U.S.-Japan Workshop on Collaboration in Science and Technology (S&T)

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Executive Summary

Science and technology (S&T) is important for economic development, military strength, and social advancement. In a global economy, international collaboration represents a critical mechanism for ensuring that countries remain at the forefront of emerging research areas. The United States and Japan are world leaders in advanced S&T, and have cooperated in a number of areas in both the public and private sectors. Yet neither government officials nor business leaders in either country understand the full breadth of such cooperation, and there are additional opportunities for Japanese and American scientists and engineers from academia, business, and government to work together. On January 21–22, 2015, Sasakawa Peace Foundation USA (Sasakawa USA), in conjunction with the Institute for Defense Analyses (IDA), convened a workshop to survey the current level of U.S.-Japan cooperation in selected areas of S&T and to identify both areas for improvement and obstacles to be removed for greater cooperation.

Workshop Overview

The workshop brought together 33 U.S. and Japanese experts from academia, business, and government. The group met in plenary session during the morning of January 21–22, and in three topical breakout sessions covering the S&T domains of aerospace, energy and climate change, and information technology on the afternoon of January 21. An evening reception allowed additional time for informal interaction and knowledge sharing.

The breakout sessions considered three questions:

- Where is there already strong collaboration between U.S. and Japanese stakeholders (government, industry, and academia)?
- Where might opportunities lie for future collaborative efforts, and what is needed to facilitate those efforts?
- Are there specific barriers that need to be overcome, and how might that occur?

Group members identified multiple opportunities for S&T collaboration among U.S. and Japanese researchers and companies in all three S&T domains. Workshop participants also identified three generic barriers to U.S.-Japan collaboration. The first is the distance between the two countries—both physically and with respect to differences in language and culture. The second barrier is related to the increased globalization of technologies and S&T expertise. While increased globalization has reduced U.S.-Japan

tensions around trade, it has also increased the number of countries with which U.S. and Japanese investigators and companies can profitably collaborate. As a result, there may be fewer incentives for U.S. and Japanese firms and scientists to work together. The final barrier is the limited availability of research funding, which hampers all new S&T collaboration, including collaboration between the United States and Japan. Participants in the aerospace breakout group further identified sector-specific barriers surrounding collaboration with respect to remaining differences in export control and classification regimes.

Recommendations

The workshop participants identified three categories of activities to advance S&T collaboration, with an eye to overcoming the barriers cited above:

- Convening efforts:
    - "Track 1.5" diplomacy efforts.[1] Such efforts would involve official and non-official stakeholders on U.S.-Japan policy topics of interest.
    - Convene "hackathons." The purpose of these small meetings that bring groups of technologists together over a short period of time would be to provide solutions to specific technical problems of interest to both U.S. and Japanese stakeholders.
    - Convene technical road mapping/visioning efforts. In scientific and technical domains with bilateral strength and common interests, meetings with the potential to lead to joint research planning and collaborative efforts would both enhance U.S.-Japan scientific and technical relationships and increase the likelihood that both countries' scientific strengths were effectively leveraged.
    - Convene consortia. In emerging technology areas or domains where there has been less frequent collaboration, additional effort may be required to initiate these collaborative research relationships. Industry and government stakeholders from both countries could meet to identify opportunities to form such ventures and facilitate planning efforts.
- Funding Efforts: Examples suggested were sponsored prize competitions or challenge prizes that had a U.S.-Japan collaborative component or specific interest to stakeholders in both countries.

[1] "Track 1.5" refers to dialogue involving both government officials ("Track 1" diplomacy) and non-government actors ("Track 2" diplomacy).

- Educational efforts: Briefings or seminars could be convened for particular government officials (either in the executive branch or the legislative branch) or industry leaders.

During the breakout sessions and in the plenary discussion on Thursday, participants elaborated on these activities by identifying 22 specific, actionable topics to explore. They are organized here under the three broad S&T domains and by category of efforts:

- Aerospace domain
  - Convene
    - industry and government around dual uses of technology such as electromagnetic launch technologies; and
    - industry, government, and academia to expand industry-academic consortia to include government agencies.
  - Fund efforts to promote mentorship of women in aerospace domains.
  - Educate
    - U.S. government staff regarding regulations on supersonics; and
    - U.S. industry on changes in Japanese defense and aerospace policy and posture
- Energy and Climate Change
  - Convene
    - Track 1.5 meeting involving the United States, South Korea, and Japan on fourth-generation nuclear reactor technologies;
    - Track 1.5 meeting involving nuclear nations on "soft issues";
    - Track 1.5 meeting around Northeast Asia energy security and clean energy framework;
    - Track 1.5 meeting around whether the United States and Japan should participate in the Chinese Asian Infrastructure Investment Bank proposal and launch;
    - Workshop to promote the visibility of the National Institute of Advanced Industrial Science and Technology (AIST) Research Center for Photovoltaic Technologies;
    - Workshop to identify lessons learned from U.S.-Japan collaborative smart grid research and demonstrations; and

    - Road-mapping workshops to address discrete aspects of specific energy technical issues.
  - Fund national laboratory personnel exchanges.
  - Educate U.S. Congress and the executive branch on energy-related technical issues.
- Information Technology
  - Convene
    - Track 1.5 discussion of legal and theoretical issues around information technology;
    - Technical discussion around stimulating development of U.S.-Japan "self-sensing" and "self-reporting" underwater cables;
    - Industry-government technical discussion to stimulate development of robotic devices for emergency response;
    - Joint hackathons on issues of U.S.-Japan interest.
  - Fund U.S.-Japan information technology and cybersecurity challenge events, especially for younger participants
- Other efforts suggested
  - Convene
    - Track 1.5 meeting on lessons learned and information sharing across DARPA-like organizations in the U.S. and Japan and
    - Track 1.5 meeting around bringing exhibits from Japanese museums to the United States, and vice versa.
  - Fund training aimed at overcoming specific barriers to technical cooperation between U.S. and Japanese scientists.

Contents

1. Introduction

A. Workshop Rationale

Science and technology (S&T) is important for economic development, military strength, and social advancement. In a global economy, international collaboration represents a critical mechanism for ensuring that countries remain at the forefront of emerging research areas. The United States and Japan are world leaders in advanced S&T, and have cooperated in a number of areas in both the public and private sectors. Yet neither government officials nor business leaders in either country understand the full breadth of such cooperation, and there are additional opportunities for Japanese and American scientists and engineers from academia, business, and government to work together to further strengthen and enhance existing collaborations.

On January 21–22, 2015, Sasakawa Peace Foundation USA (Sasakawa USA), in conjunction with the Institute for Defense Analyses (IDA), convened a workshop to survey the current level of U.S.-Japan cooperation in selected areas and identify areas for improvement and obstacles to be removed for greater cooperation. The workshop brought together 33 U.S. and Japanese experts from academia, business, and government. Appendix A lists the workshop participants and their affiliations.

The workshop was designed to maximize opportunities for interaction and community building. The group met in plenary session during the mornings of January 21–22, and in three topical breakout sessions on the afternoon of January 21. An evening reception allowed additional time for informal interaction and knowledge sharing. Appendix B provides details of the workshop agenda.

B. Workshop Summary

Welcoming remarks from Admiral Dennis Blair of Sasakawa USA, Secretary Richard Perry of Stanford University, and Dr. David Chu of IDA set the stage for the conversations that followed. Admiral Blair reiterated that the purpose of the workshop was to find practical ideas for strengthening science and technology cooperation between the United States and Japan. Implementation of these S&T ideas should help both countries work together to be healthier, safer, and more prosperous.

He also introduced three overarching questions as follows to frame discussions:

1. While there are many ongoing U.S.-Japan bilateral efforts and dialogues, is real collaborative work being done in these bilateral efforts, or are these forums insufficient?

2. Are the trends in U.S.-Japan collaboration going in the right direction?

3. Are incentives properly aligned for effective U.S. – Japan collaboration?

After the welcoming remarks, four speakers discussed the state of U.S.-Japan collaboration. Ambassador Michael Armacost described historical science and technology collaboration between the two countries during his tenure as Ambassador to Japan in the late 1980s and early 1990s. He described two projects: his efforts to involve Japan in the construction and financing of the Superconducting Supercollider and the FS-X fighter aircraft. He noted that conditions supporting S&T collaboration were difficult during that period, especially due to trade considerations. At the time, Japan had mastered key technologies in many industries, which produced balance-of-payments concerns and resulted in the loss of U.S. manufacturing jobs. Relative to that time, in his view, the opportunities for collaboration in S&T should be increasing. Japanese science and universities have improved, as evidenced by the 14 Japanese Nobel Prize winners in physical sciences since 2000. Balance of payments issues have attenuated. Greater interdependence in global S&T infrastructure means that collaboration is necessary—most major products require myriad precision manufactured components made in Japan. In addition, the rise of China and goodwill in the wake of the 3.11 disaster has strengthened U.S.-Japan cooperation. Ambassador Armacost identified fields such as space, ballistic missile defense, energy, climate change, and preventing global pandemics as areas where incentives for S&T collaboration are aligned.

Nobuo Tanaka of the Institute for Energy Economics, Japan described opportunities for collaboration in energy technologies, in the context of International Energy Administration projections of the world's and Japan's energy supply and demand. He focused on both supply-side and demand-side technologies as fruitful areas for future energy S&T collaboration. He highlighted the need for collaboration in the development of fourth-generation nuclear technologies, especially Integral Fast Reactor technology coupled with pyroprocessing of spent fuel. These technologies offer short-term benefits, especially to handle fuel and fuel debris from the Fukushima Daiichi plant by using them to generate electricity.[2] In addition, these technologies lower the risk of accidents as compared with current nuclear technologies, and they do not generate nuclear waste requiring long-term storage or lead to nonproliferation concerns.

Hidehiro Ikematsu of the Japanese Ministry of Defense (JMOD) described collaboration in aerospace and defense research, development, and product sustainment. He noted that changes in Japan's defense policy and posture, including its policies related to armaments development and sales, have created new opportunities for S&T collaboration. He noted four categories of opportunities:

[2] For more information, see http://gehitachiprism.com/.

- Cutting-edge technology development in areas such as unmanned aircraft/artificial intelligence, multi-mission platforms, and supersonic non-fighter aircraft
- Cooperation under the U.S.-Japan Acquisition and Cross-Servicing Agreement, which allows for joint training, disaster relief efforts and peacekeeping efforts;
- Maintenance and sustainment of common equipment, where Japan could become the regional sustainment base for U.S.-designed military aircraft whether operated by the U.S. military or by Japan
- Moving toward collaborative aircraft development and production or even Japanese sales of military aircraft to the United States.

Naoki Saito of the Japanese National Institute of Science and Technology Policy (NISTEP) presented analyses of the overall state of Japanese S&T; discussed Japan's current S&T priorities; and described efforts to set future priorities, policies, and programs. He identified the emphasis on innovation in the Japanese policy environment, including its inclusion as one of the "three pillars" of the current government's economic policy. This emphasis on innovation is reflected in the following actions of the Japanese government (1) changing the responsibilities and name of the cabinet-level coordinating body to the Council for Science, Technology and Innovation; (2) creating an organization similar to the U.S. Defense Advanced Research Projects Agency (DARPA) called Impulsing Paradigm Change through disruptive Technologies (ImPACT); and (3) continuing the World Premier International Research Center program for promoting collaboration between Japanese universities and leading investigators worldwide. He also mentioned that the fourth S&T basic plan (running from 2011 to 2015), is driven by Japanese society's grand challenges, with energy, healthy aging, next generation infrastructure, and regional revitalization being the current priorities. NISTEP is completing an S&T foresight exercise to identify potential priorities for the fifth S&T basic plan, which is now being developed.

After the introductory presentations, the group began a plenary discussion of the following questions:

- Where are there opportunities for future collaboration—and among whom?
- Are there common barriers across sectors that require higher-level policy intervention?

After lunch, the workshop divided into three breakout groups that focused on aerospace, energy and climate change, and information technology. Each breakout group discussed:

- Where is there already strong collaboration between U.S. and Japanese stakeholders (government, industry, and academia)?

- Where might opportunities lie for future collaborative efforts, and what is needed to facilitate those efforts?
- Are there specific barriers that need to be overcome, and how might that occur?

On the morning of January 22, the three breakout groups reported their findings from the previous day's deliberations. The plenary discussion expanded upon and refined these findings to begin the process of formulating action steps.

The next chapter of this workshop report lays out additional opportunities for collaboration, challenges to successful collaboration, and potential approaches to increasing collaboration. The final chapter identifies a specific set of actions identified in the breakout sessions and plenary discussion intended to advance the goal of promoting U.S.-Japan S&T collaboration.

2. Opportunities, Challenges, and Approaches

This chapter begins by describing the set of opportunities for S&T collaboration in the three issue areas covered in the workshop. It then describes the barriers and challenges to collaboration identified during the workshop. Some of the challenges apply to any collaboration between the United States and Japan at this time, and others are specific to particular industry sectors. The chapter concludes by describing approaches to encouraging increased collaboration that workshop participants identified.

A. Opportunities

1. Aerospace

The aerospace domain has historically seen robust U.S.-Japan collaboration involving both the public and private sectors. In addition to the FS-X fighter example mentioned by Ambassador Armacost, other historical successes mentioned by workshop participants include:

- ***Boeing 777 development.*** In the development of the Boeing 777 commercial aircraft, both large Japanese aerospace companies and smaller suppliers worked effectively with Boeing to develop and integrate new technologies. The collaboration produced an innovative, globally pervasive aircraft with great capability, reliability, and safety record. The collaboration benefited Boeing, the U.S. economy, the Japanese economy, and partner Japanese contractors.
- ***H2A launch vehicle.*** Boeing is providing the hydration tank for the second stage for this Japanese Mitsubishi Heavy Industries space launch vehicle.
- ***Delta Heavy Launch Vehicle.*** Mitsubishi Heavy Industries provides liquid oxygen components for the United Launch Alliance's Delta Heavy Launch Vehicle.
- ***Standard Missile 3 Block IIA.*** Raytheon and Mitsubishi Heavy Industries are working jointly on the development and deployment of the third generation of the Standard missile, which is intended to defend against short-range or intermediate-range ballistic missiles from either land or sea.

The change in Japan's defense policy and posture has created new opportunities for future collaboration. Japan enacted the State Secrets Act in 2013, which was an integral step in the process of creating a regime for the protection of security-sensitive information. A classification regime would allow for mutual sharing of classified information, which, in turn, would facilitate collaboration in sensitive military technologies. Japan's arms exports policy changes and its work towards the creation of a dual-use technologies export control regime will similarly facilitate and incentivize collaboration between the United States and Japan on aerospace and defense technologies.

Aerospace breakout group participants identified areas where both the United States and Japan have technical strengths, but where problems are sufficiently complex that university researchers and companies might collaborate profitably in working towards solutions. Ten different areas were mentioned as having potential for future collaboration.

1. Prototyping. Rapid prototyping is being introduced in a range of manufacturing disciplines as a means for testing new designs inexpensively and without committing customers to making initial purchases. Developing new technologies for prototyping aerospace designs is an area of potential research and development collaboration, which, if successful, could facilitate industrial and government collaboration. A specific technology application is the production of civilian tilt-rotor aircraft, in which both NASA and Japanese industry are quite interested.

2. Rocket engines. The Japanese government is funding the development of the next-generation H2X rocket, and there are opportunities for sharing expertise and development efforts between U.S. and Japanese industry to fill current gaps in the market.

3. Space Situational Awareness data sharing. Space debris poses a risk to satellites already in space as well as to future civilian space industries such as low-earth orbit space tourism. Sharing data across nations, including between the United States and Japan, is critical to ensuring that existing and future assets are not put at risk. Japan wishes to develop a memorandum of understanding with the U.S. Strategic Command for sharing data and jointly funding and sharing personnel to improve space situational awareness capability in both Japan and the United States.

4. Earth Observations data sharing. Both the United States and Japan invest heavily and collaborate directly on the development of Earth-observing systems (e.g., satellites and oceanography buoys), but the two countries have different policies regarding how the data collected should be shared and whether access should be fee-based or open. These policy differences limit data sharing and scientific collaboration in technical domains that require cross-national data.

5. Acoustics. Underwater acoustics for civil and military applications is an area where there is already some limited collaboration, but where future opportunities for expanding those collaborations exist.
6. Directed energy. Currently, the United States and Japan have been working on directed energy technologies for airborne systems (e.g., the airborne laser for missile defense applications). Expanding research to surface and subsurface vehicles will require future collaborative research and development.
7. Autonomous and semi-autonomous systems. Participants identified several potential areas of collaboration with respect to autonomous and semi-autonomous aerospace systems, including airspace management and collision avoidance air traffic control systems, air traffic control in maritime environments, and semi-autonomous unmanned aerial vehicles for military or emergency response uses.
8. Electromagnetic aircraft carrier launch systems. U.S. aircraft carriers use steam catapult systems to launch aircraft. Opportunities have been identified for replacing these systems with higher efficiency electromagnetic rail guns. Japanese companies have developed electromagnetic launch technologies for civilian train use. Collaboration between the two countries would determine if Japan's technologies could be modified for defense applications and what would be required to integrate them into existing U.S. systems.
9. Three-dimensional (3D) printing. Developments in 3D printing provides a host of opportunities for use in aerospace applications from incorporating high-strength, ultra-lightweight materials in new designs to providing tools on the International Space Station or future long-range spacecraft to design and fabricate components as needed.[3] The United States and Japan are leaders in both 3D printing and aerospace technologies, which suggests opportunities for future collaboration.
10. Supersonic flight. Both NASA and its Japanese counterpart, Japan Aerospace Exploration Agency (JAXA), invest heavily in commercial supersonic flight. One-third of NASA's aeronautics research, for example, is in supersonics. Historically, there have been many discussions between the two agencies regarding research collaboration, but to date collaborations have not been developed. Facilitating agency-to-agency contacts in this technology area might help with respect to academic and industry collaboration.

[3] National Academy of Sciences, Committee on Space-Based Additive Manufacturing, *3D Printing in Space* (2014).

2. Energy and Climate Change

Energy is an S&T domain where there is intense interest in technological improvement. Breakout session participants identified three reasons for U.S.-Japanese S&T collaboration in energy technologies at this time. First, Japan has need of assistance with nuclear energy-related technologies as a consequence of the Fukushima Daiichi disaster, and the United States is the world leader in many nuclear-related areas. Second, U.S. and Japanese companies and researchers have complementary technological strengths in renewable energy and energy efficiency technologies. Third, unconventional oil and gas ("shale gas") recovery technologies have opened new areas for exploitation on land, and there are opportunities for joint development of methane hydrate reserves from the ocean floor.

Breakout session participants identified the potential for collaboration with respect to both near-term and long-term energy technologies:

1. Nuclear technologies. In the short-term, restarting Japan's nuclear reactors was considered an implicit "fourth arrow" of the "Abenomics" program. If Japan cannot reintegrate nuclear energy into its short-term mix, dramatic increases in requirements for coal and natural gas imports will result, which will, in turn, have financial (balance-of-payments) as well as environmental effects. Workshop participants suggested that U.S. agencies were viewed in Japan as honest brokers that provide trustworthy information on nuclear technologies. In the longer term, the Japanese and U.S. nuclear industries are already closely intertwined (e.g., joint ventures such as GE/Hitachi). Workshop participants considered long-term S&T collaboration in the development of fourth-generation nuclear reactor technologies a likely area of continuing collaboration.

2. Coal-fired power plants. All projections suggest that coal will remain the primary input for electricity-generating plants in the short- and medium-term. Collaboration on increasing the efficiency of existing coal-fired power plants, as well as longer-term work on carbon capture and storage to reduce the greenhouse gas emissions from coal-fired plants, would leverage S&T strengths in both the United States and Japan.

3. Photovoltaics. Developing photovoltaic technologies that are cost-competitive with centrally-generated electricity would offer benefits to both the United States and Japan; many parts of Japan receive sufficient direct sunlight to make photovoltaics potentially competitive. Both the United States and Japan have strengths in the nanotechnology and materials science disciplines needed to increase the efficiency of photovoltaic cells further; Japanese strengths in precision manufacturing could be leveraged as well.

4. Smart grids/microgrids. Joint U.S.-Japan demonstration projects are developing the “smart grids” that will be needed to accommodate the widespread use of renewable energy (e.g., Okinawa/Hawaii and Los Alamos). Building upon these initial projects to demonstrate efficient, scalable solutions from single homes to entire cities were identified as an area for future S&T collaboration.
5. Methane hydrates. There are already collaborations between the United States and Japan on deep-sea research, such as the Integrated Ocean Discovery Program, which includes methane hydrate research (e.g., past expeditions of the Japanese-provided Chikyu drillship). Both the Japan Agency for Marine-Earth Science and Technology and the Department of the Interior (U.S. Geological Survey) and the Department of Energy support methane hydrate research, but tighter collaboration could leverage limited research resources in this domain.
6. Energy Efficiency. Japan is a world leader in many energy efficiency technologies but lags behind the United States in energy-efficient building technologies. Closer collaboration between government agencies and companies could leverage existing successes, increase efficiency, and decrease energy use and greenhouse gas emissions.

3. Information Technology

Information technology (IT) encompasses a large number of rapidly evolving domains. IT is increasingly incorporated into manufactured products, including automobiles, small home appliances, and clothing and other wearable technologies. The IT breakout session focused on a discussion of a constrained set of opportunities for U.S.-Japan collaboration, especially on cybersecurity and networking issues. Specific opportunities identified were:

1. Cybersecurity in the cloud. The migration of computing and data storage from individuals and companies to remote resources suggests both the potential for new opportunities for cyber defense (instantaneous implementation of security measures to attached devices, use of attached devices as sensors, diffusion of defensive/mitigation measures, easier recognition of behavior patterns) as well as new cyber threats. Transnational collaboration in developing new approaches that defend cloud computing so that mitigation and adaptation measures are developed before threats materialize was considered a substantial S&T collaboration opportunity.
2. Managing tradeoffs in data protection. A perfect cyber defense would ensure perfect confidentiality, perfect data integrity, and complete availability, but in practice there are tradeoffs among these attributes. New methods and tools to protect data, and the knowledge underlying the data, would be beneficial.

3. Legal and regulatory mechanisms for the twenty-first-century Internet. The United States and Japan have common goals for the development of the Internet, but they attempt to achieve their goals using different legal structures and regulatory regimes. Harmonization of approaches to allow for effective collaboration in preventing, mitigating, and prosecuting cyber crime (and cyber attacks) was considered valuable.
4. Cyber security workforce needs. A related need is the personnel who are trained as the workforce for this vital, emerging field. Educational efforts and prize competitions aimed at the cyber security domain tend to involve teams from individual schools and nations.[4] Given the importance of collaboration in defending cyberspace against malicious attack, collaborative competitions and training efforts were suggested as useful additions to existing approaches.
5. Securing undersea cables. Data is transmitted across the Pacific Ocean through undersea cables resting on the sea floor. Ninety percent of trans-Pacific cables bridge the west coast of the United States and Japan. Current technologies for identifying cable breaks lead to slow responses when faults occur, raising the possibility of network slowdowns or outages. U.S. and Japanese strengths in oceanography and sensors could be leveraged to develop new approaches for cables that detect and notify owners automatically of the existence and location of faults.
6. Robotics for disaster response. Developing new technologies for disaster response would meet needs in both the United States and Japan in facing natural and man-made disasters. The breakout session considered U.S. strengths in artificial intelligence and Japanese strengths in robotics to be complementary in this domain, suggesting opportunities for collaboration. There are already ongoing collaborations at the government-to-government level, but given that any robots developed for this purpose would be for niche markets, industry may not have sufficient incentive to invest; additional S&T collaboration by U.S. and Japanese governments may be required to develop prototypes and reduce technical risks in this domain.

B. Challenges and Barriers to U.S.-Japan Collaboration

Workshop participants identified three generic barriers to U.S.-Japan collaboration. The first is the distance between the two countries—both physically and with respect to

[4] Examples include: CyberPatriot challenge (high school), http://www.uscyberpatriot.org/; National Collegiate Cyber Defense Competition (undergraduate); "Capture the Flag" competitions intended for students in high school and college, the Japanese Ministry of Economy, Trade and Industry (METI) hosts Japanese "Capture the Flag" competitions as well.

differences in language and culture. Currently, few U.S. nationals are fluent in Japanese or possess the cultural literacy and fluency that facilitates collaboration; while learning English is a higher priority for Japanese nationals than Japanese is for Americans, the differences in language and customs are still daunting and limit opportunities to work together. The second barrier is related to the increased globalization of technologies and S&T expertise. Globalization has increased the number of countries with which U.S. and Japanese investigators and companies can profitably collaborate. As a result, there may be fewer incentives for U.S. and Japanese firms and scientists to work together. The third barrier is the limited availability of research funding, which hampers all new S&T collaboration, including collaboration between the United States and Japan.[5]

Participants in the aerospace breakout group further identified sector-specific barriers surrounding collaboration with respect to remaining differences in export control and classification regimes.[6] University investigators were considered poorly informed of the true nature of International Traffic in Arms Regulations (ITAR) requirements,[7] leading them to overestimate barriers to joint research. At least as important was the sense of the group that most U.S. companies were not cognizant of the changes underway in Japan regarding military equipment and were missing opportunities for future collaboration and business development because of a misperception that export controls and classification differences remained an insurmountable barrier. On the Japanese side, cultural concerns remain around defense activities, classified research, and dual-use technologies that limit some investigators' interest in participating in aerospace research with defense applications or working with either JMOD or the U.S. Department of Defense (DOD). While biomedical research was not a focus of the workshop, it was noted that there are differences between the United States and Japan with respect to human subject research protections that hamper collaborative research efforts, mostly because investigators are unaware of the differences and how to navigate them.

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5 This general barrier was considered especially acute in the aerospace domain where there are large disparities between U.S. and Japanese government funds available for aerospace research.

6 Participants noted that these policies are changing. Japan is developing its own export control regime, which may be controversial in Japan, but makes it easier for the United States and Japan to work together on sensitive products. Japan is also setting up its own version of the Defense Technology Security Administration and is planning to consolidate acquisition and S&T into a single agency, the Defense Acquisition Agency, inside JMOD. Legislation is pending, which, if approved, would allow the reorganization to begin in late 2015.

7 The U.S. export control regime falls under the aegis of the U.S. Department of State's ITAR. See https://www.pmddtc.state.gov/regulations_laws/itar.html for more information.

C. Approaches

The breakout sessions identified an array of needs with respect to S&T collaboration between the United States and Japan in the three S&T domains covered by the groups, as well as approaches for addressing those needs.

1. Convening Efforts

One set of activities falls under the aegis of "convening" efforts. Within this broad category are four different types of efforts.

- "Track 1.5" diplomacy. Official and non-official stakeholders already meet to address U.S.-Japan policy topics of interest, especially with respect to trade and defense policy issues. Workshop participants suggested that existing efforts could be expanded to include a greater focus on science and technology issues.
- "Hackathons." The U.S. government and the information technology sector often convene "hackathons," which are small meetings between groups of technologists to resolve specific technical problems over a short period of time. Efforts should continue to identify topics that would be of interest both to U.S. and Japanese stakeholders, and to convene high-powered groups from both countries.
- Technical roadmapping/visioning. Both industry associations and government agencies convene groups of scientists for the purpose of sketching out future research plans or roadmaps. The U.S. Advanced Research Projects Agency-Energy (ARPA-E), for example, conducts visioning workshops before launching a new programmatic effort to tap community expertise. In scientific and technical domains with binational strength and common interests, such gatherings could pursue joint research planning and collaborative efforts that would both enhance U.S.-Japan scientific and technical relationships and increase the likelihood that both countries' scientific strengths were effectively leveraged.
- Consortia. In industries where there are well-developed U.S.-Japan ties and relationships (e.g., aerospace), companies and universities assemble to create joint research ventures and consortia as required. In emerging technology areas or domains where there has been less frequent collaboration, additional effort may be required to initiate these collaborative research relationships. Industry and government stakeholders in both countries could come together to determine

if opportunities exist to form such ventures and, if so, to facilitate planning efforts.[8]

2. Funding Efforts

A second category of activities is to initiate funding of programmatic efforts, either by having a single organization fund a small effort or by assembling a group to fund more substantial efforts. A specific example mentioned by workshop participants was the idea of sponsoring prize competitions or challenge prizes that had a U.S.-Japan collaborative component or would be of specific interest to stakeholders in both countries. A second example mentioned was to foster human capital development efforts, including training and mentorship efforts.

3. Educational Efforts

A third category of efforts involves organizing informational briefings or seminars aimed at particular government officials (either in the executive branch or legislative branch) or industry leaders. These efforts would recruit technical experts on particularly complex S&T policy topics that have a U.S.-Japan aspect to educate counterparts in either or both countries.

[8] A specific example mentioned was the Boeing-catalyzed Consortium for Manufacturing Innovation, headquartered in the University of Tokyo. See https://www.cmi.iis.u-tokyo.ac.jp/event/20141017/event20141017_e.html and http://boeing.mediaroom.com/2012-06-29-Boeing-to-Begin-Joint-Manufacturing-Research-in-Japan for additional information.

3. Action Plan for Future Efforts

The previous chapter delineated the workshop participants' efforts to identify potential areas for S&T collaboration between the United States and Japan. This chapter presents the results of the plenary discussion on the second day of the workshop, which identified specific activities that might be considered. The actionable topics are presented thematically by broad S&T domain, and they include activities from all three categories of effort (convening, funding, and educational) identified in the previous chapter.

A. Aerospace

Suggested actions in the aerospace domain focused on convening and educational efforts.

- *Convene industry and government stakeholders around dual use of technology such as electromagnetic launch technologies.* Given the potential application of Japanese-developed technologies for U.S. carriers, convening Japanese government (METI and JMOD), U.S. government (DOD Office of the Secretary of Defense and U.S. Navy), and Japanese and U.S. industry stakeholders to identify the specific technical requirements and challenges associated with adapting these civilian technologies to military use could provide a path forward to meeting a critical technology need of great importance to both nations' maritime security.
- *Convene industry-academic consortia to include government agencies.* While aerospace consortia have successfully forged bilateral academia-industry relationships, these consortia do not include active participation by government agencies and program managers. Stakeholders with connections to both the consortia themselves and relevant government agencies could foster the inclusion of government stakeholders in these efforts.
- *Fund efforts to promote mentorship of women in aerospace careers.* Participants noted that the representation of women in the aerospace domain lags in both countries. Of special note was the lack of women in senior aerospace positions in Japan. A mentorship program (whether aimed generally at female students encouraging them to enter aerospace domains or specifically to pair senior U.S. female aerospace experts with junior Japanese women) could be funded to expand the representation of women in aerospace and aeronautics fields.

- *Educate U.S. government staff regarding regulations on supersonics.* Currently, U.S. regulations banning commercial aircraft from producing sonic booms over land have limited the potential commercial utility of next-generation supersonic aircraft. At the same time, DARPA and the National Aeronautics and Space Administration (NASA) are conducting research on designing supersonic aircraft to minimize sonic booms. Relevant government staff (e.g., from the U.S. Federal Aviation Administration) could be educated regarding these new technologies in the hope of spurring regulatory changes that might provide a path to commercialization and use should these new supersonic aircraft technologies prove technologically and economically feasible.
- *Educate U.S. industry on changes in Japanese defense and aerospace policy and posture.* Responding to the lack of knowledge by U.S. industry leaders regarding the strategic impact of the changes in Japan (e.g., arms export policies, Secrets Act), a "captains of industry" forum could convene, perhaps around a major conference such as the American Institute of Aeronautics and Astronautics (AIAA) or Aerospace Industries Association (AIA) annual meetings. Involving DOD and JMOD senior officials in these efforts could spur industry-government collaboration as well.

B. Energy and Climate Change

In the energy and climate change domain, participants emphasized convening efforts, particularly Track 1.5 meetings.

- *Convene a Track 1.5 meeting involving the United States, South Korea, and Japan on fourth-generation nuclear reactor technologies.* Fourth-generation reactor technologies offer the possibility of solving technical problems with reactor safety, waste management, and nonproliferation, but to date have not been adopted. Government and industry stakeholders could convene to discuss the promise of and barriers to the technology. Such an effort could also serve as a neutral forum for fostering positive relationships between Japan and South Korea.
- *Convene a Track 1.5 meeting involving nuclear nations on "soft issues."* Nuclear power is in civilian use in several countries, including the United States, Japan, European Union countries, China, India, Russia, South Korea, and Pakistan. Countries face common challenges with respect to "soft issues" such as regulatory processes, human resources/workforce, and training on safety issues. While several government and quasi-governmental organizations are working in this

area,[9] there may be value in convening U.S. and Japanese government and industry stakeholders in a neutral forum to discuss these issues.

- *Convene a Track 1.5 meeting around Northeast Asia energy security and clean energy framework.* Energy security is a topic that motivates East Asian countries such as Japan and China that are major importers of energy (e.g., from the Middle East) as well as Russia, a major energy exporter. Convening government and industry stakeholders to discuss a potential framework for joint efforts on clean energy and energy security, especially if the discussion involved Russian representatives, could yield new internationally-collaborative initiatives and proposals. A related, similar effort could be to convene stakeholders around a Southeast Asian strategic petroleum reserve and other efforts to increase the stability of energy supplies to Asian importing countries.
- *Convene a Track 1.5 meeting around whether the United States and Japan should participate in the Chinese Asian Infrastructure Investment Bank proposal and launch.* This meeting would discuss the advantages and disadvantages associated with participation, both with respect to relationships with China and influence with Asian developing countries that the bank intends to serve.
- *Convene a workshop to promote the visibility of the National Institute of Advanced Industrial Science and Technology (AIST) Research Center for Photovoltaic Technologies*.[10] AIST maintains a top-flight research center for photovoltaics research, which currently has excess capacity and is looking for additional researchers interested in collaborating or making use of the facility. AIST facility managers, U.S. and Japanese photovoltaics researchers in academia, and interested national laboratory personnel could meet to discuss the facility's capabilities and identify opportunities for future photovoltaics research collaboration.
- *Convene workshop to identify lessons learned from U.S.-Japan collaborative smart grid research and demonstrations.* As described in Chapter 2A, there are ongoing demonstration projects on "smart grids" involving U.S. and Japanese industry and researchers. A workshop could be held to discuss lessons learned from these efforts and to plan follow-on demonstration projects intended to scale "smart grid" technologies toward practical implementation.
- *Convene roadmapping workshops to address discrete aspects of technical energy issues.* Academics, government personnel and industry technologists in one or

[9] Examples mentioned included the International Atomic Energy Agency and the U.S. Cooperative Threat Reduction initiative (http://www.dtra.mil/Missions/Nunn-Lugar/GlobalCooperationInitiative.aspx).

[10] See https://unit.aist.go.jp/rcpvt/cie/ for more information.

more of the energy-related domains discussed in Chapter 2A (e.g., coal, photovoltaics, and methane hydrates) could hold meetings to identify small but scalable projects suitable for collaboration or joint investment.

- *Fund national laboratory personnel exchanges.* Science agencies such as the Japan Society for the Promotion of Science (JSPS), or the U.S. National Science Foundation (NSF) support extensive programs for the exchange and circulation of students and postdoctoral researchers. While memoranda of understanding exist that allow for researchers to be exchanged across national laboratories, there is a shortage of funding for such exchanges, especially to fund new collaborative relationships between investigators. A program could be funded to allow for exchanges of scientists between national laboratories for 6-12 months.
- *Educate Congress and the executive branch on technical energy-related issues.* Several international aspects of the energy domain lend themselves to educational efforts, especially in areas where there are potential unintended consequences due to policy choices or where available policy levers might be complex. Two potential topics mentioned were the economic and environmental consequences of legislation to allow crude oil exports from the United States and the economic and environmental consequences of the current U.S. policy restricting funding for coal-fired power plants in developing countries.

C. Information Technology

Convening efforts were again the focus of activities to advance collaboration in the IT domain.

- *Convene U.S.-Japan Track 1.5 discussion of legal and conceptual issues around information technology.* Potential topics of discussion include policies for data ownership and how to promote internationally open-Internet approaches.
- *Convene technical discussion around stimulating development of U.S.-Japan "self-sensing" and "self-reporting" underwater cables.* Given the concern identified, there would be value in convening a technical meeting bringing government and industry together to identify a research program toward developing undersea cable technologies that can identify potential damage in a timely and efficient manner.
- *Convene industry-government technical discussion to stimulate development of robotic devices for emergency response.* As previously mentioned, U.S.-Japan collaborative efforts are already underway, but the concern remains that the limited size of markets for these technologies will lead to underinvestment of new projects. Industry and government stakeholders could review existing efforts,

identify further research and technology development needs, and catalyze the development of further efforts.

- *Convene joint hackathons on issues of U.S.-Japan interest.* Efforts would need to be calibrated carefully to identify the right U.S. and Japanese technologists and right problems for this approach. Easy-to-use personal encryption technology was suggested as one potential area for convening a hackathon of this type.
- *Fund U.S.-Japan information technology and cybersecurity challenge events, especially for younger participants.* Collaborative workforce training efforts are not part of the existing set of cybersecurity-related training efforts and competitions. To fill this gap, collaborative challenge events could be sponsored, which might require crowdsourcing ideas to solve technical problems or to stimulate collaboration of youth and junior investigators. Such events could be held around existing cybersecurity-related conferences that already attract participants from the U.S. and Japan.

D. Other Efforts Suggested

Participants suggested three other efforts that were not related to a particular S&T domain.

- *Convene Track 1.5 meeting on lessons learned and information sharing across DARPA-like organizations in the U.S. and Japan.* Multiple U.S. agencies have DARPA-like authorities and organizational structures, and ImPACT is the first Japanese DARPA-like organization that has been created. Current and former officials from these organizations could meet to share knowledge and lessons learned, especially for the purpose of speeding the development of ImPACT.
- *Convene Track 1.5 meeting around bringing exhibits from Japanese museums to the United States, and vice versa.* Both the United States and Japan have excellent science museums, which are intended to spur interest in science, technology, and innovation. Mechanisms for sharing exhibits would not only provide a rich source of content but also might promote cultural literacy and understanding. U.S. government agencies such as NSF and the Smithsonian Institution and Japanese agencies such as the Ministry of Education, Culture, Sports, Science and Technology; industrial organizations; and nonprofit educational institutions and museums could meet to identify opportunities for sharing best practices and expanding cultural and scientific literacy through this mechanism.
- *Fund training efforts aimed at overcoming specific barriers to technical cooperation between U.S. and Japanese scientists.* As described above, there are differences in regulatory regimes that would hamper scientific cooperation; training activities would help to overcome these barriers. Examples suggested the

need for training scientists for how to work in an export control-relevant world (most relevant for aerospace/defense scientific collaboration) and human subject research protections training (most relevant in areas of biomedical research or social sciences).

Appendix A.
Workshop Participants

Last Name	First Name	Affiliation
Adachi	Shin	Team Representative in the Americas, NTT-CERT
Alonso	Juan	Associate Professor, Department of Aeronautics & Astronautics, Stanford University
Armacost	Michael	Shorenstein APARC Distinguished Fellow, Stanford University
Blair	Dennis	Chairman and CEO, Sasakawa Peace Foundation USA
Bloom	Jeffrey	Pacific Team Lead and Country Director for Japan and Taiwan, Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics
Bob	Dan	Senior Fellow & Director of Programs, Sasakawa Peace Foundation USA
Brandt	Larry	Visiting Scholar, The Center for International Security and Cooperation, Stanford University
Chikushi	Masahiro	Deputy Director, Economy Policy Unit, Minister's Secretariat, Ministry of Economy, Trade and Industry
Dorrell	James	Director for Advanced Development Programs, Lockheed Martin Aeronautics
Gordon	Deborah	Executive Director, Preventive Defense Project, Stanford University
Hanai	Nobutoshi	Senior Vice President & General Manager, Mitsubishi Heavy Industries America
Herberg	Mikkal	Senior Lecturer on International and Asian Energy, Graduate School of International Relations and Pacific Studies, University of California, San Diego
Hussain	Asim	Senior Director, Marketing and Customer Experience, Bloom Energy
Iehara	Masato	General Manager, Mitsubishi Heavy Industries America
Ikematsu	Hidehiro	Director of Aircraft Division, Bureau of Finance and Equipment, Ministry of Defense
Itoh	Shoichi	Manager, Senior Analyst, Strategy and Industry Research Unit, The Institute of Energy Economics, Japan
Justice	Steve	Director of Advanced Programs, Lockheed Martin's Skunk Works.
Lewis	Mark	Director, IDA's Science and Technology Policy Institute
Locke	Summer	Technology Sourcing Manager, Boeing Global Technology Strategic R&D Partnerships
Majumdar	Arun	Jay Precourt Professor, Professor of Mechanical Engineering, Stanford University; Senior Fellow, Precourt Institute for Energy
McArthur	James	Vice President, Lockheed Martin Center for Innovation
Motohashi	Kazuyuki	SPF Fellow, Stanford; Professor, Department of Technology Management for Innovation, Graduate School of Engineering, University of Tokyo

Last Name	First Name	Affiliation
Nakano	Jane	Senior Fellow in Energy and National Security Program, Center for Strategic & International Studies
O'Reilly	Patrick	Nonresident Senior Fellow, Brent Scowcroft Center on International Security, Atlantic Council
Perry	William	Michael and Barbara Berberian Professor (emeritus), Stanford University; former U.S. Secretary of Defense
Prescott	Elizabeth	Counselor and Strategic Adviser to Science and Technology Adviser to the Secretary of State, U.S. Department of State
Raduege Jr.	Harry	Senior Counselor, The Cohen Group; Chairman, Deloitte Center for Cyber Innovation
Saito	Naoki	Deputy Director-General, National Institute of Science and Technology Policy, Ministry of Education, Culture, Sports, Science & Technology
Shimabukuro	John	Japan Programs Manager - Engineering, Operations & Technology, Boeing Global Technology Collaboration R&D Sourcing
Takei	Jun	Director of Global Internet Policy and Standards, Intel Corporation; Visiting Professor at Keio University
Tanaka	Nobuo	Associate for Energy Security and Sustainability, Institute for Energy Economics, Japan; Professor, Graduate School of Public Policy, University of Tokyo
Tsuchiya	Motohiro	Professor, Graduate School of Media and Governance, Keio University
Tsugita	Akira	Chief of Science Section, Science Counselor, Embassy of Japan
Walsh	John	Professor, School of Public Policy, Georgia Institute of Technology
Wilson	Gregory	Director, National Center for Photovoltaics, National Renewable Energy Laboratory
Yamakawa	Hiroshi	Professor, Kyoto University; Member of the Committee for National Space Policy, Cabinet Office

Appendix B.
Workshop Agenda and Breakout Questions

January 21, 2015

Stanford University

Stanford, California

9:00–9:15 **Welcoming remarks**

- **Admiral Dennis Blair** (USN, ret.), Chairman and CEO, Sasakawa Peace Foundation USA
- **Dr. William Perry**, Michael and Barbara Berberian Professor (emeritus), Stanford University; former U.S. Secretary of Defense

9:15–10:00 **General state of US-Japan collaboration**

- **Amb. Michael Armacost**, Fellow, Stanford University; former U.S. ambassador to Japan and the Philippines
- **Mr. Nobuo Tanaka**, Global Associate for Energy Security and Sustainability, Institute for Energy Economics, Japan; Professor, Graduate School of Public Policy, University of Tokyo

10:00–10:15 **Break**

10:15–11:00 **General state of US-Japan collaboration (cont'd)**

- **Mr. Hidehiro Ikematsu**, Director of Aircraft Division, Bureau of Finance and Equipment, Ministry of Defense
- **Mr. Naoki Saito**, Deputy Director General, National Institute for Science and Technology Policy (NISTEP), Ministry of Education, Culture, Sports, Science & Technology (MEXT)

11:00–13:00 **Plenary discussion and working lunch**

Questions for Plenary Discussion

- Where are there opportunities for future collaboration–and among whom?
- Are there common barriers across sectors that require higher-level policy intervention?

13:30–16:30 **Breakout panels**

- Energy and Climate Change
- Aerospace
- Information **Technology**

Questions for Discussion:

- Where is there already strong collaboration between U.S. and Japanese stakeholders (government, industry, and academia)?
- Where might opportunities lie for future collaborative efforts, and what is needed to facilitate those efforts?
- Are there specific barriers that need to be overcome, and how might that occur?

January 22, 2015

9:00–10:30 **Report back from breakout sessions**

10:30–10:45 **Break**

10:45–12:00 **Common obstacles & opportunities**

Abbreviations

AIA	Aerospace Industries Association
AIAA	American Institute of Aeronautics and Astronautics
AIST	Japanese National Institute of Advanced Industrial Science and Technology
ARPA-E	United States Advanced Research Projects Agency-Energy
DARPA	Defense Advanced Research Projects Agency
DOD	Department of Defense
IDA	Institute for Defense Analyses
ImPACT	Japanese Impulsing PAradigm Change through disruptive Technologies agency
ITAR	International Traffic in Arms Regulations
JAXA	Japan Aerospace Exploration Agency
JMOD	Japanese Ministry of Defense
JSPS	Japan Society for the Promotion of Science
METI	Japanese Ministry of Economy, Trade and Industry
NASA	National Aeronautics and Space Administration
NISTEP	Japanese National Institute of Science and Technology Policy
NSF	United States National Science Foundation
Sasakawa USA	Sasakawa Peace Foundation – U.S.A.
S&T	science and technology