Appendix C: **Service / Agency Highlights**

Army

The Picatinny Technology Transfer Innovation Center (PIC)

PIC was established in November 1996. PIC is a cooperative effort involving County College of Morris (CCM), the U.S. Army Armament Research, Development and Engineering Center (ARDEC), and state and local governments with the mission to 1) accelerate the successful development of growing high tech companies by providing access to technology, services, rental space, equipment and business resources, and 2) assist the ARDEC with technology transfer to the private sector by using the business incubator process. Participating companies are provided with affordable office space, and ready access to technical, management, and financial expertise. PIC has an impressive array of resources to provide participating companies with the competitive edge they need in today's market place.

Blanket CRADA with "Big 3" Automakers

The Tank-Automotive RDEC (TARDEC) has a "blanket" CRADA with the "Big 3" automakers (General Motors, Ford Motor Company and Chrysler) to facilitate the CRADA process to quickly and effectively enter into specific collaborative agreements. TARDEC is currently in a CRADA with the Ford Motor Company to evaluate vision enhancement devices that will help drivers see better in inclement weather or in conditions with low visibility. In addition to working with General Motors, TARDEC also had CRADAs with General Dynamics Land Systems, Autosense Ltd. and Collision Avoidance Systems to study blind-spot monitoring systems for vehicles to help avoid collisions. There are many blind spots all around a vehicle and they represent a serious hazard when drivers change lanes or merge with moving traffic. Results of these efforts could be applied to private and commercial vehicles, both large and small, and help to avoid many injuries each year.

Ceramic Ferroelectric Materials

ARL has entered into an exclusive patent license agreement with TRS Ceramics, Inc. of State College, PA, to manufacture ceramic ferroelectric materials patented by Army researchers. These novel materials act as low-cost, low-loss tunable dielectrics that can be employed in phased-array antennas, varactors, and a broad spectrum of communications electronics. It is estimated that these materials will cost 1/25 of the cost of the current ferrite phase shifters required for phased-array application. This cost reduction is accompanied by a 25 percent weight reduction. ARL is presently negotiating use licenses with a variety of private corporations interested in commercial applications of the ceramic. ARL also holds, and is presently marketing, several patents concerning ferroelectric devices that employ these materials.

Technology Transferred from Commercial Direct TV/Direct PC into the Joint Global Broadcast Service (GBS) while supporting CECOM Ku Uplink and Broadcast Management Center (BMC)

The GBS provides worldwide access to high volume information products via Commercial off the Shelf Technologies (COTS) proven technologies from Direct Broadcast Industry. The CECOM Ku Uplink BMC is a testbed facility for investigation of next generation satellite broadcast technologies as well as back-up operational facility to GBS functional Testbed. This facility proves a fully functional Global Broadcast injection capability in a laboratory environment. Consequently, it is ideally suited to experimentation and evaluation of "what if" technologies. The CECOM Ku Uplink BMC can also be used to support hardware and software development and testing to evaluate candidate new technologies and provide a back-up capability for the operational system. An example of the technology is the recent hosting and rebroadcast of the Discovery Shuttle Launch.

Construction Equipment Performance Optimization

U.S. Army Cold Regions Research and Engineering Laboratory has entered into a three party CRADA with Caterpillar, Inc., Peoria, IL, and Goodyear Tire and Rubber Co., Akron, OH, to develop a numerical model simulating the interaction between tires and deformable surfaces such as thawing and soft soils. Current tire models do not consider the interaction of the tire with deformable media such as soil or snow, focusing only on interactions with pavements. This project will integrate the experimental and numerical simulation of tractive loading on deformable terrain with numerical models of tire deformation resulting in a three dimensional finite element simulation of tire-terrain interaction. The expected result of this collaboration is a design tool with the capability to design tires that perform more efficiently on unpaved roads, off-road, and in all-season conditions including snow and thawing soils. In addition, the technology will be used to explore the effects of tire and terrain variables on vehicle performance and terrain damage.

The technology developed through this CRADA is truly a dual-use technology in that this tool can be a applied to the development of commercial as well as military products. In the commercial sector, the use of this tool will greatly improve the efficiency of off-road, mud and snow, and heavy vehicle tires, increase construction site productivity by improving vehicle traction, and therefore decrease cycle time, fuel costs, tire wear, and time lost due to immobilization, surface damage and repair or reclamation costs. DoD will use this tool to improve tire design and specification, improve performance prediction for off-road vehicles and provide the capability to predict rutting of and soil damage to unsurfaced roads and Army training grounds.

CORE-LOC Concrete Armor Unit

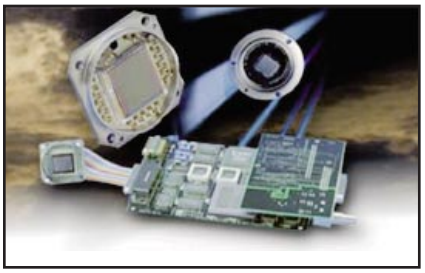
U.S. Army Engineers' Waterways Experiment Station (WES) entered into a CRADA with A. R. Wijnberg, South Africa, to gain the acceptance of CORE-LOC, an innovative coastal protection armor unit developed by engineers at WES by the coastal engineering community which is normally a very slow process. The cost of failure is typically so large that few are willing to risk trying new technology. CORE-LOC has several advantages over its competitors. A CORE-LOC armor layer has outstanding interlocking features and is extraordinarily efficient, dissipating the maximum amount of wave energy with the least amount of concrete, therefore requiring significantly less material than existing armor units. It also has a reserve stability that other structures don't have.

This CRADA allowed WES engineers to work with design engineers at A. R. Wijnberg in the model testing and prototype construction of the world's first breakwater built with CORE-LOC concrete armor units. The assistance provided by WES engineers was critical to the proper model testing of the CORE-LOC structure, as it was to the placement of CORE-LOCs on the prototype structure. A. R. Wijnberg was willing to recommend CORE-LOC for this breakwater and work with WES engineers to successfully conduct model tests and actually construct the breakwater at Port Saint Francis, South Africa.

A product commercialization that is application specific was achieved. Wijnberg's faith in the Corps of Engineers' product for protection for a peninsula and breakwater provided an early opportunity to field test the new armor unit. The early support for CORE-LOC has developed into an active foreign market. Money in the form of both royalties and reimbursable studies is helping to leverage WES' R&D funding.

This project greatly strengthened WES' negotiating position in licensing the CORE-LOC concrete armor unit. With projected royalties of $2.00 to $5.00 per metric ton, a single half-mile long breakwater built with 12 ton armor units could result in royalties of over $1/2-million. Each CORE-LOC unit weighs about 2 tons requiring these units to be built on site. Therefore, patent applications have been filed in over 40 countries and trademark applications filed in many others. The CORE-LOC concrete armor unit is now licensed to four companies, each having an assigned geographic territory. These territories include Europe and South America, North America, Japan, and South Africa. In the near future, annual royalties could easily exceed $1 million.

Evaluation of Electron Cyclotron Resonance (ECR) Plasma Technology



The U.S. Army Communications and Electronics Research, Development and Engineering Center, Night Vision and Electronic Sensors Directorate, (NVSED) entered into a CRADA with Texas Instruments, (TI) (now Raytheon) to further develop the next generation focal plane array by replacing the currently used method of liquid chemical etching with a vapor phase etching technique, Electron Cyclotron Resonance (ECR) etching. Army requirements for higher standoff distances and target recognition capability have led to concepts for next generation of arrays which will have a much higher pixel count than is present in the current generation.

In the CRADA it was agreed that TI would contribute the very high quality and many-layered mercury cadmium telluride samples which they routinely make. NVESD would then etch samples of these in its a state of the art ECR reactor. TI would then measure electrical and structural properties of the etched layers to assess suitability for the TI device architecture.
After one year the etching process looks promising. A few milestones towards developing the next generation FPA have been achieved. The etching process produced an FPA 128 pixels by 128 pixels with each pixel being 24 microns by 24 microns. TI has now purchased a plasma reactor in order to continue the research effort and will eventually integrate this technology into their future production line.

Formulation of a Liposomal Transdermal Vaccine System and Other Novel Pharaceuticals

The Walter Reed Army Institute of Research (WRAIR)and the Medical Technology and Practice Patterns Institute, Inc. (MTPPI) are collaborating in a CRADA to develop vaccine adjunct technology to devise an effective, safe and easily administered delivery mechanism for vaccination. MTPPI is dedicated to the development and transfer of medical technology through Vision for World Health Project. MTPPI has identified the need to introduce an alternative vaccine delivery system to reduce the cost and increase the accessibility of vaccination, especially in Third World settings. A transdermal vaccine delivery system fulfills this objective and is appropriate to the charters and goals of both WRAIR and MTPPI. A liposomal transdermal vaccine system would allow immunization without the need for sterile needles and syringes, trained personnel, and would avoid the complications associated with puncturing the skin.

As a result of this CRADA, a new means of transdermal vaccine delivery was discovered. An article on the technology has been published in Nature magazine. Two patent applications have been filed on inventions created under this CRADA and a third is in preparation. A major licensing agreement has been executed between WRAIR and MTPPI and sublicensing arrangements with commercial developers and end-users of the technology have begun. Substantial resources (revenues and professional scientific staff) have come into WRAIR under this CRADA with MTPPI.

The first trial to be conducted under this CRADA is for a vaccine of particular interest to the Army, E. coli endotoxin technology, for soldiers diarrhea. The vaccine will be used in field operations.

Efficacy of Advanced Infrared Sensor Technology in Medicine

A CRADA was established between Dr. Gorbach. Inc. and the U.S. Army Communications and Electronics Command (CECOM) Research, Development and Engineering Center (RDEC), Night Vision and Electronic Sensors Directorate, (NVSED) to actively collaborate with military and civilian medical research groups to investigate the efficacy of advanced infrared sensor technology in medicine. This initiative has led to over 20 human patients being imaged to date at NIH using NVESD's mid-wave infrared (MWIR) thermal imaging camera. The protocol has been approved for 50 patients, which should be accomplished over the next year. The thermal imaging technique has been used intraoperatively and has been successful in differentiating between intracranial lesions and normal functional tissue. In all cases so far, the technique localized the tumor and functional cortex. In all but 3 cases, the tumor was colder than the normal tissue. An increase in spatial resolution has been requested. Publication of results in a refereed medical journal is planned.

Advanced Modeling, Analysis and Simulation Environment (AMASE)

Monmouth University, under contract with the Army Research Office, is developing an object oriented modeling environment called Advanced Modeling, Analysis and Simulation Environment (AMASE). This model is capable of supporting system performance, engineering, and other types of models and simulations. As part of a CRADA between Monmouth University and the CECOM RDEC, Command/Control Directorate, a senior CECOM engineer participated in software design meetings with Monmouth University professors, gaining insight into concepts, rationale, and methodology required to write a model of this magnitude. Subsequently, the Army evaluated MODSIM III and its usefulness as an adjunct or interface into AMASE. This evaluation indicated that to interface usefully, external signals from AMASE would

have to control the internal MODSI clock, which is not being pursued at this time. CECOM also provides information to Monmouth University describing the new High Level Architecture(HLA) mandated by DoD for military models. CECOM assisted Monmouth University in evaluating AMASE compliance with HLA. After careful analysis it became apparent that the AMASE design is very similar to the HLA design, and compliance seems inherent.

Cheng Rotation Vanc (CRV)

A CRADA was negotiated between the CECOM RDEC and the National Institute of Standards and Technology (NIST) and Cheng Fluid Systems to evaluate the potential of a novel flow conditioning device called a Cheng Rotation Vanc (CRV) with a specific goal of objectively measuring the ability of the CRV to improve the accuracy of hot wire mass flowmeters located downstream of pipe elbow joints. The CECOM's interest in the CRV was based on the fact that an increase in accuracy of hot wire mass flowmeters in these systems could allow for a reduction in the factor of safety in the filter sizing resulting in a decrease of size and weight. This is very important for armored vehicles and helicopters.

Cheng Fluid Systems provided the CRV. NIST provided the laser anemometry facility and labor to conduct the test, process the data, and write a report. CECOM provided a laser anemometry system, a hot-wire anemometry system and bubble generation system and accompanying hard and software.

Based on the cooperative venture, the CRV could ultimately reduce the maximum error of the airflow controls in the cooling/nuclear, biological and chemical (NBC) system application by 10%. The joint research effort benefited DoD in that it offers a size and weight reduction for the advanced cooling/NBC integrated system that will protect future mission critical electronics from thermal degradation and NBC contamination. The CRADA validated the performance of the CRV in a typical military application.

Navy

Laboratories with significant patent activity have established Invention Evaluation Boards (EIBs) which evaluate the commercial potential of Navy patents. In addition, some Navy laboratories have proposed several patents to the "Laboratory to Market" program at the University of Baltimore, where they are reviewed for commercialization potential.

Weapons Team Engagement Trainer Laboratory Prototype

Collaboration continues between the National Institute of Justice and the Naval Air Warfare Center, Training Systems Division (NAWCTSD) to explore and develop simulation and other instructional system technologies which may rapidly impact the law enforcement community and identify training needs, co-development opportunities, and resource sharing strategies to address training deficiencies. A major effort under this program is the installation of the Weapons Team Engagement

Trainer laboratory prototype at the Naval Training Center, Orlando, for use by regional and federal military and law enforcement personnel.

Entrepreneurial Technology Apprenticeship Program (ETAP)

ONR funds the ETAP with the National Technology Transfer Center (NTTC) where students from HBCU/MIs are placed in the technology transfer offices of Navy laboratories. While there, they learn practical skills about technology management and contribute their knowledge and skills to the success of those offices. Seven students were placed in FY 96, five were placed in FY 97 and four were placed in FY 98. The Naval Surface Warfare Center, Indian Head Division received an award at the 1998 FLC meeting for participating in the ETAP.

Licensing Activity

The Naval Air Warfare Center, Weapons Division, (NAWCWPNS) signed one new PLA with Thermo Jarrell Ash Corporation (TJA) which is the direct result of a highly successful CRADA that resulted in four new patent applications. Under the patent License Agreement, TJA has a non-exclusive license for one NAWCWPNS pre-CRADA invention, and an exclusive license for the four inventions developed under the CRADA.

Patent Process

The Naval Surface Warfare Center, Indian Head Division (NSWCIHDIV), prepared a comprehensive "Patent Process" Instruction (IHDIVNAVSURFWARCENINST 5800.2). NSWCIHDIV's patent process changed from an ad hoc review to a formalized process for guiding a potential inventor through the total process of preparing required forms to internal and external review of invention disclosures, through the point where a patent is issued. The instruction also identifies when inventorship awards are given.

Patuxent Partnership

The Naval Air Warfare Center, Aircraft Division (NAWCAD), is a partner in the Patuxent Partnership which is a Southern Maryland support network for technology driven economic development which had its first full year of operation in 1998. During this year the partnership worked with NAWCAD to produce a publication, "Technology Partnership Opportunities," which is a plain-language catalog of NAWCAD technologies. In addition, the Patuxent Partnership produced "Commercialization of Navy Technologies: A Critical Analysis" which is a review of NAWCAD patents with commercial potential.

1-800-NAVYTEC

For the last several years ONR has maintained a 1-800 line (1-800-NAVYTEC) at the NTTC via which it attempts to match the technology needs of civilian firms with the technologies and technological expertise of the Navy laboratories.

Conrad Award

Annually ONR presents the Conrad Award, the Navy's highest honor for scientific achievement. The FY98 recipient was **Dr. Norman Owsley** of the Naval Undersea Warfare Center Division Newport. Noted in the citation was Dr. Owsley's technology

transfer efforts in applying sonar research to non-invasive diagnosis of coronary artery disease. This is the second consecutive year that an FLC Excellence in Technology Transfer Award recipient also received the Conrad Award.

Meteorological Satellite Application System

A satellite meteorological application software developed by the Naval Research Laboratory (NRL)-Monterey is being incorporated into the TeraScan software package marketed by SeaSpace Corporation. The Navy uses SeaSpace's TeraScan software on the Navy Satellite Display System-Enhanced at four regional centers throughout the world. A CRADA allows Navy operational forecasters faster and easier access to the NRL-developed meteorological application modules.

HAZMAT Protection Ensemble

The Naval Surface Warfare Center, Panama City site, has developed a head contact microphone (patent pending) for applications in the Navy Special Warfare community. Under a program with the Pittsburgh Fire Department, the Mid-Atlantic Technology Applications Center (MTAC) and the Mid-Atlantic Regional FLC organization, a prototype communication systems was embedded in a fire helmet and demonstrated. The Pittsburgh Fire Department believes this concept to be a breakthrough in fire fighting communications. As a result of a recent presentation in Pittsburgh before an audience of over one hundred firemen and manufacturers of fire fighting equipment, a CRADA was issued to Unconventional Concepts, Inc. for further development of a hazardous environment communication system.

Detection of Contraband Narcotics by Nuclear Quadrupole Resonance (NQR) (Follow-on CRADA: Fast Recovery Time Nuclear Quadrupole Resonance Detection)

The Navy has had a general interest in advanced detection capabilities for narcotics for use with its own forces. In a CRADA between the Naval Research Laboratory and Quantum Magnetics, the objective was to look at using quadrupole resonance to detect heroin hydrochloride and cocaine hydrochloride. The signal, however, was very difficult to see. It was determined that the objectives of this CRADA were too aggressive. Therefore, a second CRADA was initiated to focus on specific advanced circuitry, a rapid recovery receiver, to detect narcotics and explosives. NRL has evaluated the circuitry and has given the data to Quantum Magnetics. NRL will keep the circuit for two years for laboratory use.

The advanced circuitry studied in this CRADA will be incorporated into a larger commercial system which will result in a better scanner than what is currently available. Working in partnership streamlined the advancement of knowledge in the applications of quadrupole resonance for explosive and narcotics detection.

Ocean Bottom Profiler (OBP) Joint Project

In a CRADA, the Naval Undersea Warfare Center, Newport Division, (NUWCDIVNPT) and Precision Signal, Inc., (PSI) collaborated to develop state-of-the-art equipment known as the Ocean Bottom Profiler, OBP. The OBP was to be capable of mapping the ocean floor in deep and shallow water as well as studying the geomorphology of the bottom by returning information on sediment layers

The Ocean Bottom Profiler program produced the 512 Sonar Vehicle which was first tested and modified at the NUWCDIVNPT laboratory for use in Narragansett Bay. As a

result of this testing and calibration, acoustic transducers, receiver arrays, and acoustic baffle materials were incorporated into the 512 design that have made the 512 profiler superior in performance to all bottom profiling vehicles worldwide.

Under this CRADA, NUWCDIVNPT and PSI have worked to develop a more complex Ocean Bottom Profiler that is capable of producing three-dimensional images of the sub-bottom sea floor. With this new vehicle, buried objects in the sea floor can be located and improved data for remote classification of the sea floor can be obtained. PSI and NUWCDIVNPT have worked to develop an array of receivers for electronic near-field beamforming objects in the sediment. Using previously developed acoustic transducer and acoustic baffle technology, a large, low frequency vehicle was constructed at PSI, and test data proved the feasibility of acoustic detection of buried objects in the sea floor. Acoustic sediment layers can now be measured in the ocean floor down to a level of 64 meters with a 9cm resolution. Today new, smaller, high frequency design of this vehicle is under development for use on Autonomous Underwater Vehicles (AUVs) to survey sea floor sediments and locate buried objects in remote shallow water locations.

The results of these efforts significantly contributed to the design of the AN/WSQ-9 Sonar System, a NUWCDIVNPT initiative that will soon provide significant new warfighting capabilities in mine detection to the U.S. Submarine Fleet. The first installation of this capability into a U.S. submarine is planned for FY99. The 512 Sonar Vehicle is a dual-use development used by many universities, commercial and military users to obtain quantitative and qualitative information on sea floor sediments. The 512 Sonar Vehicle is now manufactured and marketed worldwide by Edge Tech, Inc. under an agreement with PSI.

In the course of developing the OBP, valuable research was accomplished in the disciplines of acoustics and signal processing, as well as in electronic design, to achieve a multi-channel sub-bottom imaging device which could be incorporated into several different applications.

PSI designed an “in-hull” version of the OBP to be used on large vessels for both shallow and deep water applications. A system was installed on the RV Endeaver by PSI and used by Naval Research Laboratory (NRL) to survey sea floor sediments in coastal North Atlantic waters. The data from these surveys were used by NRL to develop a sea floor classification model using Biot theory. The program was successful and, as a result, the OBP is being considered for use in the U.S. Navy.

Air Force

During FY 98, the Air Force laboratories were reorganized into a single Air Force Research Laboratory (AFRL). The Air Force Technology Transfer Program is managed by the Air Force Technology Transfer Management Team located in the Technology Transfer Branch, Technology Transfer and Corporate Communications Division, Plans and Program Office, AFRL.

In FY 98 the Air Force rewrote its Air Force Policy Directive 63-1, Domestic Technology Transfer and its associated Air Force Instructions.

1-800-203-6451

The Air Force Technology Management Team manages the Air Force "Tech Connect" service (1-800-203-6451). Tech Connect receives telephone and e-mail inquiries from potential outside partners and searches for the Air Force technical experts in the laboratories and centers who can best answer the customer's technical questions. This coming year Tech Connect will continue to expand and improve its network of Air Force technical contact points. The Air Force Technology Transfer Management Team will work with the technology transfer focal points in developing and implementing technical assessment methodologies to proactively focus their transfer activities to target industry (i.e. medical, automotive, assistive technologies, etc.).

Master's Thesis

The Air Force sponsored one Air Force Institute of Technology student master degree thesis in the area of transfer process management: "A Return on Investment Model for Air Force Technology Transfer."

Wright Technology Network

The State of Ohio, Wright-Patterson AFB, and the local leaders in Dayton worked together and organized a not-for-profit corporation, Ohio Advanced Technology Center (OATC), in 1989 to promote and assist in the transfer of Wright Laboratory (WL) technology to predominately small and medium sized businesses in Ohio. In December 1994, WL signed an Intermediary Partnership Memorandum of Understanding (MOU) Agreement with OATC to "market" and assist WL technology transfer. A major change was the regional emphasis and national scope of their efforts. As a result the name was changed to Wright Technology Network (WTN). WTN now has representation in Indiana and Kentucky. WTN works with the AFRL to match technologies to the needs of industry, identify those technologies that have potential for commercialization, provide marketing expertise, and assist small business in solving problems or partner for a CRADA.

Gulf Coast Alliance for Technology Transfer (GCATT)

GCATT
Gulf Coast Alliance for Technology Transfer

GCATT is a partnership of federal laboratories, state universities, and community colleges in Northwest Florida and Southern Alabama. GCATT's mission is simply to foster commercialization of member technologies and to enhance regional economic development. GCATT provides a single point-of-contact to the commercial world for access to member technologies and commercialization support. This support is available to private sector firms, state agencies, and other entities. Both the Air Force Air Armament Center and the AFRL, Munitions Directorate (MN), are members of the GCATT. AFRL/MN, together with the Gulf Coast Alliance for Technology Transfer (GCATT) and the Southern Technology Application Center (STAC), has established a process to review MN technologies to identify the ones with the greatest potential for commercial application. During FY 98, AFRL/MN worked with STAC and GCATT to

develop a business plan for the explosive cutter technology. The ORTA successfully target marketed five oil service companies for the explosive cutter technology and chose Halliburton as the partner for commercialization of the technology.

The Alliance for Photonic Technology (APT)

APT has been formed by the Los Almos National Laboratory, Sandia National Laboratories, the University of New Mexico's Center for High Technology Materials and the AFRL, Phillips Research Site, to enhance the global competitiveness of U.S. Industry in the critical technology of photonics by accelerating transfer of federally funded technology developed by APT's R&D participants to industry. APT has been set up as a joint program hosted by the University of New Mexico. APT focuses on coordinating the technical responses of the R&D participants to the technology needs of U.S. Industry. It holds no assets and does no formal contracting. Contracts for technology transfer activities, including joint development, are executed directly between interested companies and the relevant APT R&D participants with ATP participants and APT's technical assistance.

Office of Technology Transfer for Education (OTTE)

In 1994, OTTE was established to assist in the transfer of technology from the Phillips Laboratory to educational institutions. Its mission is to identify and introduce AFRL related technology applications and expertise in support of national, regional, and local educational goals at all levels of education (pre-kindergarten through post-graduate) and through the use of strategic partnerships, foster cooperative relationships within education between the Space Vehicles (VS) and Directed Energy (DE) Directorates, other AFRL directorates, other federal agencies, and the private and public sector. For VS, this includes the developing and fostering of strategic partners with those educational institutions that enhance or support research in and/or understanding of autonomous operations power and thermal management, sensors and communication, electronics, and structures. For DE this includes research in lasers, optical imaging, high power electronic weapons, and protection technologies. Currently, OTTE has successfully negotiated 19 CRADAs and over 35 Educational Partnership Agreements (EPAs).

Yates Award

The team from the OTTE received the 1997-1998 General Ronald W. Yates Award for Excellence in Technology Transfer. The purpose of the award is to recognize a significant achievement by individuals and teams assigned to Air Force Materiel Command (AFMC) organizations in the movement of technology between AFRL and the public and/or private sector. Cash and in-kind investments by schools, communities, and businesses exceed $16M to date. Over 15,000 students at New Mexico schools have been impacted through these partnerships. Students' math, science, and writing skills improved an average of one letter grade through participation in the Computer Assisted Mathematics Instruction Project. The New Mexico Legislature acknowledged the success of the team with a memorial-recognizing landmark AFRL education partnerships. This recognition was prompted by the receipt of over 2,500 letters of appreciation from students, teachers, and principals.

Technet, Inc.

In 1996, the AFRL, Phillips Research Site, entered into an EPA with New Mexico's Technet, Inc. Under this agreement, the AFRL transfers surplus computer equipment deemed to be educationally useful to New Mexico Technet, Inc. These computers are evaluated, upgraded and distributed to primary and secondary schools by New Mexico Technet, Inc. for use in math, science, and technology education. To date, AFRL has donated personal computers, monitors, laptop computers, and printers to New Mexico Technet Inc. worth over $3M.

Technologies for Commercial Applications

The Air Force Technology Transfer focal points at several of the AFRL directorates are implementing a Tiger Team approach to review and catalog their technologies and facilities. This approach was initiated at the AFRL, Propulsion Directorate, to look at technologies for commercial applications. This approach not only identifies the technologies with the greatest potential for commercial application, but also highlights patents for tracking which could produce the greatest royalty potential. These Tiger Teams will meet annually to assess recently developed government technology to determine its application for transfer. The teams will prioritize the technology with respect to market assessment activities and targeted outreach efforts. A subset of this activity is identifying patents, which have originated in the AFRL and measure their impact (quality) for transfer (patent mapping). Once technologies are identified that are applicable, the ORTA will disseminate it in paper and electronic format to federal and state economic development and technology transfer organizations, plus interested companies.

At the AFRL, Sensors Directorate, the first step in the Tiger Team process was to brief the corporate board (consisting of the Director and the Division chiefs) asking for one representative from each division to participate on the team. A letter, signed by the Director, was sent to all S&Es instructing them to look at their technologies for any that had commercial potential. A questionnaire outlining main commercialization criteria was attached to the letter. These questionnaires were collected and reviewed. The Sensor Directorate Tiger Team consisted of two focal points, one representative from each division, two WTN personnel and one representative from the Wright Laboratory Technology Transfer Office. Weekly meetings took place to review the technologies. Each technology was briefed by a champion on the commercialization value of the technology. There were 22 technologies briefed. The team then developed a 13-point matrix to evaluate all the candidates equally. Each technology was then reviewed, discussed and voted on. This process resulted in 11 technologies being referred to WTN for commercialization assessment. WTN analyzed each technology and produced, and briefed, a final report that indicated 5 of the technologies had potential for commercialization.

Polyhedral Oligomeric Silsesquioxane (POSS)

One technology transfer success is the transfer of Polyhedral Oligomeric Silsesquioxane (POSS) polymer and monomer technology to the private sector. Currently POSS materials are being evaluated by the chemical industry through a CRADA the AFRL, Propulsion Directorate, has with the University of Dayton Research Institute (UDRI). POSS materials are being evaluated as additives to conventional plastic formulas to enhance wear resistance, increase fire safety, and provide greater strength to existing plastic products. The most attractive

feature of the POSS technology is that industry can gain these improvements without making major changes in manufacturing methods or purchasing new equipment. The polymer and plastic technology was initially developed for application to low-cost spacecraft components, rocket motor components, and other military aerospace needs. A CRADA was recently approved with Hybrid Plastics to further develop five Air Force inventions related to POSS technology and provide analytical services to the firm and other firms using Hybrid Plastics as a conduit. This CRADA will also support further development of rocket and aero propulsion technologies by enabling lower cost manufacturing of lightweight, high strength components incorporating POSS.

Whole Spacecraft Isolation System for Taurus/GEOSAT

The Air Force Research Laboratory (AFRL), Space Vehicles Directorate has been actively pursuing ways to reduce loads imparted to satellites. A concept developed at AFRL is a "whole-spacecraft isolation system" in which the vibrations imparted to the satellite are reduced. This system replaces the 60 bolts that attach the separation system to the avionics cone and exceeds or meets all performance requirements levied by Orbital Sciences Corporation (ORBITAL).

Under a CRADA between ORBITAL and AFRL, AFRL was to design, build and flight qualify a whole-spacecraft isolation system and ORBITAL was to fly the AFRL's isolation system on their Taurus/GEOSAT Follow-On (GFO) mission (GFO is a Navy satellite being built by Ball Aerospace). In return, ORBITAL would recover the GFO safety margins using the whole-spacecraft isolation system. This flight opportunity with ORBITAL occurred because the Navy satellite GFO had unsatisfactory stress margins on ORBITAL's Taurus launch vehicle, and the AFRL's whole spacecraft isolation system could significantly recover their stress margins.

Any reduction in launch loads corresponds directly to savings in satellite weight which can then be used for additional instruments to increase the science or performance of the satellite. Also, the extra weight can be used to add more propellant to the satellite; thereby, increasing the lifetime of the satellite. The whole-spacecraft isolation system helps reduce life-cycle costs of future Air Force satellite systems by significantly reducing the launch vehicle environments. It is projected that this system has saved the Navy GFO program a few million dollars and 3-6 months in redesign efforts. Similar results are expected for all other satellites launches.

Helmet Mounted Display Fitness of Use

Wearable computers and eye piece technology are stepping stones to providing maintenance technicians with the right information at the right time and place, enabling agile combat support. In a CRADA between the Air Force Research Laboratory, Human Effectiveness Directorate, and KOPIN Corporation, a Fitness of Use study was undertaken to examine the effectiveness of Helmet Mounted Displays (HMD) in mobile computing applications.

The two main elements in the fitness of use study included a visual effects study and a usability study. This CRADA provided KOPIN with access to an actual military maintenance environment for the evaluation of the HMDs for use as a maintenance tool. The Air Force was able to provide valuable feedback to KOPIN on the use of the HMD resulting in a commercialized product.

The information collected under this CRADA will be used to support Air Force Integrated Maintenance Information System (IMIS) efforts that are currently using portable computers for the display of maintenance technical information. Several of the IMIS programs in the Air Force (F-22 IMIS, F-16 IMIS, and JSTARS IMIS) are interested in monocular displays for possible outyear technology insertion.

Defense Advanced Research Project Agency

DARPA Reaches Milestone in Robotic Surgery:

The first robotic (telepresent) surgical operation on a beating heart without using a heart-lung machine was recently accomplished by Computer Motion. This is the "Holy Grail" of heart surgery, since performing the surgery without the use of a heart-lung machine reduces cost, complication and operating time by half. The telepresence surgery project was initiated by DARPA for battlefield use. In five years the system has been developed, commercialized and is now being used on patients in Germany, and is undergoing FDA review for approval in the U.S. NASA is now evaluating these systems for possible use on the International Space Station to allow researchers on earth to conduct their own experiments remotely (e.g., on plants and animals).

Commercialization of Fibrous Monoliths:

Inc. Magazine recently announced its Annual Inc. 500 Awards for 1998. Advanced Ceramics Research, Inc. (ACR) was named for its high rate of commercial growth over the past four years. ACR is the only high-technology, structural materials firm to make this prestigious list of the fastest growing privately held companies. ACR specializes in the production and fabrication of fibrous monolithic structural ceramic and metal matrix composites used in high-temperature applications. This technology, which was developed under DARPA sponsorship, greatly reduces the fabrication costs of high-performance composites for high-temperature leading-edge structures, rocket nozzle and turbine engine components, oil drill tooling and filtration products. ACR was founded nine years ago to develop hypersonic leading edge materials. It that time the company has moved from obtaining all of their funding from federal R&D spending, to today, when approximately 75 percent of their funding is from commercial/military product sales.

National Imagery and Mapping Agency (NIMA)

The Effects of the Gravity Disturbance Vector on Inertial System Accuracy

This CRADA provides a collaborative framework for the development and validation of an analytical model to analyze the effect of NIMA's gravity disturbance vector database on commercial GPS/INS Inertial Navigation Systems. This agreement will contribute to improvements in commercial INS systems.

Interactive Mapping on the World Wide Web Through the Use of JAVA Geospatial Components

This CRADA addresses the collaborative design and development of fully functional, highly interactive, geospatial prototype applications that are platform independent using JAVA geospatial components that can be deployed through the Internet, Intranet and Browser technologies. The agreement will produce JAVA modules for use with commercial market GIS applications.

Global Access, Dissemination and Assessment of Marine Navigation Services and Products

This CRADA addresses the global access, dissemination and assessment of NIMA Marine Navigation Products using IMARST A, B, and M mobile communications services. It provides for the development and validation of proof-of–concept Internet services which will allow commercial and private sector navigators direct access to Navigation Safety Data.

Simulated Aeronautical Flight

This CRADA provides for the collaborative development and validation of a commercial 3D terrain and aeronautical data visualization tool, which can be used on a PC. It will provide a commercially available 3D airfield approach and fly-through capability [based on Digital Terrain Elevation Data(DTED)].