scientists and administrators at universities, national laboratories, and industry—shares responsibility for helping to solve problems that the workshop identified, and they suggested specific near-term actions to which the community should be prepared to make a commitment. The opportunities were tied to facilitating communication within the research community and between the research community and the government.

Facilitating the Flow of Information to and Within the Research Community

The workshop discussions often touched on the potential value of the State Department advisory opinions and "frequently asked questions" that could be posted on the DDTC Web site. DDTC officials indicated that they would welcome specific questions from the research community, and participants indicated interest in preparing such questions in the near future so that State Department responses could be made available. Research-community representatives were especially eager to obtain clearer guidance on whether the conduct of fundamental research depends on the nature of the activity rather than the location of the activity, that is, whether fundamental research can be carried out in all types of laboratories or only in university laboratories; whether work has to already have been published to qualify for being in the public domain, or whether an intention or attempt to publish is sufficient; and what is meant by *permanent abode* in the "bona fide employees" exemption for universities.

Participants proposed to establish a working group of university, industry, and federal laboratory representatives—possibly under the aegis of the National Research Council—to facilitate improved communication. Such a working group's responsibilities might include

- Encouraging interinstitutional collaboration, sharing expertise, and developing methods for streamlining ITAR processes.
- Identifying a sponsor and developing the agenda for an annual meeting to be held with the State Department.
- Creating an Internet mailing list to share relevant information within the research community.

Facilitating Government Access to Ideas and Input from the Scientific Community

In addition to suggestions for actions to promote improved communication to and within the research community, there were specific proposals for ways to improve research-community input to the government. DDTC representatives indicated an interest in having university participation in the DDTC's Defense Trade Advisory Group (DTAG), and this idea was embraced enthusiastically at the workshop. Representatives of the multi-university Council on Governmental Relations and the Association of American Universities indicated an interest in receiving names of potential DTAG research-community members and sending them to DDTC. An early task for new university-based DTAG members might be to work with the State Department on possible revisions of the USML.

Another immediate task for the research community, which would involve a somewhat longer-range target, would be to begin to develop a clear and compelling case for the basis and character of future changes in ITAR and to prepare to disseminate the results of that effort broadly across the government. Such a case would include factual descriptions of the extent to which the current application of ITAR to space science helps to reach national-security goals and articulation of the unintended consequences of current legislation. Documenting the effect on universities of delays in licensing and TAA approvals was seen as particularly important, as was documentation of any damage done to national security due to university disclosures (none was known to conference attendees). If a window of opportunity for change were to open in the near future, the first one or two requested changes in ITAR should be defined and ready for immediate action; additional requests should be prepared as time permits. Participants saw a role for relevant university and industry associations in this effort.

Finally, participants called attention to the need to follow up on university efforts to sustain discussion with government officials about the effects on universities of application of the Defense Federal Acquisition Regulation Supplement clause 252.204-7000 prepublication approval clause in government research contracts. That was cited as a subject in which university collaboration with industry is needed to ensure that the conduct and results of fundamental space science research remain outside the scope of ITAR control. University participants argued that including a mandatory contract requirement for approval before publication may endanger the fundamental-research exclusion and that discussions on removing the approval requirement for universities are needed.

Appendix A

Biographies

PLANNING COMMITTEE MEMBERS

NORMAN P. NEUREITER, *Chair,* is the director of the Center for Science, Technology and Security Policy at the American Association for the Advancement of Science (AAAS). He retired in September 2003 from the post of science and technology adviser to the secretary of state. Dr. Neureiter had a long association with Texas Instruments (TI), including service as vice president of Texas Instruments Asia. While at TI, he held a number of positions, including director of East-West business development, manager of international business development, manager of the TI Europe Division, and director of TI-Japan. Before his work with private industry, his diplomatic experience included a posting as the first U.S. science attaché in Eastern Europe from 1967 to 1969. Dr. Neureiter worked as international-affairs assistant in the White House Office of Science and Technology Policy during 1969-1973, reporting to the president's science adviser. Dr. Neureiter is the recipient of the 2003 AAAS Philip Hauge Abelson Prize, which he received for substantial contributions in building more effective relationships between the diplomatic and scientific communities and in increasing both communities' awareness of the importance of science and its value in international statecraft. He is a former member of the Space Studies Board.

SPENCE M. (SAM) ARMSTRONG retired from NASA in December 2002. As senior adviser to the NASA administrator, Gen. Armstrong promoted partnerships with academe, the Department of Defense, and industry. He was the ombudsman for academic institutions in such matters as export control, information-technology security, and NASA's grants process. Before joining NASA, he served for 34 years in the U.S. Air Force; he retired with the rank of lieutenant general. He went to NASA in 1991 from the White House-chartered Synthesis Group, which developed architectures to return humans to the Moon and send them to Mars. Gen. Armstrong was appointed associate administrator of the newly created Office of Human Resources and Education, where he was responsible for developing NASA's human-resources strategic plan and for emphasizing NASA's educational goals. He is a member of the National Research Council Government-University-Industry Research Roundtable.

DANIEL N. BAKER is a professor of astrophysical and planetary sciences and director of the Laboratory for Atmospheric and Space Physics at the University of Colorado at Boulder. He is also the director of the Center for Limb Atmospheric Sounding and is a member of the Center for Integrated Plasma Studies. His primary research interest covers the study of plasma physical and energetic particle phenomena in the planetary magnetospheres

and Earth's magnetosphere. He also conducts research in space-instrument design, space-physics data analysis, and magnetospheric modeling. Dr. Baker is a member of the Space Studies Board.

RETA F. BEEBE is a professor in the Astronomy Department at New Mexico State University, Las Cruces. Her research activities involve the study of the atmospheres of Jupiter and Saturn and in particular cloud motions and evolution in Jupiter's atmosphere. She is the author of several books and articles concerning telescopic observations of the giant planets, including *Jupiter: The Giant Planet*. Dr. Beebe manages the Atmospheres Discipline Node of NASA's Planetary Data System and was a member of the Galileo imaging team and lead scientist for the team using the Hubble Space Telescope to provide context images for the Galileo project. She is a former member of the Space Studies Board.

CLAUDE R. CANIZARES is the vice president for research, associate provost, and Bruno Rossi Professor of Physics at the Massachusetts Institute of Technology (MIT). He has overall responsibility for research activity and policy at MIT, overseeing more than a dozen interdisciplinary research laboratories and centers, including the MIT Lincoln Laboratory, the Broad Institute, the Plasma Science and Fusion Center, the Research Laboratory of Electronics, the Institute for Soldier Nanotechnologies, the Francis Bitter Magnet Laboratory, Haystack Observatory, and the Division of Health Sciences and Technology. He also oversees several offices dealing with research policy and administration, chairs the Research Policy Committee, and serves on the Academic Council and the Academic Appointments Committee. Dr. Canizares is the associate director of the Chandra X-ray Center and a principal investigator on NASA's Chandra X-ray Observatory. Dr. Canizares is a member of the National Academy of Sciences. He chaired the Space Studies Board from 1994 to 2000.

JOHN R. CASANI is special assistant to the director of the Jet Propulsion Laboratory (JPL). He is the JPL director's lead person on issues related to the International Traffic in Arms Regulations. During his long career in project management and system engineering, he has served as project manager for the Voyager mission to the outer planets, the Galileo mission to Jupiter, and the Cassini mission to Saturn, and he held project positions in JPL's early Explorer, Pioneer, Ranger, and Mariner space missions. He has received NASA's Distinguished Service, Outstanding Leadership, and Exceptional Achievement medals; the Space Systems Award from the American Institute of Aeronautics and Astronautics; the von Karman Lectureship in Astronautics; and the National Space Club's Astronaut's Engineer Award. Dr. Casani is a member of the National Academy of Engineering.

JACQUELINE N. HEWITT is a professor of physics and director of the Massachusetts Institute of Technology Kavli Institute for Astrophysics and Space Research. The focus of her research is the application of radio astronomy, interferometry, and signal processing to basic research in astrophysics and cosmology. Dr. Hewitt's honors include the American Physical Society's Maria Goeppert Mayer Award, the International Union of Radio Science's Henry G. Booker Prize, the National Science Foundation's Presidential Young Investigator Award, and the Annie Jump Cannon Award in astronomy. She is a former member of the Space Studies Board.

RAPPORTEUR

MARGARET G. FINARELLI is a senior fellow in the Center for Aerospace Policy Research at George Mason University. She began her career with NASA and other U.S. government agencies focused on strategy development and negotiations in domestic space policy and international relations in science and technology. At NASA (1981-2000), she rose to the position of associate administrator for policy coordination and international relations. She was responsible for developing the international partnerships in the International Space Station program and led the U.S. team conducting the international negotiations that resulted in the agreements governing NASA's cooperation with Europe, Japan, and Canada. As the International Space University's vice president for North American operations (2000-2006), she was responsible for strategic partnerships and business development in the United States for the Strasbourg, France–based international university.

STAFF

JOSEPH K. ALEXANDER served previously as director of the Space Studies Board (SSB), deputy assistant administrator for science in the Environmental Protection Agency's Office of Research and Development, associate director of space sciences at the NASA Goddard Space Flight Center, and assistant associate administrator of the NASA Office of Space Science and Applications. He has also been deputy NASA chief scientist and senior policy analyst at the White House Office of Science and Technology Policy. Mr. Alexander's own research work has been in radio astronomy and space physics. He received a B.S. and an M.A. in physics from the College of William and Mary.

CARMELA J. CHAMBERLAIN has worked for the National Academies since 1974. She started as a senior project assistant in the Institute of Laboratory Animal Resources (which is now the Institute for Laboratory Animal Research in the Division on Earth and Life Studies), where she worked for 2 years. She then transferred to the Space Science Board, which is now the Space Studies Board. She is an administrative assistant with SSB.

CATHERINE A. GRUBER is an assistant editor with the SSB. She joined SSB as a senior program assistant in 1995. Ms. Gruber came to the National Research Council in 1988 as a senior secretary for the Computer Science and Telecommunications Board and has also worked as an outreach assistant for the National Academy of Sciences-Smithsonian Institution's National Science Resources Center. She was a research assistant (chemist) in the National Institute of Mental Health's Laboratory of Cell Biology for 2 years. She has a B.A. in natural science from St. Mary's College of Maryland.

VICTORIA SWISHER is a research associate. She has supported SSB studies and workshops on the aerospace workforce, Mars research, research enabled by the lunar environment, and other topics. Before joining SSB, she did research in x-ray astronomy and laboratory astrophysics, which included studying x-rays from plasmas and culminated in her senior thesis, "Modeling UV and X-ray Spectra from the Swarthmore Spheromak Experiment." A graduate of Swarthmore College, she majored in astronomy and minored in English literature.

SANDRA WILSON is a program assistant for the Aeronautics and Space Engineering Board (ASEB). She came to the National Research Council in 2007 and was a temporary assistant in ASEB, the National Materials Advisory Board, and the SSB. During that time, she worked on projects involving an independent assessment of the nation's Wake Turbulence R&D Program, an assessment of NASA's Aeronautics Research Program, an evaluation of corrosion education, and a workshop on lunar research and technology. Earlier, Mrs. Wilson had served in a managerial capacity in the retail industry. She is enrolled at Prince George's Community College, majoring in accounting.

Appendix B

Workshop Participants

PLANNING COMMITTEE

Norman P. Neureiter (Chair), Director of the Center for Science, Technology and Security Policy, AAAS
Spence M. (Sam) Armstrong, Former Senior Adviser to NASA Administrator
Reta Beebe, Research Professor, New Mexico State University
Claude R. Canizares, Vice President for Research, Associate Provost, and Professor, MIT
Margaret Finarelli (Rapporteur), Senior Fellow, Center for Aerospace Policy Research, School of Public Policy, George Mason University

SCIENTIFIC COMMUNITY

Mario H. Acuna, Senior Fellow, NASA Goddard Space Flight Center
Michael A'Hearn, Professor of Astronomy, University of Maryland
Margaret Chester, Deputy Swift Mission Director, Department of Astronomy and Astrophysics, Pennsylvania State University
Max Coleman, Senior Research Scientist, Jet Propulsion Laboratory
James Frost, James Webb Space Telescope Project, NASA Goddard Space Flight Center
Caroline Himes, Executive Associate Director, Laboratory for Atmospheric and Space Physics, University of Colorado
Anne Kinney, Deputy Director, Solar System Exploration Division, NASA Goddard Space Flight Center
Charles R. Lawrence, Principal Scientist, Astrophysics Element, Jet Propulsion Laboratory
Peter R. Lawson, Systems Manager, Terrestrial Planet Finder Interferometer, Jet Propulsion Laboratory
J. Miguel Mas-Hesse, Senior Scientist, Centro de Astrobiologua (CSIC-INTA), Madrid, Spain
Barry H. Mauk, Section Supervisor, Applied Physics Laboratory, Johns Hopkins University
Daniel McCleese, Chief Scientist, Jet Propulsion Laboratory
Michael Prout, Lunar and Planetary Laboratory, University of Arizona
Jeff Simmonds, Mars Science Laboratory Science Payload Manager, Jet Propulsion Laboratory
Roy Torbert, Professor and Director, Space Science Center, University of New Hampshire

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Steven B. Eisner, University Export Control Officer, Office of the Vice Provost and Dean of Research, Stanford University
Jilda Diehl Garton, Associate Vice Provost for Research and General Manager, GTRC and GTARC, Georgia Institute of Technology
Mitchell Goodkin, Assistant General Counsel, Office of the Vice President, University of Michigan
Robert Hardy, Director of Contracts and Intellectual Property Management, Council on Governmental Relations
Jahna Hartwig, Associate General Counsel, Applied Physics Laboratory, Johns Hopkins University
Olga King, Export Control Official, Jet Propulsion Laboratory
Julie Norris, Director (emeritus), Office of Sponsored Programs, MIT
Susan Wyatt Sedwick, Associate Vice President for Research and Director, Office of Sponsored Projects, University of Texas at Austin
Tobin Smith, Senior Federal Relations Officer, Association of American Universities
Jason Van Wey, Assistant Director, MIT Washington Office
Hima Vatti, Associate Director, Office of Research Integrity and Assurance, Cornell University
Barbara Yoder, Coordinator of Research Administration Policy, Office of the President, University of California

INDUSTRY

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Randall Correll, Director of Business Development, Ball Aerospace & Technologies Corporation
Remy Nathan, Director of International Affairs, Aerospace Industries Association
John Petheram, Manager, Business Development, East Coast Operations, Sensing and Exploration Systems, Lockheed Martin Space Systems Company
Edmund B. Rice, President, Coalition for Employment Through Exports
Kerry T. Scarlott, Partner, Posternak Blankstein & Lund LLP
Debbie Shaffer, Manager of Export and International Affairs, Southwest Research Institute
Micah Walter-Range, Research Analyst, The Space Foundation
Andrew Zirkelbach, Senior Attorney and Vice President, Ball Aerospace & Technologies Corporation

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Robert Bauer, Earth Science Technology Liaison, Science Mission Directorate, NASA Headquarters
Marta Cehelsky, Executive Secretary, NSTC Committee on Science and Senior Adviser, Office of the Director, National Science Foundation
Anthony Dearth, Director of Licensing, Directorate of Defense Trade Controls, Bureau of Political-Military Affairs, Department of State
Ann K. Ganzer, Director of Defense Trade Controls Policy, Directorate of Defense Trade Controls, Bureau of Political-Military Affairs, Department of State
Paula Geisz, NASA Export Administrator, Export Control and Interagency Liaison Division, NASA Headquarters
John F. Hall, Director of the Export Control & Interagency Liaison Division, Office of External Relations, NASA
Bernard Kritzer, Director, Office of National Security and Technology Transfer Controls, Department of Commerce
Robie Samanta-Roy, Assistant Director for Space and Aeronautics, Office of Science and Technology Policy
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David Fite, Senior Member of Professional Staff, House of Representatives Committee on Foreign Affairs
John P. Hutton, Director, Acquisition and Sourcing Management, Government Accountability Office
Edward P. Levine, Member of Professional Staff, Senate Committee on Foreign Relations
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Frederic Nordlund, Head, Washington Office, European Space Agency

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Sandra Wilson, Program Assistant, Space Studies Board
Patricia Wrightson, Senior Program Officer, Committee on Scientific Communication and National Security
Ryan Zelnio, Committee on Scientific Communication and National Security

Appendix C

Workshop Agenda

SEPTEMBER 12, 2007

9:00 a.m. Welcome and Opening Remarks (N. Neureiter and J. Alexander)

9:20 Status of ITAR Implementation and Changes Since the November 2003 Workshop (S. Armstrong, Moderator)

- Summary of 2003 Workshop Highlights (C. Canizares)
- State Department Perspective (A. Ganzer)
- NASA Perspective (J. Hall)
- DOC Perspective (B. Kritzer)

10:30 Break

10:45 Resume Status Updates

- OSTP Perspective (R. Samanta-Roy)
- GAO Perspective (J. Hutton)
- Congressional Perspective (D. Fite)
- Universities' Perspective (R. Hardy)

12:00 p.m. Lunch

1:00 Issues Regarding Activities and Exports Within the United States (C. Canizares, Moderator)

- Panel Remarks on Case Studies (M. A'Hearn, C. Himes, S. Eisner, A. Zirkelbach)
- General Discussion

3:00 Break

3:15 Issues Regarding Activities with Foreign Partners Outside the United States (M. Allen, Moderator)

- Panel Remarks on Case Studies (R. Torbert, D. McCleese, J. Norris, J. Lewis)
- General Discussion

5:15 Adjourn for Day

SEPTEMBER 13, 2007

9:00 a.m. Issues Regarding TAAs, Licensing, Advisory Opinions, etc. (I. Pryke, Moderator)

- Panel Remarks on Case Studies (D. Chenette, J. Simmonds, S. Sedwick, K. Scarlott)
- General Discussion

10:45 Break

11:00 Splinter-Group Discussions of Specific Subtopics for Future Consideration

1. Problems arising from implementation of ITAR that impact international scientific cooperation and science as a global endeavor (R. Beebe, Moderator)
2. Problems arising from implementation of ITAR that impact universities' pursuit of their fundamental roles in education, development of the national workforce, and nurturing of scientific and technological innovation and advancement (J. Norris, Moderator)
3. Opportunities for near-term government actions and improvements (S. Armstrong, Moderator)
4. Opportunities for near-term scientific community (i.e., academia, federally funded research and development centers, and industry) actions and improvements (S. Eisner, Moderator)

12:00 p.m. Lunch

1:30 Splinter-Group Reports (R. Beebe, Moderator)

2:30 Break

2:45 Synthesis and Summary: Discussion of Significant Recurring Views, Needs for Information and Guidance, and Items for Future Action or Study (N. Neureiter, Moderator)

- Overarching Commentary and Policy Implications (L. Bloomfield)
- General Discussion

4:00 Adjourn