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EXECUTIVE SUMMARY

The Office of Technology Transition (OTT) was established by the Secretary of Defense in response to 10 U.S.C. 2515 to serve as a focal point for the domestic technology transfer activities of the Department of Defense. This report, required by Section 2515 (See Appendix A), summarizes the accomplishments and highlights key technology transfer efforts throughout the Department for FY 2004 and FY 2005.

This 11th report discusses our major efforts and successes in transferring technology. Appendix B displays specific data elements showing the trends in Cooperative Research and Development Agreements (CRADAs) and Patent License Agreements (PLAs), and the increase in royalty income as a result of licensing DoD developed technologies. Appendix C describes the DoD George F. Linsteadt Technology Transfer Achievement Award and provides information on the award winners. Appendix D highlights some of the technology transfers such as “the Vein Viewer” which is a system and method for enhancing visualization of veins, arteries, and other subcutaneous natural or foreign structure in the body. Appendices E and F provide the details of the Federal Laboratory Consortium (FLC) awards to DoD activities for FY 2004 and FY 2005, respectively.

In FY 2004, DoD had 364 active patent license agreements which generated over \$9M in royalties. These numbers grew to 406 and \$10.8M, respectively, in FY 2005. It was actively engaged in 2,425 partnerships using CRADAs with revenues in excess of \$78 million in FY 2004. These changed to 2,736 and over \$60M, respectively, in FY 2005. We recognize that the true value of CRADAs and PLAs is significantly higher than the income generated, because the majority of our agreements include in-kind contributions rather than funds-in to our laboratories.

The DoD Technology Transfer Program has five thrust areas: Partnership Intermediaries, Partnering with educational institutions, Support of Homeland Security needs, Collaboration with the Department of Commerce Manufacturing Extension Partnership Program, and Collaborative Relationships. These areas are discussed in Section A of this report.

Other programs within the OTT supporting transfer technology efforts include:

- The use of Independent Research and Development (IR&D) information from the IR&D database is a tool to seek and start new research and development (R&D) partnering projects required by the DoD. The IR&D program has a database to improve the way DoD program technology is communicated with industry. The IR&D database is accessible to DoD users. This service identifies defense needs, and helps to avoid duplication of contractor IR&D activities funded directly by DoD.

- The Technology Transition Initiative provides a process to move maturing technology from the science and technology laboratory environment into sustainable capabilities for the warfighter. It bridges the funding gap traditionally known as the “Valley of Death.”
- The DoD Manufacturing Technology Program focuses on production and development efforts early in the design phase to expedite the transition from technology invention to production to meet critical defense needs. It is an important tool that ensures the manufacturing of DoD weapons that are affordable and deployable anywhere in the world.
- The Defense Production Act (DPA) Title III mission is to improve the overall quality of manufacturing technology products to the DoD warfighter. It provides a cost-effective method to develop and implement technology service on demand within the U.S.

We anticipate these focused efforts to enhance our transfer opportunities and provide increased technical capabilities available for the warfighter—the ultimate customer of DoD’s technology investments.

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INTRODUCTION

Section 2515 of title 10, United States Code (Appendix A) directs that the Secretary of Defense shall establish within the Office of Secretary of Defense (OSD) an Office of Technology Transition (OTT). It further directs that the head of the office will ensure the office will monitor research and development (R&D) activities of the Department of the Defense; identify R&D activities that result in technology advances that have potential for non-defense commercial applications; serve as a clearing house for, coordinate, and actively facilitate the transfer of such technologies and technological advancements to the private sector; conduct its activities in consultation and coordinate with the Department of Energy and the Department of Commerce; and provide private firms with assistance in resolving problems related to technology transfer. It also directs the Secretary of Defense to submit to the Committees on Armed Services and the Committees on Appropriations of the Senate and the House of Representatives a biennial report on the activities of the Office at the same time the budget is submitted to Congress by the President. This report responds to that requirement.

The FY 2004 Defense Authorization Act (Section 1031(a)(23)) changes the frequency of this report to biennial, and requests it be submitted in even-numbered years. The report is to contain discussion of the accomplishments during the two fiscal years preceding the fiscal year in which the report is submitted.

This is the 11th report on the activities of OTT.

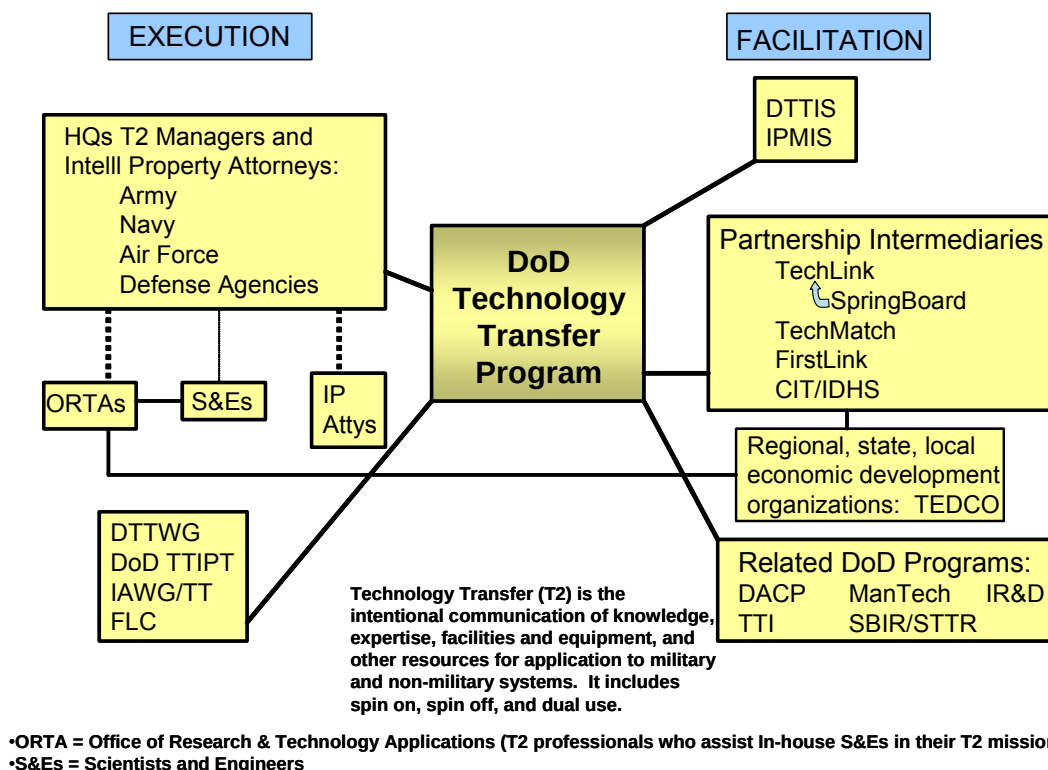
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A. Domestic Technology Transfer – FY 2004 and FY 2005

The Department of Defense (DoD) Technology Transfer Program is implemented through a decentralized process. Each Military Service and participating Defense Agency has implementing guidance, Offices of Research and Technology Applications (ORTA) at the laboratories/technical activities, patent attorneys located at the various sites, and appropriate authority to transfer technology both into and out of the laboratory. While this decentralized approach allows the local technology transfer processes, procedures, and projects to fall within the specific mission-related activities of the local laboratories, there is overarching DoD guidance in place to ensure common policy and objectives.

Technology transfer mechanisms can be beneficial to a wide range of DoD organizational activities to enhance research and development (R&D) efforts, bring in commercial technology to enhance warfighter capabilities, introduce a product in the commercial marketplace which may reduce the long term purchase cost to DoD, and provide an effective method to establish partnerships with the private sector. During the past year, we have included selected Combatant Commands as part of those organizations using technology transfer mechanisms.

In this report, specific technology transfer statistical data elements are included as Appendix B. While these data give an indication of the level of activity, they do not give the most definitive picture of the benefits of technology transfer mechanisms to DoD. These benefits are reflected on pages 32-47 and in Appendices D and E of this report highlighting awards received and successful transfers of technology for commercial and military application.



In FY 2004, DoD instituted an incentive award for technology transfer achievement. Based on the authority of 15 USC 3710b as implemented in DoD Directive 5535.3, "DoD Domestic Technology Transfer Program," this award was established to recognize a successful technology transfer individual or team each year. More information about this award and the award winners is in Appendix C.

The DoD Technology Transfer Program is unique in the federal government because DoD is the primary customer of the technology being developed in our laboratories and through contracts for military items. Other Federal Departments develop technologies for private sector consumer use or other Department use. Because the DoD focus is on military requirements, there may be less opportunity for commercial applications; however, where appropriate, we continue to pursue suitable partners to engage in technology transfer efforts.

There are a number of significant areas in the DoD Technology Transfer Program that have contributed to the overall success of the program in terms of program execution and outcomes. These efforts are described in this section of the report, as well as Appendices B through E. The program focus for FY 2006 and beyond is provided in Section 5.

FY 2004-2005 Program Focus

1. Patents/Royalties/Cooperative R&D Agreements

Appendix B is a spreadsheet with the specific data elements in response to P.L. 106-404, Section 10. This legislation requested information on plans for conducting technology transfer, plans for securing Intellectual Property (IP) rights in laboratory innovations with commercial promise, and plans for managing laboratory IP so as to advance DoD's mission and benefit the competitiveness of U.S. industry.

DoD's investment in technology research and development is to ensure we can provide the military forces with the capabilities needed to deter war and to protect the security of our country. However, this research and development must be in a form which can be useful to our forces, i.e., in a product, system, component part. One way to ensure the technology is used is through licensing. Additionally, where possible, DoD would like to purchase from an economically viable industry which can produce items for both military and commercial applications.

The FY 2003 Senate Armed Services Committee Report accompanying the Defense Authorization Act for FY 2003 requested DoD be more aggressive in marketing its intellectual property with an emphasis on increasing the royalty income. The following two charts show the trend in Patent License Agreements (PLAs) and the increase in royalty income as a result of licensing DoD developed technologies. Royalty income has increased and, as result, we are finding that the medical field is producing the largest revenue stream to DoD thus far. Royalties are used for other R&D efforts on technologies with commercial potential, inventor share, legal costs associated with world-wide patent applications, and other awards.

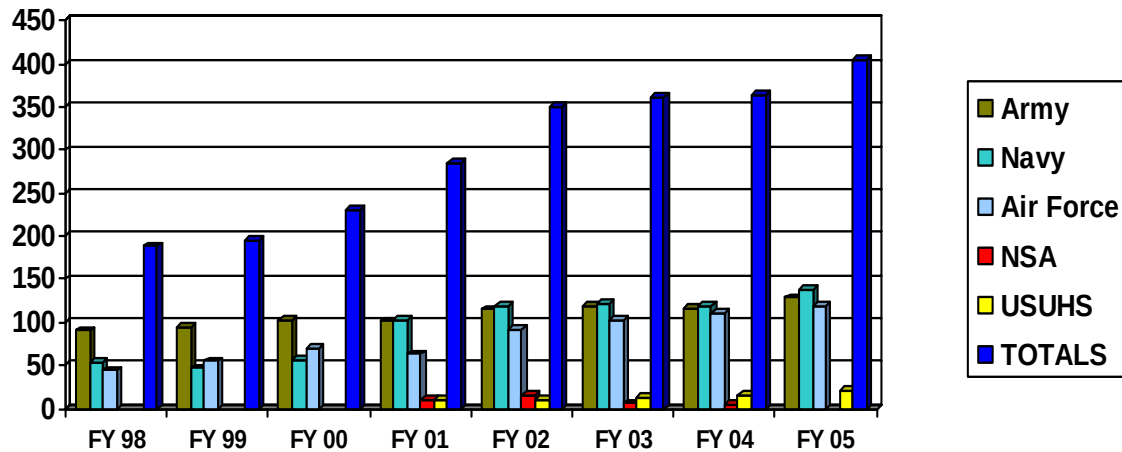


Chart 1: Number of PLAs by Military Service/Defense Agency.

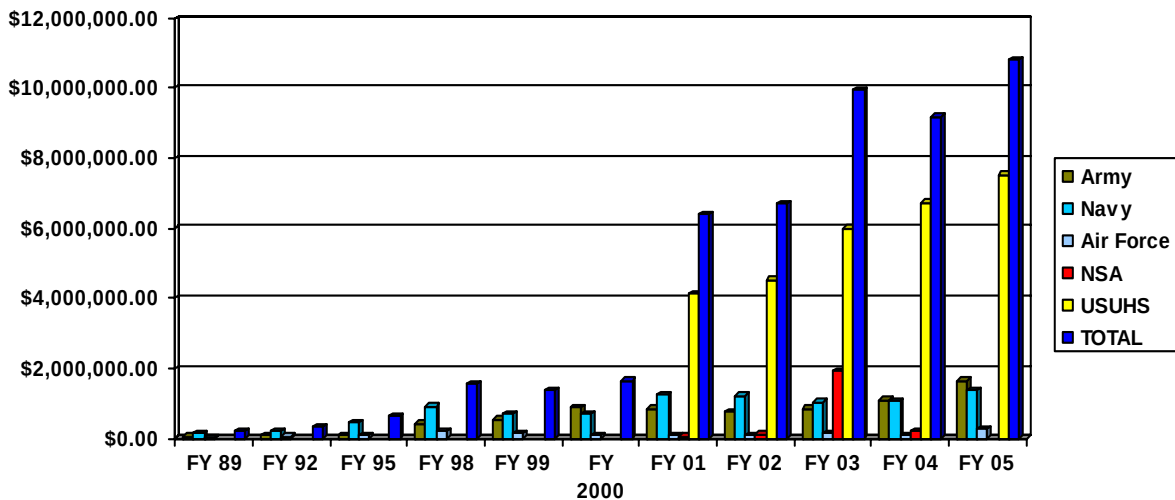


Chart 2: Royalty Income, Fiscal Years 1989, 1992, 1995, 1998-2005.

Cooperative Research and Development Agreements (CRADAs) appeared to be relatively stable in number after a rapid build-up in the 1990s and hover around 2,000 active CRADAs per year. In FY 2005, DoD was actively engaged in 2,736 partnerships using CRADAs. CRADAs are agreements outside the Federal Acquisition Regulations with IP protections for the private sector partner as well as the flexibility of working on joint research and development of technologies having both commercial and military applications. In some technical areas, CRADAs are the only tool used for research. For example, CRADAs are essential to conduct clinical research studies at Army medical treatment facilities. In CRADAs, federal government activities are allowed to accept funds from the private sector for joint research and/or development activities. The funds are used on the work covered in the specific CRADA receiving the funds. This income is reflected in Chart 4 below.

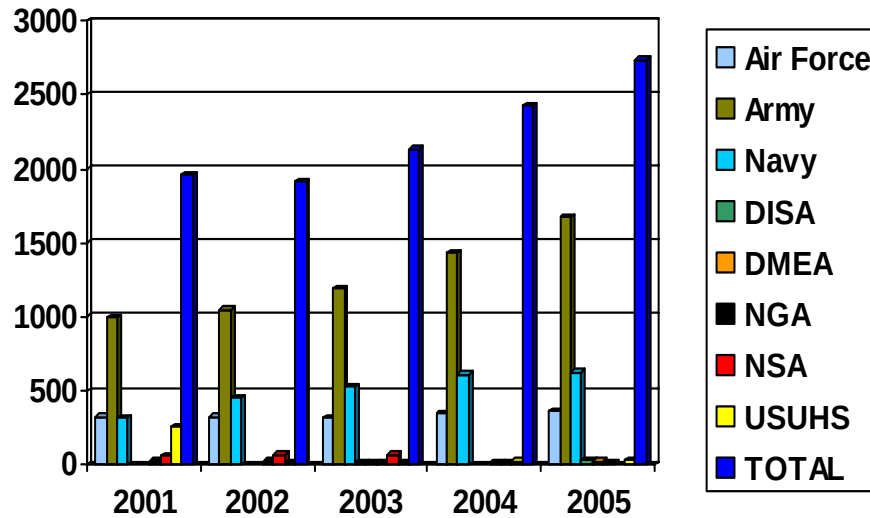


Chart 3: Number of Active CRADAs by Fiscal Year.

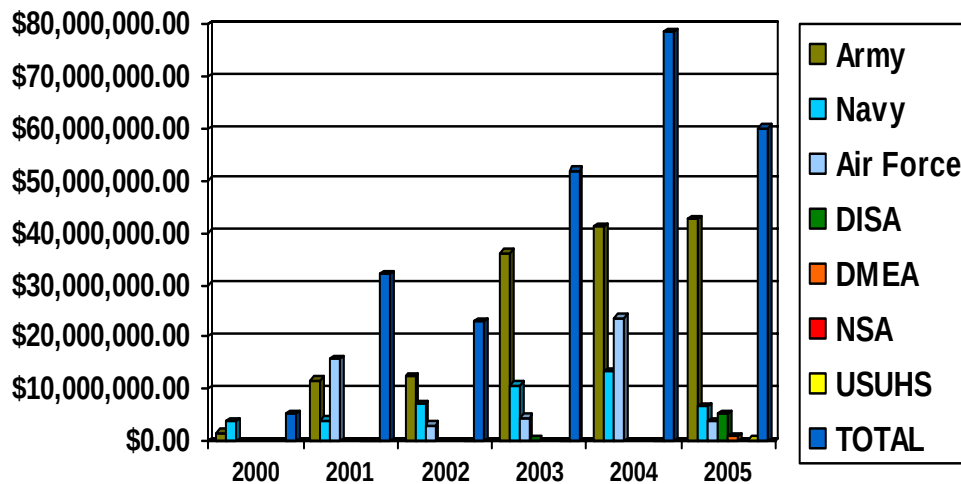


Chart 4: Revenue from Partners for Joint Development under CRADAs.

The U.S. Joint Forces Command (JFCOM) is designated the transformation laboratory in the Defense Department. In mid-2005, JFCOM established a technology transfer function to support its Joint Warfighting Laboratory, Joint Systems Integration Command, Joint Advanced Training Technology Laboratory, Joint Transformation Command - Intelligence, and Joint Warfare Analysis Center. JFCOM is quickly coming up-to-speed on technology transfer implementation and already is using various technology transfer tools such as CRADAs and Educational Partnership Agreements (EPAs). Most importantly, they have developed a collaborative environment within JFCOM for future successes using these tools.

2. Websites

Each of the Military Services, Defense Agencies, and Office of the Secretary of Defense (OSD) maintain technology transfer websites to inform the public and make available general information on this program. These websites provide information on how to contact the ORTA for technology transfer opportunities, training, success stories, and mechanisms and agreement examples to facilitate joint research and development efforts and transfer technology to the private sector. These websites are:

<http://www.acq.osd.mil/ott/techtransit>
<http://www.arl.army.mil/main/Main/default.cfm?Action=6>
http://www.onr.navy.mil/sci_tech/3t/transition/tech_tran/
http://www.afrl.af.mil/xp_xptt_home_page.asp
<http://www.mda.mil/mdalink/html/transfer.html>
<http://www.nsa.gov/techtrans/index.cfm>
<http://www.jfcom.mil/about/industry.htm>

3. Key Lessons Learned in FY 2004 and FY 2005

We review technology transfer activities at least annually to find what is working well from a process, procedural and/or technical standpoint. Some of the lessons learned over the past two years are:

- Use of DoD's partnership intermediaries is proving to be an important tool in making the DoD technology transfer program highly successful. The DoD-wide partnership intermediaries, particularly TechLink, TechMatch, and FirstLink (described elsewhere in this report) are providing a high rate of return on investment (ROI). Within the scope of each, they are assisting the labs in locating potential licensees, potential R&D partners, and in determining the market potential for DoD technologies. In addition to the DoD-wide intermediaries, many labs are developing excellent business relationships with regional and local intermediaries such as economic development authorities and business incubation centers. These are good sources for assisting small and start-up companies interested in commercializing lab technologies, particularly where a company's distance from the lab could be a barrier to technology transfer.
- Patents are often in the very early stages of technical development. Consequently, the ability to attract potential licensees and/or commercial partners can be challenging. The researcher/inventor must recognize this and continue to develop their technologies beyond the proof of concept stage in order to attract interest and capital to continue the technological development needed to transition a technology into a commercially viable product or process. The most successful technology transfers, be they CRADAs or licenses, demand that a researcher think and act in an entrepreneurial manner. They must become intimately active with the technology transfer mechanisms being implemented and act as the "technology champion" in order to successfully attract and convince a commercial entity to risk their time and capital in pursuing a partnership with the laboratory.

- Responsive and competent legal counsel is essential to efficiently negotiate technology transfer agreements, assuring that the laboratory protects its rights when a proposed change in the standard language of the agreement is considered.
- Ongoing CRADAs require more administrative attention than anticipated. For example, changes in the collaborator's technical team often require security interactions.
- ORTA participation in CRADA technical meetings is extremely beneficial in gaining an understanding of the CRADA accomplishments and identifying administrative changes.
- Software Usage Agreements (SUAs) can be helpful instruments to allow commercial partners to test drive software before signing a license. By tailoring a CRADA to facilitate the evaluation of the software by a commercial partner, the lab can receive funding for limited use of its technology, and the commercial partner gets the opportunity to work with the lab to enhance or make the software more commercially viable.
- Successful patent licensing requires a great deal of preparation. Each party should take time to understand its prospective partners' goals in pursuing the technology. Flexibility is critical as each partner's motives may be different.
- Contracting out invention disclosures for completion of prior art searches and patent application support is both an expedient and fiscally sound method of doing business.
- Greater emphasis should be placed in the development and implementation of a centralized patent process database that would be available to the ORTA. The database should include but not be limited to the following: disclosures, applications, patents issued, maintenance fee status, patent license agreements, royalty payments, etc.
- Long term viability of DoD technology transfer and dual-use programs is dependent on adequate funding of underlying technologies.
- Technology transfer can be a major vehicle for transitioning technology to the warfighter, as demonstrated by the noise filtering Attenuating Custom Communication Earpiece System (ACCES®) earplug technology developed by the Air Force and its commercial partner (see page 44).
- Technology transfer should be used strategically versus tactically in the organization's overall investment strategy. This implies that the ORTAs need to be more involved and/or included in their respective organization's program planning and development.
- The weaving of various technology transfer mechanisms into the formation of strategic collaboration with academia and industry is being better utilized, with the realization that there is no single mechanism or "silver bullet" relative to strategic partnerships.

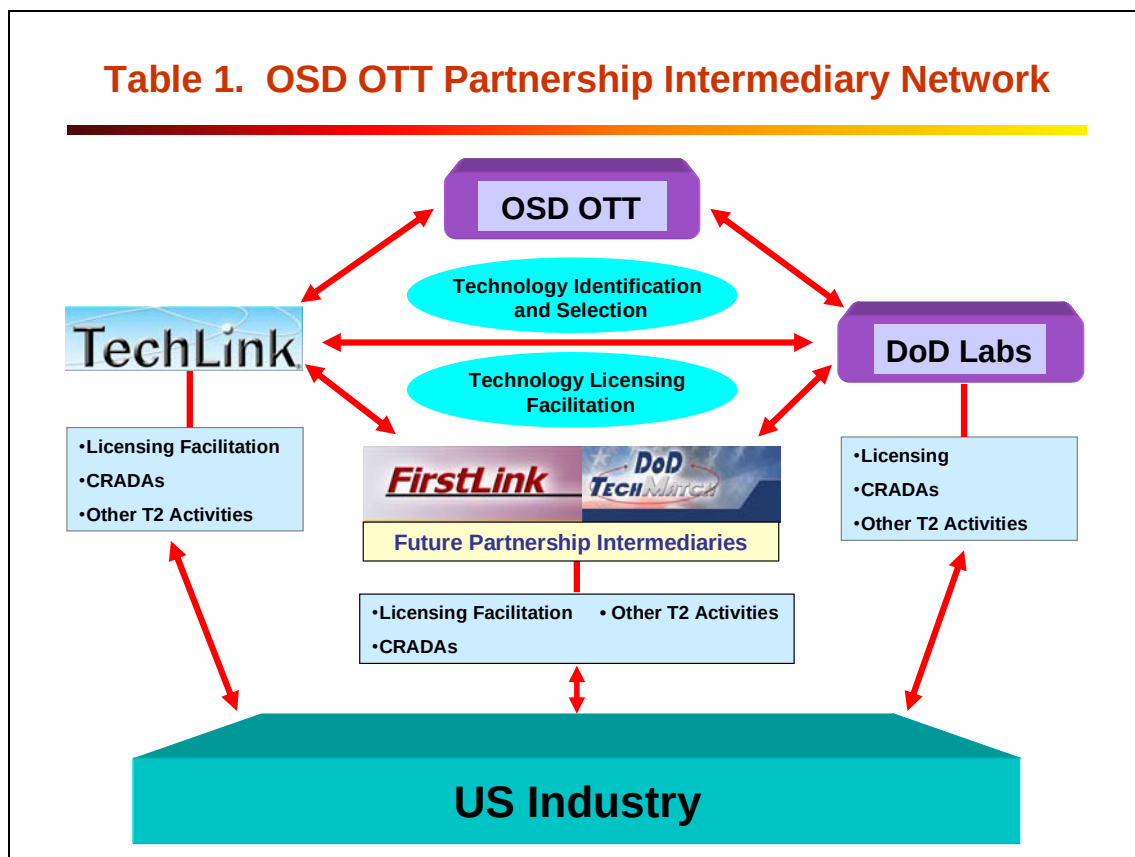
- With the growth in R&D funded by industry, some labs are developing intellectual property strategies that highlight those research areas where external collaborative partnerships would be beneficial. Then they are using TechLink to seek promising potential partners as a means to leverage the lab's research activities.
- When labs are doing work in collaboration with other Agencies or are being funded by other Agencies for the performance of work, the labs need to be explicitly aware of the technology transfer and IP policies of the other Agency. If we are not aware of these policies, there can be delays in executing CRADAs and patent licenses. This type of effort is growing as DoD works more closely with other Agencies such as the National Institutes of Health (NIH) and Department of Homeland Security (DHS).
- CRADAs with industry partners who have not had any previous business relationship with the lab are proving to be a great tool for exposing industry to the expertise and unique facilities in the lab. In return, the lab is getting exposed to commercial technology that, heretofore, has not been considered for military application.
- Through the use of a variety of EPAs, the labs have been able to develop a number of excellent relationships that are providing both near and long term benefits to all parties. In K-12 interactions, the labs are stimulating renewed interest in math and science. Through interactions with both faculty and students from high school and college, the labs are providing opportunities for these folks to work with and in the lab, and the labs are able to recruit future scientists and engineers to replace the aging workforce.

4. Thrust Areas in Technology Transfer

4.1 OSD Partnership Intermediaries

During FY 2005, the Office of Technology Transition (OTT) established an operational plan for the network of current and anticipated future DoD-wide partnership intermediary agreements managed by the Office in partnership with the Air Force Research Laboratory. These include *TechLink*, at Montana State University, which facilitates technology transfer agreements between U.S. industry and DoD labs nationwide; *FirstLink*, at the University of Pittsburgh, which connects DoD labs with private-sector companies and entrepreneurs to commercialize technologies for the U.S. first-responder community; and *DoD TechMatch*, part of the West Virginia High Technology Consortium (WVHTC) Foundation, which supports DoD technology transfer and transition by providing an Internet portal for U.S. industry to DoD's patented technologies, technology needs, laboratory capabilities, and R&D opportunities.

The purpose of the OTT operational plan is to coordinate partnership intermediary activities in order to maximize their success and minimize their potentially distracting impact on DoD lab personnel. TechLink, as OTT's oldest and most experienced partnership intermediary, is coordinating the network's marketing of DoD technologies to industry and serving as the network's primary contact to DoD labs for facilitation of licensing agreements with private-sector companies. In addition, TechLink is coordinating the partnership intermediary network's CRADA activities to avoid potential conflicts between these activities and licensing-facilitation activities. Table 1 illustrates the design of the new OTT partnership intermediary network.





4.1.1 TechLink is a DoD partnership intermediary established at Montana State University in 1999.

TechLink provides technology transfer services for DoD laboratories and centers. TechLink actively markets

DoD-developed technologies nationally and facilitates PLAs between DoD labs and U.S. industry to commercialize technologies for civilian and military applications. Since FY 2002, TechLink has helped to broker approximately one third of all DoD licensing agreements. As a key part of this activity, TechLink screens all DoD patents and patent applications for their commercialization potential.

In addition to its nationwide licensing activities, TechLink helps DoD establish productive partnerships with companies in the northwestern United States in three key ways: *First*, TechLink develops CRADAs between innovative small companies and DoD labs, which helps lower DoD's cost of new technology development. *Second*, TechLink helps DoD access innovative private-sector technologies by engaging companies in DoD's Small Business Innovation Research (SBIR) and Independent Research and Development (IR&D) programs. *Third*, TechLink's Mil-Tech Program helps transition innovative technology to DoD operational use more quickly, reliably, and cost-effectively by helping companies to overcome key technical and procurement hurdles. This program is a partnership with the Montana Manufacturing Center—part of the national Manufacturing Extension Partnership.

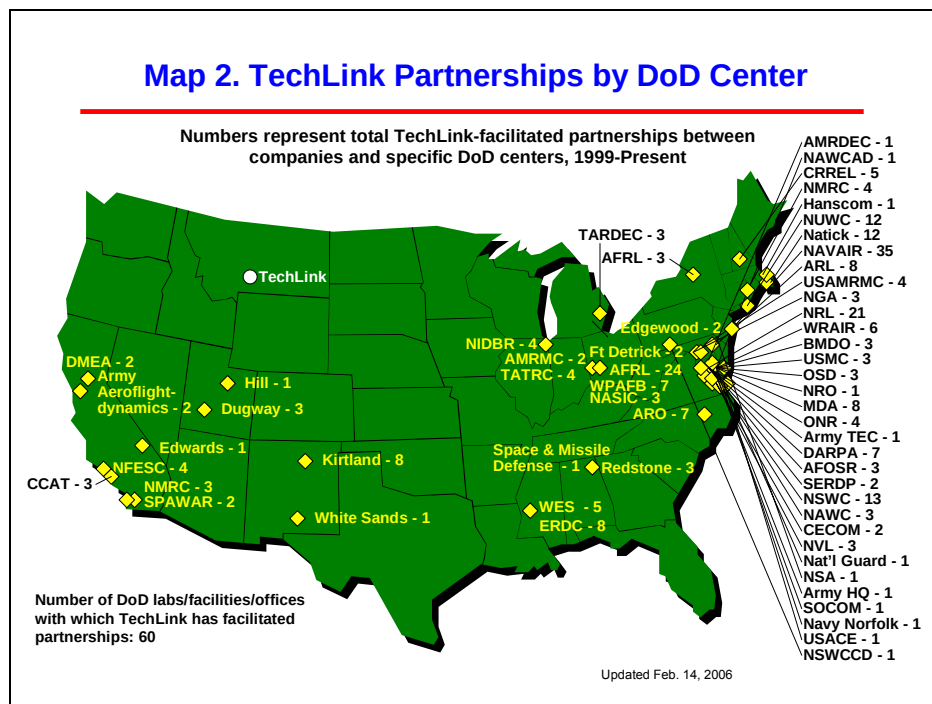
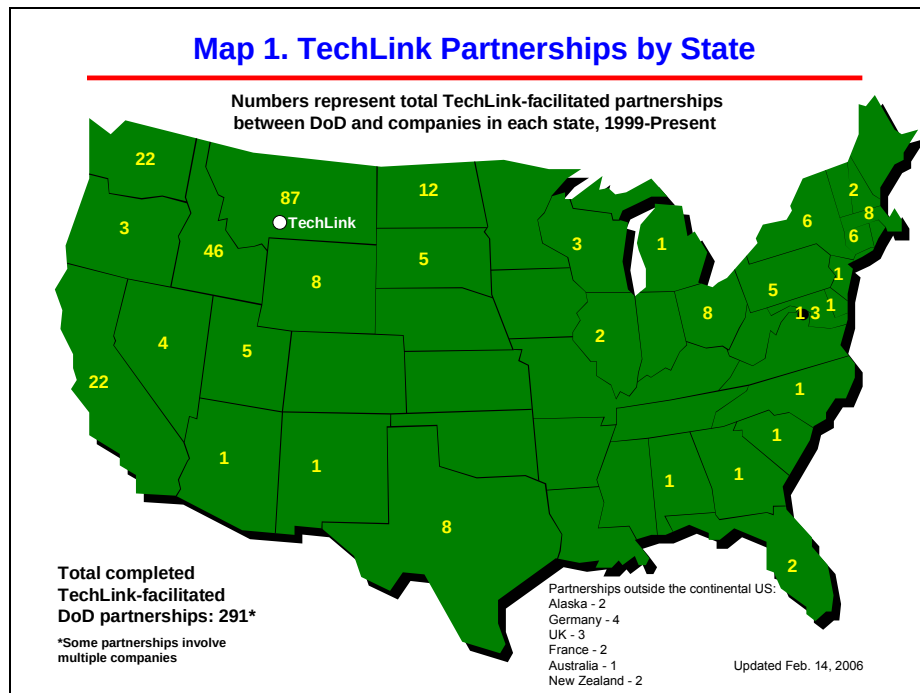
Since 1999, TechLink helped to establish over 290 partnerships between U.S. companies and 60 different DoD centers nationwide (see Maps 1 and 2 on the next page). TechLink is highly cost-effective. To date, it has yielded roughly a 4:1 return-on-investment (ROI) to DoD from licensing revenues, CRADAs, and other partnerships. In addition, the total dollar value of TechLink-facilitated contracts (SBIR and other) from DoD to companies in the northwestern U.S. is more than four times TechLink's expenditures to date.

An example of a TechLink-facilitated technology transfer involves Army software called Battlefield Management Information System – Tactical (BMIS-T), developed by the Army's Telemedicine and Advanced Technology and Research Center (TATRC) at Fort Detrick, Maryland. Designed for use on hand-held computers, this software greatly improves patient care on the



battlefield. Medics scan the patient's electronic dogtag for medical history, enter the specifics of the injury, and receive a diagnosis and recommendation for initial treatment. The Army already has deployed BMIS-T in Afghanistan and Iraq. Recognizing the technology's potential, TechLink helped broker four different technology transfer agreements that will expand use of BMIS-T far beyond the U.S. military. These include a license agreement and CRADA with a California company enabling BMIS-T to be commercialized for use in doctors' offices for electronic medical record-keeping, improved accuracy in diagnosis and prescriptions, and integrated billing; a licensing agreement to enable a Washington, DC, company to

adapt BMIS-T for use by first responders—on which TechLink partnered with another DoD partnership intermediary, FirstLink; and a licensing agreement to a London-based company that will transition BMIS-T for use by the British military.





4.1.2 DoD TechMatch is a Department-wide partnership intermediary established at the WVHTC Foundation in 2005. TechMatch began at the Office of Naval

Research, and evolved to encompass Army, Navy, and Air Force data. It is now an information backbone for technology transfer and transition within the Department. Key characteristics and information include:

(1) Tiered set of user-selected keywords. The heart of the system, the keyword matching feature allows a user to limit information to only those technology areas of interest. This saves small business owner's time – their most precious commodity.

(2) Automated tailored push of requested information. *DoD TechMatch* downloads all DoD R&D-related FedBizOpps information every business day, filters out sole source announcements, applies keywords to real opportunities, and crafts tailored e-mails to registered users – these are pushed out at 2:00 a.m. daily. Similarly, grants.gov information is pushed when announced. The biggest pushes come with SBIR and the Small Business Technology Transfer Program (STTR) pre-solicitations. For SBIR 5.3, 407 opportunities resulted in over 273,000 matches. All were delivered within 72 business hours.

(3) DoD TechMatch is connected 24 / 7 / 365. Because the system is web-based, it is available anytime from anywhere a user can access the web. Connectivity extends to all DoD technology transfer managers who coordinate activities at more than 700 labs and facilities. It includes the other partnership intermediaries, who work with customers one on one, and it is connected to the business community, solution providers for the Department.

(4) DoD TechMatch facilitates partnerships. Different from other partnership intermediaries, *DoD TechMatch* is a networking system and an information source. Its value lies in ease of access and accurate up-to-date information, along with clear navigation pathways to other elements of the DoD technology transfer and transition system. In recognition of its success in fulfilling this mission, *DoD TechMatch* has won two prestigious Federal Laboratory Consortium (FLC) awards: from the Mid-Atlantic Region in 2004 for its technology, and from the Far West Region in 2005 as an Outstanding Partner.



As of January 2006, *DoD TechMatch* has over 3,500 registered users, who spend over 2,400 hours each month on the site – looking for information and opportunities – equating to an industry investment of over \$240,000 each month. Users have access to information about 7,860 patents the DoD wishes to license. They have a smart calendar that informs them about DoD technology transfer events. And they see DoD technology transfer and transition successes – the types of successes that they might have too.

An example of the latest functionality is the **Hot Technologies** feature. The Naval Surface Warfare Center (NSWC), Coastal Systems Station, developed the High

Altitude/High Opening-Parachutist Navigation System (HA/HO-PNS) technology and owns the patent rights. They are seeking a CRADA partner to further the design; they are also seeking a partner to manufacture 2,000 or more units. They requested that their technology be posted on the site so that solution providers would become aware of their need. We envision potential partners working with CSS through TechLink, to establish the CRADA and to find a manufacturing partner.



4.1.3 FirstLink is a Department-wide partnership intermediary that was established at the University of Pittsburgh's

Institute for Entrepreneurial Excellence. FirstLink was established as the DoD's National Center of Excellence for Commercialization and Technology Transfer for First Responder Technologies. FirstLink provides technology transfer services for DoD laboratories and centers nationwide, focusing on technologies with first responder and homeland defense applications. Its key activities include:

- (1) **Establishing joint R&D partnerships.** FirstLink seeks qualified companies throughout the United States and helps to establish CRADAs between these companies and DoD labs. This activity is critical to the DoD's ability to capitalize on its existing Science and Technology (S&T) investment while allowing private industry access to vital, basic research that will enhance production of the best available solutions for the first responder.
- (2) **Providing Market Analysis.** FirstLink performs critical market, technology, and economic analysis at the earliest stages of project identification. This activity allows DoD decision makers critical information relating to whether or not to continue efforts and how they relate to first responder needs, in particular. It also allows the private sector company a sense of the cost and market desire for future business opportunities based upon the implementation of DoD technology.
- (3) **Facilitating Testing and "Focus Group" feedback from First Responders.** FirstLink facilitates pilot demonstrations, beta tests, and technology review sessions of DoD technologies with members of the first responder community to establish end user feedback. This feedback provides the DoD Laboratories and the private companies knowledge of specific adjustments and requirements necessary for the first responder community.
- (4) **Assisting small business seeking funding support.** FirstLink provides business plan development, grant assistance and introductions to small business seeking financial support from federal, state, banking and venture organizations.
- (5) **Transferring DoD-developed technologies.** FirstLink assists the licensing efforts of DoD Partnership Intermediary TechLink. In particular, FirstLink provides commercialization support to certain licensees' wishing to enter the first responder market place.

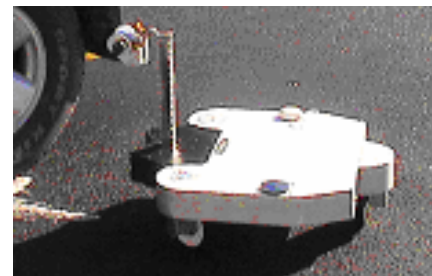
FirstLink has provided critical support as a tactical implementation mechanism for the DoD's overall effort to support Homeland Defense through the transfer of technologies and research assets to the first responder community. FirstLink has reviewed over 400 DoD patented technologies to determine their merit and value to the first responder arena. FirstLink has assisted in supporting over \$10 million in federal, state, and private financing for small business seeking to introduce new innovations into the first responder community. This includes facilitating 18 successful companies with SBIR grants.

Most recently, FirstLink assisted in the non-military deployment of a DoD robot that was initially developed for military use in Afghanistan and Iraq to perform under-vehicle inspections for contraband and explosives. The robot contributed to security efforts for Super Bowl XL in Detroit Michigan.

At only four inches high, and weighing about 30 pounds, the remote-controlled Omni-Directional Inspection System (ODIS) can travel under virtually every type of vehicle, while its multiple onboard computers and video camera capture detailed images and relay them to an operator safely removed at distances up to 100 meters. More than 20 units are currently deployed in Iraq and Afghanistan, and have a proven record of saving U.S. forces from injury and death.

Developed by the U.S. Army Tank and Automotive Research Development and Engineering Command (TARDEC) to address the shortcomings of manual inspection (necessary physical proximity to the vehicle, limited visual range, and no data capture), ODIS technology was refined for first-responder use by Kuchera Defense Systems of Windber, Pennsylvania. TARDEC and Kuchera had an established relationship when they were approached by FirstLink to consider how ODIS might be adapted for the changing needs of public and private safety and security organizations.

Although ODIS has been used in other prominent civilian settings – at the U.S. Capitol, for example, and at the high-profile trial of convicted sniper John Lee Malvo – Super Bowl XL is the largest civilian event at which it has been deployed.



Meanwhile, FirstLink continues to explore with Kuchera and TARDEC new adaptations of ODIS technology, such as survivor search missions and detection of chemical or biological hazards in contaminated areas. FirstLink also is facilitating the introduction of the technology to civilian law enforcement groups. Given the increased importance of unmanned robotic vehicles for both military and civilian operations that present high risk to personnel, there is significant opportunity to further leverage the ODIS platform. The anticipated increase in its adoption can be expected to reduce its cost and price, providing economic benefits to all of its users, as well.

4.2 Partnering With Educational Institutions Through Technology Transfer

DoD labs have developed a number of innovative approaches to working with educational institutions at all levels from K-12 and colleges. These partnering activities are helping the DoD labs to achieve their mission while at the same time assisting students and faculty develop the skills in science and math that are critical to Defense science and engineering. DoD relies on three principle legislative authorities to achieve our goals in this area. They are:

1. EPAs. Title 10 USC, Chapter 111, Section 2194 in part authorizes “the director of each defense laboratory to enter into one or more education partnership agreements with educational institutions in the United States for the purpose of encouraging and enhancing study in scientific disciplines at all levels of education. The educational institutions referred to in the preceding sentence are local educational agencies, colleges, universities and any other nonprofit institutions that are dedicated to improving science, mathematics and engineering education.”
2. Loaning, leasing or donating research equipment and computers with the legislative authority of subparagraph (b) under the Title 10 section cited in the above paragraph and under the authority of Title 15 USC, Section 3710, Paragraph (i).
3. CRADAs and Patent Licensing Authorities granted under Title 15 USC, Section 3710a and Title 35 USC, Section 209 respectively.

During this reporting period, DoD labs have initiated more than 80 new EPAs, more than 15 equipment loans and transfers involving hundreds of pieces of excess equipment and computers, and more than 40 CRADA and patent licenses that leverage the expertise and capabilities of the nation’s academic research institutions. The following provides some data and examples of successful activities in this area during the timeframe covered by this report:

4.2.1 Army

- TARDEC utilized a CRADA with U.S. For Inspiration and Recognition of Science and Technology (FIRST) to mentor local high school students on safe and efficient manufacturing procedures focused on use of tools and equipment. This assisted the students in building a robot for a science competition and at the same time gave them an appreciation on the use of innovative robots in vehicle manufacturing. TARDEC is also utilizing a CRADA with Central Michigan University which, in part, provides expertise and technology demonstrations in support of a new automotive technology curriculum.
- The Army Corps of Engineers, Geotechnical and Structures Laboratory licensed a technology to Alcorn State University, a historically black college and university (HBCU), to assist in their efforts to convert chicken waste into plant fertilizer.

In addition, various Corps of Engineers labs promote a variety of education outreach activities through minority pre-college internships, seminars for high school science teachers, a technology summer camp in conjunction with Vermont Technical College and EPAs with a secondary school district and six colleges including three HBCUs and the Haskell Indian Nations University.

- The Army Benét Laboratory worked with the University of Rochester Medical Center to develop technology for monitoring epileptic seizure events. Several years ago Benét's scientists were presented with the challenge of helping an employee whose child had a rare form of epilepsy. A seizure event often resulted in affecting the child's ability to breathe, a serious problem at any time but particularly life threatening in the middle of the night. Benét's scientists, leveraging their knowledge in gun vibrations and sensors, designed a small compact monitor that could distinguish between normal movement and a seizure. By placing this device on the child, the parents could constantly monitor their child day or night, providing them an early warning and giving them piece of mind. The University of Rochester Center has for many years been seeking a solution to the monitoring of patients with these types of symptoms and selected the Benét device, "Physical Activity Monitor," for advanced testing in FY 2004. The device is working well in a clinical setting. Several other prototypes have also been used in an educational setting for teachers who desire to have an inexpensive yet reliable monitoring device for special needs children.
- The Walter Reed Army Institute of Research (WRAIR) has instituted an EPA with McKinley Technology High School, a Washington, DC public school, to stimulate growth in minority participation in the sciences.
- The Army Medical Research and Materiel Command (USAMRMC) has co-developed technology for prolonging blood storage in collaboration with the University of Cincinnati. The technology has been sublicensed to a small company for further development and commercialization.
- To assist in developing better scientists and engineers, the Army Aeromedical Research Lab has loaned excess research equipment to Troy University of Troy, Alabama, for use by their biology and chemistry programs. The lab also has loaned equipment to six other universities to facilitate joint collaborative efforts under various CRADAs.

4.2.2 Navy

- NSWC has established working relationships with the Johns Hopkins University Entrepreneurship program whereby the school provides students to the lab for a two semester technology transfer project. The first semester, the students work in groups and conduct a commercial assessment of the technology/inventions. The second semester, they do the research necessary to locate potential commercial licensees. One group became so energized by their technology that when they left the school, they formed a start-up company to take the technology to market.

4.2.3 Air Force

- The Air Force Research Laboratory (AFRL) Sensors Directorate conducted a workshop with a number of HBCUs and minority institutions (MIs) to discuss Air Force sensors areas of need and to identify HBCU/MI technical capabilities and areas of interests to address these needs. The workshop also explored summer employment opportunities for students and faculty, co-ops, and educational partnership agreements in potential areas of mutual interest.
- The AFRL Propulsion Directorate established the Wright Scholar Research Assistant Program under an EPA that exposes Dayton, Ohio, area high school students to science and engineering careers in the Air Force (AF). The students serve a 10-12 week full-time paid internship under the mentorship of AF lab researchers. This four-year-old program supported 34 students in FY 2004 and FY 2005 that included eight valedictorians with an average GPA of 4.0. This investment is starting to pay dividends with 13 former participants now working for AFRL. The Edwards Air Force Base (AFB) site provided 131 excess items of lab equipment to five high schools in the local Antelope Valley Union High School District to stimulate student interests in physics and chemistry.
- The AFRL Materials and Manufacturing Directorate had six new EPAs in FY05, including five with HBCU/MIs. The Directorate also developed a suite of modules/kits for use by the Directorate's scientists and engineers in demonstrating material sciences to K-12 students.
- The AFRL Human Effectiveness Directorate used an EPA to provide over 100 surplus computers to the Oak Hill Union Local School District in the Ohio Appalachian corridor for use by middle and high school math and science classes.
- The AFRL Directed Energy and Space Vehicles Directorate at Kirtland AFB in Albuquerque, New Mexico has been the innovative force in the development of partnerships between DoD labs and educational institutions at all levels. To quote one of the principle architects, "the DoD labs must develop an extensive variety and quantity of relationships with the organizations that will grow our seed corn to replace current and future scientists and engineers essential to maintaining U.S. military technology superiority." In executing this strategy the lab has initiated several CRADAs with universities that have complimentary capabilities and have put in place a number of EPAs at all levels of education.
- The AF STARBASE® La Luz Academy is dedicated to raising the interest and knowledge skills of youth in math, science, engineering, and technology. The education outreach program to grades 5-12 is designed to provide a "bridge" of support and continuity for students through the difficult transitions from elementary to middle and middle to high school and into college through technology and mentoring. AF STARBASE® La Luz has three main components: Mars Missions Flight for 5th graders, Providing Engineering and Technology Experiences for Students (PETES) Flights for middle school students, and Students Planning and Conducting Engineering (SPACE) Flight for

high school students. The key goals of each Flight are to instill in the students the feeling of excitement and appreciation for math, science, engineering, and technology and a desire to continue in the Academy by participating in the following year's Flight.

o Mars Mission Flight

The Mars Mission Flight is a classroom-based Mars colonization simulation for 5th graders adapted from the Challenger Center for Space Science Education's acclaimed *Marsville®*, *the Cosmic Village* program. It integrates the AFRL Directed Energy and Space Vehicles Directorate's technologies with the *Marsville®* curriculum to provide a unique hands-on learning opportunity for students. Each year, students participate in a specific mission, which changes each year, as if they were astronauts on a manned mission to Mars. In 2004, over 2,500 students from 78 elementary schools throughout New Mexico participated in the Mars Onsite Laser Development Mission.

o PETES Flights

The PETES Core Curriculum Flight is one of three Flights for middle school students in which students attend a series of non-consecutive, technology enriched, curriculum days at the AF STARBASE® La Luz Academy located on Kirtland AFB. The goal of this Flight is for students to develop some basic skills and a realization that they can aspire to careers in math, science, engineering, and technology. Curriculum includes: Properties and States of Matter, Bernoulli's Principle, Four Forces of Flight, Aircraft Control, Flight Simulation, Newton's Laws of Motion, Model Rocketry, Space Exploration, Teamwork, Goal Setting and Air Force Core Values. For the FY 2004 pilot of the above curriculum for the PETES Core Curriculum Flight, over 200 students from 11 middle schools participated. In FY 2005, the results expanded to 569 students and 24 teachers from 18 middle schools.

A pilot of the PETES Philips Research Site Flight for middle school students was also conducted for FY 2005. This Flight is tailored to enhance students' math, science and engineering skills relevant to Space Vehicles and Directed Energy career fields. Initial curriculum includes: Meteorology and Atmospheric Physics; Principles of Directed Energy and Photonics; Principles of Space Navigation, Exploration and Satellite/Sensor Control Systems. This activity was conducted by 108 students and seven teachers from seven schools.

o SPACE Flight

Under the guidance of AFRL scientists and engineers, volunteering as mentors, teams of high school students work on a multi-year real-world R&D project. Year 1 is the Design Phase, Year 2 is the Build Phase and Year 3 is the Test and Evaluation Phase. Teachers are asked to recruit students – those who have definite education and career plans, as well as those who haven't yet decided on their plans for the future – for participation in the

SPACE Flight. All student teams who successfully complete the Initial Review and a Critical Annual Review of their project present an Annotated Briefing of their accomplishments at the annual AF STARBASE® La Luz SPACE Symposium each spring. As the SPACE Flight continues to evolve, seniors will need to complete a college-level Introduction to Systems Engineering course to complete their SPACE Flight.

On February 2, 2006, President Bush recognized both the importance of the STARBASE La Luz Academy in stimulating interest in science and math education and the importance of volunteers in the Program's success.



President Bush presented the President's Volunteer Service Award to Mike Martin from AFRL's Space Vehicles Directorate, Kirtland Air Force Base, N.M. Mr. Martin received the honor for his volunteerism at the STARBASE La Luz Academy, a Department of Defense education outreach program, sponsored by the AFRL's Space Vehicles and Directed Energy Directorates. (Air Force photo by Todd Berenger)

- In another EPA between the AFRL Directed Energy and Space Vehicles Directorate and the University of New Mexico (UNM), the lab transferred computer equipment and material for the purpose of encouraging and enhancing the study of mathematics at UNM. This particular equipment was utilized by UNM under an SBIR subcontract. A deformable mirror was delivered to the lab at the conclusion of the SBIR. This EPA benefits the Air Force by promoting the education of future scientists and engineers, and goodwill. The deformable mirror is a specialized item that is best suited for use in the femtosecond laser laboratory at UNM. It is hoped that its use will advance the state-of-the-art in femtosecond laser materials interaction for the entire scientific community.

4.2.4 Uniformed Services University of Health Sciences

- The Uniformed Services University of Health Sciences (USUHS) Department of Radiology faculty developed a medical image storage and retrieval system that includes a database nationally linked to tables that include a list of diseases and captioned medical images. The system allows for peer review, remote access and maintenance of stored data, query searches and retrieval of related image text files. The system facilitates both distance learning and remote consultation. It has been licensed to a medical educational association.

4.3 Transferring Technology in Support of Homeland Security Need

This report is on the activities of the OTT and documents some of the programs in transferring technology both to the private sector and for military application. This section does not provide the totality of what is happening in the DoD to support the DHS. Rather, this section provides SOME examples of what is happening across the Department to support first responder use of DoD technologies and make

capabilities available to Federal, state and local first responders. In many instances these technologies are directly beneficial to the warfighter in terms of their current mission in the battlefield. Here are some of these examples:

4.3.1 Army

- The Army's Edgewood Chemical and Biological Command (ECBC) maintains a number of relationships with other Government Agencies (OGAs), federal and state, which involve the exchange of technological expertise and capabilities. Such relationships are administered through different types of documents, including Memoranda of Agreement (MOAs), Memoranda of Understanding (MOUs), Interagency Agreements (IAAs), and Inter-Service Support Agreements (ISSAs). Fifteen new agreements with OGAs were initiated in FY04, with 23 additional agreements active. In FY 2005, there were 12 new plus 21 continuing agreements. While these agreements are not traditionally considered the venue for the technology transfer program, significant results were obtained in transferring technologies developed by ECBC for military defense applications to the new Homeland Security objectives, thus resulting in both enhanced public safety and savings.
 - • One example of these relationships is an IAA with EPA to provide technical assistance to plan for sampling and analytical methodology development to sample water for the presence of biological contaminants that may be introduced into the water through acts of terrorism, crime or warfare. Another effort was undertaken to develop chemical and biological equipment standards in support of the Office of Law Enforcement Standards at National Institute of Standards and Technology (NIST).
 - • In addition to the types of agreements discussed above, ECBC has other traditional technology transfer successes that are quite beneficial to homeland security. One example is decontamination enzymes. With an increasing need to respond quickly and efficiently to real world threats such as deliberate chemical warfare agent attack or accidental release of toxic industrial chemicals, ECBC developed a patented technology to neutralize organophosphorus chemical agents and pesticides. This enzyme-based technology simplifies and improves the process of decontaminating a class of highly toxic chemicals, including nerve agents, and does it in a way that is non-toxic, non-corrosive and environmentally safe. Having invented this enzyme-based decontamination technology, ECBC needed a commercialization partner to license and scale-up the manufacturing process in order to lower the unit cost of the material – an important requirement for broad adoption of the technology. At the recommendation of Dr. Joseph J. DeFrank, co-inventor and scientific team leader, ECBC's technology transfer office contacted Genencor International, Inc., the leading manufacturer of industrial and specialty enzymes, to explore the possibility of licensing and manufacturing the technology. This was a new proposition for Genencor, which had focused on commercial products and applications. After some feasibility studies, Genencor agreed to license the technology and use its

state-of-the-art fermentation plants to scale-up the manufacturing process. As a term of the license agreement, Genencor agreed to accelerate this work and bring a product to market in a fraction of the time that would be possible by DoD through normal technology acquisition procedures.

- • Genencor met its production milestone and is now successfully producing the licensed enzymatic decontamination technology under the trademark DEFENZ™. This product is being purchased by companies that produce and sell fire-fighting foams, sprays and other matrices. These companies, in turn, are formulating the enzymes into products for purchase by fire departments, hazardous materials groups, and others in the first responder community. The first commercial decontaminant that incorporates the enzymes (All-Clear™) was introduced into the market by Kidde Fire Fighting, Inc., in August 2005. With this success, the development of new or improved enzymes, more efficient production methods, and additional decontamination formulations are being pursued through CRADA collaborations with Genencor and other companies.
- The Air Force Institute for Operational Health partnered with the Hach Company, Homeland Security Technologies, Inc., to conduct research and development in the areas of threat detection for portable water delivery systems. The collaborator plans to provide real-time threat agent detection-response systems, pending successful testing, verification and validation. The purpose was to evaluate the basic sensor platform to determine its robustness, utility and to enhance final requirements. In a follow-on to this effort, the U.S. Army Engineer Research and Development Center Construction Engineering Research Laboratory (ERDC-CERL), the ECBC, and the Hach Company signed a CRADA to conduct live agent testing on the company's new technology designed to detect terrorist attacks on drinking water distribution systems. Under terms of the agreement, Hach is funding for the testing at the ECBC to evaluate its new detection/response system against live threat agents. This testing is conducted in secure laboratories under strict environmental and safety procedures. The Army and Hach will be constructing their own real-time drinking water test loop. In addition, the Corps of Engineers is conducting parallel studies with Hach that will help the Corps understand critical fate and transport chemical dynamics. The information that the Corps and Hach produce will help the Corps create and characterize new chemical conditions central to monitoring and predicting the impact of terrorist attacks on drinking water distribution systems. This evolving set of partnerships between an Air Force lab, two Army labs, and the company were all critical to the success of this technology.
- The U.S. Army Engineer Research and Development Center Geotechnical and Structures Laboratory (ERDC-GSL) conducted explosives testing under a Testing Services Agreement with HNTB Corporation in support of their design of protective measures for a major bridge in the New York City metropolitan area.
- ERDC-GSL entered a CRADA with Rogers Marvel Architects of New York City to assist in the testing and development of solutions to defeat possible terrorist

vehicle attacks in urban settings. ERDC-GSL's experience in analyzing military vehicle performance and interactions with various terrain conditions will be applied to the development of a virtual environment to simulate the relationship between vehicles and vehicle attenuation devices.

- TATRC executed a Commercial Evaluation License with Globecom21 Corporation of a TATRC patented software package for gathering and managing patient medical record data. Globecom21 intends to evaluate the applications of the BMIS-T software for a first responder solution. TATRC granted to the licensee a nonexclusive license for the evaluation purposes. Globecom21 licensed the software for the purpose of demonstrating the BMIS-T to first responder administrators in the Office of Emergency Management in 5 U.S. cities and counties.
- The Vaporous Hydrogen Peroxide (VHP) system is a breakthrough decontamination solution that will allow first responders to clean a building, aircraft, vehicle, and sensitive equipment subjected to a chemical or biological attack. The VHP technology is compatible with many materials, equipment, and environments, and may reduce the risk of human exposure to contaminated areas and objects. A modified VHP system was successfully used to remediate two facilities in excess of 1.4 million cubic feet each that were contaminated in the 2001 anthrax attacks. Originally developed by STERIS Corporation and for years used in the medical community as a biological sterilant, VHP was modified by ECBC scientists to decontaminate chemical agents as well.
 - • In FY 2004, ECBC received funding to further develop the VHP technology. Part of that funding was contracted to STERIS' subsidiary, Strategic Technology Enterprises, Inc., and the rest was used internally. A CRADA between ECBC and STERIS has been in place since July 2002 to foster the collaborative efforts between the two parties. On May 13, 2004, ECBC hosted a Congressional briefing in which a modified VHP decontamination system was demonstrated. The briefing was attended by Congressmen Ben Cardin, Roscoe Bartlett, and Dutch Ruppersberger; members from the staffs of Senators George Voinovich, Barbara Mikulski, Paul Sarbanes, and Mike DeWine; and Environmental Protection Agency Assistant Administrator Paul Gilman.
 - • In November, ECBC scientists tested the Modified Vaporous Hydrogen Peroxide (mVHP) system on a C-141 aircraft. This series of tests was conducted at Davis-Monthan Air Force Base in Tucson, AZ, and was designed to evaluate the amount of time and vapor needed to thoroughly eradicate any chemical or biological agents. The data is currently being analyzed, but initial results from the testing show promising results.
- The Army Communications-Electronics Research Development and Engineering Center—Space and Terrestrial Communications Directorate (CERDEC—S&TCD) established a partnership with Rex Systems Inc. to facilitate C3I development, integration, and technology transfer initiatives in support of the Army's Urban First

Responders. A CRADA with Rex was signed July 2004 defining the basic terms and conditions of the partnership and encompasses many related areas. The first collaborative effort under this agreement, a Responder Operation Center (ROC), focuses on formulating, developing and demonstrating a command and control operation center which provides Situational Awareness software to help track the movement and data flow for First Responders out in the disaster area. The ROC has real-time interaction with a First Responders' wearable computing body-bus and receives live video feeds, location data, bio sensor data, network data and executes live reporting tools to get a more timely and comprehensive awareness of the emergency situation. Another key component is working jointly with Rex to set up a Mobile Ad-Hoc wireless network, which has the ability to independently form the communications network or "Self Form" a secure network through RF sensing of other units within the operational range. This form of technology will provide the First Responder with a robust communication source, capable of operation in buildings and other urban-based environments. The goal is to provide First Responders with a dependable way to disseminate information across the disaster area, and maintain communications between First Responder personnel even when the connection back to the central command center is lost.

4.3.2 Navy

- The Naval Research Lab (NRL) has executed several CRADAs and a patent license with a startup company, Sword Diagnostics, Inc, to develop a real time biological pathogen detection technology. In this partnered effort, NRL is providing expertise in laser physics, spectroscopy and analytical software coupled with their swept wavelength optical detector invention and their patented OASIS™ software. This will enable the design and fabrication of a prototype instrument. Sword will incorporate their knowledge in applied microbiology to develop the critical analysis criteria for the instrument. The first technology trials are for use in meat packing plants.
 - • Because the detection of dangerous microbiological organism has taken on new urgency in the fields of food safety and homeland security, the end product could have real public benefit by filling this growing global need for rapid pathogen detection. Sword Diagnostics will focus initially on applications in the \$1.6 billion food safety testing market. The first commercial product is targeted for the meat packing industry where there have been repeated instances of recalls of more than a million pounds of hamburger for potential E. coli contamination. The company's "real time" field system will identify pathogens in a matter of minutes, whereas the current state-of-the-art lab tests take almost two days. In a later version of the product, the company plans to develop a test for prions to detect "Mad Cow" disease.
 - • Sword Diagnostics will commercialize a potential "breakthrough" diagnostic system based on the combination of a novel NRL laser based analytical instrument with patented NRL software. If successful, the revolutionary new system, based on two NRL patent applications and two issued patents,

would scan swabbed samples from the combination blood, tissue, and fecal matter typical of a beef slaughterhouse floor and, by comparing the data with identifying data in a pathogen library, could allow the detection and identification of as little as a single bacterial. It also has the potential for real time detection of bioterrorism agents such as anthrax. The New Jersey Technology Counsel selected Sword Diagnostics for its award for the NJ startup company with the “Most Innovative Product/Service.” Most importantly, company researchers testing a simplified version of the detector found a way to make a product that could be for sale in less than a year.

- The Naval Air Warfare Center Training Systems Division (TSD) continues to work closely with the Federal Law Enforcement Training Center (FLETC) (Department of Homeland Security) under an existing agreement. This partnership was designed to enhance FLETC’s access to military technology and training expertise and to provide TSD increased visibility and easy access to a large training population with many training requirements similar to those of the military for the purpose of piloting and testing new technologies and processes. FLETC designated an on-site representative at TSD to further increase opportunities resulting from this partnership in March 2004 when the agreement was signed. In 2005, FLETC added a second representative to the on-site office to further assist in identifying technologies to solve training issues. This partnership also benefits the National Institute of Justice, a long-standing TSD partner, by creating additional leveraging opportunities and providing access to a large body of law enforcement personnel to assist as subject matter experts or to provide feedback on field tests of new technologies.
- Science and Technology Research, Inc., a small company in Fredericksburg, VA, licensed a Navy developed “Shipboard Chemical Agent Monitor – Portable (Scamp).” They produce for the Navy this detection system that can detect all classic nerve and blister agents as well as other chemical agent vapors. They are working to commercialize this product as well as redesigning the reprogrammable detection chip for future threat agents and toxic industrial chemicals for Government and commercial use.
- A number of homeland security events continue to be conducted by the Naval War College (NWC). It is through the use of various facilities, expertise and technologies, that the War Gaming Department has established a reputation for assisting government agencies by applying military planning and decision-making processes to the understanding, analysis, and improvement of domestic preparedness plans. Agencies have been subjected to simulated events that stress the implementation and mechanics of their plans. In turn, the Department has benefited by increased awareness of issues confronting agencies in their efforts to prevent or respond to acts of terrorism against the United States.

The events conducted in 2005 did not involve formal and focused technology transfer activities as executed in the past, but they did involve several non-military partners from federal, state, and local agencies.

- • As indicated below, the games included the following non-military agencies:
 - o Federal Emergency Management Agency (FEMA)
 - o Department of Justice
 - o Department of State
 - o Department of Homeland Security, including:
 - Border Transportation Security (BTS)
 - Immigration and Customs Enforcement (ICE)
 - Transportation Security Administration (TSA)
 - o Department of Transportation
 - o State and local officials from Maine
 - o State and local officials from California
 - California Office of Emergency Services
 - Los Angeles Police and Fire Departments (LAPD, LAFD)
 - Long Beach Police and Fire Departments (LBPD, LBFD)
 - o Lloyds of London
 - o Longshoremen's Union
 - o Captain of the Port (COTP), Coast Guard
 - o Federal Bureau of Investigation
 - o National Transportation Safety Board
 - o Postal and Shipping Agencies (DHL, FedEx, UPS, USPS)
 - o 18 countries associated with the Proliferation Security Initiative
 - o 9 Latin American countries
 - o State and local officials from Connecticut and New Jersey

- • The following are some of the games conducted by the Homeland Defense Games Division of the War Gaming Department:
 - o **TSA War Game.** The purpose of this War Game was to identify potential incident management policy issues between TSA and the Department of Transportation and to explore their respective roles and responsibilities embedded in the new National Response Plan. The participants included civilian senior level decision makers from TSA's Marine and Land Security Branch, Border and Transportation Security, Federal Railroad Administration, Federal Highway Administration and Office of Domestic Preparedness.
 - o **NORAD-NORTHCOM AS-05/Top-Off 3 National Exercise.** The intent of this exercise was to exercise the military staffs, multiple Defense Coordinating Officers/Elements and test their ability to provide immediate resource support during the early hours of a Presidential Declared Disaster while simultaneously preparing and deploying a Joint Task Force in support of the lead agency.

- o **Senior Leadership (Los Angeles/Long Beach).** The design of this war game was to gather important input from port operating partners regarding the topics of port evacuation, port recovery, and port reconstitution. LAPD, LAFD, LBPD, LBFD, DHS/FEMA, FBI, COTP, 3rd Fleet, Lloyds of London, Longshoremen Union, ICE and BTS participated as the stakeholders and members of the area Maritime Security Committee.
- o **TSA Postal and Shipping War Game.** The goal of this war game was to conduct a seminar style game to improve homeland security policy coordination across all the postal and shipping stakeholders (DHL, FedEx, UPS and USPS) allowing the organizations to collaboratively respond, communicate and maintain Continuity of Operations Plans nationwide as a result of a terrorist attack.
- o **Proliferation Security Initiative War Game.** This was a multi-national event involving 18 countries conducted at NWC Newport for OSD. Proliferation Security Initiative (PSI) is an international protocol designed to support a collaborative international effort to halt the spread of WMD and the precursor components of WMD. Over 60 countries support the protocol which was gamed at NWC. The PSI war game allowed various policies associated with the protocol to be tested and further investigated in a controlled environment allowing interaction with member states. Issues raised were collected and will be discussed at future international PSI leadership meetings.
- o **NORAD-NORTHCOM AS-06 State Support Game (Maine).** The goal of the AS-06 Preparedness Exercise was to conduct seminar style games to familiarize local communities, State leadership, and agencies with the State of Maine's Emergency Operations Plan through the exercising of current crisis and consequence management operations, information and planning processes, and the interagency, state, and local community coordination. Through this process, the states will enhance the preparation for future National exercises conducted by NORAD-NORTHCOM.

4.3.3 Air Force

- The AFRL Information Directorate at Rome, NY, signed a MOU with the DHS Science and Technology Directorate. The MOU outlines the organizational relationship and overall responsibilities between the Air Force Laboratory and DHS. The MOU is intended to promote a free and open exchange of information, knowledge, methods, research, development, and intellectual property related to Research, Development, Test, & Evaluation Programs in the counter-terrorism arena, to include Cyber Operations, Information Management, Information Fusion and Understanding, Information Exploitation, Connectivity, Advanced Computing Architectures, and Command and Control.

4.3.4 *Missile Defense Agency*

- In FY 2004, the Missile Defense Agency (MDA) produced a report that showcases several MDA funded technologies that either could or are being used for emergency response applications. Thirteen examples are featured in this report. The Emergency Response tools were included on a CD called, "Homeland Security: Missile Defense Technologies" which also includes two other reports produced prior to FY 2004. The others are "Missile Defense Agency Sensors: Making the Unknown Known" and "Missile Defense Technologies: Tools to Counter Terrorism." This CD was distributed at several conferences and events including one focused on homeland security.
- One MDA-funded R&D effort has been adapted for use by the Army in Afghanistan and for search and rescue operations after Hurricane Katrina. The omnidirectional 3-D imaging camera surveillance sensor technology development was supported by an MDA SBIR award to Genex Technologies, Inc. for ballistic missile defense applications such as simulation training and battlefield modeling. Genex developed this technology into their OmniEye™ WellCam™ sensor package that sees in 360 degrees at all times. The sensor package is fully weatherproofed, rugged, and mobile. It also has a detachable video/power cable that allows operators to display this powerful surveillance sensor by use of a video viewing capability with a mobile display so there is no need to pause during a search. The WellCam enables faster inspection of hard-to-reach places. It is ideal for searching holes, caves, shipping containers, building rubble infrastructure, and other small areas difficult to see into or difficult or dangerous to enter. It allows the user the capability to extend their vision potentially hundreds of feet below the surface or deep into a rubble pile.

Army troops in Afghanistan have field tested the OmniEye™ WellCam™, an effective and safe method for enemy search and casualty search and rescue missions where troop safety and/or timely operations are mission critical. Genex donated the use of multiple units of this product for post-Katrina search and rescue efforts in rubble and debris by the U.S. Army Rapid Equipping Force (REF).

- MDA funded an SBIR effort to develop a readily and quickly deployable communications capability that could be used to re-establish communications as the result of a missile attack. Mr. Paul Gierow developed the Ground Antenna Transmit/Receive (GATR) which is a lightweight inflatable satellite antenna. The 2.5 meter antenna system can be set up rapidly by inserting four stakes into the ground, inflating the antenna ball, and pointing it at a satellite. Comparable conventional mobile satellite dish systems weigh tons and must be driven in on trucks.

Soon after it became apparent that Katrina would affect the Gulf Coast's communication infrastructure, Gierow was contacted by the White House Communications Agency, where he had delivered a briefing on the antenna technology. That agency asked Gierow to provide 200 of the antennas for the

recovery effort, but Gierow had only one working antenna at the time that could be delivered on such short notice. Working with Senator Jeff Session's office, MDA authorized funding to initiate the effort to get the antenna to the storm-damaged area. Gierow volunteered his time to deliver the antenna and arrived with it in Woolmarket, MS, soon after the storm hit. In



Woolmarket, Gierow set up his antenna in about an hour and had the only internet connection in Harrison County. For days, Gierow lived at the shelter, his 24-hour connection the only way hundreds of displaced Mississippians could file assistance forms and receive confirmation receipts from the FEMA. In addition, the system was used by physicians to prepare assessment reports and as a means for a CBS radio affiliate to broadcast a program for numerous evacuees to get messages to friends and family.

4.4 DoD and Department of Commerce Collaboration on Technology Transfer and Manufacturing



The DoD and the Department of Commerce (DoC) reached agreement to work collaboratively under a joint MOU to provide assistance to companies that are manufacturing items for the DoD. This MOU was signed by Ms. Sue Payton, Deputy Under Secretary of Defense for Advanced Systems and Concepts (DUSD (AS&C)), and Mr. Phil Bond, Under Secretary of Commerce, Technology Administration. The MOU serves the common purpose of providing support to the U.S. warfighter's superiority through formal collaborative efforts that cooperatively leverage DoD expertise and technologies with the national service delivery network of the DoC's NIST to enhance technological innovation and improve productivity of the U.S. manufacturing industrial base. Under the MOU, NIST provides a part time business and technology advisor to OTT. At the initiation of activities under the MOU, the NIST advisor arranged for an exchange of ideas between DoD and NIST along with tours and briefings at the NIST Scientific Research Labs, Advanced Measurement Labs, the Manufacturing Engineering Labs, the Manufacturing Extension Partnership (MEP) Program, and the Advanced Technology Program to showcase the resource capabilities available.

The NIST MEP network in support of DoD has been assisting manufacturers producing items for Army unmanned vehicle guidance systems, Navy and Air Force JDAM and SLAM-ER missile components built by Boeing, lean enterprise training and implementation for Navy shipbuilding primes and their supply chain companies, body armor, military batteries, etc.

In one example, the MEP cost-sharing model works well on Defense programs like the JDAM missile system (MEP/AF Manufacturing Technology Program (ManTech)/Boeing) where cost reductions and capacity and productivity improvements were made across the entire Boeing missile supply chain. This was accomplished by applying Lean value-added principles to the combined JDAM supply chain of Boeing and nine suppliers, rather than sub-optimizing the operations of each supplier. Everyone reaps the benefits – suppliers, the original equipment manufacturer (OEM), and the DoD warfighter.

MEP / DoD / OEM Collaboration: AF / Boeing JDAM Lean Initiative



- **Ohio MEP (TechSolve) project**
- **ManTech Funded Pilot**
- **Boeing In-Kind and Cash Match**
- **\$120M Cost Savings to Air Force**
- **Demonstration to OEM & Air Force of Return on Supplier Development Investment**

In another initiative, DoD and NIST are encouraging a collaborative relationship between DoD's Techlink Partnership Intermediary (see Section 4.1.1), the Montana Manufacturing Extension Center, and their MEP counterparts in other northwestern states. This collaborative partnership, MilTech, acts as an intermediary for the DoD, providing critical engineering, manufacturing, and business development assistance to companies in the region that are transitioning new defense-related technology. The program enables these companies to accelerate the transition of new technology to the U.S. warfighter, while lowering acquisition cost and cycle time, thus allowing DoD to realize greater return on its R&D investment with U.S. businesses. The MilTech program goal is to ensure that innovative defense-related technology is more efficiently and cost-effectively transitioned from DoD labs and private industry to the U.S. warfighter.

TechLink helps DoD transfer its technology while
MilTech & MEP help make it producible and affordable



In another effort, the California Enhanced Manufacturing Supply Chain Initiative (CEMSCI) is a similar initiative undertaken by the California MEP Center. CEMSCI operates as a virtual Defense supply network that enables small manufacturers and engineering firms to collaborate on re-engineering, updating technical data packages and specifications, manufacturing, and re-qualifying small quantity legacy parts that are difficult to source. The CEMSCI business model has shown great promise in finding qualified sources for critical Defense components and parts that are urgently needed by the Warfighter, while enlisting the specialized capabilities of small engineering, technology, and manufacturing firms that may not yet be established Defense suppliers.

4.5 Collaborative Relationships

Defense Technology Transfer Working Group (DTTWG)

The DTTWG was established in 1994 and is comprised of representatives from each of the Military Departments and most of the Defense Agencies. This group meets monthly to review technology transfer issues requiring either consistent policy or approach from a joint DoD perspective.

DoD Technology Transfer Integrated Planning Team (TTIPT) Workshop

The tenth DoD TTIPT Workshop was held in November 2005. Over one hundred fifty technology transfer professionals gathered to discuss joint projects, best practices, lessons learned, and to hear about new legislation and information sources that will affect current technology transfer efforts. Each Military Department provided an update on its technology transfer program implementation, the DoD partnership intermediaries (See Section 4.1) discussed how technology transfer activities are supported, case study training sessions were offered on CRADAs and

how to develop royalty rates in PLAs, best practices in valuation, structuring licenses, marketing, and commercialization strategies, and legal issues were discussed.

Interagency Working Group on Technology Transfer (IAWG/TT)

The three Military Services and DoD continue to participate with the other Federal Departments and Agencies on the IAWG/TT chaired by the DoC. This working group has looked at technology transfer implementation in the various federal departments, how it varies based on Agency mission, and what we can learn from each other to improve our programs. The IAWG/TT has proven to be an effective mechanism for discussions among the Federal Departments and Agencies and for identifying ways to showcase success in technology transfer activities.

DoD Participation in the Federal Laboratory Consortium for Technology Transfer

The Military Departments and Defense Agencies have been participating in the FLC since its inception in 1974. Participation is achieved through financial support, participation in annual National FLC meetings, serving as FLC Executive Board members and/or Committee Chairs and actively supporting interagency laboratory projects. The FLC provides an opportunity to share information with other Federal Agency technology transfer professionals and learn about methods employed in other agencies that could benefit DoD.

Since 2002, the FLC has been working in partnership with the National Association of Seed and Venture Funds to produce a World's Best Technology (WBT) Showcase. The purpose of WBT is to showcase technologies developed or in part funded by the Federal labs before a group of potential technology investors including venture capital funds and Fortune 500 companies. In both FY 2004 and FY 2005, DoD sponsored and DoD labs and SBIR participants presented a number of their technologies at the WBT showcases. The exposure to potential commercialization deals has been worthwhile. More information about WBT can be found at <http://www.wbtshowcase.com>.

The FY 2004 DoD financial payment for the operation of the FLC as specified in 15 USC 3710(e)(7)(A) was \$988,920 and in FY 2005, DoD's contribution was \$972,688. We are working closely with the FLC to ensure DoD obtains value for this investment.

The FLC presents Annual Awards for Excellence in Technology Transfer to recognize laboratory employees who have done outstanding work in the process of transferring lab-developed technology. Nominations are made by the laboratory representatives and are judged by a panel of experts in the field of technology transfer. The five DoD winners of the Award for Excellence in Technology Transfer for FY 2004 are identified along with a description of their technology in Appendix D. In addition, Appendix E recognizes Mrs. Mary E. Lacy, Technical Director of the Naval Surface Weapons Center, Dahlgren, Virginia, as a FLC Laboratory Director of

the Year. In the area of FLC Service awards, Dr. J. Scott Dieter was awarded the Harold Metcalf award in recognition of his sustained, significant service to the FLC, and Mr. A. David Spevack was awarded the FLC Outstanding Service Award for his notable sustained support and service to the FLC. The eight DoD winners of the Award for Excellence in Technology Transfer for FY 2005 are identified, along with a description of their technology in Appendix E. In addition, Appendix E recognizes Mr. Ted Glum, Director of the Defense Microelectronics Activity in Sacramento, California, as a FLC Laboratory Director of the Year. In the area of FLC Service Awards, Ms. Norma Cammarata was awarded the Harold Metcalf Award in recognition of her sustained (18 years), significant service to the FLC.

DoD representatives serve in both elected and nonelected positions with the FLC. These leadership positions facilitate sharing of information with other Federal Departments and Agencies and contribute to specific technology transfer activities. The following DoD personnel held positions in the FLC in FY 2004 and/or FY 2005:

FLC Position	Name/Organization
FLC Chair	Ed Linsenmeyer, Naval Surface Warfare Center, Coastal Systems Station
Chair, Program Committee	Sharon Borland, Army Corps of Engineers, Cold Regions Research and Engineering Laboratory
Chair, Legal Issues Committee	Robert Charles, Army Medical Research & Material Command
Coordinator, Northeast Region	Hans Kohler, Naval Air Warfare Center, Aircraft Division, Lakehurst
Coordinator, Mid-Atlantic Region	Dr. J. Scott Dieter, Naval Surface Warfare Center, Indian Head Division
Deputy Coordinator, Mid-Atlantic Region	Dottie Vincent, Office of Naval Research
Coordinator, Southeast Region	Kelly McGuire, Army Aviation and Missile Command RD&E Center
Coordinator, Far West Region	Kurt Buehler, Naval Facilities Engineering Service Center
Deputy Coordinator, Far West Region	Kevin Zysk, Air Force Flight Test Center
Deputy Coordinator, Mid-Continent Region; Member-at-Large	Patrick Rodriguez, Air Force Research Laboratory—Directed Energy Directorate
Deputy Coordinator, Midwest Region	Kristen Schario, Air Force Research Laboratory—Propulsion Directorate
FLC Executive Board, Member-at-Large	Lee Greenberg, Army—Benét Laboratory
FLC Executive Board, Member-at-Large	Dr. Michael Sullivan—Naval Air Warfare Center Weapons Division, Point Mugu
FLC Executive Board, Member-at-Large	Bob Morelli, National Security Agency

In addition to the above positions, Mr. John Todaro, Director, OTT, Office of the Deputy Under Secretary of Defense (Advanced Systems and Concepts) (ODUSD (AS&C)) is serving on the FLC National Advisor's Board.

5. FY 2006 Plan for Conducting Technology Transfer

For the Defense Department, technology transfer is more than giving industry access to DoD's technologies. It includes working with industry to ensure the transfer occurs in a way that makes the technology usable and is available in the future to meet DoD needs. Part of the success of DoD technology transfer efforts is the need to review lessons learned and apply them as we move forward. In our previous reports, we identified specific lessons learned and we used these to improve our technology transfer activities.

Future

We plan to continue seeking to make technology transfer an integral part of the planning process so we can maximize the effectiveness of our S&T program. We intend to deliberately participate in value-based, mission-related technology transfer activities that derive value to the Department and our partners. Leveraging resources is a key benefit of technology transfer activities within DoD. We are seeking to ensure every DoD activity uses technology transfer mechanisms strategically to manage field level R&D.

Cooperative activities with other federal departments, the private sector, and Congress are ongoing within DoD. We anticipate these efforts continuing, as well as many of the activities identified in previous reports such as participation in conferences and tradeshows.

Increasingly, we're doing technology transfer not because it is legislatively mandated, but because it enables the mission and is a good business practice. We note that in support to our warfighters, many times technologies that are currently being deployed were developed using technology transfer mechanisms. We have found an increased interest from organizations not traditionally using technology transfer mechanisms, such as JFCOM and Strategic Command implementing technology transfer efforts because the tools are effective in getting technology developed and deployed faster.

We anticipate these focused efforts to enhance our transfer opportunities and provide increased technical capabilities available for the warfighter – the ultimate customer of DoD's technology investments.

6. Key DoD Technology Transfer Success Stories in FY 2004 and FY 2005

6.1 FY 2004 Highlights

6.1.1 Army

- **Public/Private Partnering**

In FY 2004, Benét Laboratories significantly expanded its Public/Private Partnering activities by taking a strategic view of partnering with local academic research institutions and industry. Benét's objective is to better leverage and to capitalize upon the large pool of local intellectual and investment capital. Their objective is to meet current and future mission needs and concurrently assist

those partners in sharing and leveraging the lab's people, facilities and equipment.

They have continued to work with the "*Arsenal Business and Technology Partnership*" (*The Partnership*), a 501(c)3 corporation which is solely focused upon assisting Benét Laboratories and the Watervliet Arsenal on accelerating mutually beneficial new economic development on the site via fostering new relationships.

Working with *The Partnership*, Benét Laboratories has entered into CRADAs and partnering agreements with the following activities, all situated within a 10-mile radius of Benét Laboratories:

- The State University of New York Center for Nano Sciences and Engineering
- Rensselaer Polytechnic Institute
- General Electric Global Research and Development Center
- The New York State Center for Economic Growth
- Plug Power (Fuel Cells and Power Management)
- Elmhurst Research (Ultra high pressure components)
- Extreme Molding (Advanced Materials)
- Step Tools (Next Generation Machine Tools and Manufacturing)

In addition, the lab and the Arsenal have developed, in conjunction with the *Partnership*, a strategy that enables companies to locate in and utilize the buildings and facilities located there. Through these joint efforts, they have successfully located nine companies at the Arsenal working in diverse areas such as nanotechnology, advanced materials, precision coatings, semiconductors, and software for manufacturing. They have also established a Homeland Defense and Security business incubator that has attracted five additional technology start-up companies.

- TARDEC awarded a contract to Wayne State University Research Center to develop a handheld, self-powered micro electro-mechanical systems (MEMS) device based on acoustic wave and Raman microspectrometer technology to detect chemical and biological contaminants in water. A partnership with local health departments previously established under a CRADA was continued to take advantage of the dual use nature of the technology and provide a venue for field tests of the system.
- The Space and Missile Defense Command has partnered with Quantum Research International, Inc. in developing and demonstrating a Tactical Emergency Asset Management (T.E.A.M.) system for use in military operations and civil emergency response incidents. It has been demonstrated in exercises involving Federal Agencies including DoD and DHS, and also to a number of state, regional and local emergency management organizations in the

southeastern U.S. This deployable system is currently being considered for purchase by several government entities. As an example of its use, at the request of the Huntsville, Alabama Police Department, the T.E.A.M. system supported the Eric Robert Rudolph Change of Venue Hearing at the Federal Courthouse, Huntsville, Alabama. The T.E.A.M. system was collocated with the Huntsville Police Department Mobile Command Post and provided a radio bridge to link together radios from the Huntsville Police Department, Madison City Police Department, Madison County Sheriff and U.S. Marshals Service into a single, integrated radio network. That network was maintained for the duration of the Rudolph Change of Venue Hearing.

- USAMRMC had several successful transfer efforts. A patent license agreement was executed with the American National Red Cross following a CRADA with the USAMRMC for development of wound healing/bone reconstruction technology which is of high interest to DoD medical practitioners. Under this exclusive license, several issued U.S. patents and foreign patent applications that were co-developed and co-owned by the Walter Reed Army Institute of Research and the Red Cross have been sublicensed to a commercial pharmaceutical company for final development and commercialization.

Another PLA licensed two Army patents to VaxGen, Inc., a U.S. vaccine company, for the development of a second-generation anthrax vaccine. The new vaccine is expected to have fewer side effects, be more effective and easier to administer than the existing approved vaccine. The Department of Health and Human Services has budgeted funds to purchase 75 million doses of this new anthrax vaccine under Project BioShield over the next 2-3 years for the national stockpile.

- The Corps of Engineers Environmental Laboratory is conducting research and development under the Ecosystem Management Restoration Program to define stream and riparian ecosystems. This effort involves a team of 18 scientists and engineers from ten countries, and has led to determining a list of the key processes and characteristics of these ecosystems. Thought to be previously intractable because of complex interactions, the team identified 15 functions as well as indicators and measures for each. The research results have been adopted by the International Navigation Association as the basis for international guidelines for the sustainable management of inland waterways. In addition, they serve as a basis for a precedent-setting Montana court decision and are being employed for regulatory evaluations. A procedure for system assessment using these functions has been employed by the Environmental Protection Agency in developing Total Maximum Daily Loads and by the Forest Service in developing Forest Management Plans.
- ARL established a CRADA with the MEMS Exchange. The MEMS Exchange offers fabrication services for MEMS, micro, and nanotechnology devices at ARL as well as dozens of other leading, high quality foundries across the U.S. The

MEMS CRADA is a new mechanism that sets up details for the MEMS Exchange to provide fabrication services in ARL facilities for a number of businesses, universities and other government agencies quickly and directly. Through the MEMS CRADA, businesses have begun to accelerate the development of MEMS technology by providing them with access to state-of-the-art fabrication facilities and tools which otherwise would be prohibitively expensive for all but perhaps the largest of organizations. ARL sees this acceleration of the development and maturation of MEMS technology as impacting the role of MEMS devices on the battlefield. In FY 2004, they began to see the results of this CRADA. 52 runs have been done: seven for other government agencies, 30 for businesses, 13 for universities, and two others.

- The Army Communications – Electronics RD&E Center worked with Austin Info Systems to produce a commercially available intelligent search and retrieval tool known as the Open Source Automated Link Analysis Tool (OSALAT). The Internet has proved to be an extraordinary information source, but, at the same time, can quickly become information overload for intelligence analysts. The challenge is to find relevant and timely data for mission planning. OSALAT provides an intelligent search agent to find relevant documents; organize the results for easy review; supports gathering information from external sources; extracts information from the overall collection; displays findings in graphical and textual reports; and contributes to the dissemination of information. The comprehensive nature of OSALAT allows the automating of information analysts' business processes that are currently handled manually

Retrieval of documents does not guarantee useful data and useful intelligence may not be found in those documents. OSALAT extracts information from documents using several state-of-the-art processes and artificial intelligence algorithms to provide extraction capabilities that "learn from their own errors," supports identification of relationships between them and also collects this information on a case-wide basis. Through these capabilities, OSALAT provides cross-document intelligence gathering, which is being used extensively by the U.S. Army today. The company has been selected as one of the 50 fastest growing small businesses in Austin, TX, four years in a row.

- NSC worked for a long time to develop a flavorful and nutritional high energy bar for the troops. The result was the "HooAH!" bar. Based on an invention at Natick and through a CRADA with MGM Mars, inc., the HooAH! Bar is now readily available to both the troops and the civilian population. The military uses it for troops engaged in high-stress situations where a lot of energy is consumed. The civilian version is manufactured by D'Andrea Brothers, LLC under license from



Natick. Christian D'Andrea said that many products on the shelf today originated in military labs, but this is the first that has retained its roots for commercial packaging.

“When we formulated it for energy, we wanted to provide a quick increase in blood glucose and then a slow release of energy,” said Jack Briggs, Natick senior food technologist. This is accomplished with a combination of simple sugars, complex carbohydrates and just as important, fat.

The HooAH! bar has been shown to provide long-lasting, sustained energy for improved warfighter performance. “In field tests with Army Rangers, it produced a 17% increase in physical endurance... enables warfighters to think faster, move quicker, and run farther [when compared to other energy bars],” said Gerry Dasch, Director, Combat Feeding Directorate, Army Solder Systems Center.

The military operational requirements for ration storage of three years at 80 degrees or six month at 100 degrees presents a challenge not faced by other nutrition bars. It's another practical reason for a higher fat content and why commercial bars become hard as a rock over time.

Taste testers have said that unlike other energy bars in the market, the HooAH! bar does not have a “cardboard” taste. HooAH! bars are available in five flavors for the military (apple-cinnamon, chocolate, cran-raspberry, peanut butter and raspberry). In the civilian market, two flavors (apple-cinnamon and chocolate crisp) are now available in over 10,000 retail stores in the United States, including 7-Eleven and Wal-Mart. They are available for purchase online at www.hooahbar.com. In addition, it was voted “Most Loved Health and Personal Care Product of 2005” on Amazon.com.

6.1.2 Navy

- NSWC Dahlgren Division licensed a chemical agent detection technology to STR, Inc., a small business in Fredericksburg, VA. STR is the sole producer of the U.S. Navy's Shipboard Automatic Chemical Agent Detection and Alarm (ACADA) man-portable point detection system used to detect all classic nerve and blister agents as well as other chemical warfare agent vapors. The system is easily upgradeable for new and novel agents. They expect to commercialize the product as well as redesign the reprogrammable detection chip for future threat agents and toxic industrial chemicals for Government and commercial use.

- The Naval Sea Systems Command Carderock Division labs developed and licensed a new technology for processing plastic waste aboard ships. The plastic waste processor system helps the Navy meet the requirements for operating on international seaways, reduce shipboard operation costs, and protect the environment. The U.S. Navy is the world's leader in keeping the oceans clean and the plastic waste processor is the world's leading solution to treating plastics waste at sea.

Carderock licensed three U.S. patents covering the plastic waste processor technology and design to Universal Technologies, Inc. (UTI), of Estill Springs, Tennessee. This license makes the plastic waste processor available for commercial ocean-going vessels and will allow the fullest use of the plastic waste processor technology for both military and commercial purposes.

The plastic waste processor converts co-mingled, post-consumer plastic waste into a dense, sanitary disk suitable for long term storage. This includes lightly food-contaminated and clean plastic. The plastic waste processor is also designed to handle other material that may be combined with, or contain, plastic components that cannot be processed in the normal solid waste stream.

UTI has contracted to manufacture and deliver 14 plastic waste processors and their associated spare parts. The Dutch Navy has begun discussions with UTI about purchasing plastic waste processors. Since both military and commercial ships must abide by the regulations set by the International Convention for the Prevention of Pollution from Ships, there is extensive interest being shown by the cruise ship industry and the off-shore oil industry for use in remote, manned locations.

- The Naval Carderock lab has also signed a CRADA with the Florida Hydro Power and Light Company (FHPL), a start-up company that has designed and tested a new concept for a hydroelectric turbine. The CRADA calls for development and installation of an "Open Center Turbine for Gulf Stream Power Generation."

Tests from two prototype units have shown this system is capable of producing pollution free electricity at a cost lower than that of existing fossil fuel plants (coal, natural gas, fuel oil, etc.) using the current of the Florida Gulf Stream to power these units for generating electricity. As a Qualified Facility certified through the Federal Energy and Regulatory Commission, FHPL can produce and sell electricity to the wholesale markets within the State of Florida through the use of the Florida electricity grid. FHPL will manufacture the actual production units of these turbines that will be placed in the Gulf Stream.

Under this CRADA, the lab and FHPL will test and refine the design for FHPL's Open Center Turbine Unit. In order to achieve this goal, the overall system design from system generation to installation and electricity distribution will be

studied in an effort to maximize system performance, durability and production. After construction of the first production unit of this turbine, the Carderock lab and FHPL will deploy the turbine and mooring assembly in the Gulf Stream and connect the unit to the Florida power grid. Also, operational and maintenance processes for the system will be developed and implemented.

The lab has technical experts and unique test facilities that will allow timely and cost efficient refinement of the Open Center Turbine design and pre-deployment testing of installation concepts. Lab expertise in the areas of propeller and propulsor analysis, evaluation, design and fabrication, moored system design, development and installation as well as water tunnel and test basins are in place to perform the tasks needed for this development effort.

This CRADA offers a unique opportunity for the Navy lab and FHPL to **jointly participate in the development of a sea-based power generation system that is environmentally friendly, cost efficient, and infinitely renewable.** When deployed, the FHPL Open Center Turbine Units will offer our country a real opportunity to start a transition from its dependence on foreign supplied fossil fuels. Anticipation is that, for the first time in U.S. history, a renewable pollution-free source of electricity can be produced at a cost that is below all existing fossil fuel technologies. As an added benefit, this system will use renewable energy to produce hydrogen at a cost below the Department of Energy goal of \$2.00/kilogram. Achieving this goal will move the Nation closer to the production of pollution-free hydrogen powered cars and has the potential to further reduce our national dependence on foreign oil.

- The Navy Medical Research Center—San Diego developed a formulation for a pill that can prevent or reverse the effects of sensorineural hearing loss through a biological mechanism. This technology is licensed to the American Bio Health Group in San Diego and is marketed as “The Hearing Pill.”

Noise Induced Hearing Loss (NIHL) is currently one of the most common military disabilities. Hearing loss and the related subjective complaint of tinnitus rank as the number one and two Veterans Administration (VA) disorders, respectively, accounting for about \$450,000,000 in VA disability payments annually. NIHL is an operationally relevant disability that affects mission accomplishment and war fighter survivability. A substantial number of service members sustain such significant hearing loss by mid-career that they are forced to change their military specialty or involuntarily leave the service. This is costly to the military in terms of wasted training expenses involving both the physically disqualified members and their replacements and as it adversely affects retention. A mainstay of the current military hearing conservation program is the use of personal hearing protection devices (HPDs). These devices are generally effective but have inherent limitations. Such shortcomings include: the noise exceeding the protective limits of the device, problems in fitting the devices, unexpected short exposures to damaging noise, damaging acoustic energy transmitted directly

through the skull to the inner ear bypassing the HPDs and the combined and potentially synergistic damaging effects of noise plus toxins such as carbon monoxide and jet fuel fumes.

Histopathological damage to the ear by acoustic overexposure is often due to excessive oxidative stress and glutathione (GSH) depletion. Acoustic overstimulation is associated with the production of toxic free radical molecules and reactive oxygen species (ROS). This metabolic alteration may overwhelm the cochlea's antioxidant defenses depleting the key cochlear endogenous antioxidant GSH. This provides for the accumulation of ROS, which in turn leads to mitochondrial damage and eventually to the initiation of programmed cell death, also known as apoptosis. It is the accumulation of outer hair cell death that contributes to permanent threshold shifts and thus hearing loss. While acoustic overexposure can lead to mechanical disruption of delicate cochlear structures, various noise signature and intensities typical of the military environment are more apt to cause metabolic related cochlear damage. Representative noise signatures in this environment are continuous (i.e., jet engine noise), impulse (i.e., M-16 rifle fire) and kurtotic noise (i.e., complex noise similar to shipboard noise) which can all lead to permanent damage of the inner ear.

American Bio Health has obtained approval to market this as an over the counter (non-prescription) medication. This treatment has proven to be very effective in treating sound induced hearing loss in the Iraq and Afghan war zone as a result of improvised explosive device detonation.

- NRL licensed its Biosensor Technology to Seahawk Biosystems Corporation. Seahawk is currently developing a multi-use, multiplexed veterinary diagnostic system. This system is based on NRL's patented Bead Array Counter magnetic microarray technology combined with proprietary assay protocols that greatly reduce the incidence of false positives and false negatives. This unique and proven combination of technologies makes Seahawk's system more versatile, sensitive and specific than other veterinary diagnostic systems currently on the market. Moreover, the inherent simplicity of NRL's testing methods when integrated with magnetic microarray detection makes the system more compact and affordable than competing products.
- NRL licensed a smart probe that identifies underground minerals and contaminants with Austin AI, LLC. The technology has the potential to improve the way that mineral exploration, soil contaminant characterization, and petrochemical and chemical processing are done. Austin AI will take the NRL technology and develop the CP-1000 X-ray fluorescence cone penetrometer for commercial applications.

- NRL signed a licensing agreement with SoilWorks, LLC for a dust abatement technology that will make it safer for helicopters operating in dusty environments. In addition to its use of creating safe landing pads, the product may be used to abate dust around facilities such as field hospitals and around high value, critical equipment. It has many commercial applications as well, such as prevention of soil erosion, dust abatement at construction sites, and dirt road maintenance.

6.1.3 Air Force

- Scientists from the AFRL Materials and Manufacturing Directorate have invented, developed, patented and licensed a breakthrough medical technology, a Vein Viewing device that can be used to see beneath the skin and through body sections to show the vasculature, the network of blood veins in the body, in a broad range of lighting conditions. According to military medical personnel, the most pressing need on the battlefield is the ability to insert an intravenous needle into a wounded soldier to administer life-sustaining fluids or medication, especially during the first, most critical hour after the wound occurs. However, the prompt insertion of an IV can be difficult or nearly impossible under low ambient lighting or nighttime conditions. Conventional methods for finding a patient's veins rely on tactile and visual cues, a stab and guess process that requires available visible light to work. Experts in the medical imaging community struggled to discover an effective way to rapidly access veins in low light level conditions for several decades. Due to the technology's potential for a broad range of civilian medical uses, the lab established a CRADA with InfraRed Imaging Systems (IRIS) Inc., of Columbus, Ohio, to manufacture and market the technology. IRIS



has gone on to further develop the technology and create a product, the IRIS Vascular Viewer, for commercial release.

The vein viewer technology provides both the Air Force and the medical community with the solution to the need for a reliable and accurate method of viewing a patient's veins, rapidly and accurately in conditions where the lighting is less than optimal.

6.1.4 Missile Defense Agency

- Genex Technology: OmniEye™
Soldiers must search wells and caves for enemy combatants hiding themselves and their weapons. To make this job a little less dangerous, Genex Technologies, Inc., in partnership with Alion Science and Technology, developed two new products from its OmniEye™ 360° series of technologies: WellCam™ and Eyebot™.

The OmniEye WellCam was developed at the request of the U.S. Army Night Vision and Electronic Sensors Directorate in response to a critical requirement from REF. WellCam provides soldiers with a 360° image of a well without actually having to enter one; the image shows up on a laptop or personal digital assistant. OmniEye/WellCam costs less than \$1,000 in quantities. The 82nd Airborne uses OmniEye Wellcam cameras to search wells in Afghanistan for enemy combatants and caches of weapons.

Another product, EyeBot, or robot eyes, is incorporated into Alion's CaveDog – a robot that searches caves. EyeBot provides the CaveDog with a 360° field of view and the ability to zoom in on an object or person in both night and day vision. The EyeBot uses passive thermal and visible sensors for all day/night/weather operations, and it can also fuse the two images for improved detection of targets. Walls of caves are thermally neutral, so if a person is standing in a cave, his heat signature is going to stand out like a 1,000 watt light bulb.

The MDA Connection

MDA provided Genex with some of its first funding in 1996 to develop the omnidirectional 3-D imaging camera through the SBIR program for ballistic missile defense applications. Genex is now a world leader in 3-D imaging facial recognition and intelligent surveillance, with 10,000 square feet of laboratory space.

- Aura Systems: AuraGen®
Soldiers in the DoD Joint Communications Group operating in Iraq and Afghanistan are using AuraGen VIPER, a mobile under-hood induction power generator, developed by Aura Systems, Inc., for their electricity needs. The soldiers initially planned to use conventional generator systems, or gensets as their primary source of power, however, they were struggling with the disadvantages of this less advanced technology. Most conventional gensets require 30 minutes of preparation time to be started and should be shut down every 100 hours for scheduled routine maintenance. The soldiers needed something that could operate continuously whether they were moving or not, during down time or in combat.

The VIPER addresses these needs. It provides the soldiers with 60 Hertz of alternating current and/or direct current at all times. It also can operate in

engine-off silent mode and does not need scheduled routine maintenance. The soldiers ran the VIPER for 60 days nonstop in one operation and in another they ran it continuously for 40 days.

The MDA Connection

Aura Systems was funded to develop a test stand for the lightweight exoatmospheric projectile's (LEAP's) high response thrusters for ballistic missile defense from 1988 to 1991. As part of this effort, the company developed high-fidelity actuators that are central to their AuraGen product line. VIPER is a ruggedized version of AuraGen.

6.2 FY 2005 Highlights

6.2.1 Army

- TATRC has initiated a CRADA and patent license agreement with Doctors Business Services, (DBS), a small California company, for further development and commercialization of TATRC's Battlefield Medical Information System—Tactical (BMIS-T). DBS is interested in developing and commercializing products to be used as a major component in the management of electronic medical records in physician offices of less than 20 in group practice and to the extent private physicians provide care in acute and non-acute settings. The agreement provides for a non-exclusive license to DBS to develop the licensed products. The CRADA component of the agreement provides for material transfer and commercial development between TATRC and DBS as it relates to the BMIST.
- WRAIR Program for Appropriate Technology in Health (PATH) executed a CRADA with Glaxo Smith Kline (GSK) concerning further development of a multi-component malaria vaccine. This CRADA allowed WRAIR to develop and evaluate a new malaria antigen called Liver Stage Antigen (LSA-1) for which there were limited research funds, preventing development of a new vaccine candidate. Under this CRADA, WRAIR committed resources in FY 2005 to develop the antigen to a stage where it could be evaluated in Phase I clinical trials. Once the toxicology data for LSA are evaluated by the FDA (expected to be completed by December 2005) and receives an Investigational New Drug status, it will be evaluated in a Phase I clinical trial. At this time PATH has committed to providing additional resources for the clinical trial and GSK will provide their proprietary adjuvants for the trial. This CRADA has fast-tracked the development of this antigen as a vaccine candidate. The goal at WRAIR is to develop a multi-component vaccine that will protect the warfighter against malaria. However, to achieve this, each antigen must be tested separately prior to developing a multi-component vaccine. The addition of LSA to the list of RTS-S and MSP (two antigens already tested) brings the Army closer to a multi-component vaccine.

In another area of WRAIR technology, Chemicon International, a serological company, is selling several cell lines that were developed during the 1980s at

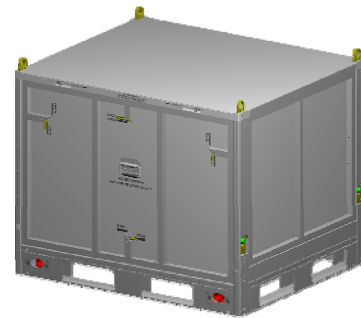
WRAIR. In the 1980's, cell lines were generally not patented. WRAIR provided the cell lines to ATTC (American Tissue Type Culture). Chemicon obtained the cell lines from ATTC. ATTC policy is to notify the depositor (here WRAIR) when deposited cell lines are used commercially. These commercially produced cell lines produce antibodies to Dengue I, II, III and dengue complex. The commercial sale of these products is providing a small royalty stream to WRAIR.

WRAIR has also licensed under a CRADA with CELLABS PTY, a technology for a new diagnostic product for detecting leishmania, a parasitic disease spread by sandflies that is common in the Middle East and a hazard for our troops deployed in the region.

6.2.2 Navy

- NSWC – Indianhead Division (NSWC—IHDIV) works with the Johns Hopkins University (JHU) Entrepreneurship Program enabling students to conduct commercial market assessments of potentially promising lab technologies and inventions. One group of students assessed the patent for the Joint Modular Intermodel Container (JMIC), and found it has the potential to replace all the approximately 122 versions of DoD pallets.

Several of the students became convinced that they wanted to license this technology from the government. They formed their own company named Baltimore Shipping Technologies, incorporated in Maryland. They provided the ORTA representative with a completed Application for License, accompanied with a business plan for taking the technology through development to a product. Several fields of use for the technology were licensed.



This newly formed company has the backing of JHU as well as the technology management resources of the JHU Applied Physics Lab to guide them. This company has prototypes ready. The Army has recently published two Requests for Proposals for JMIC technology, and Baltimore Technologies has submitted proposals for these defense-related requests. The local economic development organization in southern Maryland is also helping this company find manufacturing space at minimal cost. In addition, Baltimore Shipping has entered into a CRADA with the lab to further investigate additional prototypes for the JMIC.

- The Naval Institute for Dental and Biomedical Research (NIDBR) developed a new dental dressing that can be used by medical corpsmen to treat troops in the field. About 1/5 of all unscheduled health visits can be due to dental problems. These problems can run the gamut from gum infections and lost or fractured fillings to oral-facial trauma. Nearly half of the emergency dental visits, however, are related to fractured teeth, lost dental restorations (fillings), and loose crowns and bridges. In order to treat these simpler problems, dental officers and

healthcare workers must have a durable easy-to-mix dressing material that can be placed in a thin layer over exposed, sensitive tooth surfaces. Equally important for field use is that the material be provided in a package that is convenient to carry and simple enough to be used by nondental technicians.

NIDBR scientists developed an innovative, self-adhesive, fluoride-releasing material consisting of a powder and a liquid that change color as they are mixed to let the user determine when they have been thoroughly mixed. In order to maximize the material's user friendliness, NIDBR realized that the material would have to be properly packaged and executed a CRADA with Ultradent Products, a major dental product manufacturer in South Jordan, Utah. NIDBR and Ultradent collaborated to design and produce a special mixing and dispensing package that consists of two joined disposable syringes. Importantly for the military, the two-syringe design enables non-dental medical personnel in field conditions to consistently mix the proper amounts of powder and liquid and directly place the mixed material into the patient's mouth. The packaging system is now in the final stages of testing prior to nationwide marketing. It is anticipated that the new product will extend the availability of care by allowing independent duty corpsmen to treat simple dental problems quickly and dependably, enabling troops to return to their units and accomplish the mission. The product has great commercial potential for use in remote areas and third world countries where dental care may not be readily available.

6.2.3 *Air Force*

- AFRL Human Effectiveness Directorate's Technology Transfer Office took advantage of a unique opportunity to prove that technology transfer can truly facilitate transition of technology products to the war fighter that also have tremendous potential for commercial applications. Currently, most AF pilots are required to wear passive hearing protection (foam earplugs) while operating aircraft. This presents an inherent problem since these operators and their ground crews must also be able to hear communications. A CRADA was signed between the lab and Westone Laboratories, Inc., a company that provides products to musicians and performers. This CRADA enabled AFRL and Westone to better exploit their available resources, to share their technical knowledge and intellectual property, and to speed up the process of transferring the end product to the commercial market. The resulting product was the ACCES®, a unique technological achievement that stands poised to revolutionize hearing protection and communications in high-noise environments, improves flight line safety and drastically reduces taxpayer-supported medical expenses for treating noise-induced hearing injuries. Integrating specialized electronics and a voice communications cable into a custom-molded earpiece allows the ACCES technology user to receive clear communications while simultaneously protecting the ear from damaging audio frequencies.

Disabilities of the auditory system (hearing loss and tinnitus, or ringing in the ears) were the 3rd most common VA disability, representing 10% of total

disabilities in 2003; and the 2004 annualized VA costs were \$660 million for hearing loss and \$190 million for tinnitus. Since 1977, the VA has spent more than \$6.7 billion treating hearing-loss injuries.

This is a landmark example of technology transfer facilitating transition of products to the warfighter. Typically, the military technology transition and procurement processes involves months of paperwork but the ACCES program utilized the General Services Administration (GSA) listing and recognized the final product as a “commercial off-the-shelf” item, to speed availability to the warfighter. The ACCES program leveraged a commercial industry for transition to a military application and the value-added technology is now being transferred to other commercial applications. Examples of commercial uses in industries that have high noise environment include motor sports, industrial assembly environments, first responders and the commercial airline industry. ACCES has achieved all of a program manager’s “dream items” — rapid technology development and delivery, technology transition and transfer, partnering with private industry, improving warfighter effectiveness and safety. Now that Westone Laboratories, Inc. has received a GSA schedule contract, the technology is readily available to all government organizations via the GSA Advantage website.

- The AFRL Propulsion Directorate installed a Superconducting Wire Production System at the lab. A state-of-the-art, reel-to-reel Metal Organic Chemical Vapor Deposition (MOCVD) system recently delivered to the Propulsion Directorate’s Superconductivity Group is now operational. This system was developed by Structured Materials Industries, Inc., under a Missile Defense Agency (MDA) Small Business Innovation Research (SBIR) Phase II award for multi-kilometer length superconducting wire production. MOCVD is one of the two predominant fabrication methods chosen by industry for economic scaled-up fabrication of long length, high temperature superconducting (HTS) wire. The system will allow the Air Force to provide CRADA support to industry in the development and optimization of a MOCVD process for continuous production of HTS wire. This capability will also allow for the Superconductivity Group to investigate various means of increasing the current carrying capacity of HTS by producing thicker films of high quality and transitioning the group’s groundbreaking research in the area of magnetic flux pinning to MOCVD processing. Furthermore, the system will provide the Air Force the ability to create long length HTS wire, allowing coil testing to proceed. Such work is essential for the development of power generation systems capable of supporting new technologies such as directed energy weapons, more electric aircraft and active denial.
- An AFRL Sensors Directorate team developed a microwave radar that provides the capability of bird hazard detection and warning in the vicinity of civilian and military airfields during the critical takeoff, climb, and approach to landing phases of flight. Currently the BIRDAR is being tested by the Federal Aviation Administration.

6.2.4 Other Defense Agencies / Field Activities

- USUHS continues to achieve outstanding results in its technology transfer program. Its patent licensing program provided about $\frac{2}{3}$ of DoD's license revenue for the fiscal year. In addition USUHS has a CRADA and licensing agreement for a phototherapy technology that involves the use of light to promote regeneration of nerves and functional recovery of limbs that offers promise for improving prospects for recovery after spinal cord injury. USUHS faculty members in the Department of Radiology have developed a medical image storage and retrieval system that includes a database nationally linked to tables that include a list of diseases and captioned medical images. The system allows for peer review, remote access and maintenance of stored data, query searches and retrieval of related image text files. The system facilitates both distance learning and remote consultation and has been licensed to a large medical educational association.
- The Defense Microelectronics Activity (DMEA) mission focuses on developing, and providing solutions for microelectronics problems which affect all DoD weapon systems. To accomplish its mission, DMEA's charter allows it to serve as a joint resource, which bridges, and taps into, the capabilities of the DoD, other government agencies, industry, and even foreign allies. Microelectronics knowledge, and the use of critical semiconductor processes, were required to allow DMEA to establish a new adaptable foundry capability for the DoD, one which utilizes industry processes to effectively resolve DoD microelectronics issues as they emerge.

To accomplish its mission DMEA works closely with U.S. industry partners and establishes Government-held process licenses, to transfer the industry-developed IP and technology, into DMEA, for DoD purposes. The licenses are structured to ensure that there are no commercial conflicts, by empowering DMEA to engage in prototyping and low volume production activities, which are of great benefit to the DoD but are typically not profitable for industry. On the other hand, the agreements ensure that industry maintains the ability to perform the high volume production runs that are profitable for them.

Another critical element required to make this new business approach work effectively is convincing industry partners that their valuable IP and technologies can be adequately protected. DMEA's status as a small, organizationally independent DoD Field Activity, its demonstrated ability to protect classified and sensitive information, and the use of mutually agreed to and narrowly focused proprietary agreements, provides the basis for the IP transfer.

This strategic and cooperative approach allows DMEA to serve as a "spin-on" laboratory for industry-developed IP and technologies by acquiring, installing, and applying them towards meeting the DoD's immediate and long-term needs.

- Renoir® is a key patent and product at NSA and probably one of the most successful. It is a general-purpose desktop program for manipulating and visualizing networks. Renoir is written in Java™ to run on any platform that supports the Java Virtual Machine. Through a well-developed GUI, users can manipulate, analyze, and picture graphs. The program is very general, and applicable to visualizing any information expressing associations. Renoir creates visual and graphical relationships out of information which a user can convert into useful knowledge.

Renoir offers a variety of both automated and manual layout operations for conveying information. It provides user control of node icons, node color, node labeling, link colors, link styles, link labeling, and a host of other preferences. Graphical elements can have any number of attributes of varying types, including text, numbers, sound, and pictures. Attributes may be local or reside on other computers or in databases. Renoir offers unique capabilities to abstract the graph particularly when the graph gets complex, presenting simplified diagrams with details, which can be expanded and/or contracted real-time.

- NetTop® is the result of a significant and continuing research effort at NSA to create a user workstation computing architecture based primarily on commercial off-the-shelf (COTS) technology that can function seamlessly under varying levels of information assurance requirements while still presenting an easy-to-use interface, and managed COTS environment. The NetTop architecture reduces the physical and environmental footprint issues typically encountered in high-level information assurance solutions.

NetTop incorporates typical COTS user hardware and software found in most offices, schools, and homes. This technology is then combined with an underlying host operating system, virtual machine monitor, virtual network hubs, network encryptors, and a filtering router that allows multiple machine environments to run simultaneously and to access multiple networks all from the same physical platform.

There are numerous industrial applications for a single workstation that can be used to simultaneously access multiple networks differing in sensitivity levels. Industrial applications also include alternative methods from firewalls for providing information protection, and protected remote access solutions for telecommuting. NetTop inventors/engineers of this technology will soon be engaged in a CRADA with one of the NetTop vendors. NetTop currently has three registered trademarks which will be used to further leverage both the technology and the technology transfer program. It is currently certified NSTISSP 11, by NSA's director of Information Assurance, which is a policy that governs the acquisition of Information Assurance and Information Technology products.

- The National Geospatial-Intelligence Agency (NGA), through a CRADA with Research Systems, Inc. (RSI), has been able to expand the capabilities for processing and exploiting spectral imagery. RSI is the COTS provider of the software tool Environment for Visualizing Images (ENVI) and the programming language/data analysis tool Interactive Data Language (IDL). NGA has facilitated the technology insertion of atmospheric correction software (ENVI FLAASH) for multispectral applications and working with RSI on improvements for multiple ENVI and IDL geospatial functions. These enhancements contribute to improved workflows for geospatial analysts and image/spectral scientists for both civilian and military applications.
- NGA has a longstanding CRADA with the Environmental Systems Research Institute (ESRI) to develop standards based Geographic Information System (GIS) production tools that enhance production processes and software used to create NGA digital geospatial data and paper maps. The CRADA provides ESRI-sponsored GIS training to NGA College instructors that enhances the knowledge base of geospatial analysts using their products and also allows a rotational exchange of ESRI and NGA employees to work respectively on-site at participant facilities. Lastly, the CRADA focuses on developing standards based quality assurance software tools on the International Standards Organization (ISO) Data Quality Standards for improving the suite for ESRI software used in NGA production processes as well as the private sector. Improved compliance with ISO standards for Data Quality Principles, Procedures, and Measures enhances NGA and commercial GIS production tools and improves NGA and commercial digital geospatial data and paper maps.

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B. Independent Research and Development Program



IR&D is R&D initiated and conducted by defense contractors independent of DoD control and without direct DoD funding. IR&D includes: basic research, applied research, technology development, and, systems and concept formulation studies. IR&D does not include R&D performed under a grant or a contract from the Government, and does not include technical effort to support bid or proposal activities. DoD Components are required to consider work and accomplishments of contractor IR&D program when planning, programming and budgeting for DoD-funded R&D. DoD policy encourages contractors to undertake IR&D activities that may further national security in a broad sense, may lead to a superior military capability, or may lower the cost and time required for providing that capability. IR&D costs are recognized as necessary for doing business, particularly in a high-technology environment, and are recoverable as "indirect expenses" on contracts covered by DoD cost accounting standards (CAS). Policy on IR&D can be found in 10 USC § 2372 and DoD Directive 3204.1.

Major Defense contractors continue to spend about \$3 billion annually on IR&D activities. About half of this amount is recovered from DoD as an indirect expense on contracts subject to CAS. Summaries of contractor IR&D projects are voluntarily submitted to DoD and included in the IR&D database. Changes to IR&D law in the early 1990s caused a major change in DoD's visibility of contractor IR&D. Prior to these changes, major defense contractors were required to submit IR&D plans for DoD review and approval, and ceilings were established on the amount of IR&D costs each contractor could recover as indirect expenses under defense contracts. The current IR&D law, enacted in 1991, phased out the DoD approval requirement and the reimbursement ceilings. While applauding these changes, some contractors have expressed concerns about decreased feedback on their IR&D activities from the Military departments. While contractors are no longer required to report IR&D plans and accomplishments to DoD, many continue to advertise their technical capabilities to potential DoD customers. A number of major contractors provide information to DoD about their IR&D activities through technical interchange meetings with DoD representatives and with IR&D project descriptions submitted to the Defense Technical Information Center (DTIC) for inclusion in the IR&D Database. DoD influences IR&D decision making by providing contractors with information about DoD-funded R&D and defense technological needs through documents, conferences, and meetings. DTIC collects and maintains thousands of IR&D project summaries submitted by defense contractors in a restricted-access database. The IR&D Database can be accessed by registered DoD users over a secure internet link and is used to identify technological capabilities applicable to defense needs which have been developed by contractors, and to avoid duplication of contractor IR&D activities by R&D funded directly by DoD.

During the past two years, DoD initiated a number of efforts to both increase IR&D database use by the DoD S&T community and IR&D reporting value for contractors. A new IR&D information "push" system was developed and implemented, IR&D exhibits

were set up at several technical conferences, numerous IR&D Program briefings were made at DoD and contractor events, and an IR&D “Study Group”, consisting of DoD and contractor representatives, was convened to evaluate IR&D Program accomplishments and directions. The new IR&D “Push” capability provides IR&D database users with the ability to create, modify and schedule IR&D database searches. The saved searches are run on a user-defined, recurring basis, providing registered IR&D database users automatic updates about recent IR&D database accessions. IR&D data were also fully included in the Defense Technology Search (DTS), a search engine embedded in the new Director, Defense Research & Engineering “Research & Engineering Portal”. During the coming year, the DoD IR&D program will continue to focus on educating DoD scientists and engineers about the availability of, and policy-based need to search, IR&D data. The program will also work to improve methods of communicating DoD’s technology needs to industry.

C. Technology Transition Initiative



The Technology Transition Initiative (TTI), established in the FY 2003 Defense Authorization Act, under Title 10 USC 2359a, provides a process to identify the most promising mature lab technologies and bridges the funding gap that often exist between the time such a technology is demonstrated and when funding can be programmed to transition it into an acquisition program of record, leading to procurement/sustainment in an intended weapon or support system. This gap, where many technologies become obsolete and projects are cancelled, has been termed the “Valley of Death”. TTI is able to bridge the Valley of Death by providing a process whereby the most deserving projects receive funding and are able to transition into programs of record or acquisition vehicles. Objectives of the Initiative include accelerating the introduction of new technologies into operational capabilities for the Armed Forces and successfully demonstrating new technologies in relevant environments. TTI directly addresses the challenge of moving a maturing capability out of the S&T laboratory environment and into an acquisition program of record or contract vehicle. This helps ensure that promising technologies that can improve military capabilities and maintain our forces’ technology edge can be fielded before they become obsolete, or before their force multiplier effects are diminished.

TTI projects are selected by the Technology Transition Manager in consultation with members of the Technology Transition Council (TTC), comprised of the Acquisition and S&T executives from each Service and Defense Agency and representatives from the Joint Requirements Oversight Council. An annual call for TTI proposals is distributed to the DoD Services and Agencies through the Technology Transition Working Group (TTWG), consisting of senior representatives designated by the TTC members. The TTWG’s purpose is to assist the Council in carrying out its function: to research, identify and recommend mature technologies that meet the requirements of TTI. The TTWG has been successful in this endeavor. It also has identified lessons learned and recommended process improvements to strengthen the TTI program. Each TTWG representative receives proposals from his/her Service/Defense Agency S&T base, evaluates them against standard criteria, prioritizes them based on Joint, Service or Agency capabilities needed and submits them to the OSD TTI Program Manager (PM). The Technology Manager’s senior staff consolidates the proposal submissions, evaluates the Service/Agency recommendations, compares with available resources, and prepares a recommended list to the Technology Transition Manager for funding. The Technology Transition Manager, in coordination with the TTC, selects the highest value proposals for funding, factoring in both Service/Agency priorities and the results from the OSD staff evaluation. Additional details regarding the TTI program including the proposal template, evaluation criteria and points of contact are available at <http://www.acq.osd.mil/ott/tti>.

TTI has funded 32 projects through FY 2005. Several technologies have successfully transitioned into operational capabilities. Three examples are provided below:

Advanced Lightweight Ceramic-Based Armor

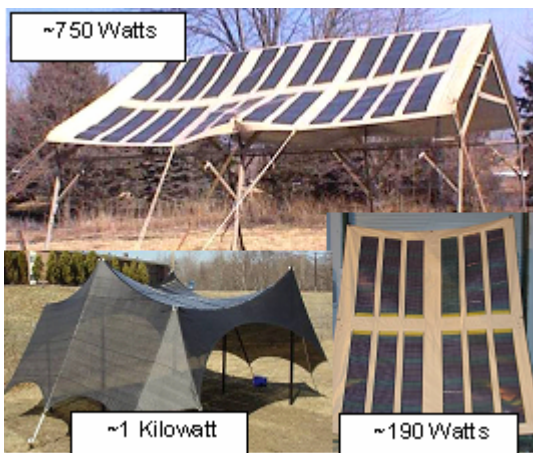
The availability of lightweight modern Small Arms Protective Insert (SAPI) body armor has been a critical issue in the Iraqi battle theater. The Air Force and Navy in-house R&D programs working in collaboration with Excera Materials Group of Columbus, Ohio (via Phase I and II SBIR's) have developed a novel ceramic strike face material for use in armor systems. The material has been used in conjunction with traditional polymer-based backing and has passed first article testing by the Army PM. Furthermore, the Army has issued purchase orders for ceramic strike faces that contain the first generation of these materials. Excera has developed a robust manufacturing process concurrently with the material. As a result they have a lightweight, high ballistic performance system that has several manufacturing advantages over traditional armor ceramics. Specifically, the material has a lower manufacturing cost and is easily shaped to meet complex human or vehicle contours. This TTI project will allow for wider availability of this material across the various Agencies and increase its range of capability (i.e., increased ballistic threats) and application (i.e., advanced personnel, vehicle, etc.). It is estimated to accelerate transition 24 months sooner than originally planned.



1LT Todd Turner shown with the SAPI body armor.

Lightweight and Conformal Photovoltaic Solutions for the Special Operations Forces (SOF) Warrior

The photovoltaic (PV) technologies being offered through the U. S. Army's Natick Soldier Center (NSC) will provide our SOF operators with unique power generating PV textile systems that are lightweight, conformable, versatile and stealthy for renewable power and potential electronics integration into Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance systems and mobile/fixed site systems currently used by SOF forces. Lightweight and conformal PV systems can be integrated into SOF Warrior Systems where many surfaces could be utilized as areas for power generation. These SOF PV systems could include, but are not limited to; unattended ground



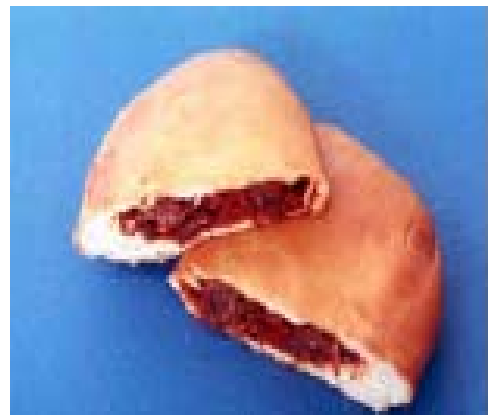
sensors, tags, command and control equipment (handheld radios), weapons sights, unmanned ground and aerial vehicles, shelter overheads, portable mats, manned ground and maritime platforms, etc. As such, flexible PV technology offers the SOF operator an unsurpassed versatility for use as a direct energy source and/or battery recharging (hybrid systems) to complement legacy generator and battery systems. This FY 2005 TTI project is focused on three prototype / initial production PV devices for lightweight and renewable power generation using two different PV technologies (developed under Phase I and II SBIR Projects with Iowa Thin Film - Amorphous Silicon and Konarka Technologies - Dye Nanocomposites). The three PV units include: AA battery rechargers (mini-pocket size and rollable portable solar panels) and two variations on conformal PV's applicable to camouflage-patterned, irregularly shaped objects.

Accelerated Transition of Shelf Stable Sandwich

Advanced development prototype shelf-stable sandwiches pioneered by NSC incorporate novel processing, packaging, stabilization and preservation technologies. These prototype sandwiches will form the cornerstone of new items for the Meal-Ready-to-Eat and future operational rations such as First Strike Ration. These sandwiches include barbecue chicken, barbecue beef, Italian pocket (pepperoni & sausage in tomato sauce), pepperoni, peanut butter & jelly, and nacho cheese flavored beef varieties.

These sandwiches are developed using hurdle technologies that utilize a series of processing barriers to inhibit the growth of organisms (bacteria, yeast and mold). This concept for eat-out-of-hand items directly supports Army doctrine and implementation of the Army's

Future Force designed to be strategically responsive and agile for rapid mission tailoring, crisis response, stability and support operations, and extended regional engagement. Individual soldier survivability, sustainability, and combat effectiveness is the centerpiece for transforming the Army of the 21st Century to ensure a soldier centric Future Force. The insertion of TTI Program funding will accelerate transition to production by an estimated 8-12 months.



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D. DoD Manufacturing Technology Program



The DoD ManTech Program develops and matures key manufacturing processes to accelerate technology improvements in the acquisition and sustainment of DoD weapon systems and components. Ensuring that technology is affordable and producible remains imperative to make our forces more agile, deployable, sustainable, lethal, and dominant anywhere in the world. The Program addresses process technology issues early in the design process, in development, in production, and into

sustainment. ManTech investments enable industry to develop and provide defense-essential, affordable, low-risk manufacturing processes that effectively transition technology into new and existing equipment for the warfighter. Teaming with industry, ManTech provides the crucial links from technology invention to production of defense-critical needs that are beyond the normal investment risk of industry. ManTech improvements generally translate into affordability improvements or cycle time reduction. However, investments also focus on developing “new” capabilities that actually may result in a more expensive component, but will provide dividends in system performance or life cycle cost that far outweigh the initial cost. The Program is structured around three major thrust areas:

- *Processing and Fabrication* activities develop affordable, robust processes and capabilities for metals, composites, electronics, and energetic and munitions critical to defense applications over the full life cycle. These projects create improvements to manufacturing processes on the shop floor and in repair and maintenance facilities (depots, logistics centers, and shipyards).
- *Advanced Manufacturing Enterprise* activities accelerate defense industrial enterprise progress toward implementation of world-class industrial practices as well as advanced design and information systems that support weapon system development, production, and sustainment.
- *Sustainment* projects coordinate common DoD requirements for maintenance, repair and overhaul technologies and advancements to affordably facilitate the use of current weapon systems far beyond their intended operational life.

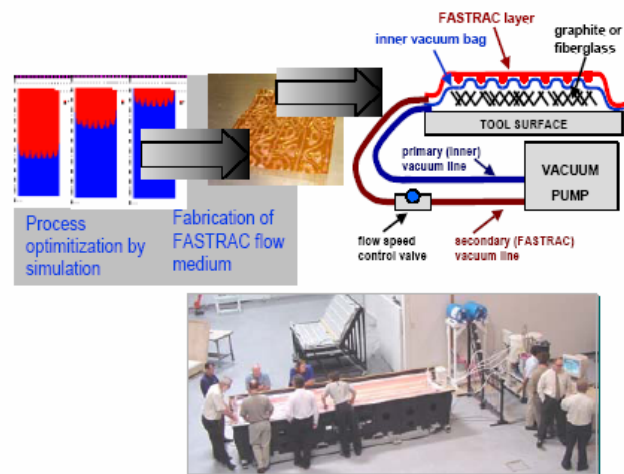
Although the requirement to submit a five-year plan for the ManTech Program has been repealed with the deletion of 10 U.S.C. Section 2521(e), the Department continues to monitor the status of transition and implementation. The most recent investment strategy is available on the Internet at: <http://www.dodmantech.com/pubs/pubs.shtml>.

ManTech Success Stories

Army

Knowledge & Process Tools for Manufacturing of Affordable Composites – Ground Vehicles Systems and Common Technologies

The Army is rapidly transforming into a lighter, more lethal “system of systems” and as such will require a new generation of materials (and combination of materials) to meet these unprecedented requirements. Polymer-based composite materials are key to enabling new levels of performance. Fast Remotely Actuated Channeling (FASTRAC) is a technology invented and patented by the Army Research Laboratory (ARL) that enables a mass-production of composite structures with a reduction in both waste and labor



compared to conventional Vacuum Assisted Resin Transfer Molding composite technology. COMPOSE software provides a powerful, user-friendly virtual environment to rapidly optimize resin impregnation of both thin and thick composite structures.

FASTRAC was demonstrated in an actual manufacturing operation in conjunction with United Defense LP of San Jose, CA, and AASC, Inc. of Stockton, CA. The demonstration was part of an integrated effort to produce structural armor modules using an array of ManTech sponsored technologies, including near-net performing, sensor-based computer controlled resin infusion, and near-net ceramic tile array placement. This project successfully demonstrated the ability to develop, implement, and operate a composite manufacturing cell with minimum labor and a high level of control over the process and the quality of the resulting product. This project has achieved a broad range of recognition, as well as awards for both the hardware and software developed under this program.

This technology has already demonstrated a 30-40% reduction in both labor and waste. The manufacturing cell technology has been identified as a critical element for scaling up Future Combat System composite material production. Sikorsky actively uses the COMPOSE process simulation environment developed under this program.

Participants:

- Sikorsky
- United Defense
- University of Delaware
- Solectria Inc.
- CoorsTek Inc.
- AASC, Inc
- Boeing.
- ARL
- TARDEC
- U.S. Army Armament Research Development & Engineering (RD&E) Center (ARDEC)
- U. S. Army Aviation and Missile RD&E Center (AMRDEC)

Navy

Cost Saving Flip-Chip Bumping Process for the F/A-18 AESA Radar

The goal of this project is to greatly increase the availability of Monolithic Microwave Integrated Circuit (MMIC) flip-chip devices for the F/A-18, DoD, and commercial applications while at the same time reducing the cost of the overall process. This includes transfer of the flip-chip bump process to commercial wafer fabrication houses for use by other DoD and commercial applications. Target programs include F/A-18, programs supported by radar technology insertion programs, other DoD communications programs, and commercial communications programs.

One of the main objectives is to transfer the flip chip bumping process from a prototype to production environment to directly support the F/A-18 LRIP AESA radar and realize cost savings by reducing touch labor and improving yields.

A new silver bumping process was developed specifically for MMIC flip-chips to reduce the radar size while maintaining heat transfer through “thermal” bumps. Process improvements include use of plating instead of evaporation and more uniform membrane deposition using sputtering equipment. A 7x reduction in touch labor has been realized which leads to less contamination and tighter process control. Pareto charts have been used to identify and correct the most common defects for improvement in die visual yield. The average cost per die has been reduced by 90% to \$37. Throughput has been increased (>3X) to provide volume for near-term production of targeted Navy aircraft.



F/A-18 AESA Radar using die with Flip Chip bumps

The transfer of the bumping process from the engineering development labs in El Segundo to the Raytheon Production Fabrication Facility in Andover, MA has been completed. The technology transfer of the key characteristics from the Raytheon foundry to TriQuint started in July 2003 and completed in May 2004. Bumped MMIC flip-chip devices are in the Transmit/Receive modules of the Active Electronically Scanned Array Radar used in operational and deployed F/A-18 E/F Aircraft.

The reduced size of the radar components has improved space and weight requirements in the F/A-18 by 60%. The increased throughput of a production fab line and transfer to the commercial fab houses will provide the needed volume for F/A-18 production. The reduction in cost for flip-chip devices utilizing this new bump technique will result in a projected cost savings of \$220 per channel over 42 systems for a total of \$24.7M. Thermal shock reliability testing of bumped MMICs received from Raytheon and TriQuint are complete. All devices passed lifetime requirements supporting the robustness of the silver bumping process.

Participants:

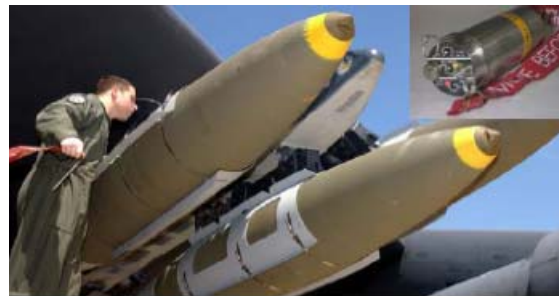
- COE EMPF
- TriQuint Semiconductor, Richardson, TX
- Raytheon RF Components, Andover, MA
- Raytheon SAS, El Segundo, CA
- PMA-265 F/A-18 Program Office

Air Force

ManTech Cooperative Venture Transitions Joint Programmable Fuze

Prior to ManTech involvement, workmanship defects led to three consecutive unsuccessful attempts by the supplier to pass AF First Article Acceptance Test for the initial production of the Joint Programmable Fuze (JPF), used in the Joint Direct Attack Munition (JDAM). Operators built assemblies using engineering documentation prior to the implementation of visual work instructions. These consisted of written instructions and a few black and white drawings. In a joint effort with Direct Attack System's Group, ManTech teamed with TechSolve to assist Kaman-Dayron to transition lean manufacturing improvements, including value stream mapping, the creation and implementation of VWI, and implementation of a Kanban (a just-in-time supply) system.

The AF ManTech team worked with the operators and manufacturing engineers to develop the standard work templates for 140 manufacturing process steps and identified and eliminated the root causes of all workmanship defects. Kaman-Dayron, the company under contract to produce the fuze, developed a solder map check-off sheet to show and identify each solder joint for inspection/validation. VWI and solder map sheets are credited with eliminating workmanship defects.



A Kanban system was implemented to trigger production subassemblies, level the demand, balance the production cells and establish a steady supply of raw material. A two-reel Kanban system was used to supply the surface mount technology machine. ManTech's successful intervention allowed Kaman-Dayron to pass the Air Force's first article acceptance test and ramp up production to more than 500 fuzes per month, enabling the Direct Attack Systems Group to begin delivery of this vital new fuze capability to the warfighter. Producing a JPF for the JDAM allows pilots to change fuze settings (delay, surface impact, and altitude burst fuze) in-flight (prior to weapon release) to respond to a wide variety of targets.

Participants:

- AF ManTech – Wright Patterson AFB, OH
- Direct Attacks Systems Group - Eglin AFB, FL
- TechSolve – Cincinnati, OH
- Kaman Dayron – Orlando, FL

Defense Manufacturing Technology Achievement Award

ODUSD (AS&C) and the Joint Defense Manufacturing Technology Panel (JDMTP) seek to recognize and honor those individuals most responsible for outstanding technical accomplishments in achieving the vision of the DoD ManTech Program. That vision is to "realize a responsive world-class manufacturing capability to affordably meet the warfighters' needs throughout the defense system life cycle." To this end the Defense Manufacturing Technology Achievement Award was established in the fall of 1999.

This annual award is made to individuals or teams from the government and/or private sector most responsible for a specific innovative manufacturing technology achievement demonstrating exceptional "jointness" and impacting one or more of the following: (a) rapid transition of defense-essential or defense-unique technologies; (b) affordability; (c) cycle time; (d) readiness; (e) best manufacturing practices; and/or (f) decoupling cost from volume. Nominated projects must have been funded by a ManTech program funded by the Services, the Defense Logistics Agency, MDA or the Defense Advanced Research Projects Agency, and completed/demonstrated in the fiscal year in which nominations were solicited.

Nominations for the annual award are made by the JDMTP subpanels. The "Selection Committee" consists of the five JDMTP principals, the ODUSD(S&T) ex-officio member of the JDMTP, and additional representatives from the Services if designated by the JDMTP Principals.

FY2004 Recipients:

Lean Depot Repair

Lean Depot Repair successes have triggered a major shift in how repair work is performed at the Warner Robins Air Logistics Center (WR-ALC). Lean practices have revolutionized Programmed Depot Maintenance lines for F-15 and C-5 aircraft, generating dramatic payback for the customer. Reduced cycle time and cost are the primary benefits, shifting critical warfighting assets out of maintenance and into fully operational status available for supporting global deployment requirements. For instance, a C-5, when mission-ready, can be deployed within 90 minutes to help project global power and global reach. Other benefits include:



- C-5 aircraft returned to the warfighter on time increased from 25% in FY 2000 to 100% in FY 2004.
- Average flow time for depot maintenance on C-5s for the Air Mobility Command was reduced from 339 days in FY 2000 to an average of 240 days in FY 2004, freeing up 3 aircraft, a significant portion of this small, but valuable fleet.
- On-time return of F-15 aircraft to the warfighter increased from 12% in FY 2000 to 80% in FY 2004.
- 22 additional F-15s were freed up - the equivalent of an additional squadron.

Upon viewing these achievements, WR-ALC has elected to extend Lean to its C-130 aircraft operations and to critical "non-factory" operations like pass-and-ID. WR-ALC cost avoidance, exceeding \$12 million in the first two years of Lean deployment, are traceable to overtime reductions and other efficiencies. Top WR-ALC leadership has vigorously embraced Lean and has adopted Lean deployment as one of their three top depot priorities. True teamwork among personnel from AF ManTech, WR-ALC, and Simpler Consulting has directly facilitated program success.

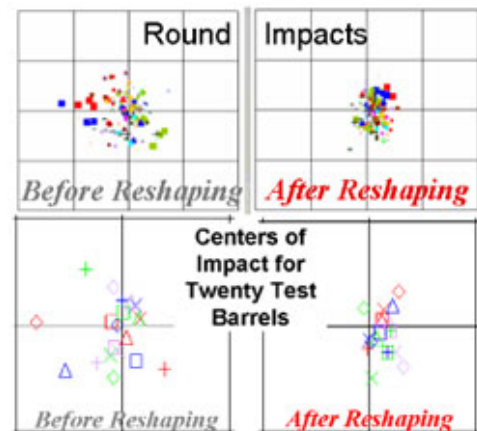
Lean depot practices are being expanded across the DoD, including Army arsenals and depots, Navy air depots, and shipyards.

Government / Industry Team Members:

Lee Alves - Simpler Consulting, Inc.
 Brenchley L. Boden II - Air Force Research Laboratory
 John Crabill - Air Force Research Laboratory
 Frances A. Duntz - HQ Air Force Materiel Command/XR
 Persis A. Elwood - Air Force Research Laboratory
 Laura Leising - Air Force Research Laboratory
 Team Robins - Warner Robins Air Logistics Center
 Debra K. Walker - HQ Air Force Materiel Command/Logistics

Uniform Cannon Tube Reshaping

The project goal was to establish an automated procedure (hardware and software) for consistently shaping new (production) tank gun barrels as well as reshaping fielded barrels to enable a 15-point improvement in the probability of hit on the first shot. Reshaping of twenty fleet-representative barrel centerlines resulted in a 20-fold tighter tolerance and a 65 percent reduction in impact dispersion across the fleet of tanks. The team has developed faster and more precise barrel straightness measurement equipment, with the design,



engineering, and fabrication of barrel reshaping machines scheduled for incorporation into the barrel manufacturing process at Watervliet Arsenal. Test firings indicate barrel reshaping will provide accuracy improvements that are unequaled in the past twenty years. All U.S. Army Abrams Tank units will benefit from planned implementation.

The tighter grouping of round impacts, as shown below, resulted in probability of hit increases ranging from 21 percent to 54 percent for the six common round types. The average reduction in tube-to-tube center of impact for the six common round types is over 50 percent.

Government / Industry Team Members:

Dr. Mark Bundy - Army Research Laboratory
Paul Durkin - Army Aberdeen Test Center
Thomas Erline (Retired) - Army Research Laboratory
James Garner - Army Research Laboratory
Robert Kaste - Army Research Laboratory
Terry Marrs - Army Aberdeen Test Center
Vincent Olmstead - Army Benet Laboratory
Albert Pomey - Directorate of Training, Doctrine & Combat Development, Fort Knox
Walter Roy - Army Research Laboratory
David Webb - Army Research Laboratory

FY2005 Recipients:

Large Aircraft Infrared Countermeasures

The Large Aircraft Infrared Counter Measures system, LAIRCM, protects large aircraft from infrared missile threats by automatically detecting a missile launch, determining if it is a threat, and activating a high-intensity directed beam laser countermeasure system to track and defeat the threat. LAIRCM uses a staring missile warning system to detect a missile launch. The system processor then directs a pointer-tracker that locks on to the missile in flight and jams the missile's guidance system with a beam of infrared laser energy. Large slow aircraft with high signatures flying at low altitudes are prime targets for MANPAD missiles and need the protection LAIRCM provides.



This ManTech project focused on two major components of the LAIRCM system: the Viper™ Laser and the Mini-Pointer Tracker (MPT) turret. The Viper™ laser provides energy on target to jam threat missiles. The MPT tracks the target and directs the laser beam in the proper direction.

The ManTech LAIRCM effort introduced manufacturability improvements dramatically improving production yield, increasing the production rate of Viper™ lasers from 2 per month to 15-20 per month. Design improvements also resulted in a 30% to 50% increase in laser power efficiency. Increased energy output contributes to threat jamming capability and greater aircraft survivability. Manufacturing improvements have led to reliability enhancements and a significant increase in mean time between failure.

The benefit of this effort to the warfighter was almost immediate. The project enabled the contractor to ramp up production one year ahead of schedule- in time for LAIRCM to protect C-17s and C-130s during Operation Iraqi Freedom. If just one aircraft has been protected from a threat missile just one time because of this project, the return on investment is immeasurable. However, measurable benefits include reduction in acquisition cost of more than 50%, so that it is financially feasible to acquire more LAIRCM systems and protect more aircraft. Reliability and reparability improvements also resulted in greater availability (less down-time) of the protected aircraft, resulting in an estimated \$1.2M to \$1.8M reduction in total ownership cost per aircraft.

LAIRCM units are already operational on Air Force and Special Operations Command (SOCOM) C-17, C-130, CV-22, and MH-53 aircraft. LAIRCM systems are or soon will be installed on more than 20 different fixed- and rotary-wing platforms across U.S. military services and several allied countries, including the United Kingdom, Australia and Denmark. The Department of Homeland Security is investing over \$45M to evaluate a Counter-MANPADS system based on the Viper™ laser and MPT turret for use on U.S. civilian airliners. Every one of these installations will benefit from the system and production improvements implemented under this ManTech effort.

Government / Industry Team Members:

Douglas K. Buse - Air Force Mobility System Wing / LAIRCM
Robert Copeland - Air Force Mobility System Wing / LAIRCM
John Gossett - Air Force Mobility System Wing / LAIRCM
Raymond J. Linville - Air Force Research Laboratory
Myron T. Maclin - USSOCOM Directed Infrared Countermeasures Project Office
Jason Reber - Air Force Research Laboratory
Scott Leonard - Northrop Grumman
James Lipscomb - Northrop Grumman
James Mocarski - Northrop Grumman
Mark Wunderlich - Air Force Sensors Directorate
Arthur Zabinski - Northrop Grumman

Large Marine Composite-to-Steel Adhesive Joints

The DD(X), the next generation destroyer, is the centerpiece to the transformation of the 21st century Navy. Reducing the weight of the ship, especially structures above the waterline, is critical. The composite deckhouse and helicopter hanger are key components that are helping DD(X) achieve operational requirements for improved performance, increased survivability, and low ownership cost. Composites are lightweight, strong, and are not susceptible to salt water corrosion. However, joining composites to steel is not easy, particularly for large marine structural joints. High quality, long life, low radar cross-section joints are needed, with adhesive bonds that provide load continuity. Current joining methods use mechanical fasteners that are expensive, have labor-intensive installation procedures, and result in high maintenance joints that can corrode from salt water. New joining techniques must be developed to maximize the benefits of composites for ships. Although composite-to-steel adhesive bonds have been successfully designed, manufactured, and tested for use in other industries, the technology has not been proven for shipbuilding because of the functional requirements, the marine environment, and the size of the structures to be bonded.



This ManTech project has developed cost-effective adhesive joining technology for the DD(X). The joint has been designed to carry both structural and combat loads between major composite and steel ship structures. The adhesive bonded joint has been demonstrated to be 40 percent lighter and 50 percent less expensive to produce than the existing bolted joint configuration. The new joint also improves the ship signature and requires less in-service maintenance.

The shipyards (Bath Iron Works and Northrop Grumman Ship Systems) have been active team members and participants in all aspects of the project since inception, and the project has been responsive to the Design Agent at every significant step of project execution. Full scale test articles were built at the shipyard under normal shipyard operating conditions to ensure that manufacture and implementation is fully within the capability of the shipyards and their manufacturing personnel. The bonded joint has been selected as the baseline for attachment of the composite deckhouse to steel hull. Engineering change activities are currently underway to incorporate the bonded joint into design drawings and manufacturing procedures for integration of the composite deckhouse to the DD(X) Flight I ship structure.

This project provides a new manufacturing capability that will have a profound impact on all future surface ship platforms where large composite structures are to be integrated with ship steel structure. The technology developed through this ManTech project will be the cornerstone for composite ship design for future generations of Navy ships.

The project team includes Naval Surface Warfare Center - Carderock, Bath Iron Works, Northrop Grumman Ship Systems, the Composites Manufacturing Technology Center of Excellence (South Carolina Research Authority), Penn State University Applied Research Lab, Boeing (Phantom Works), and the Navy Joining Center (Managed by Edison Welding Institute).

Government / Industry Team Members:

Raymond E. Bohlmann - The Boeing Company
Lawrence E. Brown - Edison Welding Institute - Navy Joining Center
Himat Garala - Naval Surface Warfare Center - Carderock Division
Dr. Kevin Koudela - Applied Research Lab/Penn State, Composite Materials Division
Terri Merdes - Applied Research Lab/Penn State, Composite Materials Division
Darlon H. Necaie - Northrop Grumman Ship Systems
Dr. George Ritter - Edison Welding Institute
Jeffrey Smith - Bath Iron Works, a General Dynamics Company
Ivan Snell - Composites Manufacturing Technology Center
John J. Sullivan - Northrop Grumman Ship Systems

E. Title III of the Defense Production Act



The Defense Production Act (DPA) (50 U.S.C. App. 2061 *et seq*) is the primary legislation for ensuring domestic availability of industrial resources and critical technology items that are essential for national defense. The Title III Program provides a vehicle to create, maintain, modernize, or expand domestic production capability for technology items, components, and resources essential for national defense and for which there is insufficient production capacity to meet these needs. A key objective of the Title III Program is to accelerate the transition of technologies from the R&D arena to affordable production and insertion into defense systems. The Title III stimulates investments in key production resources to increase the supply, improve the quality, and reduce the cost of advanced technology. It reduces U.S. dependency on foreign sources of supply for critical materials and technologies, and strengthens the economic and technological competitiveness of the U.S. defense industrial base.

The following Title III projects were active in calendar year 2005:

Beryllium Production – The project will ensure future supplies of high purity beryllium metal through a cost share program with private industry to build a new primary beryllium production facility. The current supply may be depleted in the near future when inventories of National Defense Stockpile beryllium ingots are projected to be exhausted. Imports of beryllium cannot meet the purity levels required for defense applications. Critical strategic applications, where there is no suitable substitute for beryllium include: airborne forward looking infrared systems for fighters and attack helicopters; guidance systems on existing strategic missiles; surveillance satellites; missile defense systems; and numerous others.

Flexible Aerogel Materials Supplier Initiative – This project is establishing an affordable domestic production capacity for flexible aerogel materials. Aerogels are nanoporous solids with up to 99% open porosity often called “frozen smoke.” Aerogel is the most thermally efficient material known. The nano-scale lattice and pores provide high performance with minimal weight and space. Military applications for high temperature thermal insulation include acoustic protection, infrared suppression and energy absorption. Many commercial applications for these same qualities are expected at lower temperatures. The project involves testing and qualification of the materials for potential applications and, eventually, a full scale, high volume production capacity.

Lithium Ion Battery Production – This project will establish a U.S.-owned domestic source for prismatic lithium-ion cells and batteries for space and missile systems. Lithium Ion (Li-Ion) rechargeable battery technology provides higher power for longer durations with lower weight and favorable space constraints when compared to Nickel Cadmium or Nickel Hydrogen rechargeable batteries. The Li-Ion battery offers the highest energy/power package of the developed batteries today. This technology offers designers a weight saving option when compared to other battery types for overall weapon systems performance. Additional advantages include better recharging capability with no memory effect and increased temperature operating ranges.

Military Lens System Fabrication & Assembly – The Title III Program is establishing a domestic production capacity for mono-spectral and advanced multi-spectral optical systems and lens components. It will develop a manufacturing capability for design, fabrication, finishing, coating, assembly, and testing of mono and multi-spectral night vision optical systems that can be integrated into military and commercial surveillance systems. Multi-spectral systems are shared-aperture systems that allow widely separated wavelength bands to be transmitted through a common aperture and share common elements in the optical train. They offer considerable advantages for the warfighter including weight and volume reduction by allowing the warfighter to carry fewer pieces of equipment, improved performance by allowing both bands to utilize the full aperture of the systems, and optimized system design for a larger set of operating conditions/environments.

Mini-Refrigerant Compressors for Man-Portable Cooling – This project is establishing a domestic production facility for mini-refrigerant compressors. Through Title III, a production facility will be built and facilitated with manufacturing, assembly and test equipment. Applications for personal cooling systems encompass aircrew cooling, soldier cooling (both dismounted and within ground vehicles), and personal protective equipment such as Explosive Ordnance Disposal and Chem/Bio-Hazard suits. Further, the compactness of these mini-compressors enables them to be installed within electronics cabinets to provide active cooling of components. This increases the performance, reliability, and life of mission-critical electronics systems in high temperature environments. The project will demonstrate capability for full, sustained production capacity plus improvement and optimization of production processes.

Radiation Hardened Electronics Capital Expansion – This project made substantial capital investments as part of an OSD initiative to establish a state-of-the-art production capability for advanced (0.15-micron) strategic radiation hardened (RH) devices using commercially available microelectronics equipment modified for RH production. This capability will provide substantially higher electronic operating speeds and will lower the power/size of electronics in space craft. The smaller size and higher performance made possible by the Title III Capital Expansion (CAPEX) project will generate highly leveraged savings for spacecraft in terms of size, weight, reliability, and launch costs. RH electronics enable spacecraft to operate in challenging radiation environments resulting from nuclear threats and exposure to long-term natural radiation. Several defense programs require strategic RH microelectronics. Without Title III support, these programs will have difficulty achieving system performance objectives and insertion schedules.

Radiation Hardened Cryogenic Readout Integrated Circuits — This project is establishing a viable, domestic foundry for commercial production of less than or equal to 0.35 micron, deep sub-micron Complementary Metal Oxide Semiconductor (CMOS) Radiation Hardened Cryogenic Readout Integrated Circuits (ROICs). RH cryogenic microelectronics is a critical technology employed in the manufacture of Focal Plane Arrays (FPAs) that are utilized in high altitude and space-based imaging and missile systems which must function in harsh natural or man-made radiation environments that are compounded by the cryogenic requirements of high altitude and space. RH cryogenics microelectronics process technology is used to manufacture read-out

integrated circuits, which are integral components of FPAs. The next generation imaging requirements of high altitude and space-based weapon systems are dependant on the availability of advanced ROICs that provide high density with analog components, smaller pixels (increased resolution), increased functionality (on-chip processing), lower power dissipation, lower noise, larger focal plane arrays (stitching technology), and better producibility (yield).

Radiation Hardened Microprocessors – This Title III project is scaling up production capacities for high performance RH microprocessors with a progression from radiation tolerant to radiation hardened. The much higher clock rates will lead to significant performance improvements. Other benefits include cost and weight savings for space systems. Higher performance means greater on-orbit processing capabilities and lower ground support requirements. As with the other Title III radiation hardening projects, these microprocessors will enable spacecraft to operate in the hostile radiation environments of nuclear threats and long-term natural radiation.

Rigid Polymer Materials – Title III is creating a capability to produce thermoplastic polymers with strength and stiffness characteristics that are significantly greater than other high performance thermoplastics. These materials offer tremendous benefits including transparency, toughness, resistance to fire and heat and resistance to solvents. Even small amounts of these polymers dramatically improve the strength of structural foams. They are processible by a variety of methods, including compression molding, injection molding and extrusion. Unlike most thermoplastics they are easily machined. They are currently being evaluated for selective laser scintering. Expected products include: mechanical components such as bearings and gears; transparent coatings and lightweight armor for personnel and vehicle protection; thermal protective applications such as missile components and thermal barriers. High purity forms of the products are being used in electronics manufacturing and medical devices. This project is focusing on cost reduction, the improvement and optimization of production processes and the testing and evaluation of the material.

Silicon Carbide Monolithic Microwave Integrated Circuit Devices – This project is establishing a domestic supplier of low cost, high performance silicon carbide (SiC) metal semiconductor field effect transistor MMICs that can satisfy military requirements for advanced radar systems. The project will also demonstrate improvements in the characteristics of 100mm SiC substrate and epitaxial materials and processes to enable high yield, high performance and reliable SiC MMICs that can be produced at an affordable cost. The project will develop and demonstrate substrates and epitaxial structures with defect densities commensurate with high yield production of high performance, reliable SiC MMICs.

Thermal Battery Production — The objectives of this Title III initiative are to establish, strengthen, and expand a domestic source for advanced thermal batteries. Military unique, high performance batteries are the only viable power source for many defense systems. MDA along with Service program offices have identified several high performance battery technologies for which there is insufficient availability or producibility to meet known and planned program requirements. These critical materials and technologies represent gaps that must be filled for the advanced systems to meet performance and production schedule goals. The DPA Title III Program is

incentivizing a domestic company to scale-up and expand production capacity. The applicability of these critical batteries to a wide variety of DoD weapons systems offers Army, Navy, and AF program offices the ability to substantially improve system performance.

Thin Silicon-on-Insulator Wafers – This project is establishing a domestic full-scale production capability for thin silicon-on-insulator (SOI) wafers. Thin Film SOI electronic wafers are critical materials that enable the fabrication of radiation-hard, ultra large scale digital devices such as microprocessors, application-specific integrated circuits and static random access memories. These radiation hard circuits fabricated with SOI materials are essential to defense systems, such as surveillance, communication and navigation satellites, ballistic missiles, surveillance systems, and inertial navigation systems. They provide a superior technology for sensitive ultra-low power space and, battery- powered applications due to reduced power requirements, increased device density, and faster device performance over circuits fabricated in bulk substrate technologies.

Yttrium Barium Copper Oxide High Temperature Superconductor — This Title III project will establish high volume, high quality, domestic production capacity for second-generation (2G) High Temperature Superconductor (HTS) coated conductor. The conductor, based on Yttrium Barium Copper Oxide (YBCO) material, will be a higher-performance, lower-cost replacement for first-generation HTS wire. YBCO 2G superconductor is an enabling technology for defense applications which require high electrical power, especially megawatts. These applications include Advanced Capability Electric Systems, Directed Energy Weapons, and motors, generators, transformers, primary power cabling, power converters, high field magnets (such as gyrotron magnets), etc. Ship propulsion motors employing YBCO 2G conductors can be $\frac{1}{4}$ the size and $\frac{1}{3}$ the weight of conventional systems (including cooling systems). Additional benefits include higher net efficiency, substantial power & fuel savings, and inherently quieter. Complete development of the technology will lead to transfer of the YBCO coated conductor into electric power applications such as transformers, transmission cables, motors, fault current limiters, and generators. The project will establish two domestic sources for YBCO coated conductor, making the benefits of second-generation HTS available 5-7 years earlier.

Success Story

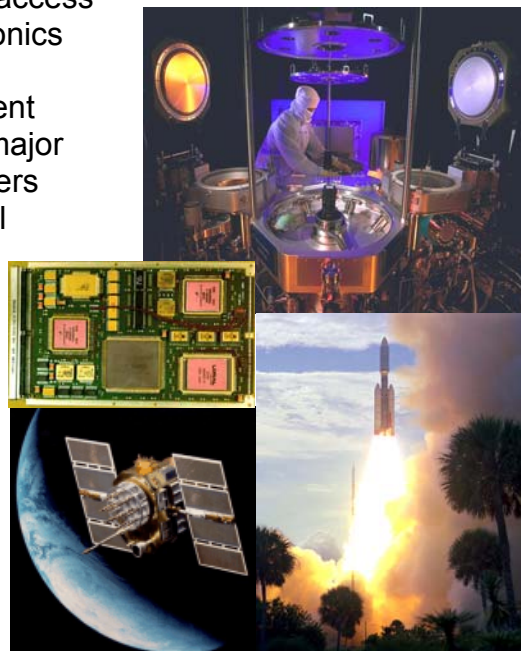
Accelerated Radiation Hardened Microelectronics Initiative

DoD requires RH microelectronics to ensure that key military systems, such as DoD Space and Missile Systems and Department of Energy (DOE) warhead maintenance programs, can perform in the combined nuclear and natural radiation environments expected during mission duration. The DoD had identified several programs that will require strategic RH microelectronics, so maintaining production capacity of these critical components in the United States was of vital national importance.

By the late 1990s, only two RH electronics manufacturers remained, BAE and Honeywell, and the DoD was in jeopardy of losing access to these capabilities. The Department's RH Electronics Oversight Council proposed the start of the RH Microelectronics Advanced Technology Development (RHMATD) program. The program called for two major elements: (1) modernization of the two manufacturers through CAPEX; and (2) development of the critical radiation hardening technology for 0.15 micron microelectronics as an S&T effort. The directive required: "...special emphasis on ensuring these components are available to DoD systems in the future..." and "...accelerate these capabilities to one generation behind commercial capabilities."

The Accelerated RH Microelectronics Initiative was identified by the Under Secretary of Defense for Acquisition, Technology & Logistics as an essential program to ensure the availability of strategic radiation-hardened microelectronics for national defense. This priority was formally communicated on 18 July 2001 in a memorandum issued to Service Acquisition Executives. The directive assigned overall responsibility for managing the Initiative to the Defense Threat Reduction Agency (DTRA) which was to work in partnership with the DPA Title III Program Office¹ who would support the capital expansion elements of the program.

Key program tasks included identification, procurement, installation, acceptance, and qualification of all necessary equipment to support DTRA's separately-managed,



¹ Title III of the DPA of 1950 provides the President with the authority to provide appropriate incentives to develop, maintain, modernize, and expand the productive capacities of domestic sources for critical components, critical technology items, and industrial resources essential for the execution of the national security strategy of the United States. These authorities have been delegated to the DoD to use to develop and maintain economically-viable suppliers for military-critical technologies. OSD, through ODUSD (AS&C) OTT, provides top-level management, direction, and oversight of the DPA Title III Program. The Air Force serves as executive agent for the Title III Program within the DoD. The Title III Program Office, located at WPAFB, Ohio, is a component of the Manufacturing Technology Division, Material and Manufacturing Directorate, AFRL. The Program Office structures and executes approved and funded projects for the Department.

manufacturing process S&T program and ultimately the key acquisition programs of the DoD. A key consideration was the ability of these domestic producers to remain financially competitive in order to assure, to the maximum extent possible, that they remain accessible to the military and its strategic systems providers well into the foreseeable future.

BAE Systems, Manassas, VA, and Honeywell, Plymouth, MN, were selected for the Title III contract awards in early 2002, (June and July, respectively). The BAE Systems Title III CAPEX effort was \$66 million; Honeywell's was \$97 million. Including the DTRA process development funding, BAE's total program was \$124.4M and Honeywell's \$152M. Both contractors completed their efforts in September and December 2005, respectively, and are producing devices for military customers at the 0.15-micron level. This brief statement of success conveys neither the importance of the accomplishment nor the scope of the effort involved in the success.

The American warfighter of today and tomorrow needs this technology. The warfighter's ability to communicate via satellite or launch a counterstrike after a nuclear weapons attack depends on rad hardened satellites and missile systems for robust, dependable navigation, communication, surveillance, and second strike capabilities, etc. The DoD depends on the U.S. industrial base to supply RH electronics, but state-of-the-art technology requires modern equipment and processes. The performance and assured survival of military satellite and missile systems require special RH microelectronics not available from the commercial market. The two leading (and remaining) domestic suppliers, BAE and Honeywell, were unable to make the required investments to modernize and develop the radiation hardening technology for the state-of-the-art microelectronics.

The long-standing Title III Program has a history of industrial investment and incentives to create, maintain, or expand production capacity for DoD. This project witnessed a number of "firsts" for Title III. It was the first project to exercise Title III authorities to purchase equipment for installation in contractor facilities. This was the first project to pay for a building expansion (at Honeywell). It was the first Title III project teamed with another government agency (DTRA) to leverage expertise and budgets, and where DTRA purchased commercial 0.15 micron technology IP.

In dealing with the two companies, the Title III Program Office made use of individually tailored agreements. The Office used agreements that fall within the "Other Transactions Authority" (OTA) of government contracting. The agreements under the OTA permitted just the kind of flexibility needed for this ambitious project.

The project's agreements approached the modernization task using spiral technology development; 0.25 micron, then 0.15 micron, reducing technical risks rather than jumping from the then-current 0.5 – 0.35 micron technology directly to 0.15 micron. They allowed the contractors to negotiate their own deals with their semiconductor equipment suppliers, and they allowed the contractors to capture cost commitments in capital and supporting government equipment.

For BAE, they chose to shut down their production fabrication facility, modernize it with new equipment and processes, and then bring it back up and recertify it. For Honeywell, they chose to continue existing production and work the modernization effort

in parallel. The agreement permitted and funded a significant expansion of the fabrication facility; taking only six months to go from a green field to production of qualification wafers. Both contractors instituted Lean Manufacturing processes that increased capacity and reduced cycle time beyond expectations.

Combined, the project purchased 89 sophisticated, state-of-the-art microelectronics production tools, ranging in cost from \$100,000 to \$10 million. Both contractors completed the entire technical effort ahead of schedule and under budget, meeting or exceeding every technical performance requirement. Significantly, BAE and the Title III Program Office team were nominated for the prestigious David Packard Award for Acquisition Excellence.

The accomplishments of the project to date and the promise for continued availability of advanced RH microelectronics pay great compliment to the hard work and effectiveness of the DTRA/Title III team. They also provide great expectations for the capabilities of the U.S. warfighter.

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Appendix A

10 United States Code 2515, Office of Technology Transition

APPENDIX A: 10 USC 2515, Office of Technology Transition

Section 2515. Office of Technology Transition

(a) **ESTABLISHMENT.** - The Secretary of Defense shall establish within the Office of the Secretary of Defense an Office of Technology Transition.

(b) **PURPOSE.** - The purpose of the office shall be to ensure, to the maximum extent practicable, that technology developed for national security purposes is integrated into the private sector of the United States in order to enhance national technology and industrial base, reinvestment and conversion activities consistent with the objectives set forth in section 2501(a) of this title.

(c) **DUTIES.** - The head of the office shall ensure that the office-

(1) monitors all research and development activities that are carried out by or for the military departments and Defense Agencies;

(2) identifies all such research and development activities that use technologies, or result in technological advancements, having potential nondefense commercial applications;

(3) serves as a clearinghouse for, coordinates, and otherwise actively facilitates the transition of such technologies and technological advancements from the Department of Defense to the private sector;

(4) conducts its activities in consultation and coordination with the Department of Energy and the Department of Commerce; and

(5) provides private firms with assistance to resolve problems associated with security clearances, proprietary rights, and other legal considerations involved in such a transition of technology

(d) **BIENNIAL REPORT.** - (1) The Secretary of Defense shall submit to the congressional committees specified in paragraph (2) a biennial report on the activities of the Office. The report shall be submitted each year at the same time that the budget is submitted to Congress by the President pursuant to section 1105 of title 31. The report shall contain a discussion of the accomplishments of the Office during the fiscal year preceding the fiscal year in which the report is submitted.

(2) The committees referred to in paragraph (1) are -

(A) the Committee on Armed Services and the Committee on Appropriations of the Senate; and

(B) the Committee on National Security and the Committee on Appropriations of the House of Representatives.

Appendix B

Technology Transfer Commercialization Act of 2000, Statistical Data on Department of Defense Technology Transfer Activities

Technology Transfer Quantitative Transaction Data FY2004 and FY2005

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Appendix C

**Department of Defense
George F. Linsteadt Technology Transfer Achievement Award**



George F. Linsteadt

In FY 2004, Ms. Sue Payton, DUSD (AS&C), established the DoD George F. Linsteadt Technology Transfer Achievement Award under the authority of DoD Directive 5535.8. This award was named in honor of Mr. George Linsteadt. Mr. Linsteadt is credited with being the co-founder of the DoD Laboratory Consortium in 1971. This founding group of DoD labs represented the first coordinated efforts to promote and facilitate the transfer of Federal technology to the private sector. Based on interests from labs in several other Federal Agencies, Mr. Linsteadt led the efforts to establish the FLC for Federal Technology Transfer in 1974. He is widely recognized as a pioneer in Federal Technology Transfer and a founding father of the FLC. He worked for much of his career at the Naval Air Systems Command China Lake Weapons Division and over the course of his career in technology transfer he helped to promote and train fellow technology transfer professionals in 17 Federal Departments and Agencies. This award recognizes the DoD technology transfer professional who has performed extraordinary efforts and has produced outstanding results in transferring technology from DoD laboratories to their partners in the public and private sectors. Recipients are also recognized for their leadership and teamwork in sharing their knowledge and skills in technology transfer with other DoD labs and/or other Federal Agencies. The award winner is presented with the official DUSD (AS&C) commemorative coin, and the DoD Technology Transfer Certificate of Recognition at the annual DoD TTIPT workshop.

**FY 2004 Department of Defense
George F. Linsteadt Technology Transfer Achievement Award Winner**



Dr. Charles Schlagel, Director, Office of Technology Transfer Naval Medical Research Center was the first recipient of the DoD George F. Linsteadt Technology Transfer Achievement in recognition of his overall performance, and the Navy medical invention called, The Hearing Pill™, (www.thehearingpill.com) which helps prevent and treat noise induced hearing loss. This technology addresses a major military need for DoD. It is estimated that DoD spends \$1.5 billion per year treating noise-induced hearing loss from weapon fire, aircraft, and other loud noises. In support of Operation Iraqi Freedom, four cases of *The Hearing Pill*™ were sent to Iraq without cost by the commercial partner American Biohealth Group in support of troops experiencing blast noise injury. As a result, troops are experiencing positive improvement from taking The Hearing Pill™. The troops claim this is “saving lives” because they are able to command direction in midst of battle conditions. Dr. Schlagel oversees 13 activities comprising the Naval Medical Research Center, the Naval Health Research Center and three major Naval Medical Centers. He has overseen the execution of almost one third of all the CRADAs in the Navy including 277 in the three years leading up to this award. During this same time frame, he negotiated 21 PLAs, generating \$100,000 in royalties per year. Another significant successful transfer was the licensing of radio frequency diathermy technology to SeliCor, Inc. for a device that provides deep tissue heating for the treatment of injuries (see page D-5). It reduces joint stiffness, provides pain relief, relieves muscle spasms, and promotes tissue healing.

For further inquiry, contact Dr. Charles Schlagel at (301) 319-7428 or via email at: schlagelc@nmrc.navy.mil

**FY 2005 Department of Defense
George F. Linsteadt Technology Transfer Achievement Award**



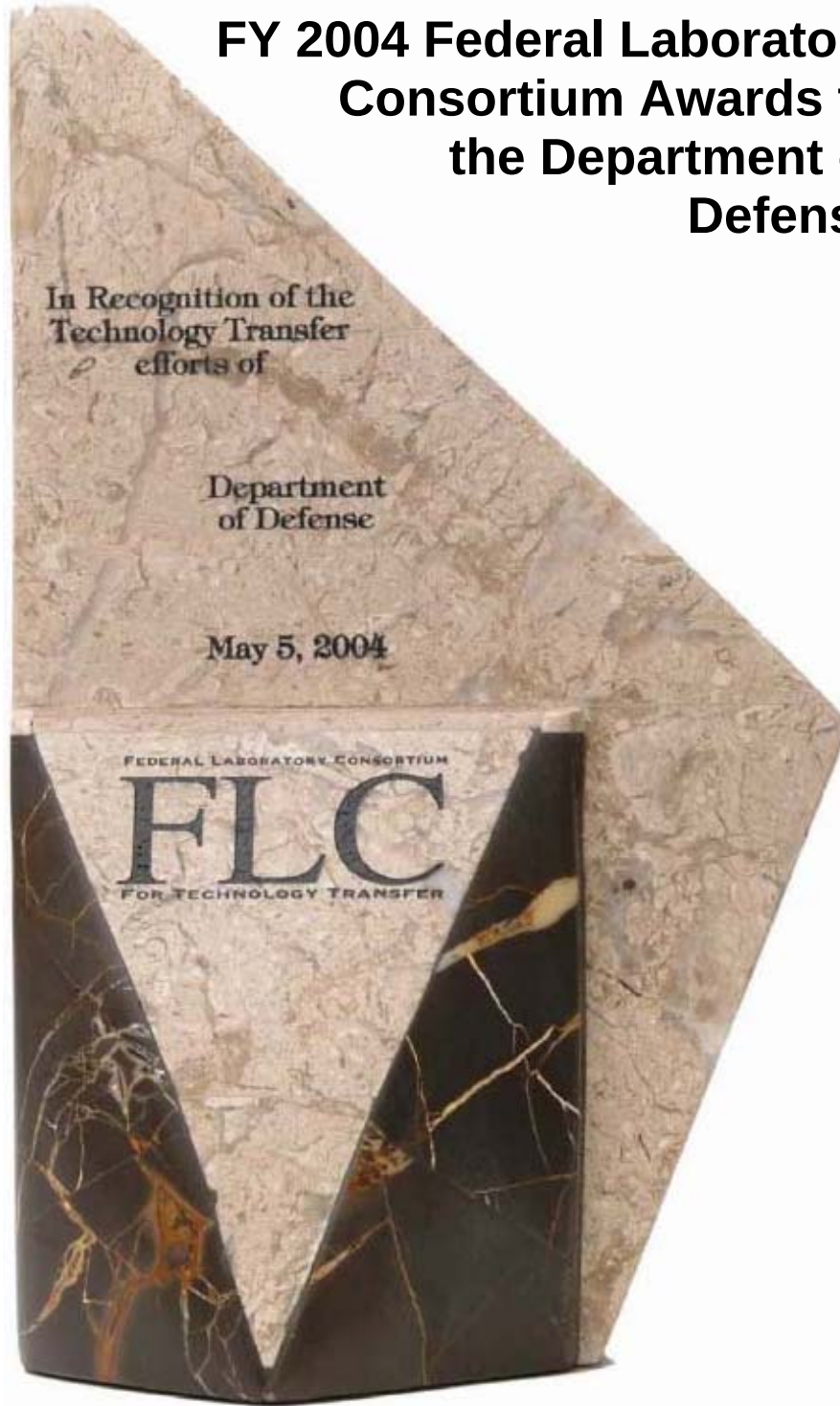
Dr. Paul C. Mele, Director of ORTA at the U.S. Army Medical Research and Materiel Command (USAMRMC) is the second recipient of the DoD George F. Linsteadt Technology Transfer Achievement Award. He was recognized for his extraordinary and timely efforts to transfer a new anthrax vaccine. The technology is based on a recombinant Protective Antigen that cannot cause anthrax infections. In the past, anthrax vaccine required six doses plus annual boosters while the new vaccine requires only three doses and no booster dose. The anthrax attacks targeted at private citizens, companies, Members of Congress and the staff, and impacting the U.S. postal facilities make this an extraordinary and timely transfer of technology. The technology was licensed to VaxGen, Inc., who received funding from the National Institutes of Allergy and Infectious Diseases to support clinical trials and product development. With the sense of urgency for bringing this vaccine to market, it was tested under Food and Drug Administration (FDA) Fast-Track designation. In November, 2004 VaxGen was awarded an \$877.5 million contract to produce 75 million doses for the U.S. Strategic National Stockpile. Other successful transfers facilitated by Dr. Mele involved products for anti-infective therapeutics, absorbable surgical glue, a water bio-monitor, and prolonged blood storage technology. Dr. Mele has also been a strong proponent in technology outreach activities. These include conferences such as BIO with over 18,000 attendees, state and regional bioscience forums, several joint programs with the Federal Departments of Health and Human Services and Homeland Security, and serving as an adviser to local economic development and business incubator programs. As with the first recipient discussed above, he has achieved a high degree of success with over 550 active CRADAs and 24 PLAs generating over \$375,000 in annual royalties.



For further inquiry, contact Paul C. Mele at: (301) 619-6664 or via email at: paul.mele@det.amedd.army.mil.

APPENDIX D

FY 2004 Federal Laboratory Consortium Awards to the Department of Defense



2004 Laboratory Director of the Year: Mary Lacey

Mrs. Mary E. Lacey is a technology transfer activist and visionary. Her exemplary leadership has transformed practices of developing, protecting, and transferring intellectual property at NSWC. As the NSWC Technical Director, Mrs. Lacey is responsible for the intellectual, equipment, and facility capabilities of the NSWC in service of DoD technical needs. She brings to this position a fundamental belief in the federal responsibility to promote technology transfer to the fullest extent that can be achieved.



Mary Lacey

Mrs. Lacey has aggressively promoted NSWC personnel to initiate and sustain technology transfer activities, including the development of internal networking. She has used her leadership skills to get technical people and ORTA representatives to share information and work together for better productivity. She regularly networks with the universities near the key technology-producing divisions. By letting them know what the Navy needs, Mrs. Lacey and her team have been able to identify and stimulate formal and informal partnerships. As Mrs. Lacey puts it, technology transfer is a “contact sport” and she continues to devise networking and educational opportunities to create an atmosphere of change among the scientists and engineers.

U.S. Army

Cascading Lasers: ARL’s Progress Toward High Performance and Entrepreneurship

What if a technology could provide high bandwidth, secure communications from a command unit to a tank or other mobile unit without interception? Suppose that a line-of-sight laser beam could transmit real-time image or voice data in a wireless form in a battlefield environment, using technology that was secure, small, inexpensive, and simple to operate. Such a technology could meet requirements for several military applications and also be available to the private sector for civilian applications. For example, this technology would make it possible to “wire” homes, buildings, or even vehicles with a small, low power unit sitting on a communication tower that beams into a nearby building a voice/data connection with no digging, conduit, or wires.

While working at the Army Research Laboratory’s Sensors and Electron Directorate, a research group of 12 scientists, led by Dr. Donald Wortman, developed a new mid-infrared semiconductor diode laser with a distinct market advantage over alternative laser technologies. The newly advanced laser is inexpensive, lightweight, robust and simple to operate, and offers far-reaching possibilities for both military and commercial application. Believing that the opportunity for commercialization was immediate, five members of the research group decided to leave the government, create a new company, raise the necessary venture funding, and license the technology they developed for the Army. This technology transfer effort not only led to the establishment

of a growing new private company, Maxion Technologies, Inc., but will also result in the application of funds to an R&D effort of direct interest to the Army. The return on investment is in the work and technical expertise of this team of Maxion employees, and the cost and savings are a result of private funding support in lieu of government salaries. In addition, there is the production of a dual-use technology for civilian use, and material and devices that will also be used in military systems. This technology transfer example serves as a success story and effective template for all federal labs and their scientists who are interested in dual-use technology opportunities.

Contact: Dr. Donald Wortman, (301) 394-5765, dwortman@maxion.com

U.S. Navy

High Volume Data Processing and Validation Improvements for Ocean Bottom Mapping



Jan Depner and Barbara Reed

A team at the Naval Oceanographic Office (NAVOCEANO) has successfully transitioned government-owned software technology to the private sector, creating many new data collection and mapping capabilities that support Naval operations, telecommunications, and numerous other commercial applications. Through a pair of well-structured CRADAs, the team transferred NAVOCEANO's unique

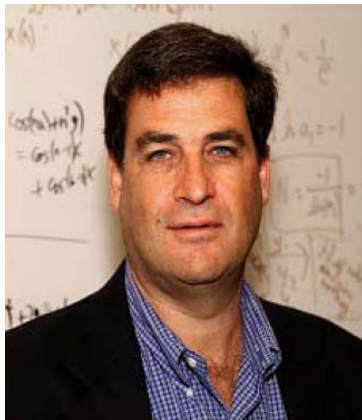
data structures and software to Science Applications International Corporation (SAIC) in Newport, Rhode Island; and to Interactive Visualization Systems (IVS) in Fredericton, New Brunswick for integration with the companies' commercial software – an effort that ultimately broadened the scope and use of the technology.

As a result of its mutual software development with IVS and SAIC, NAVOCEANO realized a tenfold improvement in the efficiency of the previously labor-intensive, interactive editing process, and garnered savings of more than \$800,000 over the last three years. In addition the NAVOCEANO team involved two universities in the technology transition effort, which contributed research results that have been incorporated into the CRADA products—further enhancing their value to a broader community. The companies' commercial opportunities have increased considerably, as evidenced by IVS' international marketing and sale of Fledermaus software through a commercial partner and the opening of its first U.S. office. New users of the CRADA-enhanced Fledermaus software include British Petroleum and the National Oceanic and Atmospheric Administration.

SAIC's CRADA-enhanced SABER software is used for system configuration in the telecommunications industry, and for aiding in the design, installation, and inspection of underwater cables. NOAA recently selected SAIC as the best-qualified supplier of hydrographic surveying services with its SABER capabilities, and awarded the company up to \$35 million over a five-year period for services that include direct and important support to U.S. Homeland Defense missions.

Contact: Barbara Reed, (228) 688-5741, reedb@navo.navy.mil

Non-Linear Signal Processing for Diagnosis of Sleep Breathing Disorders



Dr. Richard Katz

Twenty million Americans suffer from sleep breathing disorders, putting them at risk for a number of cardiac and neurological diseases. Approximately half of those sleep breathing disorder cases go undiagnosed and untreated because of lack of access to diagnostic services. To remedy this potentially dangerous situation, the Naval Undersea Warfare Center (NUWC) Division, Newport developed and patented a unique method to diagnose sleep breathing disorders in a short, easy-to-perform test.

The method uses chaos theory, a unique way of mathematically predicting behavior based on sensitivity to small changes, and applies it to signals normally collected during a sleep test. However, instead of an expensive night-

long test where the subject is asleep, the new test is performed in five minutes while the subject is awake and sitting up. In addition, the new test costs significantly less than a traditional overnight sleep clinic test.

This invention has been licensed to Vanguard Technologies, LLC of North Attleboro, Massachusetts, a woman-owned startup company formed to commercialize the technology. Under a CRADA between NUWC and Vanguard Technologies, NUWC has supported data analysis of clinical trials and assisted with the commercial development of the Non-Linear Signal Processing for Diagnosis of Sleep Breathing Disorders. Vanguard Technologies expects its product, which screens for sleep apnea and monitors sleep apnea treatment, to be available in doctors' offices within a year.

The benefits of being able to cost-effectively screen the population for obstructed sleep apnea (OSA) will save many lives and prevent many debilitating accidents. A recent report states that the annual direct costs for OSA are estimated to be approximately \$16 billion. Untreated OSA patients have hospital stays 2.8 times as long as treated subjects, and incur excess hospital costs of \$100,000 to \$200,000 plus doubled physician costs. Beyond the apparent cost savings, the Non-Linear Signal Processing for Diagnosis of Sleep Breathing Disorders will positively affect the quality of life for millions of people who will be able to share more productive lives with their families and loved ones.

Contact: Dr. Richard Katz, (401) 832-2757, katzra@npt.nuwc.navy.mil

“Body Friendly” RF Diathermy System



Dr. Richard Olsen



From left: Phil Ketner, Dr. Charles Schlagel, and Joseph Hemby, Jr.

A team led by Dr. Richard Olsen of the Naval Aerospace Medical Research Laboratory (NAMRL) has developed and commercialized a novel form of radio frequency diathermy (RFD) that uses a helical coil to deliver uniform, deep-tissue heating for treatment of pain associated with injuries. Originally designed to combat hypothermia in Navy divers, this invention circumvents the numerous difficulties of previous iterations of diathermy and allows facile application of RFD-induced thermal and nonthermal biophysical effects.

When housed in a garment, RFD can be applied in a clinical setting to facilitate core warming to enhance tissue metabolism, vascular blood flow, and physiologic homeostasis without risk of superficial burning. This is particularly critical during the passive phase of rehabilitation from muscular, connective tissue, and skeletal injuries, and provides the impetus for transfer of the Navy-developed technology to the civilian medical community.

Under an exclusive PLA, NAMRL transferred this technology to the civilian medical community through a new company formed to commercialize the technology, SeliCor Inc., of Austin, Texas. In support of its activities, SeliCor has outsourced some manufacturing and engineering activities to NASA spacesuit manufacturer ILC Dover of Frederica, Delaware, and an engineering firm, Sense Technologies of San Antonio,

Texas, to further develop the technology for future therapeutic uses in neurological, dermatologic, and sports medicine. Sales of SeliTherm units to date are outstripping the ability of SeliCor to manufacture and supply them, and market research indicates that the potential is exceedingly high to attract a significant fraction (on the order of 10%) of the billion-dollar annual market for such devices and related services.

The transfer of this technology from the Navy to the civilian medical community allows for considerable cost savings in research and development, and will ultimately translate into a major impact on occupational medicine, rehabilitative care, and the economic aspects of public health.

Contact: Dr. Richard Olsen, (850) 452-3287 x1136, co@namrl.navy.mil

U.S. Air Force

A U.S.-Manufactured Hall Effect Thruster Satellite Propulsion System



Daron Bromaghim and Dr. J. Michael Fife

The domestic manufacture of the Hall Effect thruster (HET) satellite propulsion system has been created through an AFRL Propulsion Directorate technology transfer project. A Hall thruster is a small rocket engine that positions and maintains a satellite in the correct orbit. The use of electrical rather than chemical combustion achieves fuel savings in the magnitude of tens to hundreds of

kilograms. The diminished fuel demands translate into launch vehicle downsizing, saving millions of dollars per launch.

The team of Dr. J. Michael Fife and Daron Bromaghim manage two Hall thruster development programs that have worked synergistically to yield commercially capable HET systems. Technology transfer started with the uptake of research previously performed by Russian scientists. By building on that foundation with an SBIR project, a 200-W HET became viable for the TacSat 2 satellite program. Project data and expertise were shared for the related development of a more high-powered HET to meet a military communications satellite mission. Both projects have required technology exchanges between multiple contractors and federal interests. A CRADA was put in place for the transfer of data and materials between AFRL and a prime contractor.

Development of the 200-W HET and the more powerful 4.5-kW HET has been successful, and funded missions are committed for launch dates in 2004 and 2006, respectively. Both HET systems are expected to become commercially available through the project contractors after the missions are completed.

Contact: Daron Bromaghim, (661) 275-5473, daron.bromaghim@edwards.af.mil

FLC Outstanding Service Award – A. David Spevack

Mr. A. David Spevack has dedicated his professional life to providing outstanding legal service in the federal technology transfer community. His lengthy history of service includes many achievements far beyond his job boundaries. His services are in high demand throughout the Navy and the federal technology transfer community for consultation and review of all types of agreements, licenses, patent applications and other technology transfer matters. Presently, Mr. Spevack is the ONR coordinator of a committee that is reviewing and revising the Navy's PLA and the PLA Handbook.



Throughout his career, Mr. Spevack has worked diligently to provide technology transfer insight, instruction, and guidance to ORTA representatives. His efforts have actively supported the FLC strategy to increase membership awareness of federal technology transfer legislation and models. By making available his legal expertise and promoting a dialog, Mr. Spevack has provided significant service in the identification and removal of legal obstacles and in lending consistency to government technology transfer.

Harold Metcalf Award – Dr. J. Scott Deiter

The drive and innovation Dr. J. Scott Deiter brings to his ORTA position at NSWC—IHDIV represents the value Dr. Deiter has extended to FLC ever since he became a representative in 1995. Dr. Deiter has long supported the FLC mission in various capacities. During his early years as an ORTA representative, he became an active member of several FLC committees. Participation helped him to learn the skills necessary to successfully market and license intellectual property. In addition to representing IHDIV, Dr. Deiter has served as a Deputy Regional Coordinator, and as a member of the FLC Executive Board. In 2003, he was honored to be elected by the members-at-large to serve as the Regional Director of the Mid-Atlantic Region. Dr. Deiter has enthusiastically embraced this position as an opportunity to impact positively the technology transfer programs of the regional member laboratories.



Dr. Deiter has actively supported FLC programs and processes throughout the eight years of his service as the NSWC—IHDIV Representative. He has given generously of his time to grow experience and benefit others in the field of technology transfer. He will continue to give value to the FLC in his role as the Mid-Atlantic Regional Representative. Dr. Deiter has demonstrated sustained dedication to the goals and membership of the FLC.

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APPENDIX E

FY 2005 Federal Laboratory Consortium Awards to the Department of Defense

In Recognition of the
Technology Transfer
efforts of

Department
of Defense

May 4, 2005

FEDERAL LABORATORY CONSORTIUM

FLC
FOR TECHNOLOGY TRANSFER

2005 Laboratory Director of the Year: Ted Glum

As director of the Director of DMEA, Ted Glum has created an organization unlike any other in Government: a small, agile, responsive team closely linked with the private sector serving as a microelectronics “solutions portal” for government, allies and the defense industrial base alike. Within this organization, technology transfer and public-private partnerships are not “other duties as assigned” but rather how business gets done. Mr. Glum understands the importance of technology transfer and developed DMEA to fulfill a unique role in the technology transfer spectrum.



Under Glum’s leadership, the concept of public-private partnerships has become the means for DMEA to fulfill its DoD charter. Only through extensive interaction with the semiconductor industry can DoD program managers and defense prime contractors be integrated and effective microelectronics solutions be achieved.

U.S. Army

Automated Decision-Aid System for Hazardous Incidents

James A. Genovese, team leader for the Innovative Development and Engineering Acquisitions Team at ECBC, has invented the Automated Decision-Aid System for Hazardous Incidents (ADASHI). This computer-based technology improves the ability of local emergency responders to quickly identify, contain and mitigate the effects of chemical and biological incidents.



James A. Genovese

Unlike other training and response-support solutions on the market, ADASHI integrates all disparate technical functions required to manage a hazard incident, from assessment to casualty estimation criteria to mitigation, and combines them with decision criteria. Because it is icon-based, users can easily report what they observe at the scene and quickly receive critical information to help them make what could be life-saving decisions.

Mr. Genovese began working on the concept on his own time. By 2000 it was sufficiently developed for the Army to file the first of three patents to date. OptiMetrics, Inc. of Ann Arbor, Michigan, became interested in ADASHI early on; some of its scientists who were working with Mr. Genovese on other projects occasionally participated in its development. The company was granted an exclusive license for the technology on January 28, 2002. A few months later, ECBC and OptiMetrics signed a CRADA to conduct collaborative research and development with the intent of getting ADASHI to market as quickly as possible.

Given the scope of the technology, full development will take years; however, OptiMetrics created a commercialization schedule by which it will market modules of the technology during development. Two ADASHI software products are currently on the market, with a third scheduled for release in February 2005.

Contact: James A. Genovese, (410) 436-1915, james.genovese@us.army.mil

Submersed Aquatic Vegetation Early Warning System

Engineer Bruce Sabol of the U.S. Army Engineer Research and Development Center, Environmental Laboratory (ERDC-EL) has developed a cost-effective hydroacoustic system to detect and map submersed aquatic vegetation. Called the Submersed Aquatic Vegetation Early Warning System (SAVEWS), the patented technology has been licensed and commercialized by BioSonics, Inc., of Seattle, Washington. The system is being marketed under the name EcoSAV in a suite of software designed for use in aquatic habitat and resource assessments.



Bruce Sabol

What was once an arduous, costly, labor-intensive exercise to locate and map aquatic vegetation has now become technologically more efficient and infinitely more viable commercially as a result of the unique integration of state-of-the-art hydrosonic equipment, GPS mapping technology, computer software, and a custom algorithm. Originally conceived as a tool to assist in the early detection and management of *Hydrilla*, a noxious aquatic plant seizing control of the Tennessee Valley Authority reservoir system, the SAVEWS/EcoSAV system has gone on to empower government agencies and private consulting firms entrusted with the responsibility of managing the nation's waterways. Waterways like those managed by the South Florida Water Management District proximate to the Everglades have benefited from use of the mapping system.

With more effective tools, management of our waterways becomes more effective. And with a technology like SAVEWS, the ultimate consumer benefit generally goes unseen, for it is the taxpaying public that benefits from better management of aquatic resources and the ecological services provided by aquatic habitats and ecosystems. The relationship between ERDC-EL, Sabol, and BioSonics has been one of reciprocity; however, Bruce Sabol's initiative has moved this technology forward, and the benefit will be seen for years to come.

Contact: Bruce Sabol, (601) 634-2297, Bruce.M.Sabol@erdc.usace.army.mil

A Self-Contained, Portable and Disposable Biological Sampling Kit (BiSKit)



From left: Rodney D. Hudson, Patti J. Riggs, Amy Groth. Not pictured: Christina Frain

Responding to challenges presented by anthrax contamination at the Hart Senate Office Building, Brentwood Post Office, and other sites, ECBC rapidly developed and produced a new biological sampling kit. ECBC's engineering team designed and produced this portable and disposable biological sampling kit, enabling responders to weapons of mass destruction events to collect biological contaminants from surfaces while encumbered by protective clothing.



From left: David C. Wheatley, Donna A Cannella, Mark S. Schlein, U. John Biffoni, Kevin S. Wallace, Vicki A. Upchurch, Dr. Peter A. Emanuel, Peter J.

The need for a new, simple sampling kit became obvious when sampling teams were faced with large, complicated sampling situations. Currently available sampling kits that utilize cotton swabs or sponges made multiple samplings virtually impossible, resulting in precious time consumption and involving copious steps, creating exposure situations and cross-contamination risks.

ECBC's Biological Sampling Kit (BiSKit) addresses the shortcomings of the swab and sponge sampling kits. The BiSKit, designed to sample large areas and be compatible with testing on a variety of technologies, has been evaluated and compared to other surface sampling strategies. Large surface areas sampled with the BiSKit resulted in up to tenfold higher concentrations of *Bacillus anthracis* in samples compared to other sampling methods.



The BiSKit is self-contained, portable, and disposable. It is designed so that individuals without scientific backgrounds can easily obtain samples. The kit is also specially designed for transport without leaking. This technology successfully transferred from a federal laboratory to the civilian sector in April 2003 under a nonexclusive patent license agreement to QuickSilver Analytics, Inc. The transfer of the BiSKit technology represents a significant advancement that simplifies sampling operations and significantly minimizes hazards, providing a necessary tool for critical public safety.

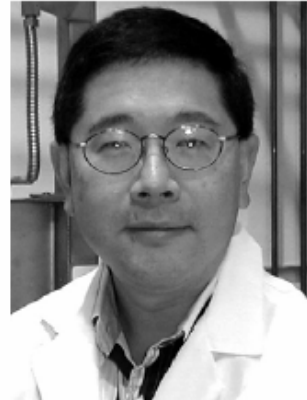
Contact: Dr. Peter A. Emanuel, (410) 436-5562, peter.emanuel@us.army.mil

High-Pressure Food Processing to Provide Increased Safety and Quality

Under the joint leadership of Dr. C. Patrick Dunne of the DoD Combat Feeding Directorate, NSC and Dr. Edmund Ting, Avure Technologies, Inc. of Kent, Washington, partnerships have been forged to foster the development and industrial application of High Pressure Processing (HPP), a revolutionary process in food preservation technology. HPP is being developed to meet the joint demands of the military for expanding variety and improving the quality of combat rations and for civilian sector convenience foods containing whole muscle meats and other thermally sensitive items, such as eggs, potato and pasta products. Since 2001, a number of HPP foods have begun to appear in the marketplace as a direct result of technology transfer between the Army and Avure.



Dr. C. Patrick Dunne



Dr. Edward Ting

The use of high hydrostatic pressure has proven to be a very effective means of controlling the activity of both spoilage and disease-causing microorganisms in refrigerated food items. High-pressure processed foods meet today's consumer demands for minimally processed, additive-free foods with fresh-like characteristics while providing the ultimate in safety. Foods such as avocado dips (guacamole) now appearing in supermarkets have superseded lower quality items filled with additives. The demand to ensure the safety of packaged, processed, ready-to-eat meats has led major corporations like Hormel Foods Corporation and Perdue Farms to adopt high-pressure processing for a variety of items.

NSC and Avure Technologies have formed a consortium involving major food producers to build a base for HPP technology. This consortium was formed under the auspices of the Army's Dual Use Science and Technology program. An approved high pressure-assisted sterilization process is expected to be approved by regulatory agencies within one year.

Although the use of high pressures to preserve food was first explored in the 1890s, it took a dedicated multidisciplinary team led by government and industrial scientists and engineers to make the promise of this revolutionary process a commercial reality. **The process has been called the biggest innovation in food processing since Clarence Birdseye developed frozen foods in the 1920s;** as a result, Avure Technologies was awarded the Institute of Food Technologists' industrial innovation award in 2002.

Contact: Dr. C. Patrick Dunne, (508) 233-5514, Patrick.Dunne@natick.army.mil

Introduction of Bullet Trapping Foamed Concrete for Live-Fire Training Ranges



Dr. Charles A. Weiss, Jr.



Dr. Philip G. Malone



Joe G.

Dr. Charles A. Weiss, Jr., Dr. Philip G. Malone and Joe G. Tom developed, patented and introduced into the commercial sector a foamed fiber-reinforced concrete that can be cast in blocks and panels that capture impacting bullets without producing dangerous ricochets. The concrete formulation was originally developed for use in Army live-fire training mazes and enclosures for grenade training. The development team modified the composition of the concrete to minimize the leaching of lead and other potential pollutants from the foamed concrete resulting in a nonhazardous material for disposal purposes. In addition, the resulting material is fireproof and has improved versatility. The estimated savings to the Army are \$180 million per year. In order to transfer the technology to the private sector, the federal team worked with industry partners through CRADAs to improve the technology and to benefit from the partner's experience marketing the new material.

The interaction with CRADA partners resulted in three patents being issued, with the CRADA partners securing licenses to the new technology. To promote product identity, the Army filed for and was issued the trademark SACON[®] for this unique concrete product. The research team presented and published four research papers on the technical developments associated with the SACON[®] product. In 2003, the first civilian firing range constructed using SACON[®] was built in Springfield, Ohio.

In 2004, in a ground-breaking agreement, the Geotechnical and Structures Laboratory issued a license to Mississippi Prison Industries Corporation. This license was unique in that it provided federally developed technology to a state-owned, not-for-profit corporation, making SACON[®] economically available to law enforcement groups across the country.

Contact: Dr. Charles A. Weiss, Jr., (601) 634-3928,
Charles.A.Weiss@erdc.usace.army.mil

Inflatable Composite Structures



Jean Hampel and Claudia Quigley



Amy Soo

Flexible composite textile technology provides structures that are extremely lightweight, rapidly deployable, and require minimal storage space during transit. Transferred from the Army to the Air Force, Navy, and NASA developers through both government and industry interaction, the technology has led to products that weigh 66% less than conventional metal items, take up less than 25% the volume when stored or shipped, and cut setup time by 60%. Flexible composite structures are referred to as airbeams; however, applications are extremely broad. These include arches to support tents, inflatable antennas and booms for space applications, fins for aircraft ejection seats, and fenders for use in sea-based operations.

An advanced understanding has been developed of the performance of inflatable composite structures through the use of classical structural analysis and finite element computer modeling tools, as well as the validation of these tools by establishing and conducting physical tests. Specialized design optimization tools have been implemented to take into account the complexity of the inflation pressures and the nonlinear fabric material kinematics. In addition, improved manufacturing technologies have been developed, incorporating emerging materials, to optimize structural design and provide a competitive industrial base. Spinoffs from the manufacturing technologies include low-cost rigid composite nose cones for missiles and next-generation chemical- and biological agent-resistant laminated fabric.

Contact: Jean Hampel, (508) 233-4692, jean.hampel@natick.army.mil

U.S. Navy

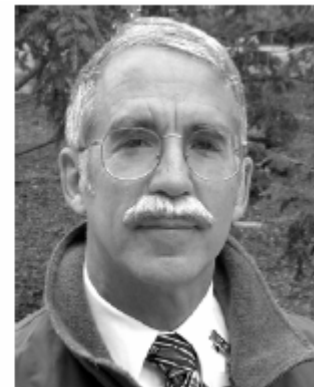
Point Security Barrier System



Chip Nixon



Robert Taylor



William Seelig

A team lead by Robert Taylor of the Naval Facilities Engineering Service Center (NFESC) has developed a modular post security barrier (PSB) system to protect the U.S. Navy fleet—valued at approximately \$300 billion—from waterside attack. The floating fence comprises synthetic netting attached to a pontoon base, moorings and deadweight anchors. Gates can be added as needed. Relatively simple to fabricate and install, the technology has been proven to stop nearly 100% of high-speed boats.

Development of a net barrier system became a top priority for the Navy following the attack on the USS Cole on Oct. 12, 2000. The pace of development was accelerated following the 9/11 attacks. Remarkably, Mr. Taylor's team took the PSB system from concept to prototype in just eight months. Funding was granted by the Office of Naval Research in April 2001, and the first installation was completed at the southern entrance of the U.S. Navy Submarine Base in Kings Bay, Georgia, in December.

The government has identified at least 11,600 likely waterside terrorist targets in the U.S., including military facilities, dams, nuclear power plants, oil platforms and more. An attack on any of these targets could result in significant loss of life as well as extensive property damage. Given the risk to civilian and commercial entities, NFESC determined that PSB needed to be commercialized as quickly as possible. Harbor Offshore, Inc. (HOI), a Ventura, California-based marine construction firm under contract with NFESC to fabricate and install the fencing, approached NFESC expressing interest in licensing PSB. Having proven its capability and motivation to enhance the barrier's success, HOI was granted an exclusive license on Dec. 29, 2003. Within a month, HOI had installed its first commercial system at Port Everglades, Florida, to protect the Queen Mary II at her winter port, as well as to add another layer of protection for the port's three petroleum slips. To market the PSB system, HOI spun off Harbor Offshore Barriers, Inc., which now offers three versions of the fence.

Contact: Robert Taylor, (805) 982-5419, robert.taylor5@navy.mil

Methods for Protection Against Lethal Infection With Bacillus Anthracis



From left: Captain Darrel Galloway, Dr. Al Mateczun and Dr. Charles Schlageel

Drs. Darrel Galloway and Al Mateczun of the Naval Medical Research Center have developed and successfully transferred to industry a DNA-based vaccine against anthrax. Anthrax has been used in bioterror attacks and is also a problem in the livestock industry. The inhaled method of contracting anthrax, the preferred method of bioterrorists, is highly lethal. The bacterium responsible for the disease can be modified into a “super” strain that thwarts current vaccines. The new vaccine technology makes it possible to respond to specific engineered anthrax attacks much more rapidly and inexpensively than existing methods. The technology also advances all future anthrax vaccines by demonstrating the importance of the anthrax “lethal factor” in generating immunity; previous vaccines relied primarily on the “protective antigen.” Drs. Galloway and Mateczun have shown that vaccines incorporating both elements will provide better immunization than previous vaccines that include only the protective antigen. Finally, the new technology also eliminates many of the issues associated with vaccinating with traditionally developed vaccines.

The vaccines have progressed to human trials and could become the first DNA-based vaccine approved by the FDA. FDA approval of this vaccine could open the door to a new wave of DNA-based vaccines against a variety of other diseases. Such vaccines would offer the same benefits as the new anthrax vaccine: low cost, fast development, and rapid adaptability to new and engineered biological threats.

Contact: Dr. Al Mateczun, CAPT(RET), MC, USN, (301) 319-7511, mateczuna@nmrc.navy.mil

Methods of Treating Autoimmune Disease via the T-cell Costimulatory Pathway

While assigned to the Naval Medical Research Center, Navy immunologist Dr. Carl June made a profound discovery—the key to a hypothesized second signal in T cell stimulation. June’s discovery of the function of the CD28 molecule in that second pathway led to major advances in the search for safe and effective therapies for autoimmune disorders. Academic and industrial collaborations centering on this fundamental discovery have resulted in the development of revolutionary new methods

for treating autoimmune diseases such as rheumatoid arthritis, lupus, multiple sclerosis, and scleroderma. These methods, using a genetically engineered form of a molecule nearly identical to CD28 (CTLA4-Ig), have been effectively transferred into the private sector, as exemplified by U.S. Patent No. 6,685,941, approved February 3, 2004. The patent is assigned to the Navy and the University of Michigan and licensed exclusively to Repligen Corporation. CTLA4-based therapy for rheumatoid arthritis is completing the final phase of FDA-approved trials, with outstanding phase II results having already been reported.

The Navy is listed on over a dozen other related patents, which have been licensed and sublicensed to companies working in the field of ex vivo activation or expansion of human T cells for treatment and/or prevention of AIDS, cancer and immunodeficiency states. Those companies include Repligen (which worked under a CRADA with the Navy), Genetics Institute, Wyeth, and Xcyte Therapies, a sublicensee created specifically to carry out further research and development in this area.

Before the promising work with CTLA4-based therapies, treatment for autoimmune disorders required that the entire immune system be suppressed. Not only do these new methods promise effective treatment of disease itself, they allow for continued immune function even during treatment.

The work done under the auspices of the Naval Medical Research Center by Dr. June and his collaborators caused a sea change in the understanding and treatment of autoimmune disorders, as evidenced by the recently approved patent. The value and significance of the work cannot be overstated.

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Harold Metcalf Award – Norma Cammarata

Norma Cammarata, FLC representative from the Army Research Laboratory for more than 18 years, has provided extraordinary service to the Army, the Army Research Laboratory, and the FLC. Since first becoming involved with the FLC in 1987, Cammarata has worked tirelessly to further the organization's ability to support the technology transfer efforts of its members. The FLC has greatly benefited from the innovative thinking and leadership ability she has demonstrated time and again. Over the years, she has served on numerous committees, including several years on the Executive Committee.



Cammarata's passion for excellence in technology transfer particularly shone during her tenure as Program Committee Chair from 2000 through 2003. Few in the FLC today have served the organization longer or possess more organizational knowledge.

Appendix F

Select Acronyms Glossary

<i>Acronym</i>	<i>Definition</i>
AF	Air Force
AFB	Air Force Base
AFRL	Air Force National Laboratory
AMRDEC	Aviation and Missile Research, Development and Engineering Center
ARDEC	Armament Research Development and Engineering Center
ARL	Army Research Laboratory
CRADA	Cooperative Research and Development Agreement
DHS	Department of Homeland Security
DMEA	Defense Microelectronics Activity
DoC	Department of Commerce
DoD	Department of Defense
DOE	Department of Energy
DPA	Defense Production Act
DUSD (AS&C)	Deputy Under Secretary of Defense (Advanced Systems and Concepts)
ECBC	Edgewood Chemical and Biological Command
EPA	Educational Partnership Agreement
ERDC-CERL	Engineer Research and Development Center, Construction
ERDC-EL	Engineer Research and Development Center, Environmental Laboratory
ERDC-GSL	Engineer Research and Development Center, Geotechnical
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FLC	Federal Laboratory Consortium
IAA	Interagency Agreement
IP	Intellectual Property
IR&D	Independent Research and Development
ISSA	In-Service Support Agreement
JFCOM	Joint Forces Command
ManTech	Manufacturing Technology Program
MDA	Missile Defense Agency
MEMS	Micro Electro-Mechanical Systems
MEP	Manufacturing Extension Partnership
MOA	Memoranda of Agreement
MOU	Memoranda of Understanding
NIH	National Institute of Health
NIST	National Institute of Standards and Technology
NRL	Naval Research Laboratory
NSC	U.S. Army Natick Soldier Center
NSWC	Naval Surface Warfare Center

<i>Acronym</i>	<i>Definition</i>
NSWC—IHDIV	Naval Surface Warfare Center - Indian Head Division
ODUSD (AS&C)	Office of the Deputy Under Secretary of Defense (Advanced Systems and Concepts)
OEM	Original Equipment Manufacturer
ONR	Office of Naval Research
ORTA	Office of Research and Technology Applications
OSD	Office of the Secretary of Defense
OTT	Office of Technology Transition
PIA	Partnership Intermediary Agreement
PLA	Patent License Agreement
R&D	Research and Development
RD&E	Research, Development and Engineering
REF	Rapid Equipping Force
ROI	Return on Investment
S&T	Science and Technology
SBIR	Small Business Innovation Research
STTR	Small Business Technical Transfer Program
TARDEC	Tank Automotive Research, Development and Engineering Center
TATRC	Telemedicine and Advanced Technology Research Center
TTCA	Technology Transfer Commercialization Act
TTI	Technology Transition Initiative
TTPIT	Technology Transfer Integrated Planning Team
TTWG	Technology Transition Working Group
USAMRMC	U.S. Army Medical Research and Materiel Command
USUHS	Uniformed Services University of the Health Sciences
VA	Veterans Administration
WRAIR	Walter Reed Army Institute of Research