REPORT TO CONGRESS
on the activities of the
DoD Office of Technology Transition

February 2002
This report responds to 10 USC 2515

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The Office of the Secretary of Defense
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Office of Technology Transition

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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 OTT accomplishments and highlights some technology transfer efforts throughout the Department for FY 2001.

We have experienced some major successes in transferring technology this year and these are identified in Section A of this report. Appendices B and C provide the numbers of technology transfer activities at our laboratories and statistical data on Cooperative Research and Development Agreements and patent licensing, respectively. Highlights, including an improved silicon rubber gasket design suitable for use in all Navy standard, manually operated non-ballistic structural closures in watertight, airtight, and even firezone applications, are identified in Appendix D. Technology transfer award winning projects are identified in Appendix E.

OTT provides leadership, oversight, and focus for programs supporting the technology transfer mission of the Department. Specific activities discussed in this report are:

- Provided leadership for the DoD Technology Transfer Program.
  - Hosted a DoD Technology Transfer Integrated Planning Team Workshop to identify and share best practices in technology transfer among the practitioners.
  - Participated in a Federal Department working group to review selected technology transfer activities with foreign participation
  - Continued sponsorship of Defense TechLink, a partnership intermediary, at Montana State University. TechLink assisted companies in applying for and receiving over 15 patent license agreements from DoD.
  - Continued supporting the Federal Laboratory Consortium with over $900,000 in funding and 14 DoD representatives serving in elected and non-elected positions. Additionally, 12 teams of DoD scientists and engineers won the Federal Laboratory Consortium Annual Awards for Excellence in Technology Transfer, one person won the FLC Representative of the Year Award, and one person won the FLC Laboratory Director of the Year Award..
- Managed the DoD Dual Use Science and Technology (DU S&T) Program.
  - Thus far, more than 400 companies, universities, and nonprofits are participating in the Program. With a total value of over $1.0B, 327 DU S&T projects have been initiated.
  - The DU S&T Achievement Award was presented to one winner and two runners-up based on military benefit, commercial viability, and quality of cost share.

- Managed the Office of the Secretary of Defense, Deputy Under Secretary of Defense (Science and Technology) Small Business Innovation Research (OSD DUSD(S&T) SBIR) Program.
  - The DUSD(S&T) is sponsoring two technology area initiatives, Cognitive Readiness and Conditioned Based Maintenance. It also is co-sponsoring two additional technology areas, biomedical and information technology for military health systems.
- Provided oversight for the DoD Manufacturing Technology Program.
  - The annual Defense Manufacturing Conference continues to be a premier activity with 875 leaders from government, industry, and academia attending the 2001 conference in Las Vegas, NV.
  - The FY 2001 Defense Manufacturing Technology Achievement Award went to the government/industry team responsible for the Enhanced Manufacturing Processes for Body Armor Materials project.
- Directed the collection and dissemination of technology transfer information by the Defense Technical Information Center (DTIC).
  - As of December 31, 2001, the Defense Technology Transfer Information System (DTTIS) contained project information on 4,634 DoD Technology Transfer Activities, including 2,293 active Cooperative Research and Development Agreements and 156 active Patent License Agreements.
  - DTIC maintains the Independent Research & Development (IR&D) database with project description and financial information reflecting IR&D efforts conducted by Defense contractor activities.
  - DTIC maintains the Virtual Technology Exposition (VTE) website with current information on DoD's most advanced technology research activities.
- Coordinated the Independent Research and Development (IR&D) Program.
  - Annual IR&D investment by major defense contractors is about $3 billion.
  - During FY 2001, DoD began implementation of an action plan to revitalize the IR&D Program. Outreach efforts to educate DoD personnel on this important resource have begun
- Provided direction and oversight of the Defense Production Act Title III Program.
  - A key objective of the Title III Program is to accelerate the transition of technologies from R&D to affordable production and to insert those technologies into defense systems.
  - In FY 2001, eleven Title III projects were active or under development.
  - Three new Title III projects under the Radiation Hardened Microelectronics Initiative are being developed.
- Provided Direction and oversight for the Commercial Operations and Support Savings Initiative (COSSI).
  - A competitive project call was issued in January 2001 and five projects were selected for funding during FY 2002.

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In Memory of Martha Harrington

On November 30, 2001, Martha Hannah Harrington passed away. The DoD Technology Transfer Community and the Naval Air Warfare Center Weapons Division China Lake Technology Transfer Office lost a vital, respected, long term champion and practitioner of technology transfer and a good friend. In 1989, Martha was a paralegal in the China Lake Office of General Counsel who was selected to join a new two person office to establish a process to implement the latest Technology Transfer guidance. This included setting up an office to originate and implement processes to negotiate Patent License Agreements as well as the new Cooperative Research and Development Agreements (CRADAs), which were the vehicles to be used in transferring Federally originated technology to the private sector. The law authorizing this activity, the Federal Technology Transfer Act of 1986, was new and implementation brought situations that were many and varied, as well as challenging. Each federal agency and Military Service independently invented a CRADA format that would encourage public-private partnering in research and development and at the same time would be legal and fair to both parties. Martha was instrumental in helping the Office of Naval Research develop the first format and set of processes for the Navy Standard CRADA. In so doing, she worked closely not only with her Navy colleagues but with her Technology Transfer counterparts throughout the Federal Government. From the earliest days of Technology Transfer, Martha was a proactive champion and expert in negotiating CRADAs and licenses. Her legal background served her well and she became well known for her legal expertise with respect to partnering agreements. Martha brought a keen intelligence, tenacity, passion, and dedication to every task she undertook. Her commitment to excellence was total. To Martha, the best she had to give was the least she could offer. She was always thinking of ways to do the job better. Martha had the trust and respect of the China Lake technologists as well as its legal staff. From the late 1980s until her death Martha was the one constant guiding light for technology transfer at China Lake. She mentored many in the profession of technology transfer. Under her mentorship the China Lake Technology Transfer Office negotiated 95 CRADAs and 9 patent licenses agreements between 1989 and 2001. Martha herself negotiated 37 CRADAs and all of the patent licenses.

A year and a half ago, Martha chaired a committee of Navy technology transfer experts chartered with completely rewriting and updating the Navy Standard CRADA. The result was the 5th Edition of the Navy Standard CRADA - easier to understand and use – and now used throughout the Navy.

Martha mentored others throughout the Federal technology transfer community through her participation in the Federal Laboratory Consortium and the DoD Technology Transfer Integrated Planning Team. She was always willing to share so others might learn and benefit from her knowledge.

Away from work, Martha was a wife, a mother, a grandmother, an avid horsewoman, an athlete, and a good and close friend of many. All who knew Martha, at work and away from work, will miss her quick smile, her positive attitude, her humor, her willingness to do more than she was asked, her experience and knowledge, her friendship, and her mentoring. Martha Harrington was a quality person and a professional. She was a person who touched many lives in many different ways.

Martha Hannah Harrington will be missed greatly by all who had the privilege of knowing her.

INTRODUCTION

Section 2515 of title 10, United States Code (Appendix A) directs that "The Secretary of Defense shall establish within the Office of the Secretary of Defense an Office of Technology Transition." 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 Defense; identify R&D activities that result in technological advances that have potential for non-defense commercial applications; serve as a clearinghouse for, coordinate, and actively facilitate the transfer of such technologies and technological advancements to the private sector; conduct its activities in consultation and coordination 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 an annual 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 and is the ninth annual report.

In November 2000, The Technology Commercialization Act was signed into law. One of the provisions in this Act requires a report on the utilization of federal technology. While this information is to be provided to the Department of Commerce and the Comptroller General, it is also relevant data to help the Defense Committees ascertain the vitality of the DoD technology transfer activities. Specifically, the report on activities in which we have been involved, the lessons learned from these activities, and the plans for technology transfer in the future show that we are maintaining our desire to ensure fruitful results from our collective investment in research and development.

In keeping with the integrated planning and process team approach throughout the Department, the activities of the Office are conducted with the consultation, support, and active participation of personnel in the Military Departments and Defense Agencies. The ultimate goal is to achieve technically superior, affordable Defense systems while ensuring that technology developed for national security purposes is integrated into the private sector to enhance the national technology and industrial base.

In this report, we have identified specific successes and some highlights in DoD technology transfer and plans to enhance our internal operations to better align this program with our overall goal to provide more affordable systems with enhanced capabilities to the warfighters.

A. Defense Technology Transfer

The Office of Technology Transition (OTT) has oversight for the Defense Department programs supporting technology transfer and discussed in this report. These programs are consolidated into one office to ensure cohesion and synergy in implementation. As we've encouraged the Military Departments to look at these programs as parts of a whole, they have started integrating them and are now organizing so that these programs are key parts of their technology transfer efforts.

This is the ninth report on the activities of the OTT. In this report we are providing more detailed data on activities across the Department in technology transfer than we have provided in the past. By providing this level of detail, we anticipate the broad scope of technology transfer efforts can be seen. This particular report is structured to show the Defense Committees some statistical data on utilization of federal technology transfer mechanisms. We have attempted to provide an explanation of the our technology transfer program for FY 2001 and the DoD plans for conducting its technology transfer function in FY 2002, including its plans for securing intellectual property rights in laboratory innovations with commercial promise and plans for managing its intellectual property so as to advance the agency's mission and benefit the competitiveness of United States industry.

Specific statistical data elements are included as Appendix C. These give an indication of the level of activity in certain areas such as Cooperative Research and Development Agreements (CRADAs) and patenting and licensing. However, they do not give the most definitive picture of how the Defense Department is using the tools of technology transfer to enhance our mission capabilities, increase partnerships and joint development activities with the private sector, nor the ways we have been able to use these tools to varying degrees at our different locations. These benefits to the Defense Department are reflected in the success stories on pages 6-9 and in Appendices D and E of this report.

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 Application (ORTAs), and patent attorneys located at various sites with appropriate authority to transfer technology both into and out of the laboratory. In FY 01, DoD had over 100 ORTAs and patent attorneys throughout the Military Services and Defense Agencies involved in the transfer of technology to enhance both our mission capabilities and the economic competitiveness of U.S. industry. 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.

DoD Technology Transfer Program in FY 2001

DoD is one of the few Federal Departments investing in technology Research and Development (R&D) for its own use. We are the primary customers of the technology being developed in our laboratories and through contracts for military items. Therefore, technology transfer is viewed as a way to enhance mission capabilities. We can develop technology and spin out to the commercial sector for consumer items, find technology in the commercial sector for military use, and jointly develop technology for both military and commercial applications.

Appendix C contains a spreadsheet identifying the numbers of CRADAs, both new in FY 2001 and continuations from previous years, invention disclosures and patents, and income from active patent license agreements.

The Annual Report to Congress for FY 2000 required by 10 U.S.C. 2515 identified the number of active patent license agreements and royalty income to the Defense Department based on a study, "Patent Marketing and the Value of Licensing to DoD Laboratories." Consistent with that report, the numbers for FY 2001 show the total royalty income to DoD is just over $6 million. The royalty income at most of our laboratories/centers does not cover the cost of payments to the U.S. Patent and Trademark office to obtain and maintain DoD patents. Royalties generally are not used to cover this expense. Royalty fees are used to 1) provide incentives, both the individual share of the royalty to inventors as well as cash awards to technical teams, and 2) provide for further R&D consistent with the R&D mission of the laboratory.

If the primary measure of effectiveness used to assess patent program success is the amount of royalty revenue brought in, then the bottom line is that the vast majority of patent programs at DoD laboratories currently do not pay for themselves, nor are they likely to do so in the future. However, we believe it is important to protect our internally developed intellectual property and make it available for use via licensing or other appropriate mechanisms.

While the heart of technology transfer is intellectual property, the technology transfer program at DoD includes more than patenting and licensing activities. Each of our laboratories has implemented technology transfer programs to support its unique laboratory mission requirements. During FY 2001 we have used a wide degree of latitude in deciding and defining what works best at our different locations. Appendix D provides some highlights from some of the laboratory locations to illustrate the variety of activities, technologies, and capabilities that are part of the DoD Technology Transfer Program.

Some of the areas in which we have been working in FY 2001 include the following groups, projects, and systems. FY 2001 major successes are identified at the end of this section.

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. Two of the areas addressed this year are:

- Data collection requirements for current and anticipated requests – this will continue through FY 2002
- General Accounting Office and Interagency reviews of technology transfer mechanisms and programs

Technology Transfer Mechanisms

Technology Transfer mechanisms are important to strategic planning at the laboratories to enable spin-off, spin-on, and dual use development of technologies. They provide a variety of tools with the potential to leverage outside resources and, potentially, reduce the development and acquisition cost of technology products. DoD would like to buy better capability at reduced costs and one way to do this is the use of technology transfer mechanisms.

The combined number of technology transfer activities in FY 2001 is identified in Appendix B; however, these are limited to Cooperative Research and Development Agreements (CRADAs), Patent License Agreements (PLAs), Facility Use Agreements, Personnel Exchange Agreements, and some of our Educational Partnership Agreements (EPAs).

DoD has been very active in the use of EPAs. We recognize that our future scientists and engineers are today's students needing both faculty resources and equipment to test scientific knowledge. We have a significant number of formal EPAs with universities and community colleges as well as local public school districts to provide the needed support in the form of technical assistance, personnel exchange, and loan/donation of educationally useful laboratory equipment.

DoD Technology Transfer Integrated Planning Team (TTIPT) Workshop

The sixth DoD TTIPT Workshop was held in November 2001. One hundred technology transfer professionals gathered to discuss joint projects, best practices, lessons learned, and to hear about new legislation and information sources that will effect current technology transfer efforts. Each Military Department provided an update on its technology transfer program implementation, the DoD partnership intermediary (TechLink) discussed how they are supporting technology transfer activities, training sessions on our proposed intellectual property database and technology assessments were presented, legal issues were discussed, and information sources currently available were highlighted (Defense Technology Transfer Information System, Virtual Technology Exposition). Additionally, roundtable discussions were held on four topics: usefulness of the Federal Laboratory Consortium, Database modules for intellectual property management, balancing the need for security with technology transfer functions, and DoD policy committee.

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 Department of Commerce. 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. It is continuing a review of foreign partners in CRADAs and how to assess potential concerns arising in these relationships. 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.

Federal Laboratory Consortium

The Military Departments and Defense Agencies have been participating in the Federal Laboratory Consortium for Technology Transfer (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.

The FY 2001 DoD financial payment for the operation of the FLC as specified in 15 USC 3710(e)(7)(A) was $959,366. We plan to work 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 FY 2001 Department of Defense winners of the Award for Excellence in Technology Transfer are identified along with a description of their technology in Appendix E. Additionally, Appendix E identifies both the FLC Representative of the Year, Ms. Kristen Schario, and Laboratory Director of the Year, Mr. Philip Brandler, from DoD laboratories.

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

FLC Position	Name/Organization
FLC Vice Chair Chair, Planning and Policy Committee Chair, Nominating Committee	Ed Linsenmeyer, Naval Surface Warfare Center, Coastal Systems Station
Chair, Program Committee	Norma Cammarata, Army Research Laboratory
Chair, Training Committee	John Griffin, Army Topographic Engineering Center
Chair, Legal Issues Committee	Vin Ranucci, Army Soldier Systems Command
Recording Secretary	Geoff Phillips, Defense MicroElectronics Activity
Coordinator, Northeast Region	Louis Jakub, Army Communications and Electronics Command
Coordinator, Mid-Atlantic Region	Richard Dimmick, Army Research Laboratory (Aberdeen)
Coordinator, Southeast Region	Kelly McGuire, Army Aviation and Missile Command RD&E Center
Coordinator, Far West Region	Michael Sullivan, Naval Air Warfare Center, Weapons Division, Point Mugu
Deputy Coordinator, Northeast Region	Hans Kohler, Naval Air Warfare Center, Aircraft Division
Deputy Coordinator, Mid-Atlantic Region	J. Scott Deiter, Naval Surface Warfare Center, Indian Head Division
FLC Executive Board Member-At-Large	Sharon Borland, Army Cold Regions Research and Engineering Laboratory
FLC Executive Board Member-At-Large	Soheir Ibrahim, Army Yuma Proving Grounds
FLC Executive Board Member-At-Large	Mary Weiss, Defense Technical Information Center

In addition to the above positions, Mr. John Todaro, Director, Office of Technology Transition, Office of the Deputy Under Secretary of Defense (Science and Technology) is serving on the National Advisor's Board to the FLC.

Defense Technology Transfer Information System (DTTIS)

The Defense Technical Information Center (DTIC) maintains the DTTIS in cooperation with the Military Services and Defense Agencies. As of December 31, 2001, we had 2,293 active CRADAs and 156 active Patent License Agreements. Numerical data from DTTIS is available at Appendix B.

The Technology Transfer Commercialization Act of 2000 was signed into law on November 6, 2000, providing additional guidance on licensing of federally owned inventions and CRADAs. It also requests specific data on utilization of federal technology. The specific data required to respond to this request were not collected by the Defense Department in any consolidated, automated way. This reporting requirement highlighted our need to better manage the intellectual property (IP) owned by DoD. We have begun to design an Intellectual Property Management Information System (IPMIS) to provide the requested information and help manage our IP. IPMIS should provide the data in a manner consistent with the request and should allow for easy transition into the DTTIS for these new data elements. We began this effort in FY 2001 and anticipate initial capability in FY 2003.

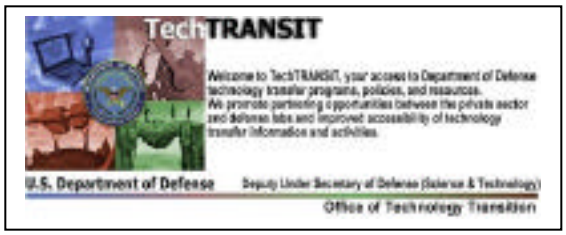
DoD Partnership Intermediary: TechLink

DoD began sponsorship of TechLink in July 1999. TechLink is a program established at Montana State University in Bozeman, Montana, to facilitate DoD technology transfer between companies in the TechLink region and all the DoD laboratories for development, transfer, and commercialization of new technologies. TechLink focuses on industries important to its region. The TechLink region includes Montana, Oregon, Washington, Idaho, Utah, Wyoming, North Dakota, and South Dakota.

The industry focus in the TechLink region is on Advanced Materials, Aerospace, Agriculture, Biomedicine and Biotechnology, Electronics, Environmental Technologies, Software and IT, and Photonics and Sensors. TechLink's accomplishments include assistance to approximately 70 different companies, assisted in creation of 6 new companies, and facilitated over 15 patent license agreements between companies and DoD laboratories in FY 2001.

TechLink success is measured on the outcome of its transactions. One metric is the number of partnerships facilitated between DoD and the private sector in the TechLink region. These have increased over the past year and TechLink has proved beneficial in finding partners for technology transfer purposes, both within the federal laboratory system and in the private sector.

Website



TechTRANSIT is the gateway to DoD technologies promoting partnering opportunities between the private sector and Defense laboratories. The website address is http://www.dtic.mil/techtransit. This website provides information of interest to the technology transfer community and includes contact information on ORTAs in the Military Services and Defense Agencies.

Major Successes in FY 2001

The following specific successes are examples of the type of technology transfer efforts within the DoD community.

ARMY

Walter Reed Army Institute of Research (WRAIR)

Testing of tafenoquine, an antimalarial drug developed at WRAIR, began in pediatric populations

First WRAIR CRADA where an Army officer has been assigned a temporary duty station (1 year) in the private sector and is provided space, equipment, and supplies to carry out the Statement of Work

Glaxo SmithKline has licensed all of WRAIR's technology on Live-Attenuated Dengue Vaccines and initiated a CRADA with WRAIR to identify the most suitable live virus tetravalent combination to produce a vaccine for commercial use.

WRAIR entered into a unique licensing arrangement with a spin-off company, Iomai. The technology license is a technique that allows the transdermal delivery of vaccines and drugs by application of the materials to bandages and replaces the requirement to use needles for delivery.

Army Medical Research Institute of Chemical Defense (USAMRICD)

USAMRICD has been supporting programs of national interest. Several congressional special interest programs are being managed at USAMRICD. These include Persian Gulf War syndrome, epidermolysis bullosa (a genetic, blister forming disease), and meurotoxin exposure treatment (with special emphasis on Parkinson's disease).

Army Construction Engineering Research Laboratory (CERL)

CERL has been conducting developmental research of recycled-plastic railroad (RR) ties for several years. In 1998, the Chicago Transit Authority (CTA) tested a few of these plastic-composite RR ties in its elevated track. The performance was so satisfactory that the CTA is going out for open bid for 21,500 recycled-plastic composite ties to be placed in both elevated and ballasted track. CERL helped CTA develop the procurement specifications for this project. In support of the EPA Region 5 Office, CERL will help monitor the performance of these new ties and publicize the results.

NAVY

Naval Space and Warfare System Center (SPAWARSYSCEN)

The Navy's SPAWARSYSCEN has established the Center for Commercialization of Advanced Technology (CCAT): $5.2M of DoD funding for the CCAT went to ONR and then to SSC in FY 01 to establish CCAT. It is a teaming partnership between the government, industry, and academia in the San Diego, CA, area. A cooperative agreement was signed between SSC-SD and San Diego State University. The purpose of CCAT is to identify technologies that have commercial and/or dual-use potential for DoD. The technologies are assessed early in their development to identify candidates for market analysis, linking to a commercial company for production and support in the form of business and market plan development as well as funding. The first solicitation for technologies resulted in the identification of 14 government technologies from SSC-SD and 85 industry and academia technologies. Technologies selected were targeted to crisis/consequence management and missile defense. CCAT is a 2-year program.

Naval Air Warfare Center Training System Division (NAWCTSD)

NAWCTSD has pioneered a new type of partnership arrangement. The Partnership 1 Building, located next to NAWCTSD on Navy-provided land, and constructed with funding from the National Institute of Justice (NIJ) and the University of Central Florida (UCF) was recently completed. It allows joint occupancy (military, academia, and NIJ), and is expected to further collaboration and technology transfer, especially between military and law enforcement activities.

Naval Surface Warfare Center Indian Head Division (IHDIV)

On July 24, 2001, the IHDIV Technology Transfer Office hosted a Technology Showcase, entitled "An Explosion of Technology." The Showcase also was supported by the Maryland Technology Development Corporation (TEDCO). The Showcase was conducted to develop jobs and new business in the state of Maryland. Approximately 500 Maryland businesses were invited to Indian Head for short presentations on

approximately 30 different state-of-the-art technologies, which have been developed for military applications, and are available for commercialization. In addition, laboratory tours were provided to the attendees. As a result of this Tech Showcase, several CRADAs were negotiated, or are under negotiation. Contacts made during this Showcase are continuing to be developed and pursued. The combination of a federal laboratory and state support to develop jobs and create new businesses is important not only for the state but also for the success of the laboratory. It is expected that any commercial product developed either under collaboration (CRADAs) or through patent licensing will help to create new jobs as well as provide commercial products that may be obtained by the DoD for future needs.

Naval Surface Warfare Center Carderock Division (Carderock)

On October 9, 2001, Maryland's Technology Development Corporation (TEDCO), along with the Carderock Division, co-sponsored a daylong series of presentations and tours in West Bethesda, demonstrating Navy expertise in a wide variety of disciplines for potential use by private sector organizations. Through posters and presentations, visitors saw many ways Carderock laboratories and technology can "create the vision" for the 21st Century. With the theme "Maritime Technology for the Marketplace," this event provided information on technology transfer, with presentations illustrating advanced technologies, processes, and facilities.

Naval Research Laboratory (NRL)

At last count, there were over 112 products on the market under license from NRL.

Naval Meterology and Oceanography Command (NAVOCEANO)

NAVOCEANO, in a CRADA with Interactive Visualization Systems, was able to eliminate an 18-month bathymetric data validation backlog in the first year of the CRADA. This CRADA combined IVS' 3-D visualization software for ocean mapping of large data sets with NAVOCEANO's multi-beam sonar data processing application, Area Based Editor.

AIR FORCE

Air Armaments Command (AAC)

AF AAC CRADA on F-16 Conformal Fuel Tank (CFT) Development with Lockheed Martin Tactical Aircraft Systems was completed during the year. This cooperative effort with Lockheed Martin Tactical Aircraft Systems explored and evaluated the use of conformal fuel tanks for the F-16. With approximately $8M total value, this is the largest dollar value CRADA ever entered into by AAC. The Air Force will gain an instrumented test aircraft with the ability to conduct conformal fuel tank testing. Lockheed will gain the use of an Air Force instrumented aircraft for test flights. The results of this CRADA will have great impact on Lockheed's foreign military sales program, making them more competitive in a worldwide market and will improve the ability of AAC to conduct future planned tests using the CFT.

Air Force Research Laboratory Materials and Manufacturing Directorate

Composite structure tooling method reduces fabrication times and costs. Engineers and scientists at the Air Force Research Laboratory's Materials and Manufacturing Directorate, the Defense Advanced Research Project Agency (DARPA) and Boeing-St. Louis have successfully developed and demonstrated a new way for significantly reducing the costs of tooling for composite structures. Their new low cost

method lowers the overall bond tool family costs by minimizing the total number of tools in a family; thus, reducing fabrication cycle times. Their new approach is already being used in prototype aircraft programs and could eventually be applied to other major aircraft development and production programs as well, saving millions of dollars while dramatically improving composite structure tooling quality. The application of the new tooling methods for composite structures may lead to significantly reduced tool fabrication costs and span times. There is already widespread use of these methods at Boeing-St. Louis. In fact, bond tools for Boeing prototype aircraft have already been fabricated using this methodology. The new approach is also making in-roads into Boeing production programs such as the C-17.

Air Force Research Laboratory – 3 Directorates

A CRADA was established between the Propulsion, Materials & Manufacturing and Air Vehicles Directorates and Delphi Automotive Systems, LLC to transfer AFRL's "brake by wire" technology to the automotive industry within the next two years. Brake by wire is a next generation braking system that stops vehicles by electrical signals versus the conventional hydraulics systems on cars today. The Air Force's interests are in validating the technology on high temperature power applications, control theory, reliable wiring and connectors for applications on aircraft and other aerospace systems. Cost reduction of components for Air Force systems is another benefit since the automotive industry would but large quantities, lowering the cost of electric systems. Federal, state and industry dollars are coming together to make this project a fiscal success. Federal dollars total $1.8 million, the state of Ohio has earmarked $1 million, and Delphi is bringing forward approximately $1.2 million.

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES (USUHS)

Antibody Technology – after an assignment of underlying technology to University inventors, USUHS, the Henry M. Jackson Foundation for the Advancement of Military Medicine, and a startup biotech company started by the inventors entered into a CRADA in 1989. Two proprietary vaccines arising under the CRADA are now sold worldwide.

FY 2002 Plan for Conducting Technology Transfer

The DoD views technology transfer as more than simply giving industry access to our laboratory technologies. We are users of the technologies in which we are interested in developing and helping transition into production. Therefore, transferring technology from our laboratories into the private sector and from the private sector into DoD systems is a key element for our Department.

A major part of any program plan involves applying lessons learned to future plans. One of the key lessons learned in the patent program was the realization that patents are often in the very early stages of technical development and therefore it becomes difficult to attract potential licensees. It becomes imperative that the researcher/inventor recognize this and continue to develop their technologies beyond the proof of concept stage in order to attract interest and ultimately capital to continue the technological development needed to transition a technology into a commercially viable product or process.

At some of our laboratories, the trend in CRADAs appears to be moving towards combining CRADAs with license agreements. Quite often, a license agreement is signed on a technology that has been successful through the proof–of-concept stage but needs additional research to bridge the technology gap to where it becomes commercially viable. Since the inventor is the one most intimately familiar with the technology, the signing of a CRADA with the laboratory can be the fastest and most economical way of developing the technology further so the technology and technical expertise underlying the invention can be more readily transferred to the licensee. This can also serve to reinforce the "technology champion" role of the inventor in this process.

As we become better managers of our intellectual property, we are finding that Invention Evaluation Boards at some locations include the ORTA, at others, it does not. The ORTA could provide valuable insight by having a "seat at the table" at those locations where they are not involved currently. Additionally, efforts to protect all inventions throughout the development process must be diligent. Attempts to commercialize one particular innovation led to the realization that the original patent did not adequately protect modifications to the original concept, and the licensing opportunity was lost. This lost opportunity has highlighted the realization that many researchers do not understand technology transfer mechanisms. Several activities are making an effort to provide opportunities such as "lunch seminars" on topics related to technology transfer so scientists have a better understanding of technology transfer and their responsibilities as federally employed scientists.

Technology transfer efforts are not generally included in the planning, budgeting, or execution of Science and Technology programs within DoD. We are seeking to make the technology transfer efforts an integral part of this planning so that as we begin research we consider when to partner with industry and what they might bring to the effort along the way. One example of how we are attempting to reconcile the need to include upfront planning for DoD systems with enhancing the competitiveness of U.S. industry is in the Air Force.

The Air Force Research Laboratory has established 5-Year Strategic Goals for its technology transfer program. The core strategies are: 1) integrate technology transfer into the acquisition strategy – technology transfer programs need to be integrated into the laboratory's technology roadmaps to bridge resource gaps, 2) identify technologies for commercial application, 3) market resources and technologies, 4) promote technology transfer training, and 5) share Air Force technology with the private and public sectors – the primary benefit of transferring technology is enhancing the accomplishment of the Air Force mission while providing economic and social benefits to the public and private sectors.

Another lesson learned in FY 2001 is that our partnership intermediaries, both TechLink and the Air Force-sponsored PIs, improve the ability to find potential CRADA and licensing partners. Many of our laboratories plan to continue and expand the use of

these resources to highlight top technologies with the highest potential for commercialization. For TechLink, we have established new goals for FY 2002. These new goals include 1) facilitate a minimum of 30 DoD-related licenses, CRADAs, and other partnerships, 2) increase the number of license applications from the region by 25%, and 3) increase the number of companies in the core region submitting DoD SBIR proposals by 25%.

Based on the mission needs of our laboratories, some focus areas for this next year are:

- Marketing: The marketing objective will include not only those technologies identified as having high commercial potential in the market assessment process but also other laboratory resources such as unique facilities, specialized equipment, and in-house expertise. After each marketing event (i.e., trade show, symposium), the ORTA will assess the quality of technology transfer leads to determine the following year's participation at the particular event.
- DoD IR&D: One of the areas on which we plan to build is utilization of the DoD IR&D database maintained by DTIC to identify potential collaborators. This database, which is a means for the private sector to identify its independent research and development activities, has the potential to help match private sector R&D initiatives with DoD laboratory R&D activities for mutual benefit through cooperation.
- Education: Educate scientists and engineers on what to patent and how to patent to ensure maximum protection is obtained for DoD-owned IP. Educate S&Es on the licensing process – what to expect, the pitfalls, time involved, etc., so that they will be prepared for the process.
- Position Descriptions: For those locations where it is not already, seek to ensure technology transfer is a part of position descriptions for laboratory directors, management, scientists, and engineers.
- Defense Information Systems Agency: DISA is supporting a DoD education initiative on several important aspects dealing with equipment donations, information technology management, and partnerships with educational institutions. We anticipate increased activity in this area during FY 2002.

Our overall strategy is to make technology transfer an integral part of the planning process so we can maximize the productivity of our S&T program. However, it must be recognized that future technology transfer activities are directly dependent upon maintaining an acceptable positive return on investment and perceived value-added to the mission. Leveraging resources is a key benefit of technology transfer activities within the DoD. As these opportunities are realized and the benefits are assessed, we anticipate increased usage of technology transfer mechanisms.

B. Dual Use Science and Technology Program

The ability of the United States to retain technological superiority on future battlefields will, in many cases, depend on the Nation's ability to take advantage of technological advances occurring in commercial industry. Commercial technology developments in areas such as electronics, advanced computing, communications, and medical research, are racing forward. These commercial developments are funded at levels vastly exceeding what the Department is currently able to apply. Greater reliance on commercial technologies not only will provide the Defense Department access to advances in technologies occurring in the commercial sector but also allows the Department to take advantage of the competitive pressures and market-driven efficiencies inherent in the commercial sector. This competitive, market-driven approach will increase the pace at which technological improvements are incorporated into defense systems while at the same time, reducing the costs of those systems.

The Department of Defense's (DoD) Dual Use Science and Technology (DU S&T) Program is designed to help the Department incorporate commercial technologies into defense systems. The Program was established in the Fiscal Year 1998 Defense Authorization Act and has two primary goals. The first is to jointly fund and develop dual use technologies with industry. To support this goal, the Act provides for 50/50 government/industry cost share of development. Other incentives for industry to work with DoD's DU S&T Program, besides the 50 percent project cost share by the government, include: access to technology from the government, and increased market opportunities with the Military Services. In addition to these business incentives, the Department is making it easier for commercial companies to enter into agreements with the DoD by using procedures that are not subject to most of the Federal procurement laws and regulations. These procedures, known as "Technology Investment Agreements," which include "Other Transactions" and "Cooperative Agreements," offer a great deal more flexibility and fewer regulatory requirements than standard government contracting. The use of alternative procedures provides the Department the ability to attract many commercial firms that would not otherwise do business with the DoD. The second goal is to make the development of dual use technologies with industry a normal way of doing business within the Services. The Fiscal Year 1998 Authorization Act established goals for the initiation of dual use projects. These goals started at 5% of each Department's applied research program in Fiscal Year 1998 and grew to 15% by 2001.

Thus far, more than 400 companies, universities, and nonprofits are participating in the Program. 327 DU S&T projects were initiated with a total value of over $1.0 billion. In addition to the growing size of investments, it is encouraging to see the number of commercial firms that have become involved in the Program. These firms are bringing many new ideas to the table. Service participation in the DU S&T Program has been key to the Program's success. Now, execution of the Program is transitioning

from OSD to the Services. A sixth solicitation for Fiscal Year 2002 proposals was issued in April 2001 and closed at the end of July 2001. Approximately $60 million in government funding ($30 million Service DU S&T and $30 million Service field funds) are anticipated to form new partnerships with industry and to bring commercial technology development to the benefit of the Department. As with the previous solicitation, this was a joint solicitation issued by the Air Force and was used as a vehicle to launch an extensive outreach effort to industry.

Dual Use Science and Technology Achievement Award

In FY 2000, the Deputy Under Secretary of Defense for Science and Technology established an annual Dual Use Science and Technology Achievement Award to recognize successful dual use projects and honor those individuals responsible for their initiation and execution. Winning projects are selected by committee based on military benefit, commercial viability, and quality of cost share. The responsible individuals identified from the winning project received a $5,00 award, and the two runners-up each received $2,500.

The following three projects were the winners and runners-up for the 2000 DU S&T Achievement Award. These projects highlight the success DU S&T is seeing in partnering with industry to leverage our scarce S&T dollars to develop the best technology available for both defense and commercial application.

Electronically Controlled Active Braking System for Medium Duty Vehicles

Mr. Brad McNett, Program Manager, and Mr. Mark A. Mushenski, Project Engineer, of the Army's National Automotive Center, Tank-Automotive and Armaments Command shared first prize for their work with Continental Teves in developing an electronically controlled active braking system (ABS) for medium duty vehicles. The project resulted in an affordable ABS that will be used on the Army's HMMWVs and on medium class commercial trucks to improve safety and performance. The project involved developing and integrating the MK50 ABS with low speed traction control on a M1097A2 HMMWV. The project successfully advanced the state-of-the-art for ABS for commercial vehicles while including the unique needs of the HMMWV early in the development cycle. As a result of this project, Continental Teves had commercial orders for more than 50,000 units per year in 2001. In addition, Continental Teves was selected as the brake supplier for the next generation HMMWV, the A4. Production of the A4 is expected to begin in 2003 and volumes are projected to be 3,000 to 5,000 vehicles per year. The expected ABS acquisition cost for the A4 is $500 to $700 per unit compared to approximately $2,500 per vehicle without a commercial production base. This will reduce A4 acquisition costs by more than $50 million.

Renewal of Legacy Software Systems (ROLSS)

The first runner-up award was presented to Mr. Charles Caposell, electronics engineer, at the Navy's Air System Command, Patuxent River, Maryland. Mr. Caposell

worked with CPU Technology of Pleasanton, California to develop a process to update aging and obsolete hardware without requiring the costly rewrite and validation of already proven software. The project resulted in a family of configurable processor frameworks called CFrame that allows processors and systems-on-chips to be quickly and cost-effectively configured to any given instruction set. The CFrame family offers a range of performance, up to an industry leading five billion instructions per second, 256-bit framework, the fastest in the world. One version of the CFrame is being used in a Programmable Display Generator for the F-16 and is saving tens of millions of dollars according to the F-16 program office. A CFrame is also being used to modernize the F-16's fire control radar with projected savings of $150 million. The overall savings from the project are estimated at up to $1 billion over the next decade. CPU Technology is actively participating in discussions with commercial aerospace companies to identify commercial applications of the technology.

Future Air Navigation and Traffic Avoidance through Integrated Communications, Navigation and Surveillance (FANTASTIC)

The second runner-up award was presented to Mr. Joel Arnold, project engineer, of the Air Force Research Laboratory at Wright Patterson Air Force Base. Mr. Arnold worked with Rockwell Collins to develop a cost-effective solution for upgrading tactical fighters, general aviation aircraft and business jets to meet future FAA regulations. These regulations will require that all aircraft be capable of reporting their GPS position, altitude, heading and air speed over SATCOM, have collision avoidance capability, and send, receive and display English text via a data link. This project successfully demonstrated an effective solution to meet these requirements. The system developed overcame the space restraints on tactical fighters and the cost restraints of the commercial general aviation and business jet market to develop a true dual use technology. The technology is planned for use on the F-22 and will result in an acquisition saving of over $100M. It is also expected to be the technology of choice on the Comanche helicopter with similar cost savings, and is being considered for the Joint Tactical Radio System and the Joint Strike fighter. Rockwell Collins will be expanding into the huge (over 1,000,000) general aviation, and personnel aircraft market, which will reduce the cost to the DoD through economies of scale.

C. Small Business Innovation Research (SBIR)

The purpose of DoD's SBIR program is to harness the innovative talents of our nation's small technology companies for U.S. military and economic strength. DoD's SBIR program funds early-stage R&D projects at small technology companies -- projects which serve a DoD need and have the potential for commercialization in private sector and/or military markets. The program, funded at over $500 million in FY 2001, is part of a larger ($1.2 billion) federal SBIR program administered by ten federal agencies.

As part of its SBIR program, the DoD issues an SBIR solicitation twice a year, describing its R&D needs and inviting R&D proposals from small companies -- firms organized for profit with 500 or fewer employees, including all affiliated firms. Companies apply first for a six-month phase I award of $100,000 to test the scientific, technical, and commercial merit and feasibility of a particular concept. If phase I proves successful, the company may be invited to apply for a two-year phase II award of $750,000 to further develop the concept, usually to the prototype stage. Proposals are judged competitively on the basis of scientific, technical, and commercial merit. Following completion of phase II, small companies are expected to obtain funding from the private sector and/or non-SBIR government sources (in "phase III") to develop the concept into a product for sale in private sector and/or military markets.

The Deputy Under Secretary of Defense (Science & Technology) SBIR Program is sponsoring two technology area initiatives this year, Cognitive Readiness Technology and Conditioned Based Maintenance Technology. We are also co-sponsoring two additional technology areas, biomedical technology and information technology for military health systems, with Defense Health Affairs.

All three Military Services are participating in the Office of the Secretary of Defense (OSD) program this year. The Service laboratories act as our OSD Agent in the management and execution of the contracts with small businesses. The Army, Navy, and Air Force laboratories, often referred to as a DoD Component acting on behalf of the OSD, invite small business firms to submit proposals under this SBIR program solicitation.

Objectives of the DoD SBIR Program include stimulating technological innovation, strengthening the role of small business in meeting DoD research and development needs, fostering and encouraging participation by minority and disadvantaged persons in technological innovation, and increasing the commercial application of DoD-supported research and development results.

The Cognitive Readiness focus area provides a cross-component, multidisciplinary S&T framework to focus on the human dimension of joint warfighting capabilities. In addition, Cognitive Readiness serves to highlight a useful criterion for

warfighting capability - fully prepared joint-warfighters, fighting and winning in an information rich, distributed firepower battlespace using human-centered hardware and systems.

The Cognitive Readiness focus area is intended to be highly responsive to achieving Joint Vision capabilities. *Joint Vision 2010* identifies readiness in terms of people, training, leader development, and first-rate equipment, as the foundation for enabling joint operational capabilities. *Joint Vision 2020* reinforces and extends this philosophy by emphasizing and encouraging human innovation as the key force multiplier of the future. Hence, the goal of the Cognitive Readiness focus area is to enable a high degree of Warfighter readiness and mission performance with affordable systems and a smaller force deployed across the globe under diverse conditions. For the full range of weapon systems and Joint Operational Capabilities, Cognitive Readiness technologies are integral to major gains in operability, effectiveness, and affordability.

The optimization and enhancement of human performance is challenged by many different factors, such as general health issues, mental and physical stress, cultural and societal influences, environmental stressors (e.g., heat, cold, altitude, information overload), adequate education and training. Currently, there are two "core" DoD program areas organized to address Cognitive Readiness issues, the Biomedical and Human Systems programs, with subcomponents dealing in health, psychology, sociology, personnel and training, and human factors engineering issues.

The Cognitive Readiness topics selected for this solicitation are listed below:

OSD01-CR01	Cognitive Fightability Index for Warrior Systems by the Army Research Laboratory
OSD01-CR02	Field-Practical Automated Battery for Assessing and Monitoring Cognitive Readiness by the Army Research Laboratory
OSD01-CR03	Screening Test for Detection of Major Psychiatric Disorders in Young Adults by the Army Medical Research Acquisition Activity
OSD01-CR04	3D Components for Virtual Environments By the Army Simulation and Training Command (STRICOM)
OSD01-CR05	Real Time Collective Performance Feedback For Combat by the Army Research Institute
OSD01-CR06	Scenario Based Decision Skills Training for Geographically Distributed Teams by Air Force Research Lab Human Effectiveness Directorate, Williams AFB
OSD01-CR07	Professional Leadership Development Skills Training for the 21st Century by Air Force Research Lab Human Effectiveness Directorate, Brooks AFB
OSD01-CR08	Tactics, Training, and Procedures for the Warfighter Reacting to Crowd Dynamics by Air Force Research Lab Human Effectiveness Directorate, Brooks AFB

OSD01-CR09	Cognitive Demands of Warfighter Readiness by Air Force Research Lab Human Effectiveness Directorate, Williams AFB
OSD01-CR10	Assessment Methods for Tactical Knowledge and Cognitive Readiness of Intelligence Tasking, Processing, Exploitation and Dissemination (TPED) Teams by Williams AFB
OSD01-CR11	Authoring Shell for Case-Based Instruction by the Office of Naval Research
OSD01-CR12	The Grain Size Of Student Models As Factor In ICAI Effectiveness by the Office of Naval Research
OSD01-CR13	Toolbox/Intelligent Advisor for Creating Pedagogically Correct, Interesting and Motivating Instructional Content by the Naval Air Warfare Center
OSD01-CR14	Intelligent Assistant for Web-based Training Vignette Design by the Naval Air Warfare Center
OSD01-CR15	Instructional System for Enhancing Seakeeping Cognitive Readiness and Decision-Making Skills by the Special Operations Command

Maintentance comprises a major portion of the total operational cost for DoD weapons systems. Unnecessary or inappropriate maintenance contributes to inflated ownership costs and generally reduced readiness for deployable assets, while unscheduled maintenance requirements can be very costly and disruptive. Proper application of Condition-Based Maintenance (CBM) practices, which apply a methodology for the performance of maintenance only where there is objective evidence of need, as part of an overall maintenance effort can reduce operating and support (O&S) costs and work-hour requirements. Furthermore, maintenance decisions can be focused on those maintenance actions most needed to ensure safety and mission readiness. In doing so, CBM provides a means to manage the risk of mission-degrading failures.

Condition-Based Maintenance and Predictive Diagnostics are logical and appropriate successors to the very successful Reliability Centered Maintenance approach to equipment reliability and affordable operation. Ideally in condition-based maintenance, the operational health of specific components or a complex system is determined through sensors or a sensing system. This information then is used to make maintenance or operational usage decisions. Accurate and reliable predictors of current equipment health and the remaining useful life of equipment in service may be used to determine operating risk for the next operations or maintenance cycle, the most efficient scheduling of maintenance actions or inspections, or usage modifications to delay failure or repair. Prudent application of CBM has the potential to reduce operations and maintenance costs while stabilizing or increasing materiel readiness.

Advances in miniature sensors, life-prediction methodologies and real-time computation, signal processing and multi-sensor data fusion, and intelligent reasoning and control are providing a technological foundation for condition-based maintenance. Significant progress has been made in the rapid assessment of machinery condition

through monitoring debris in lubricating oils and the condition of oils themselves, severity of hidden corrosion and general corrosiveness of environments, and acoustic and vibrational measures. Nevertheless, major challenges face the practical implementation of CBM technologies and operational practicality. Among these are the development and integration of self-powered or power-harvesting wireless micro-sensors capable of operating in high thermal or high mechanical load environments; models and methodologies that can predict health and expected life based on physical, mechanical, or other measurements; reliable methods to measure and predict corrosion degradation in unstable environments; predictive tools for advanced materials, materials systems, and structures and design concepts for in-service monitoring; and design tools to assist in selecting the most appropriate monitoring approach for a specific mechanical or electrical system.

The Condition-Based Maintenance Topics are:

- OSD01-CBM01 Airframe Health Monitoring using Acoustic Emission Crack Detection with Bragg Grating by Naval Air Systems Command
- OSD01-CBM02 "Smart" Machinery Spaces by Naval Sea Systems Command
- OSD01-CBM03 Fully Automated Bearing Residual Life Prognosis Wireless Sensor by Naval Sea Systems Command
- OSD01-CBM04 Fiber Optic Strain Field Measurement for Aging Aircraft by the Air Force Research Laboratory, WPAFB
- OSD01-CBM05 Development of An Evanescent Microwave Probe Scanner for Detecting and Assessing Corrosion Beneath Painted and/or Sealed Surfaces by the Air Force Research Laboratory, WPAFB
- OSD01-CBM06 In-Line Health Monitoring System for Aircraft Hydraulic Pumps & Motors by the Air Force Research Laboratory, WPAFB
- OSD01-CBM07 In-Line Hydraulic Fluid Contamination Multi-Sensor by the Air Force Research Laboratory, WPAFB
- OSD01-CBM08 Fretting Fatigue Model by the Air Force Research Laboratory, WPAFB
- OSD01-CBM09 Reliability Algorithms for Corrosion Fatigue Assessments by the Air Force Research Laboratory, WPAFB
- OSD01-CBM10 Structural Component Substantiation Methodology by the Army Aviation and Missile Command
- OSD01-CBM11 Power Scavenging in a Cold, Dark Storage Environment by the Army Aviation and Missile Command
- OSD01-CBM12 Battery Optimized for Long Term Storage and Intermittent Use by the Army Aviation and Missile Command
- OSD01-CBM13 Non-Destructive Life Prediction and Component Interaction

Fault Tree for Energy Related Systems by the Engineering Research and Development Center, Construction Engineering Research Laboratory

- OSD01-CBM14 Smart Coating/Sensor Blankets for Health Monitoring by the Engineering Research and Development Center, Construction Engineering Research Laboratory

The Deputy Under Secretary of Defense (S&T) and Defense Health Program Office are jointly sponsoring this focus area to explore biomedical technology research issues. The biomedical technology area is focused to yield essential technology in support of the DoD mission to provide health support and services to U.S. Armed Forces. Most national and international medical S&T investment is focused on public health problems of the general population. Military medical S&T is concerned with developing technologies in order to preserve combatants' health and optimal mission capabilities despite extraordinary battle and non-battle threats to their well being. Preservation of individual health and well being sustains warfighting capabilities. The Biomedical Reliance Panel is included within the overarching structure of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee, which provides joint coordination and cooperation to ensure synergy across all biomedical programs.

The biomedical technology topics are:

- OSD01-DHP01 Development of a Vaccine for the Treatment and/or Prevention of Cancer by US Army Medical Research Acquisition Activity
- OSD01-DHP02 Development of a Serum Based Biomarker for the Detection of Cancer by US Army Medical Research Acquisition Activity
- OSD01-DHP03 Lightweight Trauma Module by US Army Medical Research Acquisition Activity
- OSD01-DHP04 Photoactivated Chemical for Tissue Bonding by US Army Medical Research Acquisition Activity
- OSD01-DHP05 New Biosensors for Real-Time Terrestrial Toxicity Monitoring by US Army Medical Research Acquisition Activity
- OSD01-DHP06 Rapid Diagnostics for Detection of Respiratory Pathogens by the Naval Health Research Center
- OSD01-DHP07 Biomarkers of Musculoskeletal Soft-Tissue Injury by the Naval Health Research Center
- OSD01-DHP08 Production of Purified Recombinant Proteins for Development of Vaccines of Military Importance by the Naval Medical Research Center
- OSD01-DHP09 Reduction of Motion Side Effects and After Effects by the Special Operations Command

The Deputy Under Secretary of Defense (S&T) and Defense Health Program Office are jointly sponsoring this SBIR program focus area to do applied research on Information Technology (IT) issues directly supporting the Military Health System

(MHS). The MHS has approximately 80 major Military Treatment Facilities, 500 clinics, 160,000 healthcare personnel, and 8.3 million eligible beneficiaries. This health system results in approximately 900,000 outpatient visits and 10,000 hospital admissions per week.

The objective of these topics is to support the MHS optimization plan that includes the areas of: 1) Access to care, 2) Provision of care, 3) Manage the business and 4) Population health management.

The SBIR topics in this technology area, managed by Telemedicine and Advanced Technology Research Center, a part of Army Medical Research and Material Command at Ft. Detrick, Maryland are:

- OSD01-DHP10 Technology Enhanced Human Interface to the Computerized Patient Record
- OSD01-DHP11 Cognitive Patient-Clinician Encounter Model
- OSD01-DHP12 Health Information Data Mining

D. DoD Manufacturing Technology Program

DoD's Manufacturing Technology (ManTech) Program develops new and improved manufacturing processes to facilitate more affordable production of DoD weapon systems and components. The Program addresses process technology issues from the systems development phase through transition to production and into sustainment. ManTech investments target defense-essential needs that industry would not otherwise pursue, alone, in a timely manner. ManTech improvements generally translate into cost avoidance or cycle time reductions. 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 processes for metals, composites, electronics, and energetics/munitions by improving factory floor and repair and maintenance facility (depots, logistics centers, and shipyards) processes.
- *Advanced Manufacturing Enterprise* activities accelerate implementation of world-class industrial practices, advanced design, and information systems that support weapon system development, production and sustainment.
- *Sustainment* projects coordinate common DoD opportunities to increase the reliability and reduce the cost of repair processes for aging systems.

In response to the requirements of 10 U.S.C. section 2521(e), the Department issues an annual Five-year Plan for the ManTech Program in March of each fiscal year. The Plan, available on the Internet at http://www.dodmantech.com/pubs/pubs.shtml

- Describes the ManTech Program's goals, priorities, investment strategy, management and planning processes.
- Presents Military Department and Defense Logistics Agency funding for current and future years.
- Includes a description of all recently completed projects, and the status of implementation.
- Assesses the extent of cost sharing with commercial enterprises, defense program offices, other federal agencies, institutions of higher learning, and other sources.
- Summarizes program measures of effectiveness and the results of internal and independent reviews.
- Provides examples of success stories and achievements.

Technology Transfer & Dual Use

The ManTech program is driven by defense needs for technologies and systems that provide a superiority edge to the warfighters. In today's environment DoD is involving the commercial industrial base as soon as possible, by either adopting its best practices or transferring results of military processes to the commercial arena.

An example is the project that received the 2001 Defense Manufacturing Technology Achievement Award. This annual award recognizes Defense and private sector individuals responsible for developing innovative manufacturing processes that improve the affordability, cycle time, or readiness of Defense weapon systems or components.

Thanks to the dedicated and outstanding efforts of the government/industry team responsible for the Enhanced Manufacturing Processes for Body Armor Materials project, the Soldiers and Marines who may be in harm's way participating in Operation Enduring Freedom will be wearing the best ballistic protection available in the world today!

The Interceptor body armor jacket could stop 9mm handgun bullets in their tracks. Now, because of the work of this team and the success of this ManTech project, two highly effective, lightweight ceramic armor materials have been developed and implemented which vastly enhance the Interceptor's capabilities. Siliconized silicon carbide and boron carbide plates that can stop rifle or machine-gun fire—which was not possible with this jacket in the past—are now available to insert in the jacket's pockets. Simula, with a production capacity of 5,000 plates per month, has already delivered 45,000 of its siliconized silicon carbide plates and is under contract to deliver 140,000 more; 12,000 of CERCOM's boron carbide plates have also been fielded. The new armor plates are 55% lighter than traditional body armor, and have a cost approximately 60% lower than the high performance armor plates that were available at the start of this project. Because of the lower cost, it is anticipated that police departments across the U.S. will also adopt this product.

Also highly noteworthy is that this project exemplifies the "jointness" aspect of the ManTech Program. It utilized not only Army ManTech money but also significant funding contributions from Army and Marine program offices as well as from private industry.

Recent Management Initiatives & Accomplishments

The Joint Defense Manufacturing Technology Panel (JDMTP) recognized the need to provide specialized training to ManTech project engineers and managers. Currently a one and one-half day training session is offered. The training is provided by the JDMTP to help ManTech project engineers and managers become more effective in planning and executing ManTech projects. Offerings of this one and one-half day course are being conducted about every three months and have been attended by over 120 individuals.

The annual Defense Manufacturing Conference continues to be a premier activity for networking and sharing the results of ongoing and completed manufacturing programs across the DoD, industry, and other government agencies. The 2001 conference was held in Las Vegas, Nevada. Over 875 leaders from government, industry, and academia attended. The conference featured panel sessions providing customer viewpoints from both the weapon systems and logistics community. Exchange of technical information was promoted by use of concurrent briefings spanning over 100 technical projects, and via evening receptions held with 84 exhibitors from DoD, industry, and academia.

To improve ownership and advocacy for the ManTech program, the JDMTP initiated action to develop a hard-hitting booklet designed to improve program advocacy with the internal and external program customers across the DoD, with Congress, industry, and academia. It is expected that the booklet will be published in mid-2002.

The Science & Technology (S&T) Affordability Task Force continues to establish processes to strengthen the affordability and improve the transition of the DoD's S&T programs. The objective is to identify mechanisms that focus DoD's technology programs on implementing Integrated Product and Process Development , and facilitate use of Integrated Product Teams for key S&T programs expected to transition to the next phase of acquisition. Accomplishments to date include:

- Conduct of nine Affordability Conference/Workshops (see www.affordability.org for proceedings concerning the most recent conference).
- Development and application of *criteria* and *measures* to enhance S&T understanding of weapons systems acquisition needs to facilitate timely transition of technology.
- Review of over 100 S&T programs for best practice case studies.
- Development of guidelines for technology transition and a handbook on the process of affordability.
- Suggested training curriculum and formulation of a new course for S&T program managers.

E. Defense Technical Information Center

The Defense Technical Information Center (DTIC) is a major component of the Defense Department's Scientific and Technical Information Program because it maintains data on R&D programs conducted by the Military Departments and Defense Agencies. It contributes to the management and conduct of Defense research, development, and acquisition efforts by providing access to and transfer of scientific, technical, and management information for DoD personnel, DoD contractors, and potential contractors, and other U.S. Government agency personnel and their contractors.

Support to Defense Science and Technology Program Management

As part of its mission, DTIC is directed by DoD Instruction 3200.14 (E7.2.4) to "provide information services which utilize the appropriate information technologies to acquire, analyze and disseminate information to support oversight and management functions and to improve overall Department of Defense management." DTIC staff members work with client organizations within DoD to assess and define information gathering, analysis and dissemination requirements, and then meet these requirements using information science and information technology techniques.

A change to DoDI 3200.14, which implements the DoD Scientific and Technical Information Program (STIP), was issued on June 28, 2001. The change replaced the DoD Technical Effort and Management System (TEAMS) with the series of prescribed S&T planning, programming, and budgeting documents used to manage the DOD RDT&E program. These include the Joint Warfighter S&T Plan, the Defense Technology Objectives, the Defense Technology Area Plans, and the Research and Development Descriptive Summaries. Through the development, coordination, and use of these documents, the Defense Reliance process of program reviews, coordination of investment decisions, and assessment of program results promotes an environment of timely and cost-effective RDT&E management and facilitates the elimination of unnecessary duplication of effort.

DTIC in conjunction with the OSD (C3I) Office of Security policy is sponsoring development of a training guide for marking DoD documents. This includes guidance on the full range of markings including security classification, technical document markings using DoD Distribution Statements, Privacy Act statements, etc. This material will be available as printed matter and online.

DOD Technical Reports

In Fiscal Year 2001, DTIC supplied 178,016 output products directly to the non-government sector of the Defense Community. In addition, DTIC supplied 10,366 technical reports to the National Technical Information Service (NTIS), the Federal government's focal point for redistribution of unclassified unlimited technical information to the public.

Portions of the technical report collection are also available on the Internet through DTIC's Scientific and Technical Information Network (STINET). Secure STINET, restricted to qualified, registered members of the Defense Community, provides encrypted transmission of citations and downloadable text of hundreds of thousands of documents, including unclassified, limited distribution reports. Public STINET, available to anyone, contains citations to unclassified, unlimited technical reports, as well as the full text of many thousands of releasable documents.

In Fiscal Year 2001, there were 157,955 external accesses of Secure STINET, and 116,029 searches of the secure system, yielding 53,523 megabytes of information. There were 5,452,548 external access of Public STINET, and 523,264 searches of the unrestricted site. Public STINET delivered 3,963,112 megabytes during the Fiscal Year, serving an average of 5,726 users per week. Owing to regulatory restrictions on collecting data about visitors to public Web sites, DTIC is unable to analyze the composition of this group.

Registration for Access to DOD Technical Information

At the end of Fiscal Year 2001, there were a total of 5,202 registered users of DTIC. Of this total, 2,013 represented non-governmental industrial organizations, and 911 were educational organizations and institutions. The number of registered users is less than reported in FY 2000, owing to DTIC's commitment to the Defense Community rather than to users with only a tenuous business relationship to the DOD. The information needs of these customers can be served adequately by NTIS and by DTIC's Public STINET service.

DTIC facilitates awareness of technology through its registration program by targeting prospective participants in the DOD Small Business Innovation Research (SBIR) program. Of the non-government industrial organizations registered with DTIC in FY 2001, 346 were registered in the SBIR Program.

Defense Technology Transfer Information System (DTTIS)

DTIC operates and maintains DTTIS on behalf of the DOD Technology Transfer (T2) Program office. As of December 31, 2001, DTTIS contained project information on 4,634 DoD Technology Transfer Activities, including 2,293 active Cooperative Research and Development Transfer Agreements (CRADAs) and 156 active Patent License Agreements. Approximately 100 Technology Transfer professionals are registered to use the DTTIS secure World Wide Web site to view and analyze T2 data. FY 2001 input into the DTTIS included 674 new records and 2039 modifications.

Independent Research and Development (IR&D or IRAD) database

DTIC maintains a database with project description and financial information reflecting Independent Research and Development efforts conducted by Defense contractors. In 2001, the database received over 2,350 project descriptions reflecting almost 2.7 billion dollars in 2001 IR&D investment. It is estimated that this reflects well over 80% of the cost recoverable independent research and development efforts performed by defense

contractors. The information in the database is proprietary and disseminated to over 1100 registered U.S. government personnel via a secure, DTIC-hosted, scientific and technical information World Wide Web site. Also in 2001, DTIC accomplished many its implementation tasks under the DOD IR&D Action Plan which brought additional value for IR&D database users and visibility to the IR&D Program.

Internet/World Wide Web (WWW)

The DoD maintains its leadership in deploying innovative Information Technology (IT) solutions to improve information access and availability. In its development and maintenance of more than 90 DoD Web information systems, the DTIC utilizes leading-edge technologies to create and maintain applications that collect and distribute technology transition information in the most timely and accessible manner.

The DTIC support for technology transition is exemplified by the Virtual Technology Exposition (VTE). This Web site provides access to current information concerning the DoD's most advanced technology research activities to the Department and its academic and industrial partners. Through easily accessed descriptions of recent research advances, the VTE offers the acquisition community greater visibility of emerging technologies. This format allows program managers to become more familiar with the technical resources available to them, and thus more effective in transitioning appropriate technologies into their specific weapon systems programs. In addition, the VTE can also be utilized to identify new collaborative opportunities with partners that possess specific expertise, experience in unique technologies or who have common program objectives. A wide array of program categories is included in the VTE, as well as other sources of published information related to research in these areas. Information is organized in categories for easy access by the acquisition, requirements, and science and technology communities. The overarching purpose of facilitating this information transfer and relationship establishment is to create improved processes that will result in reduced cycle time and development/production costs.

The VTE currently offers information on high level DoD projects, manufacturing and technology projects, and NASA inventions. The VTE continues to expand, providing users with a broad view of innovative technologies throughout the federal government. The site currently contains only unclassified information and is open registered users within the DoD research community and other government agencies.

F. Independent Research and Development (IR&D)

Independent Research and Development is R&D initiated and conducted by defense contractors independent of DoD control and without direct DoD funding. Major defense contractors spend about $3 billion annually on thousands of IR&D projects. These projects provide an important supplement to R&D funded directly by DoD. Defense contractors recover a portion of their IR&D spending as an indirect expense on government contracts

Defense contractors and DoD play complementary roles with respect to IR&D activities. Primary control of these activities rests with the contractors, who are free to determine both the amount of their IR&D activities and the focus of these activities. However, contractors are motivated to focus on technical areas of interest to DoD. While contractors are no longer required to report IR&D plans and accomplishments to DoD, they do advertise their technical capabilities to potential DoD customers. Most major contractors provide information to DoD about their IR&D activities through technical interchange meetings (TIMs) 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 decisionmaking 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 and to avoid duplication of contractor IR&D activities by R&D funded directly by DoD.

In November, 2000, DoD prepared an IR&D Action Plan to improve the processes within DoD and industry for managing IR&D activities and to increase the effectiveness of IR&D spending to support national defense needs. The Plan focuses on improving communications between DoD and industry regarding defense technology needs and contractor IR&D accomplishments.

During FY01, the Technical Coordinating Group (TCG), a senior level steering group for the IR&D program, met twice to guide and review the Action Plan and associated implementing activities. A Working Group is the driving force behind implementation of the Action Plan. During FY01, the Working Group instituted monthly meetings to coordinate IR&D Program activities and to ensure continuing progress in efforts to strengthen the IR&D Program.

Outreach efforts have been increased to educate DoD personnel about IR&D accomplishments and about requirements to consider contractor IR&D in DoD S&T

planning. The IR&D Program is working with DoD schools, such as the Defense Acquisition University/Defense Systems Management College, to ensure IR&D issues are covered in relevant acquisition courses. A Web-based survey of DoD personnel is collecting information to assess awareness of IR&D issues within DoD and to help develop additional strategies to ensure efficient and effective use of IR&D information throughout DoD. To raise basic awareness of IR&D, a brochure for DoD personnel was distributed at technical meetings and conferences.

Websites are becoming an increasingly important means of communications for the IR&D Program. Industry can access information about DoD's R&D plans and activities and about DoD's mission needs and operational requirements at various sites (some with restricted access) sponsored by OSD, the Military Departments, and other DoD Components. The number of sites and volume of information pose a challenge to any company wishing to identify defense R&D activities and technological requirements that correspond to the company's capabilities. The IR&D Program developed a website that concisely presents all the relevant information needed for an understanding of the IR&D program. The site is available at http://www.dtic.mil/ird/ .

The TCG and working group continue to meet regularly to complete Action Plan activities and to assess how well the IR&D program is working.

G. Title III of the Defense Production Act

The Defense Production Act (DPA) is the primary statutory authority aimed at ensuring timely availability of industrial resources and critical technology items that are essential for national defense. The purpose of the DPA, Title III Program is to create, maintain, modernize, or expand the productive capacities of domestic sources for critical components, technology items, and industrial 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.

Title III accomplishes its objectives by providing domestic industry with a variety of incentives, which reduce the risk of establishing the needed capacity. These incentives include purchases, purchase commitments, development of substitutes, loans and loan guarantees and the purchase of advanced manufacturing equipment for installation in Government or privately owned facilities. Purchases and purchase commitments are the incentives used most frequently.

The Department organizes and executes the Title III program as a DoD-wide program, generally focusing on materials and components that can be used in a broad spectrum of defense systems. The Office of the Secretary of Defense provides top-level management, direction, and oversight. The Air Force, acting as the Executive Agent for the program, structures and executes approved and funded projects for the Department.

The Title III Program is unique among DoD programs since it is the only program that is focused on the creation or expansion of domestic production capacity.

In FY 2001 eleven Title III projects were active or under development. Projects being developed include three new Title III Projects under the Radiation Hardened Microelectronics Initiative. These projects will be executed in FY 2002.

ACTIVE PROJECTS

Laser Eye Protection (LEP)

The objective of this project is to establish a viable, highly responsive, and affordable production capacity for thin film dielectric coatings on polycarbonate substrates, which will be used to make laser protective eyewear. The widespread proliferation of lasers in military operations is posing an increasingly significant threat of eye injury to military personnel. Exposure to laser energy can cause injuries that range from temporary incapacitation to permanent blindness. Current eyewear using absorption organic dye technology severely reduces visible light transmission, which

impairs the effective and safe performance of operational tasks when worn at night or in low-light conditions. This project will ensure the establishment of a domestic source with the capacity to supply affordable devices in sufficient quantities to meet defense needs.

Technical sponsors for this project include the Army's Military Eye Protection System (MEPS) Program Office within US Army Soldier and Biological Chemical Command; the Navy Project Manager for Aircrew Systems, Naval Air Systems Command; the Air Force 311th Human Systems Program Office; and the Air Force Research Laboratory.

The capacity established by this project will be capable of producing approximately 50,000 LEP units per year. In August 2000, a $5.39 million cost sharing contract was awarded to Rockwell Science Center, Thousand Oaks, CA. Title III funding is $4.09 million with the contractor providing an additional $1.30 million in cost sharing. The project is expected to run through mid-2002. There is an additional option for $0.78 million to provide for the production of 50 flight helmet visors each to the Navy and Air Force.

Silicon-on-Insulator (SOI) Wafers

The objective of this project is to establish a viable domestic source for SOI substrates capable of producing low-cost, high-performance devices that can be effectively and affordably inserted into DOD systems. SOI materials significantly reduce costs and improve the performance of electronic devices used in defense systems such as military satellite communications, upgrades for ballistic missiles, surveillance systems, and inertial navigation systems. SOI materials are also cost effective to fabricate low power and/or radiation tolerant devices.

In March 2000, a 4-year Technology Investment Agreement (TIA) was signed with Intersil Corporation, Melbourne, FL (formerly Harris Semiconductor Division). The total value of this effort is approximately $14.3 million. Title III incentives are $6.63 million with Intersil cost sharing the remaining amount. The TIA will incentivize Intersil to expand and create a merchant production capacity. The technical sponsor, Naval Surface Warfare Center (NSWC), Crane, IN continues to lend strong support for the program.

Microwave Power Tubes (MPT)

This project will strengthen the supplier base to the Microwave Power Tube (MPT) industry by selectively targeting supply chain problems associated with critical materials and components required by the MPT original equipment manufacturers (OEMs).

MPT OEMs require high quality materials and sub-components from their suppliers to meet stringent DoD system requirements. However, the supply base for

such critical materials and sub-components has been unable, for various reasons, to respond to the needs of the OEMs. Consequently, MPT OEMs are having difficulty procuring critical materials and sub-components such as helix tapes, filament wires, and cathodes to the required specifications.

MPTs generate and amplify microwave energy for radar systems, electronic warfare systems, and telecommunications systems. They are required for applications requiring high frequency and high power. MPTs will be used in these and similar military applications for at least the next two to three decades since there are no foreseeable replacement technologies.

The Illinois Institute of Technology Research Institute (IITRI) is the project integrator for this initiative. The Naval Surface Warfare Center (NSWC), Crane, IN as the technical sponsor, and the Electronics Industry Association (EIA) both strongly support the program. This project was initiated in September 2000 with a contract value of $2.83 million. Additional FY 2001 funds of $1.88 million will be placed on contract in the first half of FY 2002.

Silicon Carbide (SiC) Substrates

The objective of this project is to establish long-term domestic sources of high-quality silicon carbide semiconductor substrates. This project will increase material availability, improve quality, reduce cost, and accelerate the insertion of SiC technology into defense applications. It will enable the transition to full scale manufacturing by establishing the capability to produce 75-mm diameter SiC substrates for device fabrication.

High power electronics and electronic power management are essential ingredients in future defense technologies which, in many cases, already exceed the basic physical properties of silicon (Si) based semiconductor devices. Semiconductor devices fabricated on SiC will enable the development of systems with performance capabilities that are unattainable with current materials. The advantages gained by the application of SiC technology are essential for the continued technological superiority of U.S. defense weapon systems. This initiative will strengthen the position of the U.S. industrial base with respect to this critical state-of-the-art technology.

In September 1999, the Air Force, as the Executive Agent for the Title III program, awarded contracts to Cree Inc., Durham, NC; Litton Airtron Inc., Morris Plains, NJ (since purchased by II-VI, Inc., Saxonburg, PA); and Sterling Semiconductor Inc., Danbury, CT. This project is planned to run through December 2002. Title III funding is $8.48 million with the contractors investing in excess of $9.0 million in cost sharing.

Titanium Metal Matrix Composites (Ti MMCs)

The objective of this project is to establish an economically viable production capability for Ti MMC materials by reducing the cost of Ti MMC parts to affordable

levels and promoting the use of such parts in gas turbine engines and other aerospace applications.

Ti MMC is an advanced composite material of titanium reinforced with either silicon carbide particulate or filament. Parts fabricated with Ti MMC are significantly stronger, lighter, and considerably more resistant to the stress of extreme temperatures than conventional titanium or superalloys. This technology is key to improvements in propulsion systems for the next generation of commercial and military aircraft. Substantial cost, performance, and durability benefits are expected from the use of Ti MMC components in transport and fighter aircraft engines. Other potential applications for Ti MMCs include airframes, medical equipment, and chemical processing.

Ti MMCs will be used primarily for the fabrication of various gas turbine engine components, including fan blades, fan frames, actuators, rotors, vanes, cases, ducting, shafts, and liners. A major objective of the project is to demonstrate a "production ready" industry in time to incorporate this material in the Joint Strike Fighter (JSF). Other applications for use of this material include the F-22 (F119 engine) and the F-14/F-15/F-16 (F110 engine). Other DoD and commercial aircraft engine applications are expected to follow.

The project was initiated in August 1996 with the signing of a multi-phased, multi-year cooperative agreement between the Air Force and the Titanium Matrix Composites Turbine Engine Components Consortium. The Title III funded portion of this effort is $25 million with a matching industry cost share of $25 million. The project is scheduled to be completed in December 2001.

Power Semiconductor Switching Devices (PSSDs)

Power Semiconductor Switching Devices (PSSDs) are pervasive within defense and commercial sectors for a variety of power control, conversion, and conditioning applications. These devices are used as medium and high-power electrical switches for both military and commercial applications, replacing larger, heavier electro-mechanical switches. This allows for increased switching efficiency and power handling capability with reduced acquisition and life-cycle costs. Avionics, missiles, and command, control, communications, computers and intelligence (C^4I) applications will combine to dominate military power supply markets for PSSDs in the immediate future. These devices will be essential to future applications for aircraft, ships, and ground vehicles as well as directed energy weapons and systems such as the Electromagnetic Aircraft Launch System being developed by the Navy.

Title III incentives will be used to establish a production capacity, perform product and process improvement, and have customers evaluate and qualify devices. Total contract value is $11.47 million with Title III investing $9.67 million and the contractor cost sharing an additional $1.80 million. This project was initiated in August 1998 with the award of a contract to Silicon Power Company (SPCO) of Exton, PA. The project is scheduled to run through December 2003.

Wireless Vibration Sensors

The goal of this project is to strengthen domestic production capabilities for wireless vibration sensors by facilitating the insertion of these sensors in the Advanced Amphibious Assault Vehicle (AAAV) program. Wireless vibration sensor technology is a critical element in Condition-Based Maintenance (CBM).

Title III coordination and support will allow insertion of this superior technology into a variety of defense applications. This will result in improved reliability, maintainability and reduced life-cycle costs, and, in some cases, reduced acquisition costs. The development of a low cost, wireless vibration sensor will enable the widespread application of CBM to new and legacy systems. A major effort to bring CBM capability to the Marine Corps largest acquisition program, the AAAV, was initiated recently. The Joint Strike Fighter (JSF) program office, the Air Force, and the Navy are also evaluating this technology in order to realize similar savings. Title III funding for the project is $0.90 million.

Aluminum Metal Matrix Composites (Al MMCs)

The primary objective of this program was to design, fabricate, and test a selectively reinforced aluminum Al MMC single pin track shoe for the Bradley Fighting Vehicle System. An additional objective was to qualify the track for subsequent insertion on the Bradley Fighting Vehicle. The project demonstrated that Al MMCs provide an optimal cost/performance alternative approach to fabricating military components by combining a low cost, high performance silicon carbide whisker reinforcement with the high volume, near net shape processing capability of squeeze casting.

In addition to shoes for tracked vehicles, other applications for Al MMCs incorporating silicon carbide whisker include missile and space vehicle structural parts, powertrain parts, optical system components (e.g., mirrors), and electronic packaging components.

Replacing the current steel track with Al MMC track is expected to produce significant life cycle cost savings, reduce vehicle weight by 600 pounds, and extend track shoe service life from the current 600 miles to 3000 miles.

The U.S. Army Tank-Automotive and Armaments Command executed the project via a contract with Advanced Refractory Technologies, Inc., Buffalo, NY. The contract for this project was awarded in January 1998 and completed in December 2001. Title III investment in this project was $3 million.

PROJECTS UNDER DEVELOPMENT

Radiation Hardened (Rad Hard) Electronics Capital Expansion Initiative

This project will provide the funding to modernize and maintain a viable production base for radiation hardened microelectronics. The primary objective is to purchase and install up-to-date production equipment in the facilities of the remaining radiation hardened producers. This will enable them to migrate their manufacturing capabilities from the obsolescent 0.35-micron feature size to the 0.18/0.15-micron size needed to meet the performance requirements for future defense space and missile systems.

Advanced radiation hardened microelectronics are a critical technology required for national defense. Microelectronics in defense space and missile systems must be able to withstand the deleterious effects of radiation ranging from long-term exposure to naturally occurring radiation in space to extreme events such as the intense radiation from a nuclear burst. These forms of radiation produce both prolonged and immediate effects in microelectronics. Radiation hardening requirements for defense applications are unique and require special materials and manufacturing processes to produce devices that can function and survive in high radiation environments. Maintaining a capability to produce these components domestically is of vital national importance.

Several defense programs require radiation hardened microelectronics, including Space Based Infrared System-low (SBIRS-low) and Advanced Extremely High Frequency (AEHF) system, which require 0.25-micron technology, and Space Based Radar and Hyper Spectral Imaging, which require 0.18-micron technology.

All future major space and strategic missile programs are likely customers of the radiation hardened electronics that will be produced as a result of Title III investments.

Radiation Tolerant/Hardened Microprocessors for Missile and Space Applications

This project will establish a manufacturing capability for radiation tolerant and radiation hardened microprocessors for military and commercial space applications. The effort will involve productization of an advanced commercial microprocessor to meet military requirements for radiation hardening and production of the microprocessor. Emphasis will be placed on creating an accelerated (and repeatable) fabrication process and utilization of commercial capabilities for affordable production.

This project will enable production of an advanced microprocessor, capable of meeting increased processing needs and protecting against severe radiation levels. Radiation hardened microprocessors based on current commercial microprocessors will reduce the unit cost. Use of commercial technology will also ensure an industrial infrastructure capable of meeting the hardware, software, and technical support needs of the radiation hardened microprocessor for years to come. Strong technical sponsorship for this initiative is being provided by the Air Force Research Laboratory (AFRL/VSSE) and the Defense Threat Reduction Agency.

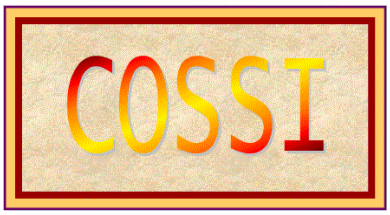
Radiation Hardened Thin Film Silicon-On-Insulator (SOI) Wafers for Digital Devices

This project will create and improve domestic production capabilities for Rad Hard thin film silicon-on-insulator (SOI) wafers for a variety of digital circuit applications. Emphasis will be placed on radiation hardening, improved material quality, increased production yields, and reduced production costs.

Radiation hardened thin film SOI wafers will significantly improve the radiation hardness and performance of microelectronic devices in numerous military space and strategic missile systems. It also enables significant improvements in key microelectronic device characteristics, such as reduced power consumption, increased circuit density, and faster performance. Radiation hardened thin film SOI wafers are used for fabricating radiation hardened ultra-large-scale digital devices such as microprocessors, application specific integrated circuits, and static random access memory. These devices are used in surveillance systems, communications systems, ballistic missile systems, radars, passive sensors, and inertial navigation systems. The project will leverage commercial SOI wafer fabrication processes to create a better-quality, lower-cost material for radiation hardened applications. The project will result in a world-class domestic production base that is responsive to defense needs for radiation hardened thin film SOI wafers.

Strong programmatic support for this project is provided by the Navy (Naval Surface Warfare Center - Crane, the Strategic Projects Office and the Naval Research Laboratory), the Defense Threat Reduction Agency, and the Sensors and Materials and Manufacturing Directorates of the Air Force Research Laboratory.

H. COMMERCIAL OPERATIONS AND SUPPORT SAVINGS INITIATIVE



The Commercial Operations and Support Savings Initiative (COSSI) uses commercial technology to improve the performance of legacy systems. Typically, a commercial technology cannot be used in a military system without a certain amount of nonrecurring engineering and testing to ensure the technology performs as required. COSSI provides the funds to perform this nonrecurring engineering and testing required. The technology insertions improve the performance of the system by significantly increasing reliability and reducing operations and support costs.

A competitive project call was issued in January 2001, and five projects were selected for funding during FY 2002. These projects are:

Electronic Characterization and Diagnostics (ECAD) of Wiring in Aircraft and Submarines DoD spends a considerable amount of time, money and effort maintaining the wiring and cables in aircraft and submarines. Often, wiring and cable failures can only be detected through a process of elimination as maintenance personnel troubleshoot a system failure. In some cases, electronic components are removed and tested when in fact the failure is due to faulty wiring and not the component itself. This project will modify a technology originally developed for the nuclear power industry and apply it to determine the condition of wiring in military systems. ECAD can detect subtle changes in wiring properties so failures can potentially be predicted and corrective actions taken before failures actually occur.

Support for the Modernization of the STANDARD Missile Common Guidance System The STANDARD Missile (SM) is the principal surface ship defense weapon for the Navy. There are several variants of the SM and each one has its own guidance system. This project will support the development of a common, high reliability guidance system that can be used on all variants. Six unique plates will be replaced by two common plates based on an open commercial standard, resulting in a higher reliability guidance system. Many of the obsolescence problems currently being experienced will also be eliminated.

Integrated Malaria Augmentation Package Malaria constitutes a serious infectious disease threat in many parts of the world. Some U.S. forces contracted malaria during Operation Restore Hope (Somalia) and Operation Uphold Democracy (Haiti). The current method for diagnosing malaria involves microscopic examination of a blood sample and does not lend itself to rapid in-theater diagnosis. This project will modify an existing commercial malaria test and treatment kit for field use and perform the testing needed for Food and Drug Administration (FDA) approval. Although the kit is currently available outside the U.S, FDA approval for sales within the U.S. is required before it can be used by our military personnel. The kit uses test strips instead of microscopic examination and can be deployed in the field.

Synthetic Instrumentation for Automated Test Systems The Consolidated Automated Support System (CASS) performs automated testing for all Navy avionics and electronic systems. CASS is based on 1980s technology and is comprised of a collection of individual instruments with unique interfaces. Because it was developed in the 1980s, CASS is experiencing obsolescence problems. Recent commercial technology allows for the development of synthetic instruments that can be configured in real time to perform various test functions. Signals are converted into digital representations which are then analyzed using high speed digital signal processing techniques. As a result, a single "synthetic" instrument can replace numerous single function instruments thereby reducing the logistics footprint and solving obsolescence problems.

Health and Usage Monitoring System for U.S. Army Special Forces' Aircraft This project will install a Health and Usage Monitoring System Processor Module on the U.S. Army Special Forces fleet of MH-47D and MH 47E helicopters. The module will provide the capability to perform embedded diagnostics including rotor track and balance, performance monitoring, exceedance detection, and vibration monitoring. This on board capability will significantly reduce the labor and test flight hours needed for rotor track and balance. Other benefits include a reduction in scheduled and unscheduled maintenance actions, an expected reduction in accidents, and accurate tracking of aircraft usage of flight hours from HUMS data instead of pilot logs.

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) ANNUAL REPORT. – (1) The Secretary of Defense shall submit to the congressional committees specified in paragraph (2) an annual 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 Appropriations of the Senate; and

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

Number of Reported Active Technology Transfer Mechanisms by Laboratory/Center FY 1997 through FY 2001

ABERDEEN TEST CENTER ABERDEEN PROVING GROUND MD
AERONAUTICAL SYSTEMS CENTER WRIGHT-PATTERSON AFB OH
AIR FORCE ACADEMY COLORADO SPRINGS CO
AIR FORCE DEVELOPMENT TEST CENTER EGLIN AFB FL
AIR FORCE FLIGHT TEST CENTER EDWARDS AFB CA
AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH
AIR FORCE MATERIEL COMMAND WRIGHT-PATTERSON AFB OH
AIR FORCE RESEARCH LAB EGLIN AFB FL
AIR FORCE RESEARCH LAB KIRTLAND AFB NM
AIR FORCE RESEARCH LAB ROME NY
AIR FORCE RESEARCH LAB WRIGHT-PATTERSON AFB OH
AIR FORCE WEATHER AGENCY OFFUTT AFB NE
AIR INTELLIGENCE AGENCY SAN ANTONIO TX
AIR UNIV MAXWELL AFB AL
ARMSTRONG LAB BROOKS AFB TX
ARMY AEROMEDICAL RESEARCH LAB FORT RUCKER AL
ARMY ARMAMENT RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ARMY AVIATION RESEARCH AND TECHNOLOGY ACTIVITY FORT EUSTIS
ARMY AVIATION RESEARCH AND TECHNOLOGY ACTIVITY MOFFETT FIELD
ARMY AVIATION RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ARMY CECOM INTELLIGENCE AND ELECTRONIC WARFARE DIRECTORATE
ARMY CECOM RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ARMY COMMUNICATIONS-ELECTRONICS COMMAND FORT BELVOIR VA
ARMY ELECTRONIC PROVING GROUND FORT HUACHUCA AZ
ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG MS
ARMY INST FOR SURGICAL RESEARCH FORT SAM HOUSTON TX
ARMY MEDICAL RESEARCH AND MATERIEL COMMAND FORT DETRICK MD
ARMY MEDICAL RESEARCH INST OF CHEMICAL DEFENSE ABERDEEN PG
ARMY MEDICAL RESEARCH INST OF INFECTIOUS DISEASES FORT DETRICK
ARMY MISSILE RESEARCH DEVELOPMENT AND ENGINEERING CENTER
ARMY NATICK RESEARCH DEVELOPMENT AND ENGINEERING CENTER MA
ARMY RESEARCH INST FOR THE BEHAVIORAL AND SOCIAL SCIENCES ALEXANDRIA VA
ARMY RESEARCH INST OF ENVIRONMENTAL MEDICINE NATICK MA
ARMY RESEARCH LAB ABERDEEN PROVING GROUND MD
ARMY RESEARCH LAB ADELPHI MD
ARMY RESEARCH LAB CLEVELAND OH
ARMY RESEARCH LAB FORT MONMOUTH NJ
ARMY RESEARCH LAB HAMPTON VA
ARMY RESEARCH LAB WHITE SANDS MISSILE RANGE NM
ARMY RESEARCH OFFICE RESEARCH TRIANGLE PARK NC
ARMY SIMULATION TRAINING AND INSTRUMENTATION COMMAND ORLANDO FL
ARMY SPACE AND STRATEGIC DEFENSE COMMAND HUNTSVILLE AL
ARMY TEST MEASUREMENT AND DIAGNOSTIC EQUIPMENT ACTIVITY REDSTONE ARSENAL AL
ARMY TOPOGRAPHIC ENGINEERING CENTER ALEXANDRIA VA
ARNOLD ENGINEERING DEVELOPMENT CENTER ARNOLD AFS TN
CENTER FOR HEALTHCARE EDUCATION AND STUDIES FORT SAM HOUSTON TX
CLINICAL INVESTIGATION REGULATORY OFFICE FORT SAM HOUSTON TX
COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH
CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN IL
DEFENSE LANGUAGE INST MONTEREY CA
DEFENSE NUCLEAR AGENCY ALBUQUERQUE NM

Number of Reported Active Technology Transfer Mechanisms by Laboratory/Center FY 1997 through FY 2001

DEFENSE NUCLEAR AGENCY ALEXANDRIA VA
EDGEWOOD RESEARCH DEVELOPMENT AND ENGINEERING CENTER ABERDEEN PG MD
ELECTRONIC SYSTEMS CENTER HANSCOM AFB MA
HUMAN SYSTEMS CENTER BROOKS AFB TX
HYDROLOGIC ENGINEERING CENTER DAVIS CA
JOINT TRAINING ANALYSIS AND SIMULATION CENTER SUFFOLK VA
MARINE CORPS COMBAT DEVELOPMENT COMMAND QUANTICO VA
NATIONAL IMAGERY AND MAPPING AGENCY BETHESDA MD
NATIONAL IMAGERY AND MAPPING AGENCY RESTON VA
NATIONAL IMAGERY AND MAPPING AGENCY ST LOUIS MO
NAVAL AIR WARFARE CENTER AIRCRAFT DIV LAKEHURST NJ
NAVAL AIR WARFARE CENTER AIRCRAFT DIV PATUXENT RIVER MD
NAVAL AIR WARFARE CENTER TRAINING SYSTEMS DIV ORLANDO FL
NAVAL AIR WARFARE CENTER WEAPONS DIV CHINA LAKE CA
NAVAL AIR WARFARE CENTER WEAPONS DIV POINT MUGU CA
NAVAL CMD CNTL AND OCEAN SURVEILLANCE CTR IN-SERVICE ENGRING SAN DIEGO CA
NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER INDIAN HEAD MD
NAVAL FACILITIES ENGINEERING SERVICE CENTER PORT HUENEME CA
NAVAL MEDICAL CENTER PORTSMOUTH VA
NAVAL MEDICAL CENTER SAN DIEGO CA
NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND BETHESDA MD
NAVAL METEOROLOGY AND OCEANOGRAPHY COMMAND STENNIS SPACE CTR MS
NAVAL OBSERVATORY WASHINGTON DC
NAVAL POSTGRADUATE SCHOOL MONTEREY CA
NAVAL RESEARCH LAB STENNIS SPACE CENTER MS
NAVAL RESEARCH LAB WASHINGTON DC
NAVAL SEA SYSTEMS COMMAND WASHINGTON DC
NAVAL SURFACE WARFARE CENTER PORT HUENEME CA
NAVAL SURFACE WARFARE CENTER CARDEROCK DIV BETHESDA MD
NAVAL SURFACE WARFARE CENTER CRANE DIV IN
NAVAL SURFACE WARFARE CENTER DAHLGREN DIV VA
NAVAL SURFACE WARFARE CENTER INDIAN HEAD DIV MD
NAVAL UNDERSEA WARFARE CENTER NEWPORT DIV RI
NAVY CLOTHING AND TEXTILE RESEARCH FACILITY NATICK MA
NAVY EXPERIMENTAL DIVING UNIT PANAMA CITY FL
OFFICE OF NAVAL RESEARCH ARLINGTON VA
OGDEN AIR LOGISTICS CENTER HILL AFB UT
PHILLIPS LAB EDWARDS AFB CA
ROME LAB ROME NY
TACOM RESEARCH DEVELOPMENT AND ENGINEERING CENTER WARREN MI
TRADOC ANALYSIS CENTER FORT LEAVENWORTH KS
UNIFORMED SERVICES UNIV OF THE HEALTH SCIENCES BETHESDA MD
WALTER REED ARMY INST OF RESEARCH WASHINGTON DC
WARNER ROBINS AIR LOGISTICS CENTER ROBINS AFB GA
WATERVLIET ARSENAL NY
WHITE SANDS MISSILE RANGE NM
WRIGHT LAB WRIGHT-PATTERSON AFB OH
YUMA PROVING GROUND AZ

Number of Reported Active Technology Transfer Mechanisms by Laboratory/Center
FY 1997 through FY 2001

FY 1997	FY 1998	FY 1999	FY 2000	FY 2001
3	2	2	3	3
6	6	3	4	3
			1	
8	3	3	4	6
8	13	15	22	18
		7	9	10
87	72	14	11	4
		8	9	10
		32	40	39
	9	27	33	41
		110	117	123
			1	1
	2	12	4	3
			2	
		1	1	
17	20	30	28	36
27	40	47	52	55
		21	27	28
		34	36	32
2	2	5	4	4
10	11	12	13	11
30	34	44	40	40
12	11	18	25	32
1	1	1	1	2
43	56	105	103	109
	4	6	7	10
5	6	17	18	21
1	1	11	10	11
66	70	103	101	103
11	15	27	32	39
31	39	56	61	67
5	6	6	7	7
11	11	26	29	27
		68	62	61
		62	64	59
		1	1	1
		96	97	96
		31	27	26
		5	5	5
1	1	1	1	1
1				2
2	1	1	7	7
		1	1	1
2	4	6	5	5
1				2
1	1	2	2	2
34	95	179	256	325
25	34	89	95	104
39	48	73	78	77
4	3	4	4	4
		1	1	1

Number of Reported Active Technology Transfer Mechanisms by Laboratory/Center FY 1997 through FY 2001

		5	5	5
11	21	27	28	35
8	25	13	13	13
		1	1	4
		1	1	1
1	1	1	1	1
			1	
		2	2	8
		7	7	4
		1	1	5
		1	1	2
		16	14	9
2	7	9	7	8
34	43	51	51	55
6	9	10	15	11
		1	2	4
		4	4	4
	2	1	1	1
			6	10
	4	10	14	24
39	45	71	103	183
2	3	4	3	3
	1	1	1	1
6	9	6	11	12
		3	3	1
		106	101	91
		1	1	1
	2	2	2	
14	18	25	20	23
8	10	7	7	6
14	18	36	36	36
9	14	13	15	21
21	25	3	18	29
2	2	28	3	2
	1	2	1	1
39	45	1	1	
24	12	6	2	4
		12	3	1
		11	8	
28	37	67	71	68
1	1	1	1	2
2	2	3	3	3
89	104	179	199	206
8	13	11	6	3
8	13	23	30	31
	1	1	1	
73	22	5	2	1
3	4	5	6	7

Statistical Data on Utilization of Federal Technology

DoD ACTIVITY PERFORMANCE MEASURES for FY 2001

AGENCY	COLLABORATIVE RELATIONSHIPS						INTELLECTUAL PROPERTY MANAGEMENT			
	Cooperative Research and Development Agreements (CRADAs)						Invention Disclosures and Patents			Other IP
	Total		Non-Traditional		Other Types		Invention	Patent	Patent	Active
	Active	New	Active	New	Active	New*	Disclosures	Applications	Issued	Licenses
Air Force	320	49	14	5	213	81	85	101	114	0
Army	998	235	0	0	0	0	292	262	156	0
Navy	317	167	72	46	0	0	573	421	320	0
NIMA	17	1	0	0	0	0	0	0	0	0
NSA	57	4	0	0	4	0	35	15	11	0
USUHS	256	3	244	31	0	0	20	10	18	5
Total	1,965	459	330	82	217	81	1,005	809	619	5

NOTES

* For the Air Force 73 of 81 are Educational Partnership Agreements. For USUHS, nontraditional CRADAs are Material Transfer Agreements and in addition to the 10 patent applications, there are 9 provisionals.

APPENDIX D

Highlights of the DoD Technology Transfer Program in FY 2001

Appendix D: Highlights of the DoD Technology Transfer Program in FY 2001

These highlights are offered to give a perspective on the variety of activities, technologies, and capabilities that are part of the DoD Technology Transfer Program. They key highlight of the year is at the end of this appendix.

Army

- ***Benet Laboratories*** at Watervliet Arsenal is part of the Army's Tank and Armaments Command's Armament Research and Development Center. It has unique expertise in large bore cannon design and development. Seven employees at Benet have been recognized with R&D achievement awards. Benet made advancements in development of a new structural coating with Defense and nondefense applications, with 8 new invention disclosures in process. Additionally, Benet has entered into an educational partnership agreement with Hudson Valley Community College.
- ***Space and Missile Defense Command*** provides space and missile defense capabilities for the warfighter and the Nation. It has multiple site locations and expertise. An effort has been made to more closely link technology transfer efforts with systems engineering functions and to continue outreach to support State RDT&E efforts via participation on review boards, support local endeavors such as a business incubator, and create alliances with NASA.
- ***Communications and Electronics Command's (CECOM) Research, Development and Engineering Center*** identifies, develops, evaluates, and tailors emerging information technologies, facilitates the transition of selected technologies into operational systems, and performs and promotes Systems of Systems integration. CECOM seeks to be the universally recognized leader in providing information dominance capabilities to our warfighters. CECOM has focussed on using several existing programs to support the technology transfer effort. These are: the Small Business Innovation Research Program (SBIR) to develop partnerships and bring in new technologies for our systems; Dual Use Science and Technology Program (DUS&T) to develop dual use technologies with industry; Independent Research and Development Program (IR&D) as technology leveraging opportunities; and CRADAs.
- ***Aeromedical Research Laboratory's*** objectives are to prevent or minimize health hazards in the military operational environment and to sustain aviator performance. This includes acoustics, vision, crew workload, stress and fatigue, repetitive impact, and life support systems. Four of the invention disclosures filed in FY 01 were in the area of speech intelligibility measurement that should have an impact in the area of assistive technologies.
- ***Clinical Investigation Regulatory Office*** serves as a second level review for all clinical research conducted by the U.S. Army. Due to budgetary constraints, the CRADA process has become the primary method for legally securing funds that are essential to the ability to conduct clinical research within Army Medical Treatment Facilities (MTF). The Commanding General, the Army Surgeon General, and the Assistant Secretary of Defense (Health Affairs) are briefed on

an annual basis on the status of these technology transfer initiatives. FY 01 was a very successful year with 109 new agreements signed, 57 completed, and 181 continuing. These high numbers are directly attributable to streamlined negotiation and legal review procedures as well as an increased Command emphasis on the use of CRADAs to extramurally fund clinical research within Army hospitals.

- ***Soldier & Biological Chemical Command, Natick Soldier Center*** seeks to be the R&D Center of Choice for individual warrior-related technologies and warrior systems and internationally known as a preeminent provider of research, development, engineering, and integration services (food, clothing, airdrop, and shelters for the individual warfighter and organizational units). Mr. Philip Brandler, laboratory director, was named Federal Laboratory Consortium Laboratory Director of the Year in FY 01.
- ***Edgewood Chemical and Biological Center*** experienced a significant leveraging of resources with its 39 new technology transfer agreements, including one with Fiberteck, Inc., to pursue dual-use applications for the Short Range Biological Standoff Detection System to include commercial, military, and other Government agencies' use.
- ***Engineer Research and Development Center*** supports civil and environmental engineering missions. Royalties from patent license agreements (PLAs) have been used to support legal costs associated with worldwide patent applications and to support other R&D efforts on technologies with potential commercial applications.

Navy

- ***Naval Space and Warfare System Center*** *(SPAWARSYSCEN)* is the Navy's RDT&E and fleet support center for command, control and communication systems and ocean surveillance and the integration of those systems which overarch multiplatforms. Its vision is to be the Nation's preeminent provider of integrated C4ISR solutions for warrior information dominance. Emphasis is on transitioning emerging technologies and concepts into the early system design phases, thereby impacting the design of new major platforms and systems. To encourage inventors to commercialize their patents, the Center has recently doubled inventor patent application and issuance awards and doubled the inventor's share of royalties received. The new policy will provide $500 for each patent application, $1,000 upon issuance, and 40% of all royalties received from PLAs.
- ***Naval Surface Warfare Center Indian Head Division*** (IHDIV) is involved in energetics R&D, manufacturing technology, engineering, testing, manufacturing, and fleet support. Through a PLA and follow-on CRADA for technical assistance, a commercial product using IHDIV technology for a differential pressure flow sensor should be on the market in the spring 2002.
- ***Navy Clothing and Textile Research Facility*** *(NCTRF)* works in support of clothing, textiles, and related fields associated with service clothing and environmental protective clothing. In FY 01, the NCTRF allowed industry access

to its unique equipment/capabilities in thermal and flame assessments via Testing Agreements.

- ***Naval Undersea Warfare Center Division Newport*** *(NUWCDIVNPT)* provides the technical foundation to help ensure the undersea superiority of the U.S. Navy. NUWCDIVNPT operates a highly efficient patent program believed to be the most productive in U.S. government when using the invention disclosures per scientist/engineer metric. In FY 01, 190 invention disclosures were recorded, 100 patent applications were filed, and 78 patents were issued or allowed.
- ***Naval Air Warfare Center Weapons Division*** *(NAWCWD)* mission is to ensure battlespace dominance by performing RDT&E, logistics, and in-service support for guided missiles, free-fall weapons, targets support equipment, crew systems, and electronic warfare systems. Technology Transfer and Strategic Partnerships are primary thrusts in the NAWCWD Strategic Plan.
- ***Naval Surface Warfare Center Carderock Division*** is the principal Navy resource, national focal point, and international leader in surface and undersea vehicle science, ship systems, and related maritime technology. One technology developed and patented is an improved silicon rubber gasket design. The new gasket has been adopted for use by the entire Navy fleet as well as the U.S. Coast Guard.

Air Force

- The ***Air Force Research Laboratory*** *(AFRL)* mission is to lead the discovery, development, and integration of affordable warfighting technologies for our aerospace forces. AFRL customers include the Air Force major commands who operate and maintain the Air Force's weapon systems.
  - The AFRL has established web-based technology transfer training for scientists and engineers as well as established a course, "Management of Technology" at the Air Force Institute of Technology's School of Engineering and Management to provide training on technology development and transfer.
  - *Air Force* ***Air Armament Center*** *(AAC)* is one of four product centers in the Air Force Materiel Command and is the focal point for all Air Force conventional armaments and all air-delivered conventional weapons. The AAC's 46th Test Wing operates a unique asset, the McKinley Climatic Laboratory, capable of testing military hardware as large as a bomber in environments ranging from minus 65 to plus 165 degrees Fahrenheit with 100-mph winds, icing, clouds, rain, and snow.
  - Both the AFRL ***Space Vehicle and Directed Energy Directorates*** at Kirtland AFB, NM, have focussed efforts on technology transfer for education. In addition to the FLC award identified in Appendix E, the program director received the 2001 State of New Mexico Distinguished Public Service Award on behalf of this program. Over 49,000 students from more than 120 schools in New Mexico have benefitted from the Technology Transfer for Education (TTE) program efforts to date. Currently, the TTE has 77 Educational Partnership Agreements and 18 CRADAs with local school districts.

Defense Agencies

- ***Defense Advanced Research Projects Agency*** *(DARPA)*: DARPA is the central R&D organization for the Department of Defense (DoD). It manages and directs selected basic and applied R&D projects for DoD, and pursues research and technology where risk and payoff are both very high and where success may provide dramatic advances for traditional military roles and missions. DARPA accomplishes this mission through working with DoD and other federal department laboratories, contracting with private industry, and partnership arrangements supporting collaboration for technology development. While it does not own or develop intellectual property itself, the labs, industry, and academia working with DARPA have been able to exploit the DARPA-supported technology advancements for both commercial and military benefit.
- ***Defense Information Systems Agency*** *(DISA)*: DISA is a combat support agency of the Defense Department. It is the central manager of major portions of the Defense Information Infrastructure. DISA is a relatively new agency and is in the early stages of educating its workforce on a technology transfer program. Several companies have contacted DISA concerning partnerships and joint efforts using CRADA authority; however, none have resulted in CRADAs or other partnerships as of the end of FY 2001.
- ***National Imagery and Mapping Agency*** *(NIMA)*: NIMA focuses on imagery, imagery intelligence, and geospatial information. NIMA does not have a traditional R&D laboratory with employees that produce inventions. However, it works with industry partners to develop problem solutions for insertion into commercial off-the-shelf packages and/or current production items. Use of CRADAs enhances this capability.
- ***National Security Agency*** *(NSA)*: NSA is the Nation's cryptologic organization. Its technology areas include computing, communications, networking, microelectronics, biometrics, advanced mathematics, and signals processing. While NSA approached technology transfer cautiously at first, this technology sharing and collaboration have resulted in direct benefits to technology challenges faced by the Agency.

KEY HIGHLIGHT:

Admiral Bowen Award Nomination and a Signed Patent License Agreement:

Carderock Division has also recognized Frank McMullin and Marlin Rowe by nominating their patented new gasket for watertight closures for an Admiral Bowen Award, which is named in honor of Vice Admiral Harold G. Bowen, who was the first CNR. The award honors one patent that is determined to have had a significant impact upon the sailor and the Navy.

For over fifty years, the Navy has relied on a neoprene type gasket material to provide a watertight (WT) and airtight (AT) seal on virtually every manually operated structural door, hatch, and scuttle installed on Navy surface ships. While this gasket was suitable for the intended purpose, its service life was relatively short. The gasket

material lacked resiliency and would quickly develop a permanent set or groove from being compressed against the knife edge sealing surface of the closure frame. The gasket would dry out, harden, and crack with age, making it difficult to compress. Replacement of the gasket material was relatively inexpensive but the labor involved was arduous and time consuming, often requiring two men for approximately 2-4 hours.

Gasket material for use in closures in firezone boundaries is extremely hard and virtually incompressible, with a rough surface texture that quite often does not provide a proper watertight or airtight seal. Replacement of this gasket material is expensive and the labor involved in its replacement is even more difficult and time consuming than the other gasket.

Mr. McMullin has recently developed and patented an improved silicon rubber gasket design that is suitable for use in all Navy standard, manually operated non-ballistic structural closures in watertight, airtight and even firezone applications. The unique feature of this gasket design is its configuration. A radius cutout in the back of the gasket provides added resiliency and allows for quick and easy installation in the "C" shaped gasket channel of the closure. The new gasket has been adopted for use by the entire Navy fleet as well as the U.S. Coast Guard.

Numerous advantages were realized by the use of this new gasket. The most significant advantages are as follows:

1. Labor savings – Installation time is reduced by 90%, thereby reducing maintenance hours spent on gasket replacement.

2. Increased service life – Silicon rubber gasket material remains soft and pliable after many years of use. It is unaffected by extreme temperatures, prolonged exposure to sunlight, and retains it shape after repeated and extended periods of compression.

3. Less component wear – Due to the softness of the gasket, the force required on the operating handle of quick acting doors to dog the closure is reduced by 40%. This results in less friction on the operating mechanism, less wear and tear on the bearings, dogs, and dog wedges and provides smooth and easy operation of the closure. This reduction meets the operating force requirements of ASTM F1166 fo the 5th percentile female.

4. Increased ship survivability – The new gasket, through extensive testing by NRL, has far superior fire resistant qualities. Therefore, all closures installed with this gasket, will significantly decrease the spread of fire and smoke.

5. Cost savings – Gasket in firezone boundaries will realize a cost saving of approximately $18 per linear foot. Cost savings are also realized through

the reduction in installation labor, longer life cycle, and less wear on moving parts.

Implementation of this new gasket is being accomplished on existing ships in the Fleet through attrition and ship alteration. More than 50,000 manually-operated watertight and airtight closures are affected by this gasket. Over 1,000,000 feet of gasket has already been installed throughout the Fleet.

The development of this new gasket was achieved at a minimal cost. Approximately $8,000 was used by CDNSWC for prototyping and testing while fire testing by NRL added another $10,000 to the overall cost. This is truly amazing when considering the impact this invention will have on the sailor and the Navy.

A patent license agreement was signed with Pacific Aerodyne.

APPENDIX E

FY 2001 Federal Laboratory Consortium Awards to the Department of Defense

Appendix E: FY 2001 Federal Laboratory Consortium (FLC) Awards

2001 FLC Representative of the Year: Kristen Schario

As FLC Representative of the Year, Ms. Schario has provided excellent leadership to her own organization, is a recognized leader in Air Force Research Laboratory command, and has volunteered contributions at the national level for the FLC.

Ms. Schario works extensively with personnel to identify collaboration opportunities with other federal agencies. Due to her extensive activity and network of FLC contacts, she acquires and maintains a significant database of up-to-date knowledge of research going on in other federal agencies. Ms. Schario has expertly used this knowledge to identify multiple potential partners for research efforts at her laboratory. One recent example led to a partnership between the Air Force Research Laboratory and the Department of Energy.

Ms. Schario has shared her successful expertise on identifying technology transfer partners with others in the FLC through briefings and presentations, so that other laboratories would have an opportunity to implement it in order to improve their rates of successful commercialization. She is also active in the marketing of technology transfer, by regularly contributing to FLC NewsLink, and organizing tours and presentations for other government agencies, partners, and companies interested in technology transfer opportunities. Ms. Schario's exceptional leadership in technology transfer has set a model of success for other representatives to emulate.

2001 FLC Laboratory Director of the Year: Philip Brandler

In his capacity as laboratory director, Mr. Brandler ensures that every opportunity is taken to support and promote technology transfer efforts. He encourages his researchers and engineers to develop technologies and products right from the start with both military and commercial applications in mind.

Under Mr. Brandler's leadership, technology transfer activities at the Natick Research Center have steadily increased over the past several years. Currently, the laboratory has 37 active CRADAs with such notable companies as L.L. Bean, Frito-Lay, W.L. Gore, DuPont, and Sara Lee.

Of particular note, Mr. Brandler's technology transfer efforts resulted in the establishment of the National Protection Center, a joint pilot agency program operated

in conjunction with the NASA Ames Research Center, and the National Institute for Justice Office for Law Enforcement and Corrections Technology. As a consolidated source of expertise and resources, the National Protection Center provides state-of-the-art protective equipment for military personnel as well as civilian emergency personnel, saving millions in taxpayer dollars.

Defense Department 2001 FLC Awards for Excellence in Technology Transfer

Transferring Technology for and to Students

Gerald Mora, Ronda Cole, Marla Griego and Raina Pellegrino, Air Force Research Laboratory at Kirtland Air Force Base

Of all technology transfer activities, education outreach has the greatest impact on the future by benefiting those who have the biggest stake in the future: today's students. AFRL's Technology Transfer for Education (TTE) Program team touches the future by bringing the technology and expertise of Air Force research and development (R&D) scientists into New Mexico classrooms.

The team meets educators' needs by providing mentors, technologies, and methodologies to bridge the gap between lagging education resources and cutting-edge, real-world technologies. Mentors involved in the TTE Program work in such diverse fields as computer science, physics, chemistry, and engineering. The students they mentor receive a broader understanding of potential career fields available to them and what educational planning is necessary to succeed. The mentoring activity concludes with a student team's full development and the completion of an R&D activity based on a specific technology area.

The AFRL team uses both Education Partnership Agreements (EPAs) and Cooperative Research and Development Agreements (CRADAs) with school districts as mechanisms to pursue technology transfer. This involves using the teachers and students in Air Force R&D, as well as donating or loaning equipment to participating schools. The effort that the AFRL team has put forth is yielding positive results. Over 39,000 students from more than 120 New Mexico schools have benefited from the TTE Program, resulting in increasing student success in math, science and technology curricula. The TTE program has received state and national recognition, including commendations from the New Mexico Legislature, the Governor of New Mexico, and the New Mexico members of the U.S. House and Senate. In addition, the team received including the General Yates Award, the highest honor that can be bestowed on an Air Force technology transfer project.

Everyone who participates in the TTE Program reaps its benefits. Teachers benefit by having resources to enhance their math, science, and engineering courses. Students have the opportunity to be involved in unique educational opportunities offered by AFRL. Mentors benefit from the opportunity to strengthen their leadership skills by working with the students and teachers. Most importantly, the state of New Mexico benefits by having students with stronger interests in math, science and engineering, thus increasing the future job applicant pool in those areas.

For more information: Gerald Mora (505) 846-6936, Gerald.Mora@kirtland.af.mil

Holographic Polymer-Dispersed Liquid Crystals (H-PDLCs)




Dr. Wade Adams, Dr. Larry Bidwell, Dr. Tim Bunning, Fred Sinder
Air Force Research Laboratory (AFRL), Materials and Manufacturing Directorate

Research by the AFRL Materials and Manufacturing team has led to significant technological advancements in the development of a wearable holographic display that allows pilots to keep their eyes on the action while viewing data and color images projected directly into the retina. Holographic polymer-dispersed liquid crystals (H-PDLCs) allow complex optics to be designed into lightweight thin films whose optical properties can be changed by applying a modest electrical field similar to that used in watch and calculator displays. This technology replaces bulky and relatively heavy lenses by reducing component weight and size.

The effort to transfer this technology took shape when the AFRL team partnered with Science Applications International Corporation (SAIC) to license the H-PDLC. After achieving initial success and discovering the vast commercial outlets in which the technology could be used, SAIC became interested in securing the intellectual property rights to H-PDLC and marketing it. A dual-use cost-share program was utilized to move the technology even further. Based on the success of the technology transfer efforts, a startup company was created - DigiLens of Sunnyvale, California - which has an exclusive agreement with SAIC to commercially develop the technology.
As the H-PDLC expands its presence in the marketplace, industries will find its versatility a plus. The lightweight high-resolution optical display may someday provide the warfighter with an added advantage in combat situations. The H-PDLC will also enable next-generation cellular phone displays for the Internet; wearable displays for

videos, game devices and personal computers; and improvements in rear-projection high definition television.

For more information: Dr. Wade Adams, (937) 255-6825, Wade.Adams@wpafb.af.mil

In Situ Densification of Carbon-Carbon Composites

Dr. Wesley Hoffman, Dr. Steve Jones, Dr. Philip Wapner, Dr. Kevin Chaffee, Tom Duffey, Philip Counts, Hong Phan, and Marietta Fernandez
Air Force Research Laboratory (AFRL), Propulsion Directorate (PROP)

The use of carbon-carbon composites is crucial to the construction of aerospace equipment, including aircraft brakes, rocket nozzles, exit cones, and nose tips. Significant costs are associated with manufacturing equipment using these composites, as well as lead times as long as six to eight months. There is a long-standing need for carbon-carbon composites that not only have a uniform density, but can also be fabricated in thick pieces. In addition, as the composites are used in additional applications, there will be interest in producing them at a lower cost. To this end, the team has developed a low-cost, rapid processing route for the production of high-quality carbon-carbon composite material.

In Situ densification places matrix material between the carbon fibers and produces composite materials in 5 to 25 percent of the time and at 10 to 50 percent of the cost of current commercial processes. In addition to being more rapid and less expensive than commercial ones, the in situ process can produce carbon-carbon composites that cannot be produced by any other technology.

Once the team developed this technology, they entered into a Cooperative Research and Development Agreement (CRADA) with B.F. Goodrich Aerospace, the world's largest manufacturer of aircraft brake material. As a result of the CRADA, Goodrich has been able to incorporate the lab's densification process into its production cycles. Another technology transfer partnership involves SMJ Carbon, a spinoff company, which negotiated an exclusive license to manufacture carbon-carbon products for all markets except aircraft brakes.

Currently, both technology transfer partnerships are still in progress and are proving to be successful for all parties involved. The uniqueness of the in situ densification process provides a combination of benefits. Not only is it less expensive and quicker than other processes, it also produces a superior product with more uniform density. In addition, the process can densify thicker parts than other methods. The material can also be used in a number of diverse applications, including thermal management,

chemical processing, silicon wafer processing, and high temperature furnace components.

For more information: Dr. Wesley Hoffman, (661) 275-5768, Wesley.Hoffman@ple.af.mil

The Second Generation High Temperature Superconducting Wire

Dr. Paul Barnes
Air Force Research Laboratory, Propulsion Directorate

The Air Force is placing significant emphasis on the development of directed energy weapons (DEW) for tactical and support operations. Large amounts of power are required, particularly for high power microwave weapons. Although this power can be provided by conventional means, it requires large and heavy generators that impede battlefield mobility and, in particular, make airborne operations impossible. High temperature superconducting (HTS) yttrium barium copper oxide (YBCO) generators are significantly lighter and more compact, thus enabling the DEW technology.

Dr. Barnes has developed several technologies that make it possible to manufacture the YBCO coated conductors. A highlight of this research is the discovery of a previously unknown substrate grain boundary effect in coated conductors. This effect has a strong influence on the critical current that the HTS film can carry. Dr. Barnes has successfully transitioned YBCO coated conductors and many other AFRL-developed technologies to industry by developing and nurturing collaborative efforts involving multiple industry partners.

Dr. Barnes initiated and led the development of a Cooperative Research and Development Agreement (CRADA) among Intermagnetics General Corporation (IGC), the Materials Laboratory, and the AFRL, as well as securing cost share funding from IGC. This resulted in the establishment of a new company, IGC SuperPower, LLC. The new company will use AFRL-developed technology to produce YBCO coated conductors. In June 2000, IGC SuperPower opened a new YBCO coated conductor manufacturing facility.

Dr. Barnes also played a key role in creating a partnership with the University of Wisconsin Applied Superconductivity Center and the AFRL Superconductivity Group. This partnership resulted in the discovery of a grain boundary effect that sets a standard for substrate grain alignment for production of the textured substrate used in HTS coated conductors by industry.

The discovered grain boundary effect has helped the entire HTS coated conductor industry develop improved products. All of these technologies improve the coated conductor samples currently made, and help in the development of the long-length

coated conductor that is needed in the power utility market and the high power generators used by the military. Complete development of the technology will lead to industrial commercialization of the YBCO coated conductor in such electric power applications as transformers, transmission cables, motors, fault current limiters, and generators.

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An ARL Communications Technology Success Story

Dr. Louise Sengupta, Dr. Somnath Sengupta, Luna Chiu, Xubai Zhang, Steven Stowell, Eric Ngo, and Jennifer Synowczski
Army Research Laboratory (ARL)

A team of ARL scientists developed a new ceramic material technology with far-reaching possibilities for both military and commercial communications and radar. Using a unique ferro-electric ceramic material, the team designed low-cost, tunable scanning antennas for satellite communications, voltage tunable filters and devices, and ultra-fast scanning phase shifters.

The Army's belief in the team's abilities-along with its significant need to reduce the size, weight and cost of existing ferrite phase shifters-resulted in its funding of this successful effort for more than six years. Once ARL's state-of-the-art technology was created, decisions were made about how to best transfer it. Four members of the team created a private firm, called Paratek, that would license the patents that are the heart of the ceramic material technology, while two members of the team remained at ARL to work on the military application of the technology. An exclusive license was negotiated by ARL and signed by Paratek in late 1999, thus marking the first time in Army history that an employee inventor team would license the technology they invented.

In the years since its startup, Paratek has grown from four employees to 90, and the products the company is preparing for production range from new to revolutionary. The company's ceramic material technologies will be used in personal communication devices, cell phones, and home and office direct satellite communication systems as enabling technology that can both reduce cost and expand capability. This technology has far-reaching consequences-not only for critical military needs, but also for an estimated billion dollar commercial field of broadband wireless communication systems.

For more information: Dr. Louise Sengupta, (443) 259-0140

Centrifugal Casting of Metal Matrix Composites

Amarnath Divecha and Subhash Karmarkar
Carderock Division, Naval Surface Warfare Center

Because of the hazard asbestos poses, the Navy can no longer use brake shoes made of asbestos on bronze friction drums. Shoes using replacement materials destroyed the drums in about 100 hours of use. A new material was needed for the drums that would reduce the amount of wear and tear. This team invented a composite casting technique that creates a material as strong as asbestos.

By carefully selecting a metal alloy for matrix metal (such as aluminum) reinforced with other materials (such as silicon carbide), as well as a very hard powder for the desired wear-resistant characteristics, the team created a wide variety of parts, including tubes, brakes, clutches and gears, that have different material properties. Depending upon the respective densities of the metal matrix and the particles, it is possible to produce tailor-made composites with reinforced wear surfaces on the outer or inner surface of the part as desired. The Navy constructed friction drums using this material and, in nearly 1,000 hours of use, the drums with the replacement metal matrix composites have shown no significant wear.

Divecha and Karmarkar partnered with two companies to transfer the technology through Cooperative Research and Development Agreements (CRADAs) and licensing. John Crane Marine intends to apply the technology to shipboard mechanical seals, which are very expensive and must be replaced frequently. Using the metal matrix composites will significantly reduce operating costs for the company. MSE Technology Applications, Inc. will apply the technology to a number of items, including disc brake rotors, golf clubs, boring tool disks and electronic heat sinks, to create longer lasting materials at a lower operating cost.

It is estimated that this technology will save the Navy as much as $38 million during the next five years without returning to the use of asbestos brake shoes. In addition, Metal Matrix Composites will provide benefits for builders and consumers of high performance automobiles, long distance trucks, airplanes, and ships.

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LaserNet Fines Optical Debris Monitor

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Industry studies show that about 25 percent of U.S. production capacity is inoperative at any given time due to mechanical failure. The consequences of such failures vary from inflated prices, lost productivity, production delays and increased costs, to loss of life and personal tragedy if the equipment that fails is a component of an airplane, helicopter, or other vehicle. Maintaining equipment properly to avoid failure is also time-consuming and expensive. This NRL team has developed a system that can automatically detect mechanical defects.

The LaserNet Fines (LNF) Optical Debris Monitor is a broadly applicable, optically based system that automatically detects and identifies faults or incipient failure in mechanical systems due to excess wear, and detects contamination in hydraulic and fuel systems. The monitor determines the size distributions of debris particles in lubricating systems and classifies the particles according to the mechanical process responsible for their production. The LNF also identifies contaminants in hydraulic and fuel systems from external sources such as sand, fiber, and water.

The NRL team transferred the technology by entering into a licensing agreement with Lockheed Martin, which in turn entered into an agreement with Spectro Inc. for marketing and distributing the monitor. In addition, the LNF system is already deployed onboard ships to improve the Navy's condition-based maintenance programs.

The LNF will benefit numerous industries, including railroad and trucking, electric power generation, construction, commercial shipping, commercial airlines, mining, and offshore oil drilling. Use of the LNF results in the improved safety, reliability, and availability of a wide range of mechanical equipment, accompanied by substantially reduced maintenance costs in terms of both personnel and operations. Additionally, safety is increased by substantially reducing failures that occur during operation, which lowers liability costs.

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Quantitative Mobility Spectrum Analysis (QMSA) for Evaluating Semiconductor Electronics Materials

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The Quantitative Mobility Spectrum Analysis (QMSA) is a new method, developed by this NRL team that characterizes the fundamental electrical properties of layered semiconductor structures. From electrical measurements as a function of a magnetic field, QMSA can simultaneously determine the properties of as many as ten different charge carriers in a complex multilayered structure. These properties are directly related to the performance of semiconductor-based devices, such as high-speed computer circuits, making QMSA a valuable new tool for research and development, diagnostics, and quality control in the areas of semiconductor manufacture and research.

NRL worked with the University of Western Australia to develop the QMSA, constructing its software architecture into a commercially marketable package. Once the technology was commercially viable, the lab then identified Lake Shore Cryotronics, Inc. (LSCI), a developer and international supplier of technology for property measurement and process control, as an excellent commercial partner. NRL and LSCI signed a Cooperative Research and Development Agreement (CRADA), as well as a licensing agreement. Under the patent license, LSCI is selling QMSA as a software product.

By using QMSA to monitor materials in near real-time, manufacturers can increase product quality and decrease the number of wafers that fail to meet specifications, leading to an overall reduction in cost. The semiconductor chip industry is intensely competitive; thus, any cost savings are especially important to profit margins.

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Single Molecule Biosensors

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The single molecule biosensors developed by this NRL team represent a revolutionary class of biosensors that are capable of detecting a variety of biomolecules, including proteins, viruses, and bacteria. The patented biosensors use the principles of atomic force microscopy (AFM) to measure the strength of single DNA-DNA and antibody-antigen bonds-in effect detecting and characterizing single molecules of DNA or antigen.

The NRL team transferred its technology to Gravitron, Inc., which is negotiating a sublicense to a large biotechnology company. Gravitron intends to apply the technology in a number of areas, including biological diagnostics, environmental monitoring, and portable gas monitoring. By linking micromachined sensors to basic biological and chemical methods, the single molecule biosensors will provide unprecedented sensitivity, cost-effectiveness, accelerated data management, integration, and reliable detection. Moreover, since the entire process is conducted on a single chip, it is inherently smaller and less expensive than other sensors.

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The Temporally Ordered Routing Algorithm (TORA)

Vincent Park
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Computer and communication networks such as the Internet are multilayered, highly complex systems that rely on a plethora of protocols and algorithms for seamless, reliable operation. However, the traditional routing algorithms used in today's networks are designed for operation in relatively static hardwired networks and are not well-suited for emerging mobile wireless networks. Park has created an enabling technology for the development of mobile wireless networks.

TORA possesses the essential aspects of traditional approaches, but also has unique attributes that make it better suited for use in the more dynamic and bandwidth-constrained wireless networks needed to support our increasingly mobile society. Park designed the technology to minimize communication overhead, thus preserving the precious bandwidths and resources of wireless systems. TORA establishes a multipath routing structure that improves robustness and reduces the frequency of protocol reactions to network dynamics. Designed to be highly adaptive, efficient and scalable, TORA has the properties essential to support the intended network environment.

Park's technology, which has a patent pending, resulted from his master's thesis research at the University of Maryland (UMD). The University was also a partner in the technology transfer effort, as NRL negotiated a licensing agreement with UMD and

Nova Engineering, Inc. Currently, Nova Engineering has marketed a wireless router product (the NovaRoam 900) that is based on the TORA technology. In addition, Park's technology transfer partnership with UMD has proven to be so successful that the university is looking for other licensing opportunities from NRL.

This technology enables the deployment and use of computer and communication networks in new environments and applications where networking was previously not possible. By facilitating the formation of mobile wireless networks, TORA supports the extension of Internet-type information and services to users on the move or in remote locations-such as establishing a telemedicine link between a doctor in a hospital and a paramedic at a remote site, or providing current tactical information to rapidly deploying Marines in hostile territory. The range of potential applications for this technology and the communities that it can benefit are vast.

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Automated Oil Spill Detection System

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Rapid, reliable spill detection is an essential yet often overlooked part of oil spill prevention and response strategies. Early detection of a petroleum leak or spill enables responders to take immediate actions to stop and contain the released material. By enhancing the ability to exercise timely countermeasures, early detection offers an effective means of minimizing the environmental and financial impact of a spill. On the other hand, a failure or delay in recognizing the existence of a spill leads to a delayed response, which may result in a larger spill volume and costlier cleanup effort. Current oil spill detection methods rely solely on human observation to identify the presence of a spill-a very unreliable practice. To address this issue, the SPAWAR team developed an automated spill-sensing technology.

The automated technology provides early notification of a petroleum spill on water. The fluorescence-based sensor operates just below the water surface and continuously tests for an increased hydrocarbon concentration, which is indicative of a spill. When a spill is detected, a radio signal is immediately transmitted to a base station computer for analysis, display, and electronic alarming. Once a spill has been detected, responders immediately receive an automated phone call alerting them.

To transfer the technology, the SPAWAR team entered into a licensing agreement with Applied Microsystems Ltd. (AML), a Canadian company that designs and manufactures water quality monitoring instrumentation. Currently, AML is marketing the detection system globally under the name "Spill Sentry."

This technology will provide numerous benefits since it has the potential to significantly reduce the amount of oil that enters the environment every day due to pipeline leaks, tank overflows, and illegal dumping. In addition, it will serve to minimize the resulting adverse economic and environmental impacts caused by unpreventable spills. The public will benefit from a cleaner aquatic environment made possible by SPAWAR.

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Micro-displays

Dr. Stephen Russell
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Dr. Russell invented a novel, high performance micro-display that allows high performance microelectronic circuitry within and adjacent to a transmissive liquid crystal display to be fabricated. The result is a high resolution and high brightness display that eliminates the need for millions of interconnections between the display and its control circuitry. Dr. Russell's technology offers improved imaging and video in virtual presence applications for war fighter and emergency service personnel, as well as in advanced devices such as hand-held computers and cellular phones.

To transfer the technology, Dr. Russell used an innovative process that formed a coalition of government and industrial partners. Subsequently, the Center entered into a Cooperative Research and Development Agreement (CRADA) with Proxima Corporation to market the technology. A second CRADA was established with Optron Systems, a display and component manufacturer. Both CRADAs resulted in licensing agreements for Dr. Russell's invention. In addition, Radiant Images-a spinoff company from Optron Systems-will produce the first commercial version of the micro-displays within the next year.

The initial beneficiaries of the technology will be the Department of Defense and emergency service personnel. As the technology becomes commercially available, it will have the greatest impact on portable information technology devices.

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