

Balancing a Business Operations Model for R&D Services to Both Government and Industry: Technology Transfer for Space Applications

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Technology Transfer for Space Applications is APL's focused outreach effort to transfer technology and collaborate in the R&D application of that technology with the private aerospace industry. To achieve these ends, the Laboratory needed to make significant but balanced changes to its business operations model. APL's traditional government contractor model has a single customer focus—agencies of the federal government. The new business model requires nontraditional government contracting means, expansion of APL's service role to become a two-way distributor of technology and innovation to government and industry, and experimentation with industrial collaborations. The process by which APL has moved toward new business methods and the development of the Laboratory's industrial outreach endeavor in space science and engineering are presented in this article.

INTRODUCTION

APL is exploring ways to increase interactions with private industry in order to transfer technology and collaborate in the R&D application of that technology. One example is the Technology Transfer for Space Applications (TTSA) Initiative in which APL is making available its technologies, technical capabilities, and specialized facilities for research in space science and technology to the commercial aerospace industry. Through this mechanism APL can begin to build relationships with industry in which both parties derive benefit from cutting-edge research and technology development.

The Laboratory also acknowledges the need to bring governmental and commercial capabilities together in a synergistic relationship to serve the public interest.

This requires APL to address its historic orientation to the U.S. government and the business operations that support the contracting relationship. The challenge for APL is to adapt to the often conflicting modes of operation between government and industry while maintaining its traditional R&D role. The TTSA model is a major step toward creating the synergy desired by government officials and is organized around three aspects of the Laboratory's involvement in space science and engineering (Fig. 1).

This article looks at APL's efforts over the past 2 years to develop collaboration through the TTSA paradigm. The methods used to plan and implement changes to APL business practices, challenges encountered, and

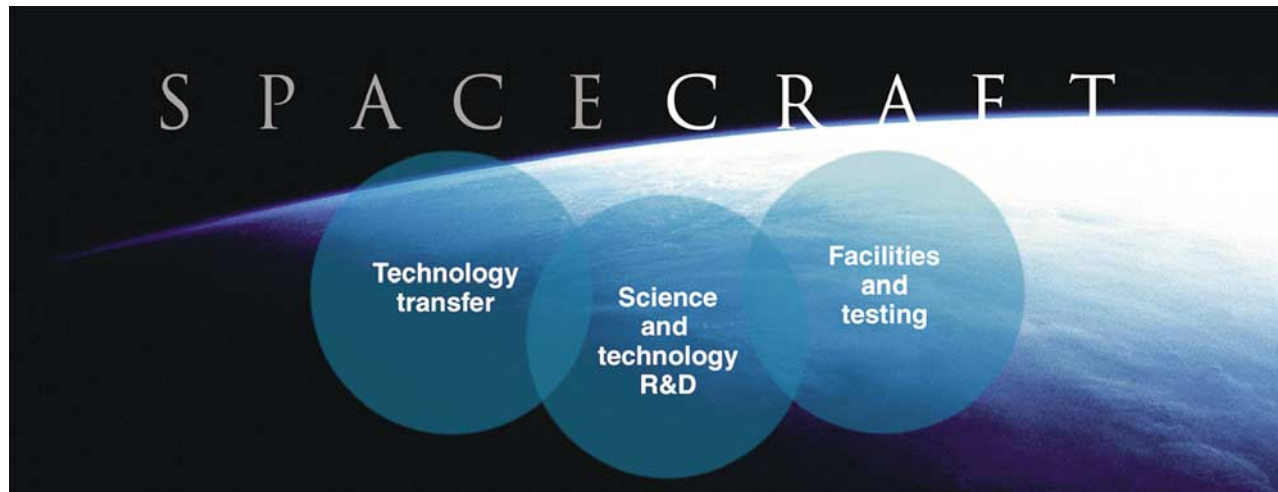


Figure 1. Vision of the Technology Transfer for Space Applications Initiative.

progress to date in creating a multiple customer focus in the Laboratory's business operations are also presented.

BACKGROUND

Defining the Problem

APL has been a government-focused R&D laboratory since its founding in 1942. With a secure sponsor base, why would APL want to venture into the turbulent world of commercial enterprise?

The reasons have their roots in the changing needs of our government sponsors and in the Laboratory's desire to remain a vital research institution that continues to deliver practical solutions to the nation's most vexing security problems. The government is increasingly reliant on the private sector for technology advances that support continued military superiority and seeks to leverage government and private investments. Understanding and applying the fruits of industrial research is an essential capability that APL must bring to its government sponsors. In addition, the Laboratory recognizes the role of technology as a driver in economic development and the untapped (dual-use) potential of APL inventions to advance the welfare of the United States, and more particularly, the local Maryland economy.

Industry as a Customer

In the evolving business operations model, industry becomes both a collaborator and a customer. Managing this nontraditional relationship poses numerous challenges for APL. We must be able to understand the business practices and respond appropriately to the very different requirements of both our government and industry customers. Since our business systems are highly tuned to the needs of government sponsors, significant modifications have been needed to respond to the

commercial world. Balancing these two sets of requirements is as difficult for a government-oriented research laboratory as it is for a commercially oriented private firm when responding to the specialized demands of government contracting.

Another complicating factor for APL is maintaining compliance with government regulations regarding organizational conflict of interest (OCI). OCI is defined as any relationship APL has with a nongovernmental entity that would compromise the Laboratory's ability to provide independent, objective advice, or that would give either APL or the nongovernment entity an unfair competitive advantage. Both actual and perceived conflicts of interest are important to control. Avoiding OCI issues while simultaneously finding innovative ways to work with and for industry requires a delicate balancing act.

APL STRATEGIC PLANNING: THE BIRTH OF THE TTSA INITIATIVE

Strategic Planning

In the late 1990s, APL undertook an update to its strategic plan in response to several drivers for change. The government, principally the DoD, sought to revise its acquisition process to streamline the development of new systems to achieve faster cycle times and reduce costs. These new acquisition practices challenged APL to take on a partnership role with industry in addition to maintaining its traditional role as an industry evaluator. The government also recognized commercially driven R&D as the pacesetter in technology development, and explored ways to make technology transfer a two-way process—from government to industry and from industry to government. APL's role in applying technology to solve complex problems requires that it be able to leverage R&D from

both. Finally, JHU encouraged APL to engage in technology transfer of its intellectual property for the benefit of the local economy. It was recognized that the creation of spin-off companies and technology licensing agreements to existing firms could provide impetus for new products, new employment opportunities, and economic development in Maryland. These influences shaped APL's strategic planning process.

Studies and Recommendations

A Laboratory-wide strategic planning process began in 1998 with the formation of several teams chartered to study specific aspects of the existing and expected business environments. One team was chartered to do an environmental assessment, which gave rise to a subteam chartered to examine the influence of acquisition reform. Another team reviewed APL's past practices related to technology transfer and recommended changes to Laboratory policies that would permit a more aggressive program. Other teams reviewed APL's existing technology bases and emerging technology areas of high interest to government sponsors.

The acquisition reform subteam articulated the need for APL to adapt to the DoD's changing business practices. Many sponsors wanted the Laboratory to serve as a member of industry-led R&D teams, continue the transfer of APL-developed technology to industry via subcontracts, and bring knowledge of industrial research to the early stages of concept development and prototype testing.

If APL was to accommodate these new roles, we would have to develop mechanisms to protect our ability to perform as a trusted agent for government sponsors. In that role, APL often evaluates the work of other organizations, assists in technical evaluations of competing proposals, and functions as the government's independent advisor throughout the production and deployment of new systems. The Federal Acquisition Regulation contains specific restrictions on the activities of government contractors to avoid OCI. Specifically, when APL serves the government as a trusted agent evaluating or reviewing the proprietary information of a private firm, we may not also have a business relationship in which the Laboratory is the subcontractor to that firm. Receipt of payment from the private firm or other business arrangements could be perceived as influencing APL's impartial judgments or cause other firms to perceive that an unfair competitive advantage exists favoring the APL business partner. Laboratory practices would have to be developed to ensure that no violations of OCI rules occurred.

A technology transfer team reviewed the Laboratory's intellectual property and licensing policies, the history of APL's licensing activities, and the climate that discouraged entrepreneurial activities by staff members.

The team recommended the formation of a Technology Transfer Office, staffed by full-time professionals experienced in successful licensing and start-up business activities (see the article by Gray, this issue). They also recommended changes to Laboratory policy with regard to sharing the rewards with APL inventors and mechanisms to accommodate staff that wished to create start-up businesses or work for licensees of the technology they created. Technology transfer to fuel local high-tech spin-off companies was also to be supported. All of these recommendations were implemented.

Subsequent planning teams identified ways to further the development and application of key technology interest areas through internal R&D, government sponsored R&D, collaboration with industrial researchers, or a combination of these methods. The TTSA model was identified by one team as a means to developing relationships with high-tech firms.

Defining TTSA

The TTSA team developed as an offshoot from a larger team examining future technology areas. They recognized that continued exploration of space was of public interest in terms of scientific research, commercial space applications, and space-based national security applications. APL was already a significant contributor to two of these areas: scientific research and national security. If we could participate in industrial applications by sharing our existing capabilities and facilities and by learning from our R&D counterparts in industry, significant long-term benefits to APL's public service role could be obtained. As with any undertaking, the positives and negatives of TTSA had to be considered:

- Pros
 - Expanded access to industrial R&D to enhance opportunities for public service
 - Strong technology transfer potential (two-way)
 - Extension of APL's existing technical base
 - APL's reputation as one of providing technical excellence
- Cons
 - Lack of experience in interacting with the commercial world
 - Unaccustomed to industrial business practices (e.g., fixed price terms, competitive bidding)
 - Potential for OCI (real and perceived) with many industry leaders
 - Government prohibition on APL in competing with industry

The initial round of study teams reported their findings and recommendations in October 1998. These reports led Laboratory management to adopt a number of strategic initiatives, three of which bear directly on

TTSA: Work for Industry (WFI), Technology Transfer, and Space Technology Applications. The specific recommendations presented by the space technology sub-team were as follows:

- Develop guidance on working for and partnering with industrial organizations
- Develop an OCI policy consistent with working for industrial organizations and maintaining our trusted agent role
- Choose a few projects (with limited Laboratory risk) to provide experience in working in the commercial space area
- Identify/hire staff that could provide business guidance for contracting in the commercial arena
- Create appropriate business practices to accommodate commercial methods

APL management was willing to engage in an experimental program to try to overcome the negatives and gain the potential positives. If the TTSA goals were met, we would have established the pattern for more broad-based synergistic relations with industry.

DEVELOPING A “WORK FOR INDUSTRY” MODEL

Designing the WFI Management Process

A turning point in the development of the TTSA model was the Laboratory’s decision to develop a mechanism that would allow closer ties with private industry. Since APL’s work brings it into a trusted agent role over nearly every major (and many smaller) defense contractor in the U.S. industrial base, managing OCI issues was a major concern. While some Navy sponsors had already expressed a desire for APL to work with and for industry in some programs, others were more traditional in their approach and were expected to react negatively. Compounding an already complex problem was the fact that the Navy and the rest of the government did not speak with one voice. This resulted in conflicting priorities and expectations on our business conduct.

The WFI implementation team began by consulting with many within government who had experience

with or an opinion on acquisition reform. For example, they conferred with the Navy’s Naval Surface Warfare Center, which had developed a mechanism to permit its scientists and engineers to work on the DD 21 ship design program for two *competing* industrial teams *and* the government program office. They also encountered a model in the commercial investment world that identified clients of one corporate division as off-limits for independent investment advice by a second division of that same corporation. Another major principle was the use of full disclosure as a mechanism for dispelling perceptions of conflict of interest that were not, in fact, real. These were the seeds of an approach that would allow APL to carefully screen and select industrial collaboration opportunities that would not threaten our trusted agent role with DoD.

The second major step was to map out the kinds of work APL could perform with regard to our strategic long-term relationship with DoD. The Laboratory may compete for science and technology work, but not for engineering development or production work. Since most work for industry is competitive in nature, understanding these boundaries was essential. Another issue concerned the end user of the work, i.e., DoD or non-DoD. For the former, APL would be required to make its DoD-sponsored technical capabilities available to all competitors to maintain a level playing field. However, if the same capabilities were used for a non-DoD end user, no such requirement would be imposed, and APL could enter exclusive teaming arrangements. For reasons of general business policy, APL chose to maintain a strong preference for nonexclusive teaming in all WFI opportunities. In addition, APL elected not to consider any kind of production work, since doing so would be inconsistent with its role as a university R&D laboratory. A matrix was developed to aid in the decision-making process and is summarized in Table 1.

Next, to provide guidance to APL program managers, several firms were identified with whom it would not be prudent for APL to engage in WFI opportunities owing to the strong likelihood of OCI.

The fourth major step established a Business Review Council (BRC) to evaluate each WFI opportunity and

Table 1. APL policy guidelines for competition/teaming in pre-award situations.

Type of work	End user	APL as prime (compete with industry)?	APL as subcontractor (nonexclusive teaming)?
Science and technology	DoD	Yes, selectively	Yes, preferred
Science and technology	Non-DoD	Yes, selectively	Yes, preferred
Engineering and manufacturing development	DoD	No	Yes, with government approval
Engineering and manufacturing development	Non-DoD	Yes, selectively	Yes, selectively
Production	DoD	No	No
Production	Non-DoD	No	No

assess risk versus potential reward. Each WFI case was documented, reviewed with the sponsoring APL program manager, and checked against specified criteria for business fit, absence of OCI, appropriateness with the not-for-profit charter of the organization, and investments required. If the BRC approved the case, it would be disclosed to DoD (NAVSEA University Management Office). Upon NAVSEA review and concurrence, the case would be authorized by the BRC for submission of a proposal.

It was essential to bring our principal government sponsor, the Navy, into the review process. We advised NAVSEA that we would share detailed background on every case with their University Management Office to ensure that conflict of interest situations would not occur. Full disclosure was intended to accomplish the following objectives:

- Continuation of the existing open and trusting working relationship between APL and the Navy
- Opportunity for the Navy to observe the rigor of the internal APL review process before it was asked to concur with an APL decision
- Opportunity for the Navy to raise concerns about perceptions of conflict of interest that may not have been apparent to the APL review team
- Opportunity for the Navy to raise concerns over any aspect of the new business practices of APL

This new process was approved by senior Laboratory management, the University Trustees Committee on APL, and key Navy sponsors. WFI policy, practices, and procedures were then formally documented and communicated to staff for execution in the business development process.

Generic Cases

As the WFI process matured, the concept of “generic cases” was developed to obtain general approval for use of specialized facilities, jointly owned by APL and the government, for commercial purposes. Once the generic case was approved, subsequent identification and approval of specific commercial users could be streamlined. The generic case for the Satellite Communications Facility (SCF) and the Environmental Test Facility (Fig. 2) described ownership of the facilities, terms under which commercial use would be permitted (e.g., noninterference with government use), payment of rent to the government, pricing, etc. Once approved, basic ordering agreements with commercial firms were established to permit rapid access to the facilities as needed.

The primary benefit of opening access to these selected APL facilities was to reduce the cost of maintenance and operations to government programs by fostering a larger user base. In addition, industry was provided access to costly capital facilities of a specialized nature at competitive rates.

DEVELOPING THE TTSA INITIATIVE

Business Plan

The APL Space Department, the technical unit responsible for space science and engineering programs, was assigned to manage the TTSA Initiative. The department had recently completed a strategic plan to guide their mission into the 21st century which included a goal to forge new alliances and address collaborations with commercial companies for technology transfer. The Space Department was ready to take on the implementation of this challenging initiative.

In early GFY1999, the Space Department began a process to develop a formal business plan for the initiative using an industry model. Consultants were hired to work with the team and guide the development of the business plan, understand and explore the commercial space market, and develop a communications plan.

The formal business plan addressed policy considerations, defined a commercialization strategy, contained a market analysis and plan, and provided the framework for managing and implementing an outreach effort to commercial industry. The initiative took the form of the three major technical thrust areas shown in Fig. 1:

- Science and technology R&D
 - Remote sensing systems
 - Space systems engineering
 - Software engineering
 - Communications systems
 - Navigation systems
- Technology transfer
 - Instrument technologies
 - Global Positioning System (GPS) based technologies
 - Ultrastable oscillator technologies
 - Integrated power system and battery technologies
 - Specialized component technologies
 - Electrical, electronic, and electromechanical (EEE) parts technologies
- Facilities and testing
 - Environmental testing
 - Satellite communications
 - EEE parts testing
 - Radio-frequency antenna range

The plan was to begin by transferring some existing technologies to industry and by making available some of the services of our specialized facilities. As interest was expressed by industry and our defense sponsors, the program could be expanded to support collaborative R&D with the aerospace industry.

TTSA Management Team

To lead the TTSA effort, the Space Department appointed a director and a team composed of technical and business professionals from the Space Department,

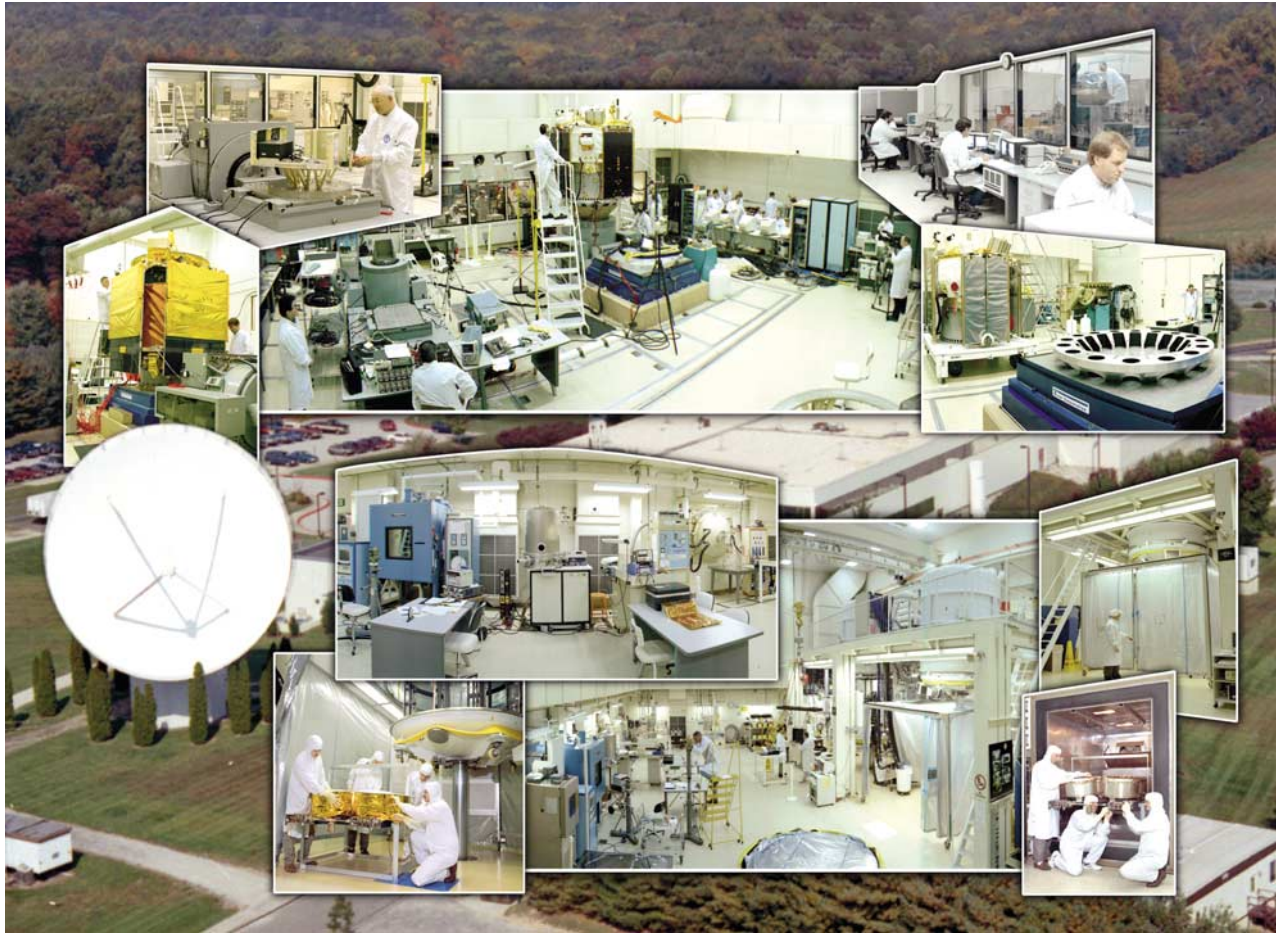


Figure 2. APL made the Environmental Test Facility available for outside use under a WFI generic case.

Office of Technology Transfer, and Business Services Branch. On average, no more than 10 people working 10 to 15% of their time, supplemented by the consultants, would bring the program to realization.

Initiative Benefits

Many benefits, both direct and indirect, are expected from the TTSA Initiative. For APL's government sponsors the effort will

- Contribute to science and technology development in space science and engineering (a national priority)
- Increase APL's understanding of industrial research for application to government programs
- Enhance technology transfer opportunities to enable commercial production of new products needed by the government
- Reduce program costs to government customers
- Foster economic growth through technology transfer

Benefits to industry include

- Access to a previously closed pool of expertise in space science and engineering

- Reduction of program costs through use of APL capabilities and facilities
- Enhanced opportunities for two-way technology transfer involving government and industry-sponsored R&D

Benefits to JHU focus on enhancing APL's public service performance by

- Increasing APL's knowledge of commercial technology and production practices through regular interaction with the aerospace industry
- Contributing to science and technology development in space science and engineering
- Fostering economic development through technology licensing, creation of spin-off companies, and development of strategic partnerships/cooperative agreements

CHALLENGES TO IMPLEMENTATION

The development of WFI policies and the pursuit of TTSA objectives were challenging. The regulatory and business environment was highly constrained, leaving

little room for a new policy. APL's strategy was one of conservative experimentation, followed by gradual liberalization of policies where appropriate. Gradual change continued through 1999 and 2000, resulting in a moderate shift in the Laboratory's business policies. During this period the management team charged with successful implementation faced several difficult challenges.

One of the most difficult of these challenges was broadening industry relationships without jeopardizing APL's traditional role with our principal government sponsors. Providing full disclosure of all cases and responding constructively to all expressions of concern assured these sponsors that we would protect our ability to serve as their trusted agent.

Risk mitigation was another issue. Historically, the Laboratory has been "risk adverse." Commercial work, however, entails a variety of technical and business risks. As a result, our approach to business policies was restructured to *manage* risk. A business and technical risk assessment was incorporated into the decision-making process for approval of TTSA opportunities.

Significant also was the challenge of developing a reputation for technical excellence and integrity—already established with our government sponsors—in the commercial sector. APL was largely an unknown entity in the commercial space business environment prior to implementing the TTSA Initiative. Despite 2 years of activity in sharing knowledge of our capabilities and past accomplishments, APL is still a newcomer. We are collaborating with industry on small efforts, attending conferences, and increasing our educational and public outreach to industry through various routes.

Finally, we faced a cultural obstacle, i.e., achieving acceptance within APL. The dominant culture has been one that is loyal to government sponsors, prefers the traditional government contractor model, and is strongly supportive of the public service mission of the University. However, a number of APL staff members had an interest in developing new ways to respond to a

changing government policy environment and entrepreneurial interests in technology transfer opportunities. Changing the culture sufficiently to allow greater flexibility without damaging the Laboratory's dedication to government sponsors and other public service needs was the challenge.

PROGRESS

Metrics are evolving to evaluate the performance of the TTSA Initiative and measure its success. Assessing performance in meeting key goals is vital to its support, survival, and growth. Table 2 shows quantitative measure of outcomes expected from TTSA activities. Qualitative measures are also important and may include subjective assessments of the degree to which APL meets its public service mission.

During the latter parts of GFY1999 through 2000, much effort was expended to develop the necessary business practices, systems, and information tools to distribute our message appropriately in order to complement APL's core business areas. A communications campaign was implemented externally and internally to properly educate all parties on the focus of the initiative and on policy changes such as WFI. The new business operations model has been developed and implemented and is successfully supporting the TTSA Initiative.

To date, the Laboratory has negotiated many business arrangements with commercial firms including SAIC, Honeywell, Litton Amecon, Universal Space Net, SwRI, Mission Research Corporation, Orbital Sciences, Swales, Dynatherm, Jackson and Tull, SEAKR, Planetary Systems, Wideband Systems, Honeywell Technology Solutions, BF Goodrich, Link Plus, Lockheed Martin Space Operations, and Federal Data. A total of \$4 million in new funding has been received, and three new licenses involving space-oriented technologies have been completed. A new spin-off company—Syntonics LLC—has also been created through the transfer of APL ultrastable oscillator technology and is now thriving on its own (see the article by Suter et al., this issue).

Table 2. Metrics for assessing TTSA Initiative performance.

Key goals	Possible metrics
Enable two-way technology transfer	Number of technology sharing relationships with commercial firms
Reduce cost for government sponsors	Frequency of use of APL capital facilities by commercial firms for government end users
Develop regional economy	Market value of spin-off firms using APL technologies
Fulfill government needs for alternate contracting methods	Frequency of collaborating with industry on government programs
Maintain trusted agent role for government sponsors	Dollar value of direct government funding of existing tasks and additional new tasks for performance of trusted agent activities

CONCLUSION

Working for industry and implementing the TTSA Initiative constitute significant developments in the business practices of APL. The future is promising, and

APL is now better poised to implement industrial collaborations. The changes described in this article set the stage for APL to respond constructively to the government's call for increased collaboration among government, industry, and universities/laboratories.

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