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DOMESTIC TECHNOLOGY TRANSFER:

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A SURVEY OF DESIGNATED AIR FORCE LABORATORIES ON THE IMPLEMENTATION OF THE PROGRAM

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SECTION 4224, PUBLIC LAW 102-484, OCTOBER 23, 1992

This report responds to the above statute It is an assessment of the potential of certain designated Air Force activities to promote technology transfers, and recommendations on the manner in which each such activity might better promote such transfers.

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ANNEX C: DEPARTMENT OF THE AIR FORCE

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INTRODUCTION

This report is submitted in partial satisfaction of the requirements of Section 4224 of the Defense Authorization Act (Public Law 102-484). The subject section requires the following:

> (1) An assessment of the potential of each defense laboratory to promote the transfers described in 2514(c) of title 10, United States Code, as added by subsection (a).
>
> (2) Recommendations on the manner in which each such laboratory might better promote such transfers. [This describes what each lab is planning to do to improve.]
>
> (3) A description of the extent to which each such laboratory has implemented effectively the plan established for the laboratory under subsection (c) during the year preceding the date of the report. [This report simply states what the labs are doing and will serve as the basis for comparison for subsequent reports.]
>
> (4) Recommendations of the Secretary for improvement of the Federal Defense Laboratory Diversification Program established pursuant to such section 2514(c).

In compliance with Section 4224, this report describes the capabilities and efforts of the designated Air Force activities to conduct technology transfer with the private sector. Designated activities have been selected based upon the criteria specified by Congress; namely, laboratories whose Research, Development, Test, and Evaluation (RDT&E) budget is more than $50M.[1] The Air Force activities so selected (shown on the maps on the next page) are--

Armstrong Laboratory	Wright Laboratory
Phillips Laboratory	Air Force Development Test Center
Rome Laboratory	Air Force Flight Test Center

The report is structured as follows:

In Section I, the mission and facilities of each activity is presented, followed by a description of the Office of Research and Technology Application (ORTA). There are many related programs, such as publishing of technical reports and R&D contracting, that enhance technology transfer. Section I describes each activity's participation in these programs. The data presented are not intended to completely describe the activities' efforts; rather, they are only examples of the types of things that they are doing and how they relate to technology transfer.

Section II presents each activity's plans for enhancing technology transfer for FY 1994.

Section III describes selected successes in commercializing Air Force technologies with the private sector.

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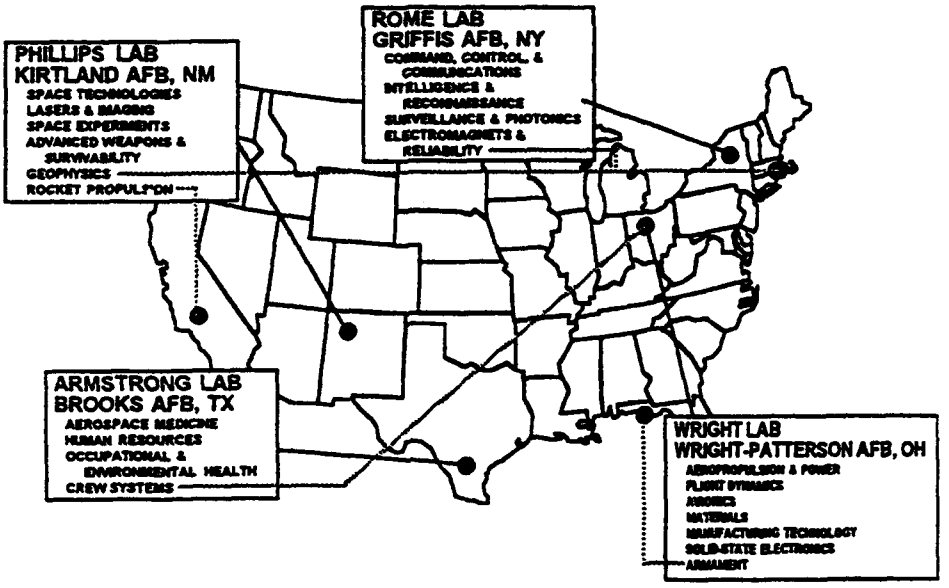
[1] Other Air Force activities actively participate in Domestic Technology Transfer. They include--

Aeronautical Systems Center	Ogden Air Logistics Center
Electronic Systems Center	Oklahoma City Air Logistics Center
Human Systems Center	Sacramento Air Logistics Center
Space and Missiles Systems Center	San Antonio Air Logistics Center
Arnold Engineering Development Center	Warner Robbins Air Logistics Center

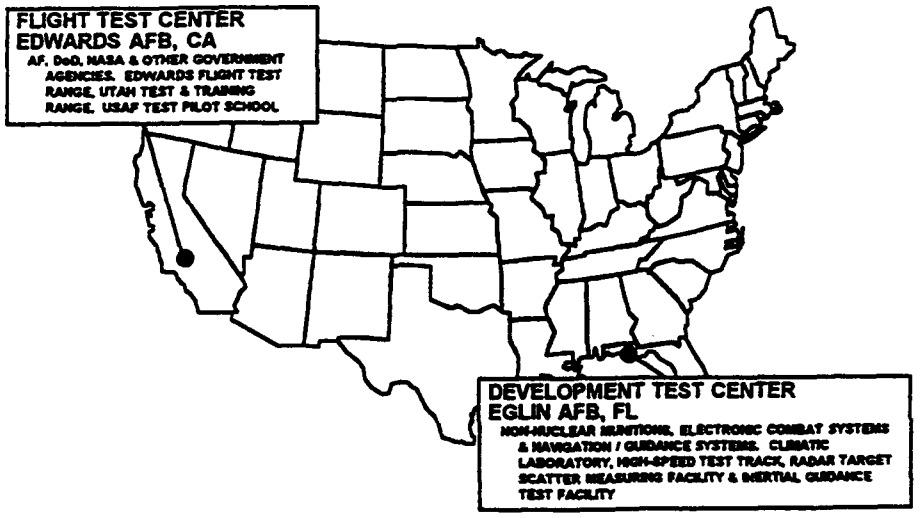
AIR FORCE ACTIVITIES REPORTING PER PL 102-484 SECTION 4224

AF LABORATORIES



AF TEST CENTERS

DEVELOPMENT TEST AND EVALUATION



TECHNOLOGY "TRANSFER" *VS* TECHNOLOGY "TRANSITION"

There is some interest at OSD to change the name of the program from Technology Transfer to Technology Transition. The Air Force believes that changing the name would be detrimental for the following reasons:

- Government scientists and engineers--those who make the program work--know the program by the current name; it would require an major re-education effort with no value added.
- It would certainly also confuse industry to have DoD use a different name than the other Federal agencies and state governments.
- The term technology transition is currently used by the Services to describe the internal process of moving their laboratory-developed technology to their own systems.

The following factors should also be considered.

- The program complies with the National Technology Transfer Act of 1986.
- There would be confusion with the Federal Laboratory Consortium for Technology Transfer and its dealings with industry. In fact, the FLC agrees with the Air Force that the OSD proposal to use the new term is ill advised.
- There would be confusion with the National Technology Transfer Center and the Regional Technology Transfer Centers.
- There would be confusion with the Commerce Department's Interagency Working Group on Federal Technology Transfer

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Section I: Assessments of the Technology Transfer Potentials of Designated Air Force Activities

SECTION I. ASSESSMENTS OF THE TECHNOLOGY TRANSFER POTENTIALS OF DESIGNATED AIR FORCE ACTIVITIES

This section presents assessments of the potential of each of the six selected Air Force activities to transfer technology to the private sector. Each assessment is a description of the mission and R&D interests of each activity, its Office of Research and Technology Application, and selected additional efforts that enhance technology transfer.

The following are explanations of how a number of these additional efforts relate to technology transfer:

TECHNICAL REPORTS.

Current Department of Defense and Service regulations require that the results of every RDT&E effort be documented in the form of interim and final reports. This included in-house and extramural (grant and contract) efforts. These regulations further require that every technical report, whether prepared by government employees or by contractors, be submitted to the Defense Technical Information Center (DTIC). DTIC is the central repository for the Department of Defense technical reports. It is accessible by DoD personnel as well and current ant potential defense contractors. These users are able to search an automated bibliographic database containing a listing of the reports collection, and to order copies of reports on line. Almost half of the reports submitted to DTIC are approved for public release. DTIC forwards these reports to the National Technical Information Service, which provides unrestricted access to the entire public.

Access to technical reports and an automated bibliographic database enhances technology transfer in several ways. Identifying, ordering, and reading a technical report provides the potential recipient of government technology with a basis for identifying potential applications not envisioned by the government developer and supports the decision to pursue the technology. The ability to perform on-line searches of the bibliographic database not only assists in identifying technical reports of potential interest, it also allows users to identify government scientists with common interests and can lead to dialogues that can result in identifying additional common interests and cooperative efforts.

PUBLICATIONS

This refers to articles in scientific, technical, and professional journals. Publishing in journals has several benefits over technical reports. First, they are disseminated quickly and widely, and to a broader audience than the current and potential defense contractors or, in the case of unclassified/unlimited reports, to more than those registered with the National Technical Information Service. Further, articles are published in journals having a readership that has a high level of interest in the subject matter. The peer-review process of many scientific journals adds credibility to the articles. On the other hand, technical reports are able to provide more information than journal articles, which are page limited. Also, technical reports can contain classified or limited-distribution information. Clearly, the process of publishing information on basic research and interim results of applied research in journals combined with detailed technical reports annually and at the end of projects provides the best information to the public and enhances their awareness of Defense dual-use technologies.

CONFERENCES AND SYMPOSIA

Presenting a paper at a scientific or technical conference or symposium is the most timely method of conveying the results of scientific and technical investigations. It has the added advantage of allowing question and answer sessions. Further, attendees are able to talk about related efforts during coffee breaks and meals. Those who do not attend conferences can obtain copies of published proceedings.

CONTRACTS

RDT&E contracts represent a direct commercializing mechanism for Government technologies. This is because the contractors acquire commercial rights to the technologies that they develop under contract. The Government generally retains royalty-free rights to use the technology.

ARMSTRONG LABORATORY

The Armstrong Laboratory plans, manages, and conducts research, advanced development, and specialized operational support, all focused on the readiness, maintenance, protection, and enhancement of human capabilities. The Armstrong Laboratory ensures the Air Force's weapon systems and the people operating them are compatible. It also provides a healthier environment for Air Force members.

The laboratory researches and develops technology for maintaining, protecting, and enhancing human capabilities during Air Force operations.

The laboratory is an integral element of the Human Systems Center (HSC), the prime systems-independent advocate for human-centered concerns in Air Force weapon systems design, development, and deployment. Laboratory research and development efforts complement, are coordinated with, and link HSC programs in development planning and human systems acquisition.

Laboratory products ensure human system performance at individual, crew, team, and force levels, enabling the Air Force to meet current and future operational requirements in the functional areas of aerospace medicine, crew systems, human resources, and occupational and environmental health. Highlighting man as the ultimate enabling factor in Air Force weapon systems, the Armstrong Laboratory sponsors and conducts research and development in the fields of biodynamics, biocommunication, toxic hazards, radiation/directed energy bioeffects, aeromedical selection/retention, human engineering, crew protection/life support, logistics and human factors, force acquisition and management, instructional strategies, job skill development and retention, and training devices/systems.

Responding to customer needs and maintaining our superiority in the human systems technology area, the laboratory builds the technological framework upon which systems acquisition excellence is based.

The laboratory consists of a command section, operations and support, financial management, contracting staff, plans and programs functional directorate, and four functional technical directorates. The functional directorates are interdisciplinary entities structured to address Air Force future capability needs in aerospace medicine, occupational and environmental health, crew systems, and human resources.

The **Plans and Programs Directorate** is responsible for program and process analysis, planning, and decision support for the Armstrong Laboratory's scientific, technical, and operational support programs. It reviews existing scientific and technological capabilities, and future system needs, to ensure the laboratory provides its customers state-of-the-art technology.

The directorate reviews mission and planning documents as well as systems under development to identify relevant human systems technology needs and objectives which meet users' needs. The Plans and Programs Directorate coordinates customer activities and develops advocacy products for the Armstrong Laboratory.

The **Aerospace Medicine Directorate** conducts research, development, and operational support applying medical principles to the selection, retention, and maintenance of people in Air Force operations. It is responsible for monitoring various disease study-groups in the flying population and maintaining

Findings from these studies support the early detection of disease in this critical Air Force personnel resource, enabling more successful treatment and return to the cockpit where flight safety is not compromised. Within this directorate are special laboratory programs in epidemiologic research and field support, dental service equipment evaluation, hyperbaric medicine, and certified substance abuse testing.

The **Occupational and Environmental Health Directorate** assesses risks to personnel from hazardous materials, noise, electromagnetic radiation, and occupational processes in Air Force operations, and conducts research and development to reduce such risks.

The directorate works with all echelons of USAF commanders to acquire, operate, maintain, and dispose of weapon systems within the guidelines of environmental law and regulation. Through broad field consultation responsibilities, it captures and maintains an extensive data base of observed occupational illness and environmental hazards.

It studies interactions between environmental hazards, USAF operations, and personnel and applies the resulting knowledge to mitigate impacts on health and to maintain technological superiority concerning the biological effects of radiation/directed energy.

The **Crew Systems Directorate** conducts research, development, and field support to integrate human operators with weapon systems and to optimize human combat performance, protection, and survivability. It researches how human operators interact with weapon systems to optimize people's performance, protection, and survivability in combat.

It researches human physical, physiological, and behavioral characteristics and stress tolerances to develop permissible crew exposure limits, crew station and equipment design criteria, and protective countermeasures.

The directorate develops design tools and prototype crew stations and equipment to provide a competitive advantage to military combat crews. It manages laboratory programs in anthropometry, workload analysis, helmet-mounted systems, bioacoustics and biocommunications, biodynamic modeling, escape systems, life support, chemical defense, aeromedical evacuation equipment evaluation, sustained operations, spatial orientation, and crew vulnerability reduction. It provides field support to solve related problems encountered in operational systems.

The **Human Resources Directorate** performs scientific research and develops technologies and methods to acquire, classify, train, integrate, manage, and retain Air Force human resources for maximal combat effectiveness.

Human resources studies seek to match people with the most appropriate jobs, to enhance productivity through understanding the elements of job performance, to model and predict force-wide career flow options, and to analyze manpower, personnel, and training components to reduce weapon systems life cycle costs.

It develops training devices/systems and instructional strategies with particular emphasis on aircrew skills. It develops methods, processes, and tools to facilitate early incorporation of supportability considerations in the acquisition process, thereby improving weapon system sustainability and reducing operational resource requirements. It also develops methods to improve intelligence and space support systems, and combat logistics technologies to aid maintenance performance.

The **Environics Directorate** supports the Air Force mission by reducing the cost of cleaning up past waste sites while assuring, through compliance, the completion of critical wartime and peacetime missions. Environmental quality efforts at Tyndall Air Force Base, Florida, center on low-cost, highly effective ways to prevent environmental problems and to restore existing facilities.

The directorate has a state-of-the-art analytical laboratory, staffed by engineers, chemists, microbiologists, other scientists, and technicians. The extended research base that supports this laboratory includes investigators from colleges and universities throughout the United States as well as cooperating research partners in private institutions, industry and other federal laboratories.

As part of its special relationship with the Air Force School of Aerospace Medicine, the Armstrong Laboratory provides instructional expertise and access to its vast aeromedical data bases, information resources, and laboratory facilities.

OFFICES OF RESEARCH AND TECHNOLOGY APPLICATION

The lab has one full-time ORTA and a point of contact for technology transfer in each of its five directorates. Combined manhours for these points of contact is estimated at one-half manyear. In addition. the ORTA has under contract one individual three-quarter time and two technology assessment teams who together contribute one-half manyear. Budget for the ORTA was $150k in FY 92 and $300k in FY 93.

The lab's marketing activities begin with the identification of the possible commercial relevance of technology and conclude with the actual transfer of intellectual or real property to the technology user under a written agreement with the government. Person-to-person contact has been validated as the most effective means of marketing technology. They have completed twenty-one technology assessments, have nine in progress, and plan an additional thirty seven in the next year.

The ORTA participated in seven technology transfer conferences thus far in FY 1993. Included were Industry/Technology 93 in Kansas City, the Armed Forces Communications-Electronics Association Conference in Washington, DC in June 1993, and the NASA Technology 2002 Conference.

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

The laboratory submitted 44 technical reports to DTIC in FY 1992 and 30 in the first half of FY 1993. Additional reports were submitted by the laboratory's contractors. Examples include--

Environmental Microbiological Laboratory Capabilities
The Medical Acceptability of Soft Contact Lens Wear by USAF Tactical Aircrews
Meta Evaluation of Four Intelligent Tutoring Systems: Promises and Products
Measuring Hearing Protection Device Performance using the Metrosonics db-3100 Sound Level Analyzer (Dosimeter)

CONFERENCES & SYMPOSIA

Armstrong Laboratory either conducted or participated in 90 conferences and symposia in FY 1992 and 97 in FY 1993. Examples include the Annual Meeting of the Optical Society, the American Control Conference, International Workshop on Rollover Crashes, the IEEE Signal Processing Society Meeting, and the Conference on Applications of Neural Networks. Included among the laboratory-sponsored conferences was the Annual Toxicology Conference, jointly sponsored with the Environmental Protection Agency and the National Academy of Science. The laboratory sponsors annual industry days.

EXCHANGE PROGRAMS & VISITS (INDUSTRY, ACADEMIA, STATE & LOCAL GOVT)

During FY 1992 and 1993, Armstrong Laboratory hosted five Intergovernmental Personnel Act visitors (generally professors on sabbatical). The lab's summer research program supported 38 researchers during this same period, comprising both university faculty and graduate students. In addition there were over a dozen engineer exchanges with industry. Finally, laboratory personnel participated in almost two dozen outside professional advisory groups.

GRANTS AND COOPERATIVE AGREEMENTS

The laboratory has a number of grants with universities and regularly donates equipment to academia. For example, the laboratory has an educational partnership with the University of Texas related to the Fundamental Skill Tutor project. Combustion diagnostic equipment included as Government Furnished Equipment to UC Irvine was released to the university as was NOX diagnostic equipment to Boston College. Finally, the laboratory has over a dozen active research and development grants with various universities.

SMALL BUSINESS INNOVATION RESEARCH

Laboratory participation in SBIR totaled $4.8M in FY 1992 and $12.2M in FY 1993

USE OF LABORATORY FACILITIES

In FY 1992 and 1993, there were three testing agreements with private industry. These generally involved testing of aircraft seats and passenger restraints

CRDAS

The laboratory currently has ten active CRDAs and an additional 24 pending. There has not been income from CRDAs to date.

INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHTS, AND TRADE SECRETS

Armstrong Laboratory was issued nine patents in FY 1992 and six patents in FY 1993.

Armstrong Laboratory has executed three exclusive license agreements. In addition there are two nonexclusive and one exclusive agreement under negotiation. The laboratory received $4000 in royalties in FY 1993. The laboratory holds one software patent.

TECHNOLOGY REINVESTMENT PROJECT EFFORTS

Armstrong Laboratory has signed letters of intent to support for eleven technology reinvestment projects. Efforts have involved ten laboratory scientists and engineers.

INTERACTIONS WITH NON-DOD ORGANIZATIONS

The laboratory has interacted with dozens of other Federal agencies as well as state and local government. Examples include test and evaluation of intelligent/adaptive tutoring systems with NASA, aeronautical decision-making skills R&D with the FAA, and informal data exchange agreements with the U.S. Coast Guard.

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PHILLIPS LABORATORY

The Air Force's Phillips Laboratory is headquartered at Kirtland Air Force Base, New Mexico. It is part of Air Force Materiel Command and reports to and supports the Space and Missile Systems Center at Los Angeles Air Force Base, California. The Laboratory is the Air Force's focal point for all space- and missile-related research and technology, including geophysics, propulsion, space vehicles, survivability, and directed energy weapons. The Laboratory has more than 2,000 military and civilian employees at Kirtland, as well as Hanscom Air Force Base, Massachusetts, and Edwards Air Force Base, California. Phillips Laboratory, one of Air Force Materiel Command's four super laboratories, is set up to allow exploitation of the technologies involved in developing spacecraft, ballistic missiles, and directed-energy weapons. The Laboratory places a great emphasis on integrating and transitioning its research technology into military systems, which are used by operational commands and maintained by Air Force Materiel Command.

With an annual budget of over $700 million, the Phillips Laboratory conducts its research through six main technical directorates: propulsion, geophysics, space and missiles technology, lasers and imaging, advanced weapons and survivability, and space experiments. The **Advanced Weapons and Survivability Directorate** develops high-energy plasma and microwave technologies, electromagnetic pulse hardening, space systems survivability, and advanced techniques and computer simulations for weapon effects. The **Geophysics Directorate** conducts research to further Air Force understanding of the environment between the Earth and the Sun and its effects on systems and operations. This work is conducted by Laboratory people at Hanscom Air Force Base. Core technologies for the **Lasers and Imaging Directorate** involve demonstrating the technical and engineering feasibility of lasers and imaging systems. The **Propulsion Directorate** focuses on advanced concepts involving motors, propellants and test techniques. Most of this work is performed by Phillips Laboratory employees at Edwards Air Force Base. Researchers in the **Space and Missiles Technology Directorate** focus their work on spacecraft structures, power and thermal management, sensors, and electronics. The **Space Experiments Directorate** plans, manages and conducts space experiments-in a ground, balloon-home, aircraft or space mode. Also included are related ground acceptance and space/launch environmental testing.

OFFICE OF RESEARCH AND TECHNOLOGY APPLICATION

The Office of Research and Technical Applications is located in the Industrial and International Programs Division. It comprises four personnel, two military and two civilian. The Division Director is also heavily involved in the ORTA's efforts. In addition, there are two stay-in-school personnel who provide administrative support and two scientists in the Geophysics and Advanced Weapons Directorates who are dedicated ¼-time to technology transfer. The contract with the State of New Mexico provides the services of four additional individuals. The division's other responsibilities include the Small Business Innovation Research Program, Independent Research and Development, international programs, and Scientific and Technical Information, all of which serve to enhance its technology transfer efforts. In FY 1993, the ORTA budget was--

Travel	$ 35,000
Supplies	15,000
Conference Support	65,000
Aerospace Support Task	110,000
Alliance for Photonics Technology	180,000
State of New Mexico Support Contract	600,000
Total	$1,005,000

The Phillips Laboratory ORTA has developed a number of strategic alliances under a Memorandum of Understanding with Los Alamos and Sandia National Laboratories. These alliances enhance technology transfer to the private sector, stimulate shared strategic awareness, enhance national recognition, leverage resources in shared program areas, and encourage collaboration in basic research among the partners. Successes include--

- Airborne Laser with Los Alamos.
- Defense Supercomputing Research Alliance (DESRA) with four laboratories, 4 universities, and 10 companies.
- Alliance for Photonic Technologies--Generated 10 CRDAs to date.
- Library Alliance with the University of New Mexico, New Mexico State University, Sandia, and Los Alamos.
- Strategic Alliance for Space Applications (SALSA).

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

The laboratory submitted 183 technical reports to DTIC in FY 1992 and 96 in the first half of FY 1993. Additional reports were submitted by the laboratory's contractors. Examples include the following:

Automatic Tornado Prediction with an Improved Mesocyclone-Detection Algorithm
The Design and Construction of a 25-kW Rotating Disk Chemical Oxygen-Iodine Laser
Vortex Shedding by Blunt/Bluff Bodies at High Reynolds Numbers
Cloud Data Set for Neural Network Classification Studies
Evaluation of an Expert System for Forecasting Weather under Data-Sparse Conditions
Applicability of the High-Power Microwave Pump for Plasma Lasers

PUBLICATIONS

The laboratory published 273 technical papers in FY 1992 (198 in refereed journals) and 192 in the first half of FY 1993 (131 in refereed journals). Journals included Advanced Imaging, Electronic News, IEEE Spectrum, Laser Focus World, Scientific American, Sky and Telescope, and Space News.

CONFERENCES & SYMPOSIA

Phillips Laboratory participated in or hosted almost 50 conferences and symposia. Examples include First International Symposium on Semiconductor Wafer Bonding, 28th International Telemetering Conference, AAS/AIAA Aerodynamics Conference, Optical System Contamination, Applications of Artificial Neural Networks. Intense Laser Beams, 23rd AIAA Plasma Dynamics and Lasers Conference, and the Institute of Environmental Sciences Conference.

EXCHANGE PROGRAMS & VISITS (INDUSTRY, ACADEMIA, STATE & LOCAL GOVT)

There were over 600 exchange visits in FY 1992 and approximately the same number through August of FY 1993. Included were over 100 Inter-governmental Personnel Act visitors, 5 National Defense Science and Engineering fellowships, and 40 Laboratory graduate fellowships. In addition there were over 3000 contractor visits.

CONTRACTS

There were 134 RDT&E contracts in FY 1992 and 150 through August of FY 1993. Total values of these contracts were $108M and $171M, respectively.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM

The Laboratory invested over $16M in SBIR in FY 1993 and over $34M in FY 1993, divided among Phase I and Phase II efforts.

CRDAS

Phillips Laboratory has 15 active CRDAs; an additional 20 are being processed for award. Examples include developing and transferring prototype intelligent tutoring systems to be used in education and industry, loaning industrial equipment to the laboratory to support testing of improvements in the Global Positioning System and possible commercialization of the technology by the contractor, and the evaluation of contractor developed enhancements to the laboratory Neutral Particle Beam Test Stand Program.

INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHTS, AND TRADE SECRETS

The laboratory was awarded 13 patents in FY 1992 and FY 1993.

TECHNOLOGY REINVESTMENT PROJECT EFFORTS

The laboratory expended six man-months to promote the program, answer inquiries form industry, and reviewing proposals for ARPA.

INTERACTIONS WITH NON DOD ORGANIZATIONS

Interaction with non-DoD organizations was mainly related to the alliances described above.

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ROME LABORATORY

Rome Laboratory at Griffiss Air Force Base, N.Y., is the Air Force Materiel Command center of excellence for Command, Control, Communications and Intelligence (C3I) research and development. C3I is the military process of managing U.S. forces on a worldwide basis. The effective planning, directing, coordinating, and controlling of forces requires surveillance, communications and information processing.

To provide the U.S. Air Force a more effective C3I capability, Rome Lab develops techniques and equipment for the surveillance of ground and aerospace objects, and for inter-theater and intra-theater survivable communications. Rome Lab is also the Air Force center of expertise for the development of technologies for battle management information systems and the handling of intelligence data.

Engineers and scientists at the laboratory are also involved in the following technologies: software engineering, artificial intelligence/expert systems, solid state sciences and materials, electromagnetics, photonics, signal processing, computer architectures, reliability, maintainability and compatibility of electronic systems.

State-of-the-Art Facilities

Rome Lab operates three technical directorates at Griffiss Air Force Base, N.Y., and one at Hanscom Air Force Base, Mass. Occupying more than 18 acres of floor space, Rome Lab houses some of the finest research and development facilities in the country. These include areas for research in signal processing, microelectronics, antennas, and solid state devices and materials.

The laboratory also operates off-base research sites at various locations in New York and Massachusetts, where research and engineering is conducted in functions such as surveillance, communications, antennas, and scattering.

Established in 1951 as Rome Air Development Center, Rome Lab became one of the Air Force's four "super" laboratories in December 1990. Laboratory personnel developed the technology that was incorporated into such systems as the Ballistic Missile Early Warning System (BMEWS), the Distant Early Warning (DEW) Line, the Semi-Automated Ground Environment (SAGE) system, the Back-Up Interceptor Control (BUIC) system, Over-the-Horizon (OTH) Radar, Joint STARS and the Airborne Warning and Control System (AWACS).

Using the National Aeronautics and Space Administration Echo I balloon satellite, laboratory scientists were the first to transmit an intercontinental voice signal via satellite in August 1960. In recognition of its numerous scientific achievements, Rome Lab has earned the Air Force Outstanding Unit Award -- the service's highest organizational honor -- on six different occasions. In addition, the laboratory was honored in 1990 and 1992 with the Organizational Excellence Award. Laboratory scientists and engineers have been honored five times with the Harold Brown Award, recognizing significant individual achievement in the realm of research and development.

OFFICES OF RESEARCH AND TECHNOLOGY APPLICATION

The lab has four full-time persons assigned to the ORTA. There are also half-time points of contact in each of the five mission directorates. The ORTA budget for FY 93 was $93k. The ORTA is very active in producing publications, brochures, and print-related efforts related to tech transfer. Included is the annual *Industry Looks at Rome Laboratory*, advertisements in *Technology Transfer Business Magazine*, Articles in *Technology New York Newsletter*, and an article in *Defense Electronics*.

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

Rome Laboratory submitted 48 technical reports to DTIC in FY 1992 and 17 through the first half of FY 1993. Additional reports were submitted by the laboratory's contractors. Examples include--

Analog Very Large Scale Integration (VLSI) Implementations of Artificial Neural Networks
Evaluation of Space Communications Networks
Phased Measurements for Rotating Antennas
Time-Division Optical Interconnects for Local-Area and Micro-Area Networks
Increasing Software Confidence: Where We're headed in Software Testing Technology

PUBLICATIONS

The laboratory was very active in publishing articles in scientific and technical journals, publishing 288 articles in FY 1992 and 156 through July of FY 1993. Journals included the IEEE Spectrum, Society of Photo-optical Engineers, Journal of Vacuum Science and Technology, and Software Engineering Notes.

CONFERENCES & SYMPOSIA

Rome Laboratory hosted over two dozen conferences in the last two fiscal years. Included were two industry days and two that focused on dual-use technologies. Others included the following: Annual Software Quality Workshop, Antenna Applications Workshop, Workshop on Moisture Measurement and Control of Micro-Electronics, and the 7th Annual Knowledge-Based software Engineering Conference.

EXCHANGE PROGRAMS & VISITS (INDUSTRY, ACADEMIA, STATE & LOCAL GOVT.)

The laboratory had cooperative exchange agreements with the State University of New York and Syracuse University, The first involved three students while the latter involved 7 professors.

CONTRACTS

The laboratory awarded 1671 RDT&E contracts in FY 1992 and 1352 through July of FY 1993. Total value of the contracts were $230M and $190M, respectively.

GRANTS AND COOPERATIVE AGREEMENTS

The laboratory is initiating a cooperative agreement to support their Advanced Thermionic Research Initiative. The award should be made in FY 1994 in response to an RFP issued in August 1993.

They donated 46 personal computers to the State University of New York, College of Technology, and loaned adaptive optics equipment to Syracuse University. In addition, they are negotiating three education partnerships with the Rome City School Board, Tufts University, and the City University of New York.

SMALL BUSINESS INNOVATION RESEARCH

The laboratory has been active in the SBIR program since its inception. In FY 1992, there were 19 Phase I awards and 11 Phase II awards; in FY 1993 there were 35 and 16, respectively.

USE OF LABORATORY FACILITIES

The laboratory has one memorandum of agreement with the Photonics Development Corporation. They provided 14 mandays of testing of photonics devices in FY 1992 and 10 Mandays in FY 1993.

CRDAs

Rome Laboratory has 30 active CRDAs with an additional 19 under negotiation.

INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHTS, AND TRADE SECRETS

The laboratory was awarded 20 patents in FY 1992-93. There were three patent licenses during that time and a royalty income of $5,760.

TECHNOLOGY REINVESTMENT PROJECT EFFORTS

The laboratory expended 285 hours on the program in the 3rd quarter of FY 1993.

INTERACTIONS WITH NON-DOD ORGANIZATIONS

The extent of the laboratory's interactions with non-DoD activities (other than CRDAs) is mainly in the area of education. There is a number of Coop programs, summer fellowships, and education partnerships. Of particular note is the Expert Science nd Engineering Program, which involved 76 faculty members and graduate students at a value of $3.8M

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WRIGHT LABORATORY

Wright Laboratory, headquartered at Wright-Patterson Air Force Base, Ohio, is the Air Force's largest laboratory complex. Its mission is to lead the discovery, development, and transition of aeronautical technologies which enable the U.S. Air Force to remain the best in the world. The laboratory also has a corporate responsibility for developing materials, solid state electronics, and manufacturing technologies for the entire Air Force.

With a deep heritage, Wright Laboratory traces its origins back to the Airplane Engineering Department, Aviation Section, U.S. Army Signal Corps, which was established at McCook Field near downtown Dayton, Ohio, in October 1917. Organizationally, Wright Laboratory is part of Aeronautical Systems Center (ASC), the base's host unit and that arm of the Air Force Materiel Command which is responsible for research, development, test, evaluation, acquisition, and support of aeronautical systems and related equipment for the Air Force.

More than 3,200 military and civilian employees work in Wright Laboratory, which has an annual budget of more than $1 billion. Approximately two-thirds of the laboratory's personnel have degrees in science and engineering disciplines, with almost half that number having advanced degrees. In-house research is conducted in 183 facilities located at Wright-Patterson Air Force Base and Eglin Air Force Base, Florida, and demonstrator aircraft are flown at Edwards AFB, California, to test technologies developed by the laboratory. Many of the technologies developed are available for transfer to academia, local and state governments, and the private sector for non-military use.

Research is conducted at Wright Laboratory through seven major technology directorates: Materials, Aero Propulsion and Power, Solid State Electronics, Avionics, Armament, Flight Dynamics, and Manufacturing. All directorates are at Wright-Patterson Air Force Base except the Armament Directorate, located at Eglin Air Force Base. Each directorate (except Manufacturing) performs the full spectrum of basic research, exploratory development, and advanced development in its respective technology discipline.

Additionally, a Plans and Programs Directorate is the laboratory focal point for investment strategy and technology transition planning, and three other directorates—: Operations and Support, Research and Development Contracting, and Research and Development Comptroller, —provide support across the entire laboratory structure.

Materials Directorate explores new materials and processes for advanced aerospace applications. Current focus is on thermal protection materials, metallic and nonmetallic structural materials, aerospace propulsion materials, and electromagnetic, electronic, and laser-hardened materials.

Aero Propulsion and Power Directorate focuses on air-breathing propulsion and aerospace power technology, which includes fuels and lubricants, turbine engines, and high-performance/high-Mach air-breathing propulsion applications. Aerospace power research up to megawatt-class systems centers around electrochemical energy storage, hyperconducting generators, and power conditioning subsystems.

Solid State Electronics Directorate is responsible for electronic device research and development in the areas of microelectronics, microwaves, and electro-optics. Research extends from fundamental semiconductor layer growth and device fabrication through integrated circuits. In the electro-optics area, lasers, detectors, and integrated focal plane arrays are developed.

Avionics Directorate conducts research and development activities in the fields of offensive sensors (e.g., radar, infrared search and track, and forward-looking infrared), weapon delivery systems, reconnaissance, electronic warfare, navigation, communications, and avionics integration. Engineers emphasize not only performance enhancement, but avionics reliability and affordability as well.

Armament Directorate develops conventional armament technologies and integrates those into air-vehicle and other delivery platforms. The directorate provides conventional armament technology for four major thrusts which include advanced guidance, weapon flight mechanics, ordnance, and strategic defense.

Flight Dynamics Directorate conducts the full spectrum of flight vehicle research. Primary areas of interest include aircraft structures, vehicle subsystems (e.g., landing gear, transparencies), flight control, and aeromechanics. In addition, this directorate develops and maintains a fleet of experimental test vehicles to demonstrate integrated technologies—avionics, flight control, propulsion—in an airborne environment.

Manufacturing Technology Directorate serves as the focal point for planning and executing an integrated manufacturing program across the Air Force. In addition to a focus on manufacturing process technologies and computer integrated manufacturing, the directorate also focuses on design for producibility, quality, and life cycle costs, otherwise known as Integrated Product Development.

OFFICES OF RESEARCH AND TECHNOLOGY APPLICATION

The Wright Laboratory ORTA comprises four individuals, including a supervisor and three subordinates. In addition, the laboratory has an additional eight focal points in the various directorates.

The Wright laboratory ORTA works closely with of a number of alliances and other similar entities, including the following:

- Ohio Aerospace Institute, comprising the nine Ohio universities, two Federal laboratories, and more than 12 industrial firms. It develops graduate programs related to aerospace.
- Ohio Advanced Technology Center, a partnership between the laboratory, academia, and industry. It promotes partnerships to promote technology-based economic development.
- Ohio Technology Transfer Organization--OTTO--is a state-funded network of technology transfer experts and technical business specialists.
- Ohio Computer Technology Center, a consortium of computer and information-technology companies. and university departments in southwest Ohio.
- Ohio Thomas Edison Program.
- Center for Artificial Intelligence Applications
- Miami Valley Research Institute, a consortium of the four academic institutions (Wright State, University of Dayton, Central State, and Sinclair Community College).

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

Wright Laboratory submitted over 150 technical reports to DTIC in FY 1992 and nearly 50 during the first half of FY 1993. Additional reports were submitted by the laboratory's contractors. Examples include--

Advanced Composites Reinforced with a Blend of Poly(P-Phenyl Benzothiazole) and HVR Nicalon Fibers
Ultrasonics as a Method of Bird Control
Advanced Propulsion Technology
Light-Activated Solid-State Opening Switch

PUBLICATIONS

Wright Laboratory published several hundred articles in scientific and technical journals. Journals included: IEEE Transactions, Journal of the Society of Photo-Optical Engineers, Shock and Vibration Bulletin, American Society for Testing and Materials, American Institute of Aeronautics and Astronautics, Society of Automotive Engineers, Human Factors Society, Institute of Environmental Sciences, and the American Society of Mechanical Engineers.

Example Journal Article Titles

Aircraft digital Flight control Review
Neural Networks for Control Reconfiguration
Quantitative Laser Velocimetry Measurements in the Hyupersonic Regime by the Integration of Experimental and Computational Analysis
Injection Molding of Aircraft Transparencies

CONFERENCES & SYMPOSIA

Wright Laboratory hosted a number of "Industry Days" and both conducted and participated in many technical symposia. Examples include the Society of Unmanned Vehicles, Aerospace Atlantic Symposium, National Annual Technical Meeting of the Institute of Environmental Science, Conference of Offshore and Polar Engineering, International Symposium of Fatigue of Aircraft materials, Fire Control Symposium. 9th Thermoplastic Matrix Composites Review, FAA Conference on Fire-Resistant Aircraft Materials

EXCHANGE PROGRAMS & VISITS (INDUSTRY, ACADEMIA, STATE & LOCAL GOVT)

Wright Laboratory was visited by over 30 representatives from academia (professors and graduate students) and industry.

CONTRACTS

Wright laboratory awarded some 600 R&D contracts during FY 92 and the first half of FY 93. The total dollar value of these contracts was almost $700M. The laboratory points out that the one of the purposes of the Manufacturing Technology contracts is to establish a manufacturing capability that will serve not only defense needs but also the needs of private industry. With the remainder of the R&D contracts, while commercialization is not a contract requirement, there are many examples where the contractor is indeed pursuing commercial applications. Further, a number of contracts include technology transfer assessments and the number of contracts with this requirement is increasing.

GRANTS/DONATIONS OF EQUIPMENT TO UNIVERSITIES, COOPERATIVE AGREEMENTS

Wright Laboratory donated a number of laboratory items to local universities. Included were optical equipment to Wright State. The Armaments Directorate at Eglin AFB, FL, has donated land to the University of Florida for the construction of the university's Graduate engineering Research Center. They provided mechanical testing equipment to Pursue The laboratory regularly turns over Government Furnished Equipment to universities at the completion of grants and contracts.

Education Partnerships included an Infra-Red Imaging technology with the University of Hanburg, GA, vapor-phase lubrication with Cleveland State, chemical kinetics with the University of Illinois, synchrotron research with Cornell. The Armaments Directorate is negotiating an Education Partnership Agreement with the University of Florida to facilitate advanced degree research with laboratory facilities, equipment, and personnel. The laboratory is supporting a summer intern program with Wright State for student with disabilities.

The laboratory has an informal relationship with the University of Dayton where their researchers have access to Air Force turbine research equipment and facilities. Additional universities with which the laboratory is working include Arizona State, MIT, Cal Tech, North Carolina A&T, and the universities of Arizona, Virginia, Iowa, Michigan, and North Carolina.

USE OF LABORATORY FACILITIES

One example is McDonnel Douglas' testing of aircraft fuel tank sealing techniques testing under simulated environmental conditions with fuel. There have been over 100 DoD and commercial users of the lab's Rain Erosion Facility.

CRDAS

The laboratory has over 25 active CRDAs, and is currently negotiating an additional 36. Royalty income from CRDAs was $32k in FY 1992 and $28k in the first half of FY 1993.

INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHTS, AND TRADE SECRETS

Wright Laboratory was awarded 36 patents in FY 1992 and 15 in the first half of FY 1993. Based on patent licenses, the laboratory received $41k in royalties in FY 1992 and $77k in FY 1993.

TECHNOLOGY REINVESTMENT PROJECT EFFORTS

Wright Laboratory was heavily involved with ten proposals that were submitted to ARPA in July. The role varies from being on the evaluation board, to being ARPA agents, to being testers of the new technologies, to being active participants. Wright Laboratory technologies would be adapted to medical trauma care, automobiles, robotics, opto-electronics, general aviation aircraft, and process control for electronics manufacturing.

INTERACTIONS WITH NON DOD ORGANIZATIONS

Wright Laboratory has many interactions with the Federal Aviation Administration (particularly aircraft hardening), the National Aeronautics and Space Administration (particularly in the area of in-flight simulation), and the Department of Energy (SANDIA and Los Alamos). The lab also works with several State of Ohio organizations including the Ohio Advanced Technology Center and the Edison Welding Institute. They consult with the Transportation Department regarding power system needs for magnetically levitated trains.

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AIR FORCE DEVELOPMENT TEST CENTER

The Air Force Development Test Center (AFDTC), of Air Force Materiel Command, is located at Eglin AFB, FL. Its mission includes the full spectrum of planning, directing, and conducting the test and evaluation of non-nuclear munitions, electronic combat, and navigation/guidance systems. AFDTC is also responsible for all host and base support functions for Eglin AFB. The Test Center accomplishes its mission through its two component wings - the 46th Test Wing and the 646th Support Wing.

The Air Force Development Test Center's 46th Test Wing manages the overall test and evaluation program for AFDTC. To perform this task, it is equipped with approximately 36 aircraft of various types, and highly instrumented ground facilities. To accomplish its mission, the Test Wing manages all the large land test ranges located throughout the 724 square mile Eglin complex, as well as the 86,500 square smiles of water ranges in the adjacent Gulf of Mexico. Major tests on or above AFDTC's ranges involve all types of equipment, including aircraft systems, subsystems, missiles, guns, bombs, rockets, targets and drones, high-powered radars, and airborne electronic countermeasures equipment. These systems are tested in a variety of environments, and combat conditions are realistically simulated. One of the Test Wing's unique assets is the McKinley Climatic Laboratory, capable of testing military hardware as long as bombers in environments ranging from minus 65 to plus 165 degrees Fahrenheit with 100 mph winds, icing, clouds, rain, and snow.

Under the 46th Test Wing is the 46th Test Group at Holloman AFB, NM. Among its unique facilities are a ten mile high-speed test track, two radar target scatter measurement facilities, and the Department of Defense Central Inertial Guidance Test Facility.

The 646th Support Wing provides major medical, civil engineering, personnel, logistics, communications, computer, security, and all other host services to AFDTC units and approximately fifty associate units, such as the USAF Air Warfare Center and the 33rd Fighter Wing, that make Eglin AFB their home. These support services are provided to more than 70,000 active duty, civilian, retired personnel, and dependents that reside in the area. In addition to its normal host base support function, the Support Wing also runs one of the largest mobility functions in the Air Force. In support of wartime taskings it is responsible for mobilizing more than 5,400 people and 22,000 tons of cargo.

ORGANIZATIONAL AREAS OF EXPERTISE

- Modeling, simulation, analysis, and testing of explosive phenomena and effects
- Electromagnetic compatibility and interference testing
- Anechoic chamber and open air testing of radiating and receiving devices
- Subminiature instrumentation and accurate time, space, and position information
- Radar, infrared, and electro-optical measurements
- Optical tracking systems including high-speed television
- Climatic and operating environment simulation
- Telecommunication linking of test facilities
- Real-time data collection, recording, reduction, and analysis
- Air and land multi-target tracking and remote control

UNIQUE FACILITIES
(AVAILABLE FOR SMALL COMMERCIAL FIRMS AS WELL AS DEFENSE CONTRACTORS)

- CRAY YU-MP Supercomputer: integrated into a high-speed network which provides in-depth analyses capability and real-time control during test missions.

- McKinley Climatic Laboratory: a one-of-a-kind national resource capable of testing very large articles (747 aircraft) with engines operating in environments ranging from -65° to +165° Fahrenheit with 60 knot winds, clouds, rain, and snow.

- Guided Weapons Evaluation Facility (GWEF): the only facility of its kind able to test weapon seekers and sensors under one roof, including millimeter wave, laser, infrared, radio frequency, and electro-optical. Employs digital, hardware-in-the-loop, modeling, and simulation techniques.

- Preflight Integration of Munitions and Electronics Systems (PRIMES) Facility: consists of a fighter aircraft-sized anechoic chamber and six shielded laboratories providing secure, realistic testing in a controlled RF environment in static or dynamic flight simulation conditions.

- Fully Instrumented Open-Air Test Ranges: Land: 724 miles^2, Water: 86,500 miles^2.

- Central Inertial Guidance Test Facility (CIGTF): provides precision inertial test capability including accelerometer and gyro test tables, 30g and 100g centrifuges, and environmental test chambers and tables (Holloman AFB, NM).

- High-Speed Sled Track: the most accurately aligned and best instrumented facility of its kind used for high g and hypersonic testing (Holloman AFB, NM).

- Radar Target Scatter (RATSCAT) Facilities: two radar cross section (RCS) measurement ranges capable of mono-static RCS measurements on targets up to 30,000 pounds and mono-static/bi-static RCS on targets up to 100,000 pounds (Holloman AFB, NM).

OFFICE OF RESEARCH AND TECHNOLOGY APPLICATION

The AFDTC ORTA comprises four individuals, two permanent and two temporary. The budget for FY 1993 was $87k.

The AFDTC ORTA was instrumental in the creation of the Gulf Coast Alliance for Technology Transfer (GCATT). GCATT is a group of 16 military and academic institutions in northwest Florida and southern Alabama, whose purpose is to come together to interactively foster technology transfer. Participation in the alliance leverages the efforts of the other partners and enhances the effectiveness of the AFDTC ORTA. In addition, AFDTC has joined with the University of Florida to establish a Graduate Education Research Center (GERC) in Fort Walton Beach to meet the Scientific and Engineering needs of this region and Eglin AFB. In addition to Masters and PhD engineering programs, the GERC is a research center with a major focus on Technology Transfer. The Center is currently working several R&D projects and is poised to take on additional technology transfer taskings that will serve its combined educational, research, and transfer goals.

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

The center submitted 39 technical reports to DTIC in FY 1992 and 21 during the first half of FY 1993. Additional reports were submitted by the center's contractors. Examples include--

Aircrew Eye/Respiratory Protection Program Development Test and Evaluation: Chemical Protective Hood/Mask Assembly Evaluation
Miniaturized Airborne Global Positioning System (GPS) Receiver
Rockwell Advanced Inertial Measurement Unit Sled Test

PUBLICATIONS

In addition to publishing technical reports that are distributed to the public through the Defense Technical Information Center and the National Technical Information Service, AFDTC publishes technical articles in technical and professional journals such as Electronic Warfare Digest, Electronic News, And the Journal of Electronic Defense. There were 25 such publications in the last two fiscal years.

CONFERENCES & SYMPOSIA

AFDTC hosted a Technology Transfer workshop attended by over 100 Air Force personnel involved with the process. In addition, the hosted two Industry Days at Eglin Air Force Base, each with over 500 attendees.

EXCHANGE PROGRAMS & VISITS (INDUSTRY, ACADEMIA, STATE & LOCAL GOVT)

There were three exchanges with industry in FY 93.

CONTRACTS

There were 369 active RDT&E contracts in FY 1993, totaling $843.7M.

ASSISTANCE TO INSTITUTIONS OF HIGHER LEARNING

AFDTC has developed a close relationship with the university of Florida Graduate Engineering Research Center. In addition to the donation of audiovisual equipment, AFDTC provided $175k for the renovation of the faculty/administrative staff building. The Air Force also provided a 110 acre site on the Eglin Reservation to house the new 50,000 sq. ft. Graduate Engineering Research Center being funded by the State of Florida AFDTC also has three R&D contracts with the graduate school.

USE OF LABORATORY FACILITIES

Industry is currently involved with weapon component and power supply testing at AFDTC. There are four such tests, with a value of $474k.

CRDAS

The center has no CRDAs at the present time, however one is under negotiation and two are more are being considered.

INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHTS, AND TRADE SECRETS

There were 5 patents and 19 patent applications in FY 1993. There are five patent attorneys at Eglin AFB. They provide training to scientists and engineers on a case-by-case basis.

TECHNOLOGY REINVESTMENT PROJECT EFFORTS

Center personnel expended approximately 100 hours on TRP thus far in FY 1993

AIR FORCE FLIGHT TEST CENTER

The home of the Air Force Flight Test Center is 301,000 acres on the western edge of the Mojave Desert. Here, at Edwards AFB, California, the Air Force has tested all the aircraft in its inventory and is currently testing the B-2, F-22, and C-17.

The AFFTC supports the Air Force Materiel Command by conducting and reporting on development test and evaluation for Air Force units, the Department of Defense, NASA, and other Government agencies. The center develops, operates, and maintains the Edwards Flight Test Range and Utah Test and Training Range. It also operates the U.S. Air Force Test Pilot School.

It is the site of lifting body research flights, critical to the design and development of the space shuttle. The space shuttle's approach and landing tests were conducted in 1977. The first shuttle landings from space began in April 1981. The B-2 bomber made its maiden flight at Edwards in 1989, the F-22 in 1990, and the C-17 in 1991.

To fulfill its mission, AFFTC resources include the test and evaluation mission simulator, the Benefield Anechoic Chamber, Ridley Mission Control, and the integration facility for avionics systems testing. Civilians, contractors, and military people work together to flight test and evaluate new aircraft and upgrades to aircraft already in inventory.

Among these tests are improvements to radar weapons delivery and navigation systems and a system to give tactical pilots the ability to strike ground targets from low altitudes at night and in adverse weather.

The Avionics Test and Integration Complex (ATIC) supports the AFFTC primary mission of flight testing manned and unmanned aerospace vehicles and avionic systems. The ATIC provides an integral step in the Test and Evaluation (T&E) process for testing both federated and integrated avionic systems at the AFFTC. The ATIC is dedicated to meeting flight test program challenges in risk management, cost savings, and improved capabilities by providing the expertise and facilities needed to field software intensive systems. Highly integrated avionic systems dictate a thorough use of ground test capabilities ranging from digital modelling and simulation to installed systems test capability in order to technically validate avionics functions and performance prior to and during flight test programs.

The ATIC comprises three collocated core facilities/capabilities that can operate independently or in connection to satisfy specific customer requirements. Digitally simulated flight with operator-in-the-loop is conducted in the ATIC's Test and Evaluation Mission Simulator (TEMS) to test air/space vehicle performance and flying qualities. This capability is integrated with real avionics hardware-in-the-loop testing on spread benches in the Integration Facility for Avionic Systems Testing (IFAST) when required to test integrated fire and flight control functions. When installed systems testing is appropriate, the complete test platform is placed in the Benefield Anechoic Facility (BAF). The BAF provides a large electronically secure/quiet environment which realistically simulates an outdoor range for testing strategic/transport/cargo-sized aircraft and single/multiple tactical-sized aircraft. The BAF environment is significantly more realistic of an outdoor range environment than that provided by smaller anechoic facilities. The co-location of the BAF to both TEMS and IFAST affords opportunities for all three ATIC facilities to share instrumentation and personnel which, in conjunction with the IFAST spread benches and the large size of the BAF, provides a powerful T&E synergism that is unequaled in the nation.

ATIC facilities are technically commensurate with the integrated and distributed processing nature of modern avionics and provide capabilities needed to meet the complex technical challenges for Department of Defense (DoD) and other Government/civilian programs in a timely and effective manner.

Structured testing directed by flight test personnel in state-of-the-art ATIC facilities supports analysis before and after flight through the use of realistic simulation and stimulation in test conditions as well as those encountered in flight. This application of a scientific approach to test and evaluation (T&E) maximizes the concurrent use of test resources at the least expensive levels from digital simulation to outdoor ranges.

The proximity of the ATIC to other facilities which include Combined Test Forces, avionics maintenance shops, propulsion test stands, weapons and electronic combat test ranges, data processing and range control centers, contractor development resources, and nearby major range and test facilities bases (such as the Naval Air Warfare Center/Weapons Division China Lake Echo and Golf Ranges, Pacific Missile Range Test Center, and the Western Missile Test Range) afford considerable opportunities to share limited test resources in bridging the development at contractor plants with flight test on a western range complex where the flying weather is excellent year-round.

Edwards Air Force Base has two unique natural resources that help make it the premier flight test facility in all the world—Rogers and Rosamond dry lakebeds.

> Rogers Dry Lake is the largest of the two and has been used since 1977 as the landing site for many space shuttle test and operational flights. But both lakebeds have been used for emergency and test landings of aircraft for more than 40 years. And these natural flat surfaces have literally saved hundreds of aircrew lives and aircraft valued at millions of dollars because they offer a broad expanse of hardened clay on which to land aircraft in emergency situations. Rogers has a surface of about 44 square miles and is the lakebed next to which the main Edwards complex has been developed. There are seven "drawn on" runways crisscrossing the surface of Rogers, the longest— BEING 7.5 miles.
>
> Rosamond Dry Lake, several miles southwest of Rogers, offers 21 square miles of smooth flat surface which is also used for routine flight test and research operations and for emergency landings. The flatness of the lakebeds was revealed following a measurement of the Rosamond lakebed surface which has a curvature of less than 18 inches over a distance of 30,000 feet.

OFFICE OF RESEARCH AND TECHNOLOGY APPLICATION

The Air Force Flight Test Center (AFFTC) Office of Research and Technology Application has one full-time individual.

EFFORTS THAT SUPPORT TECHNOLOGY TRANSFER

TECHNICAL REPORTS

The Air Force Flight Test Center submitted 40 technical reports to DTIC in FY 1992 and 16 during the first half of FY 1993. Additional reports were submitted by the center's contractors. The following are examples:

Results of Passive Anti-Drown device and Anti-Suffocation Valve Parachute Tests
Standard Heads-Up display Symbology Evaluation
Active Noise Reduction Equipment Compatibility and Parachute Jump Test

GRANTS AND COOPERATIVE AGREEMENTS

One example of the AFFTC efforts in the local area is their assistance in integrating kindergarten through junior college curriculum with emphasis on careers, work ethics, and interpersonal relationships.

USE OF LABORATORY FACILITIES

The AFFTC has agreements with commercial flight test and aircraft modification facilities at Mojave Airport to use restricted airspace on a scheduled, non-interference basis. The center is also working with the FAA on commercial flight tests using the center's unique facilities and capabilities. All aerospace companies use this capability for their aircraft hazardous testing. The Air Force level of effort is on the order of $500k per year.

CRDAS

There is one CRDA under final review. An additional three are being contemplated.

INTERACTIONS WITH NON-DOD ORGANIZATIONS

The NASA Dryden Flight Test Center is a tenant on Edwards AFB. The Air Force provides support to NASA on an ongoing basis. The agencies have worked joint research programs over the years, including the X-15 hypersonic research program, continuing today as the AFTI F-16 and X-29.

Section II: Technology Transfer Plans for Fiscal Year 1994

ARMSTRONG LABORATORY
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FY 1994

SECTION I, TECHNOLOGY TRANSFER PLANS FOR IMPROVEMENT (FY94)

A. SCIENTISTS AND ENGINEERS JOB DESCRIPTIONS FOR TECHNOLOGY TRANSFER.

Per the Federal Technology Transfer Act of 1986, each Federal laboratory scientist and engineer (S&E) is responsible for technology transfer. It is the policy of the Armstrong Laboratory (AL) that technology transfer activities shall be considered positively in official job descriptions and performance plans and be used in the evaluation process of job performance. In an effort to achieve this, an entry for the position descriptions and performance plans for AL S&E positions is currently being reviewed by AL management for implementation in FY94. This entry is as follows:

"Incumbent supports the transfer of Human Systems Center (HSC) science and technologies to civilian industrial and academic institutions, providing necessary and appropriate consideration for classified subjects; prepares technology application assessments interpreting and expressing appropriateness for transfer; coordinates with Armstrong Laboratory Office of Research and Technology Applications to foster cooperative research and development arrangements with civilian institutions; incorporates technology transfer considerations into program and technical reviews; using awareness of complementary civil sector research and development activities, identifies opportunities for development of technology area consortia or other creative arrangements; participates in broader HSC technology transfer initiatives as required."

B. OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA) PERSONNEL INCLUDED IN OVERALL LABORATORY MANAGEMENT-DEVELOPMENT PROGRAM.

To better ensure that the technology transfer thrusts of the Armstrong Laboratory are part of the overall laboratory investment program, the following strategy will be implemented in FY94, pending final review by AL management. This strategy consists of three primary steps.

Establishment of Technology Transfer Thrusts. With the concurrence of AL management, the ORTA and designated representatives at AL operating locations will establish measurable goals and objectives of the laboratory technology transfer program and set milestone for achieving these goals within the short term (next budget year) and the long term (next five years). These goals and objectives will make up the laboratory's technology transfer thrusts. Although tailored to each operating location's research and development (R&D) focus and management objectives, these thrusts will be ranked according to the laboratory's overall management-development program. Each operating location will establish its return on investment considerations based on its unique goals and objectives, such as value of CRDAs or amount of royalties received.

Allocation of Required Resources into Laboratory Budget. Once the technology transfer thrusts are approved by AL management, each supporting operating location shall commit a level of resources (people and money) necessary to accomplish the mission of transfer consistent with the levels of priority established. It allows for the integration of resources and a baseline for AL management to assess the transfer effort. The resources necessary to carry out the technology transfer strategy are submitted as budgetary requirements into the Planning, Programming, and Budgeting System (PPBS).

Assessment of Technology Transfer Initiatives. At the end of each fiscal year, each AL supporting operating location shall determine their success in meeting their specific technology transfer goals and objectives including return on investment tailored to their specific goals. The ORTA will evaluate this information and submit to AL management the laboratory's overall strengths and weaknesses of its technology transfer program and make recommendations as to what activities need additional resources and what activities are the most promising for meeting the objectives. This information will make up the investment strategy for the next fiscal year's technology transfer program, which will be part of the overall laboratory management-development program.

C. OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA) STAFFING AND RESOURCES.

For the last two fiscal years (FY92 and FY93), the Armstrong Laboratory has spent approximately $230k per year for support of its technology transfer program. Of that amount, approximately $150k per year was spent for contract support, and the remaining funds were used to support civilian pay, travel, and supplies. For FY92 and most of FY93, the AL ORTA was primarily staffed with one full-time individual and a part-time administrative assistant.

With the increased technology transfer activity at AL, the resources required to fully implement its technology transfer program will be increased.

Internal Staffing Support for ORTA. In addition to the one full- time individual at Brooks AFB, TX serving as the AL ORTA, an additional full-time individual at AL's operating location at Wright-Patterson AFB, OH will be assisting the ORTA. Each of AL's five directorates will appoint a collaborative research focal point who will work with the ORTA. Due to geographical separations of three of the directorates, four divisions within these directorates will also appoint a collaborative research focal point.

Legal Support. AL has received, and will continue to receive, adequate legal support. There are three field offices supporting AL based on the originating operation location of the technology transfer activity requiring legal review. The Brooks Judge Advocate (HSC/JA) reviews activities originating at Brooks AFB TX and Williams AFB, AZ; AFLSA/JACPD reviews AL activities from Wright-Patterson AFB, OH; and the 325th FW/JA reviews AL activities at Tyndall AFB, FL. All AL licensing activities not originating from a Cooperative Research and Development Agreement are reviewed and negotiated by AFLSA/JACP in Washington DC.

Contract Support. The contract support for FY94 will have two primary thrusts: (1) market assessments of AL technologies, and (2) identification and promotion of AL technologies available for collaborative research and/or licensing.

There will be contract support to initially assess thirty AL technologies and develop eight license agreements. This will be performed by two primary teams: one in San Antonio, TX and one in Dayton, OH. In San Antonio, the team will be headed by the Texas Research and Technology Foundation (TRTF), a non-profit organization whose charter is to facilitate local economic development. The participants of this Technology Transfer Team of San Antonio (T3SA) include individuals with the appropriate technical expertise to assess the specific AL technologies provided for market assessment. In Dayton, the team consists of individuals from Wright State University, University of Dayton, and the Ohio Advanced Technology Center (OATC). The participants of this Technology Transfer Team of Dayton (T3D) include individuals with the appropriate technical expertise as well as individuals with economic and business backgrounds.

The second focus of contract support is to identify and promote AL technologies and resources available to private industry for commercial development. Under this contract, at least fifty technology transfer opportunities (technologies, expertise, facilities, and equipment available to industry) will be identified and documented. In addition, at least twenty five technology transfer successes will be documented to heighten the awareness (both to the public and internally to the lab) of the importance of transferring federal technologies to the private and public sectors.

D. Technology Transfer Awards Program.

The Armstrong Laboratory is in the process of developing a Technology Transfer Awards Program to reward its scientific, engineering, and support personnel who contribute to the transfer of AL technologies and resources to the public and private sectors. This program is separate and in addition to a) royalty sharing from patent inventions, b) invention disclosures and patent issued income, and c) cash awards for scientific achievement and invention awards under the authority of AFR 900-4, The Air Force Suggestion Program. This program will be implemented in FY94.

SECTION II. TECHNOLOGY TRANSFER ACTIVITIES.

A. Commercial Application Assessments of AL Technologies.

In FY 91, Armstrong Laboratory developed a technology assessment process to determine the market and commercial potential of Federal laboratory technologies. This is a five-phase process: 1) identifying and selecting technologies with potential for commercialization, 2) conducting preliminary assessments and ranking the technologies, 3) conducting full-scale evaluations and developing commercialization plans, 4) promoting the technologies according to the strategies developed, and 5) implementing an effective post-transfer administration process. This is a community-based approach to obtain an independent "white-hat" commercial potential assessment of laboratory technologies. To help determine which of the technologies have the greatest (least) potential for successful technology transfer, a detailed analysis is performed on ten technology attributes. These attributes are 1) technology strengths, 2) technology weaknesses, 3) technology ownership, 4) ease of replication, 5) commercial applications, 6) commercial strengths, 7) commercial weaknesses, 8) market sales potential, 9) Government financial benefits, and 10) other government benefits. This process is briefed by the AL ORTA at the Federal Laboratory Consortium (FLC) meeting twice a year as a model for all the Federal agencies to implement. The AL ORTA is also documenting this process in a handbook for the FLC that will be distributed to all FLC members.

The initial assessment team was formed in FY91 in San Antonio, TX and consisted of the University of Texas of San Antonio, Texas Research and Technology Foundation, and Southwest Research Institute. In FY92 an assessment team in Dayton, OH was formed which consists of Wright State University, University of Dayton, and the Ohio Advanced Technology Center.

In FY91, twelve technologies were screened for commercial potential. Commercialization plans for four of the technologies were developed. An exclusive license agreement for two of these four technologies has been signed. In FY92 and continuing into FY93, twenty three technologies were screened for commercial potential. Twelve commercialization plans, which address seventeen of the technologies, have been developed. Currently two license agreements for six of the patented technologies are being negotiated with industry. In FY93 and continuing into FY94, thirty technologies will be screened for commercial potential. License agreements for eight of the technologies will be developed.

B. Dissemination of AL Products, Processes, and Services.

Currently underway in FY93 is the identification and promotion of AL technologies and resources (expertise, processes, services, equipment, and facilities) that have potential application to the state and local governments and to private industry. A minimum of fifty technology transfer opportunities will be documented. In addition, a minimum of twenty five technology transfer successes will be publicized and disseminated to the public and private sectors.

Previous to the above initiative, AL has been proactive in promoting appropriate technologies and resources to the public and private sectors. A portfolio of "Armstrong Laboratory Technologies" contains abstracts of AL patents for the past five years and select write-ups of unique laboratory facilities and of technologies available for collaborative research and/or licensing opportunities. In addition, AL established and manages the Crew System Ergonomics Information Analysis Center (CSERIAC) as a central source for up-to-date human factors information and technologies. CSERIAC's mission is to provide a quick and reliable source for analytical services, topical publications, software programs, and databases pertaining to human factors. These types of information and technologies are disseminated to support the requirements of all parties within the Government, industrial, and academic sectors concerned with human-machine systems. The AL ORTA and S&Es also disseminate the above described information at trade shows, conferences, and exhibits.

In FY93, AL began an active national marketing campaign to promote its technologies and services available for collaborative research and/or licensing opportunities. Prior to this campaign, approximately twenty technical requests for information were received by the AL ORTA per year. This request for information has increased to approximately 250 per year due to AL's marketing efforts and national recognition through the Federal Laboratory Consortium for Technology Transfer.

C. Participation with the Federal Laboratory Consortium, the National Technology Transfer Center, and Others.

The AL ORTA is also the Federal Laboratory Consortium (FLC) Mid- Continent Regional Coordinator (effective August 1992). As Regional Coordinator, the AL ORTA is also a member of the FLC Executive Committee which formulates policy and procedures for the Consortium. The mid-continent region consists of fourteen states with one hundred twenty federal laboratories/centers. As coordinator, the AL ORTA has initiated several projects for the FLC. These projects include 1) developing a detailed directory of the mid-continent laboratories and centers, 2) providing technology transfer training (market assessments, licensing procedures, negotiating license agreements, intellectual property protection, measuring technology commercialization effectiveness, marketing strategies etc.) to other federal technology transfer focal points and to state affiliates within the region, 3) holding business opportunities forums to promote federal technologies with an emphasis to small businesses, 4) matching federal technologies and expertise to industries with a corresponding need, and 5) assisting defense-dependent industries by the application of Federal technology in manufacturing commercial products. A close working relationship has developed in support of these projects with the NASA Mid-Continent Technology Transfer Center (MCTTC) headquartered at Texas A&M.

The AL ORTA frequently interacts with the National Technology Transfer Center (NTTC), the MCTTC and FLC both in fielding requests for information and in referring industry's requests to one or more of the above organizations for information. In addition, the AL ORTA is working with state affiliates who act as technology transfer catalysts within the mid-continent region to facilitate the linking of industry to Federal laboratories for commercial development of technologies.

D. Technical Assistance to State and Local Governments.

Examples of AL's providing technical assistance to state and local governments include the following activities: 1) briefing the city council in Parker, FL on technologies for environmental cleanup (local paper mill and chemical company); 2) providing occupational analysis software to a county government to validate their fairness of personnel management policies and procedures; 3) meeting with the Ohio Technology-Related Assistance Information Network (represents six state agencies) to define user requirements and establish contract with industry on AL technologies appropriate for the disabled; and 4) working with high schools throughout the United States in developing an intelligent tutoring system in fundamental skills.

E. Participation in Regional, State, and Local Programs Designed to Facilitate or Stimulate the Transfer of Technology.

Examples of AL's participating in regional, state or local programs designed to stimulate technology transfer include the following: 1) providing input to the Texas Governor's Task Force of Economic Development on how to minimize the impact of downsizing the defense industry and identification of dual-use technologies for local economic development and new business opportunities; 2) assisting in the planning and establishing of a National Center for Industrial Competitiveness based in Dayton, OH; 3) providing advice to the Ohio Defense Conversion Coordinating Office, Department of Development/Technology Innovation Division on technologies appropriate for dual-use; 4) providing commercially viable AL technologies to the Texas Innovation Network in a three-state project (Texas, New Mexico, and Colorado) designed to match Federal resources to high-tech companies with specific technology needs; 5) briefing (AL ORTA) small business development centers, chambers of commerce, and industry (large and small) on technology transfer opportunities within the Federal government; 6) collaborating with the Iacocca Institute at Lehigh University to exploit training technology for the enhancement of American education and competitiveness; and 7) forming the Joint Cockpit Alliance of the big eight airframe manufactures to share and leverage common development efforts with the laboratory.

F. Technology Transfer Training.

In addition to the above mentioned training (mid-continent technology transfer focal points, state affiliates, industry, technology transfer facilitator), the AL ORTA has briefed AL's S&Es on technology transfer responsibilities and opportunities available to further the economic development of the United States. This training includes but is not limited to various mechanisms for technology transfer (i.e. cooperative research and development agreements, license agreements, cooperative research agreements, other transactions), market assessment of Federal developed/funded technologies, intellectual property protection, and organizations designed to assist in the transfer of Federal technology.

In FY89, the AL ORTA wrote the Domestic Technology Transfer Handbook, which was adopted by the Air Force Materiel Command (formally Air Force Systems Command) as the official Air Force technology transfer handbook (Department of Energy also used portions of the handbook for their technology transfer program). This handbook, currently under revision, was used as supplemental material in the training of AL's S&Es and will likely be used Air Force wide.

G. Technology Transfer Agreements.

Cooperative Research and Development Agreements (CRDAs). Signed CRDAs, effective date, and collaborating parties:

1) Knowledge Based Training Systems, 17 Jan 89, University of Texas of San Antonio (UTSA)
2) Intelligent Tutor Systems in Fundamental Skills, 28 June 91, UTSA
3) ISD/LSAR Decision Support System, 8 July 91, Dynamics Research Corporation
4) Multiship Network Performance Analysis, 3 Sep 91, IBM Federal Sector Division
5) Bioeffects of Electromagnetic Fields, 31 Mar 92, Trinity University
6) Image Generation System, 8 Jun 92, Evans & Sutherland
7) Food Safety Technology, 30 Oct 92, Texas A&M
8) Type B Cytochromes: Sensors and Switches, 2 Nov 92, CRC Press, Inc.
9) Human Systems Advanced Technology, 25 Jan 93, Northrop Corporation
10) Biodynamic Neck Response, 30 Jun 93, Simula Company
11) Groundwater Remediation, 3 Aug 93, Dow Chemical Company
12) Molecular Sieve Oxygen Generating System, 25 Aug 93, Arbor Research Corporation
13) Pulse Oximetry Monitoring, 25 Aug 93, Miami Valley Hospital
14) Rapid Optical Screening Tool, 3 Sep 93, Unisys Corporation

In addition, there are approximately eighteen CRDAs in various stages of development and negotiation.

License Agreements. Signed exclusive license agreements, effective date, and licensee.

1) ISD/LSAR Decision Support System, 10 Sep 91, Dynamics Research Corporation
2) DNA Probe for Ureaplasma Urealyticum, 11 Oct 92, University of Scraton/ Research Corporation Technologies
3) Molecular Sieve Oxygen Generating System, 2 Mar 93, Arbor Research Corporation

AL currently has six patents being negotiated under two license agreements (one exclusive and one non-exclusive). It is estimated that these license agreements (the ones signed and those currently being negotiated) will bring a minimum of $300k in royalties by FY95. To date, the upfront licensing fees for AL license agreements has resulted in five AL employees each receiving $1,000 in royalties.

Technology Reinvestment Project (TRP) Agreements. The AL is a participant in twelve proposals of the Advanced Research Projects Agency's (ARPA's) TRP. AL's involvement in these proposals is through Memoranda of Agreement, CRDAs, or Affiliation Agreements.

H. Other Technology Transfer Activities.

Effective 15 Nov 91, AL implemented a "Conflict of Interest Policy and Procedures for Technology Transfer Activities." In addition to the overall goals of the policy, policies and procedures for the following activities were specified: 1) CRDAs and license agreements, 2) outside employment, 3) royalties, 4) laboratory mission, and 5) licensing intellectual property. This was the first conflict of interest policy regarding technology transfer activities implemented within DOD.

PHILLIPS LABORATORY
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FOR FY 1994

BACKGROUND

The Phillips Laboratory has had a full-time ORTA since 1986. Since then, the office has grown from 1 full-time IPA (Intergovernmental Personnel Act--usually a state\local government or university employee working in a Federal facility on a 1- to 2-year appointment) into a division integrating 12 programs focused on cooperative research and leveraging resources and a staff of 15.

The ORTA has a three-year contract with the State of New Mexico's Economic Development Department to provide staff support to its technology transfer and Outreach Programs. The State of New Mexico provides support with individuals having over 70 man-years of technology utilization, marketing, and business development experience.

The guiding philosophy for this plan will be to continue to try new ideas on a small scale and then modify or expand those that have been successful. Training is one such example. The Project Officers Handbook will be updated to include technology transfer and dual-use with emphasis on identification of commercial opportunities. Tools available for transfer and commercialization of Phillips Laboratory developed technology will also be addressed. This material will then be used as the basis for a Lab-wide training of personnel.

The ORTA is currently staffed with personnel having a mixture of technical, programmatic, business, finance, and marketing skills. The Phillips Laboratory will continue to work with higher headquarters to co-locate an intellectual property attorney and a procurement specialist with the ORTA. These additions would improve the quality of our agreements and the integration of technology transfer in our other business practices.

Currently, the Phillips Laboratory has technology transfer focal points in three of our technology directorates. During the coming year, our plan is to establish focal points in the other technology directorates.

ORTA SERVICES

The Phillips Laboratory ORTA will expand the services provided to internal and external customers in the coming year. For our internal customers, the ORTA will perform initial assessments of the dual-use potential of their programs. For those programs found to have a high degree of potential for commercial use, in-depth market assessments will be performed. As the Project Officers are trained, they will be able to perform the initial assessment.

For our external customer, the Phillips Laboratory is establishing a Technology Outreach Office. This office will complete and update our inventory of technical expertise, intellectual property, and unique equipment and facilities that are available for use by the private sector. This office will share this information through a coordinated outreach program. They will work closely with the Air Force Technology Transfer Office and the regional and national technology transfer centers.

EDUCATIONAL OUTREACH

The Phillips Laboratory is expanding its cooperation with local universities through a regional alliance that includes the Phillips Laboratory, Sandia National Laboratory, Los Alamos National Laboratory, and a dozen universities from New Mexico and the surrounding states. The laboratory is also expanding its outreach programs for secondary schools such as the High School Space Experiment and Intelligent Tutor programs.

PARTNERS

Building upon the long standing relationship with the State of New Mexico, the office will be involved in assisting the state with the development of a public sector technology utilization program. This program aims to solve state and local public sector problems that can be addressed through laboratory technical resources. The results of such activities will be viewed for transition to other states and possible commercialization.

In addition, the Phillips Laboratory has been very successful working with other local government agencies such as Sandia National Laboratory, Los Alamos National Laboratory, and the University of New Mexico through a variety of programs, i.e. the Alliance for Photonics Technology, the Strategic Alliance, etc. During the coming year, the laboratory will expand its partners to include other regional organizations such as the Sacramento Air Logistics Center and Allied Signal in Kansas City.

TECHNOLOGY TRANSFER MECHANISMS

Phillips Laboratory's current technology transfer program emphasizes a wide variety of tools. Three areas will be emphasized in the coming year.

- Technology transfer from our external research program will be expanded. We will identify dual-use technology development as a goal in our contracted research. Those companies that are successful will be identified and rewarded as appropriate. The Phillips Laboratory will expand its use of grants and cooperative agreements to encourage technology transfer where appropriate.

- The Small Business Innovative Research (SBIR) program has been a successful way to achieve technology transfer to the small business community for two of our directorates. The SBIR program will be expanded to include technology transfer for all of our technology directorates.

- The new Independent Research and Development (IR&D) program that Phillips Laboratory is starting will provide a very effective means of communicating with industry. The program will consist of a series of meetings, each focused on a different, specific technology, i.e. space power. At these meetings, the Phillips Laboratory will outline its research goals in that technology and solicit industries plans. These meetings should provide a natural forum for the development of joint research project.

LONG-TERM VIABILITY OF DOD TECHNOLOGY TRANSFER PROGRAMS

Long-term viability of DoD Technology Transfer and Dual-Use Programs is dependent on adequate funding of base technologies. Without adequate funding for core technologies, there is no technology to transfer. In addition, there has to be a long-term commitment by management to technology transfer and dual-use. This translates to real commitment of resources and personnel.

In order to improve the technology transfer process, the Phillips Laboratory will work with the Air Force and DoD Technology Transfer offices. We have identified the following as our goals:

1) DoD provide specific funding levels for the following:

a) ORTA funding which includes salaries for personnel within the ORTA of each lab and monies for travel, training, promotion, market assessments, technology transfer demonstrations, local and state government interactions, and internal lab technology transfer award programs.

b) Provide project funding for technology transfer partnerships and/or projects much like DoE's technology transfer program ($243M for FY 94).

2) Acknowledge and identify other technology transfer mechanisms available within DoD and provide the lab/center commander/director with the authority to approve the use of those resources locally (i.e., SBIR, STTR, grants and CRDAs, equipment donations, etc.).

3) Create an effective outreach strategy that targets specific organizations (public and private) that can be effective users of lab resources. Utilize the personnel exchange programs, publications, and oral presentations to effectively promote the lab/center capabilities.

4) Assess the unique facilities and capabilities of the lab/center and market those resources.

5) Provide training for new employees on technology transfer and provide periodic training of existing lab/center employees.

6) Develop focal points ("Sorta ORTAs") in each directorate and/or division to augment and support the ORTA.

7) Create a DoD Technology Transfer Awards Program to acknowledge the technology transfer activities within DoD. Categories of awards that should be considered include--

a) Annual technology transfer awards to scientists, engineers, and technicians who have successfully contributed to the transfer and commercialization of technology (100 awards across DoD).

b) Annual award for excellence in technology transfer for ORTAs.

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ROME LABORATORY
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FOR FY 1994

There are four major areas addressed: Internal Laboratory Promotion of Technology Transfer Activities, the Development of ORTA Personnel through Laboratory Management Programs, the Adequacy of Rome Laboratory (RL) ORTA Staffing and Resources, and the RL ORTA Activities.

INTERNAL LABORATORY PROMOTION OF TECHNOLOGY TRANSFER ACTIVITIES

Personnel Policies: RL is active in the implementation of technology transfer activities in its personnel policies. In 1993 the laboratory increased the number of personnel in the ORTA to three full-time workers. In addition, the Laboratory provided the ORTA with five ½-time personnel from the laboratory's mission directorates. These personnel were hand picked for their knowledge of mission directorate programs and dedication to the transfer of technology to the private sector. The increase of the permanent ORTA staff showed the commitment of RL to the technology transfer program. The laboratory wrote job descriptions for these personnel to specifically carry out the technology transfer functions for the laboratory. It entrusted the execution of the laboratory technology transfer program to these individuals and made them accountable for the success or failure of the program through the Job Performance Appraisal System evaluation process.

Promotion Opportunities: In setting up these three personnel as full time in the ORTA, the laboratory also set up a promotion potential for the ORTA. The ORTA staff is made up of a GM-15, GS-14, and a GS-13. In 1994 and beyond, it is the intent of the laboratory that this career ladder continue to allow for future promotion possibilities for both personnel within the ORTA and throughout the laboratory within the guidelines of Office of Personnel Management personnel promotion policies.

Job Performance: In 1994, RL intends to change the position descriptions of the five ½-time personnel working for the ORTA to document specific requirements for support to RL ORTA activities. Currently, these personnel perform their technology transfer activities as a detail from their mission directorate supervisors. With the formal changing of their position descriptions to reflect their key duties in facilitating the transfer of technology from their individual mission directorate to industry, university and other government entities, these individual's duties can become more stable and better defined than they have in the past. In addition, to further encourage the transfer of technology from the laboratory to the private sector, RL will add new statements to promote technology transfer activities to the position descriptions of all supervisory personnel in RL. As a result of these changes to the job performance descriptions,the supervisors of these personnel will also consider the quality and quantity of technology transfer activities in their annual job appraisal rating.

DEVELOPMENT OF ORTA PERSONNEL THROUGH LAB MANAGEMENT PROGRAMS.

Specific development of ORTA personnel was pursued in 1993 through the enrollment of one of the ORTA staff in the RL Executive Development Seminar Program. This training exposed the ORTA staff to a broad spectrum of seminar topics conducted by nationally recognized instructors from Strategic National Planning to Federal Budgetary Pressures to Federal Technology Transfer. In addition, this

seminar program, which is conducted at the laboratory, also has 20 RL senior personnel participating in it. This allows the ORTA staff to interact with not only external professional experts but also internal senior management officials from the laboratory. It affords the ORTA staff the opportunity to become more sensitive to the needs of the laboratory's technology developments and also to sensitize senior laboratory managers to the benefits and mandates of technology transfer legislation. In 1994, the ORTA plans to continue its personnel development through continued participation in this excellent management development program. Also, in 1994 there are plans for conducting a team building effort that will include all ORTA personnel, part-time Directorate Reps, and other key technology transfer activity personnel from within the lab. This program will be conducted through a contracted professional team building service. The purpose of the program is to further build a sense of trust within the technology transfer team, to promote even better teamwork, and enhance the growing esprit de corps among the technology transfer Team.

ADEQUACY OF RL ORTA STAFFING AND RESOURCES

There has been a tremendous amount of activity in the area of resource, commitment, and allocation within the RL ORTA during 1993, and even more activity is planned for 1994.

Manpower Allocation: The laboratory allocated additional manpower slots to the ORTA function, increasing the number of full time personnel devoted to technology transfer activities to three. These manpower allocations were taken from within the laboratory's authorized strength and shows the commitment of the lab to the technology transfer function. In addition, the laboratory allowed five personnel to devote 1/2 time to the performance of technology transfer activities within the RL mission directorates. The RL ORTA staff also routinely calls upon the expertise in the laboratory's Judge Advocate Office, Procurement Office, Financial Management and Accounting Office, and the Public Affair Office for advice, guidance, and council. The laboratory encourages the use of these offices to facilitate the technology transfer activities of the RL ORTA.

Organizational Changes: To further establish the ORTA function within the laboratory structure, the RL Commander made an organizational change to formally accommodate and separately identify the ORTA activity. A new division within the Directorate of Plans and Programs, designated XPT, the Technology Transfer Division, was formally established.

Space Allocation: Along with the establishment of the new division, RL allocated additional office space to the ORTA staff to accommodate the increased manpower and activity of the office. Improvement in the ORTA physical facilities are planned for 1994. Complete renovation of the current ORTA office space, to include replacement of old furniture is planned. This renovation will allow the ORTA to accommodate frequent visits by industry, academic, and government representatives in the ORTA offices. Currently, laboratory conference rooms are used whenever they are available.

Budget Allocation: Laboratory funds were made available in 1993 to contract for needed administrative support of the ORTA. These funds were combined with other funding to allow the ORTA to participate in technology transfer activities throughout the year. Laboratory funding in the amount of $93K was used by the ORTA during 1993. This amount does not include ORTA staff charges made for travel and manpower in support of technology transfer activities. These charges were made from the laboratory's overhead account, and although the amount was adequate for ORTA activities during the year, additional activities could have been pursued if additional budget was available. In planning for 1994, the RL ORTA has submitted a budget for consideration by the laboratory. This budget shows an increase in the amount necessary to continue to grow the technology transfer activity within RL. There

is a limit to the amount that the laboratory can provide to the technology transfer activities and still be able to perform its main mission of C3I technology development for the Air Force. Additional funding should be made available to the laboratories -- specifically Air Force technology transfer.

Communications Resources: The RL ORTA office is planning to improve its current mode of communications both within the staff and with external customers. The ORTA staff personnel are distributed across the laboratory with the permanent full time staff in one location and the mission directorate representatives at other directorate locations including the Electromagnetics and Reliability Directorate at Hanscom AFB MA. Improved communication among the technology transfer staff through the use of mutually accessible data bases, the establishment of a local area communication network, and uniform electronic mail software for the distribution of industry's technology transfer inquires will all continue to improve the efficiency of the ORTA in 1994. RL is also planning to incorporate our technology transfer opportunities onto an on-line data base that can be queried and searched remotely--by industry, academia, and other government agencies.

RL ORTA ACTIVITIES:

Technology Transfer Assessment: In 1993 RL opted to have the renowned Maxwell School of Public Policy from Syracuse University review the RL Technology Transfer Program, provide an assessment of it, and make recommendations to the lab on ways to improve its external coordination and transfer mechanisms. The final report is due to RL by 30 Sept 93. In 1994 RL plans to study the recommendations and implement as many as is feasible given the manpower and budget available to the RL ORTA.

Dissemination of Information: During 1993 the RL ORTA has worked very hard at dissemination of information on laboratory technologies that would be of interest to both the private sector and the state and local governments. Through many briefings and face-to-face contacts on a variety of technologies available for transfer, the ORTA has generated interest in RL technologies across the spectrum. The ORTA has also had advertisements for RL technology put in the Technology Transfer Magazine (specific technologies included the Binary Phase Only Filter and the Tactical Optical Disk System) and Defense Electronics Magazine. In fact, Defense Electronics featured RL's optical memory technology in its September 1993 issue. The RL Technology Transfer office has received numerous telephone calls from industry representatives, who mentioned the RL advertisements. They called to inquire about RL's Optical Memory Technology as a result of these advertisements. The RL Technology Transfer Team is currently following up on these inquiries. In 1994, the RL ORTA plans to continue and expand our RL publicity campaign. The ORTA has budgeted enough to highlight one different RL technology per month in a widely read technical or trade publication.

In addition, the ORTA will increase the internal education program on technology transfer for RL engineers, scientists, and staff personnel. New briefings will be given to alert all RL personnel about the new technology transfer mechanisms that are now available to the laboratory. These new mechanisms include Education Partnerships, Cooperative Agreements, and Grants. Additional briefings will be provided for lab personnel on intellectual property rights, patents, and licensing with the help of the Regional Patent Office in Waltham MA. Lastly, to maintain the awareness of technology transfer to the general laboratory scientists, engineers, and staff personnel, the ORTA will schedule specialized education briefings at the laboratory division level. These briefings will be focused upon the philosophy, methodology, and benefits to the laboratory and the nation of technology transfer activities.

FLC Participation: In 1994, RL will continue its support of the Federal laboratory Consortium (FLC). During the past year RL had its ½-time directorate technology transfer representatives and all but one of its full-time staff go through the FLC training course. In 1994, the last member of the full-time staff will attend training during the meeting in Tulsa, Oklahoma FLC meeting. RL will also continue its support of the Northeast Region of the FLC.

State Government Technical Assistance: RL has been active in working with the New York State Science and Technology Foundation. The purpose of this cooperative venture is to find ways to incorporate RL technology into state programs designed to enhance the New York competitive advantage and to make the state government services more efficient. In 1994, RL will continue its efforts as well as look into possible ways to have a state representative become resident at RL, to even further enhance the possibility of transferring RL technologies to state functions.

Simulation of Technology Transfer: The RL ORTA and staff continue to serve on several local and state committees whose purpose is to facilitate technology transfer. Examples of such bodies include the Industry, Labor, and Education Council (ILEC) the seven New York State Technology Development offices and the ten New York State Industrial Innovation Extension Services (IIES) offices. As a result of RL initiative, New York State formed the not-for-profit Photonics Development Corporation (NYPDC) located adjacent to RL. RL has a memorandum of Understanding (MOU) with NYPDC which allows intense interaction on technology transfer initiatives. One of RL's Associate Chief Scientists sits on the Board of Directors of NYPDC. RL is a member of the Oneida County Technology Transfer Committee and sits on the board of the Rome Industrial Development Corporation Incubator Committee.

To further extend the Federal laboratory technology transfer to the private sector, RL is planning to issue a Broad Agency Announcement (BAA) that will solicit the cooperative development of technologies between RL and industry through the use of unique facilities at RL. Current plans are similar to an incubator, in that industry, principally targeting small businesses, would be allowed to come into our facilities for a set amount of time, and work along side RL scientists and engineers. The RL ORTA is working out the final details for the BAA for a 1994 issuance.

WRIGHT LABORATORY
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FOR FY 1994

The activities in technology transfer at Wright Laboratory, Wright Patterson AFB, OH, have greatly increased during the past year. This increase in activity can be attributed to two major factors: (1) a major increase in awareness at all levels of the benefits and need for technology transfer and (2) the defense conversion activities.

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS

The number of Cooperative Research and Development Agreements (CRDA) that Wright Laboratory has signed increased from five to twenty during the past year. In addition there are 60 to 70 CRDAs in various stages of formation, from about to be signed by the non-Government partner to an initial contact with an expression of interest. The ORTA has conducted two day-long workshops to educate the technical people at Wright Laboratory on what is a CRDA and how to start the process. Topics covered include intellectual property rights, steps leading to a CRDA, publicizing the laboratory technologies, and facilitating commercialization. Every Directorate has a focal point who spends a large part of his or herr time assisting the engineer in all aspects of technology transfer and in developing CRDAs. The goal for FY 94 is to increase substantially the number of CRDAs signed, and to continue to provide training workshops--including a section on how to view technology and see a commercial possibility.

STATE AND LOCAL GOVERNMENT INVOLVEMENT

The State of Ohio has funded an organization, Ohio Advanced Technology Center (OATC) that will leverage the technologies at Wright Laboratory and be proactive in linking industry to the Laboratory. As a result of the efforts of OATC several CRDAs have been signed with their members. The ORTA office has also worked extensively with the various Edison Centers around Ohio that work directly with small and medium businesses. In working with the local community a council of local government people, industries, Edison Centers, trade organizations, and WL meets six times a year with the purpose of pooling information, networking, and receiving briefings on technologies available and technology problems. The ORTA has served as secretary and major sustaining force for several years. In cooperation with the Ohio Department of Development and others, WL is a participant in several proposals to TRP. Efforts to enlarge the scope of OATC and the mutual benefits will be pursued in the coming year. The ORTA efforts with the state and local government agencies will continue to receive priority.

MARKETING

Although there has been some marketing in the form of advertising, making presentations, and preparing brochures, it is not adequate to do what is needed.

FEDERAL LABORATORY CONSORTIUM & NATIONAL TECHNOLOGY TRANSFER CENTER

The ORTA has initiated several programs to help market the technologies at Wright Laboratory, work with the Federal Laboratory Consortium (FLC) and National Technology Transfer Center (NTTC), and state and local governments. The new FLC directory for the Midwest Region will include Wright Laboratory patents available for licensing, advertising has been placed in national technology transfer magazines, and presentations have been given to industry trade organizations. These organizations include the National Automotive Center in Dearborn MI, Ohio, Department of Development regional seminars, and the Institute for Advanced Manufacturing Sciences. The FLC has recently acted on an idea from the WL ORTA office to work with industry trade organizations to create an industry pull for the Federal technology. The Foundryman's Society has furnished the Midwest Labs with a list of technology needs. This is an ongoing project. Contacts with NTTC have been increasing, the FLC representative from WL is working with them to provide easy access to WL. It is planned that these projects continue and similar efforts be initiated. In particular added emphasis will be placed on working with the NTTC as our contact with the newest technology transfer organization has been limited but growing.

ARMAMENT DIRECTORATE, EGLIN AFB, FLORIDA

As part of Wright Laboratory at Eglin AFB FL the Armament Directorate has been instrumental in establishing the Gulf Coast Alliance for Technology Transfer (GCATT). Its purpose is to facilitate the flow of technology from the laboratories for regional and national economic competitiveness. The State of Florida has recently agreed to fund a full-time director. This effort will continue to receive support from the Armament Directorate including the ORTA. A dual-use pilot program from each Division to pursue during the next year has been selected. Through the efforts of the ORTA the Armament Directorate is participating in seven proposals to TRP. Emphasis will be put on these pilot programs to produce commercial results.

MANPOWER

At the present time the manpower provided is adequate to sustain the ORTA. The use of focal points in each Directorate and organizations, like OATC & GCATT have leveraged the present ORTA work force in a way that is producing excellent results. It is planned to increase the leverage factor in the coming year so more technology transfer can occur without adding personnel to the ORTA office. It is an objective for FY 94 to include a technology transfer paragraph in position descriptions when they are revised. The next step is to get this area included as part of the annual evaluation review.

AIR FORCE DEVELOPMENT TEST CENTER
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FOR FY 1994

AFDTC is extremely interested in being at the forefront of Technology Transfer (T2) activity. While the center's interest level is high, resources are as constrained here as elsewhere. To date AFDTC has one full-time military person, one part-time civilian and two contract employees supporting the effort. The military member is assigned as an overage until he retires in FY 94. The civilian is supporting both T2 and Technology Insertion activities and the two contract employees will be continued only if funds are available. One additional civilian authorization has been obtained and that person will come on board in Oct. 93, also to support both Technology Insertion and T2. Thus, AFDTC will have 3 people supporting the T2 effort in FY 94.

AFDTC TECHNOLOGY TRANSFER SUPPORT

FY93 TECHNOLOGY TRANSFER BUDGET

Travel Supplies	10k
Civ Pay (3 Mos/Part-time, GM-14; Series 801)	10k
TEAMS Contract Support	51k
Gulf Coast Alliance for T2 (GCATT)	20k
TOTAL	91k

FY94 PROPOSED BUDGET

Travel/Supplies	35k
Printing	10k
Civ Pay, 1 Part-time GM-14, Series 801	35k
1 Part-time GS-13; Series 801	30k
TEAMS Contract Support	180k
Gulf Coast Alliance for T2 (GCATT)	20k
TOTAL	310k

TEAMS Contract Support	180k
Gulf Coast Alliance for T2 (GCATT)	20k
TOTAL	440k

AREAS TO PURSUE AGGRESSIVELY

Technology Assessment. AFDTC has conducted a cursory review of its technology transfer potential. They need to assess the skills, facilities, and expertise AFDTC possesses and determine which of those are needed by the private sector. One full-time person will be assigned to this effort.

Training. There are approximately 7500 personnel at AFDTC and over 20,000 for all of Eglin AFB. Fewer than 1 percent have had even an introduction to T2. This is addressed below.

Outreach and Marketing. Two full-time people will work this area, with support from part-time technical area experts.

PROCESS ACTION TEAMS

Two separate Process Action Teams are in operation--one developing a marketing process and plan and the other laying out the criteria and process steps to develop CRDAs with commercial customers. AFDTC is focused on what must be done to establish a strong technology transfer program and is aggressively pursuing funds to implement the team recommendations.

ADDITIONAL INFORMATION

OVERVIEW

The Air Force Development Test Center has created a detailed roadmap of the technology transfer activities for FY 94. This roadmap is an integral part of the Center's Strategic Plan and will be frequently reviewed by the Commander and Executive Council. The roadmap is in 4 areas:

The first area "Define T2 Processes" is focused on how the Center prepares internally to support T2. Much of the groundwork is complete. As soon as we have validated and documented the work accomplished we can initiate training of the work force and the other major efforts remaining.

The second area, "Initiate Pilot CRDAs" is very dynamic as two CRDAs are now in draft or development stages and meetings are underway for a third agreement.

The third area is "Develop/Support GCATT." GCATT is the Gulf Coast Alliance for Technology Transfer, a regional alliance of 11 Federal Laboratories and 5 Universities/Colleges across Northwest Florida and South Alabama. The purpose of the alliance is to promote technology transfer in the region and to generally enhance the ability of each member institution to service the private sector by combining our resources and knowledge.

Finally, marketing is essential to make known the skills, knowledge, facilities, and willingness of Federal Laboratories to participate in T2. Since this is an area unfamiliar to most people in the DOD, considerable effort will be needed to be successful.

LABORATORY JOB DESCRIPTIONS

One of the key activities for the upcoming year is training. AFDTC will provide T2 training to all S&E personnel and everyone in their supervisory chain. Once people and their supervisors understand what T2 is about, they will be able to incorporate meaningful requirements into position descriptions and work plans. After the supervisors and S&Es are trained the center will provide introductory T2 training to support personnel.

ORTA PERSONNEL INCLUDED IN LABORATORY MANAGEMENT-DEVELOPMENT PROGRAM

All government employees who work in the Office of Research and Technology Application are registered in the Acquisition Career Development Program.

APPLICATION/MARKETING ASSESSMENTS OF SELECTED R&D PROJECTS

ORTA personnel are accessing existing and planned projects within AFDTC. Since we are a Development Test Center the majority of our normal work (weapon system testing) does not appear to readily lend itself to technology transfer or commercial applications. However, we expect that after all our personnel have been trained in technology transfer it is likely that market potential will become evident. We also expect to redefine our capabilities to include private sector needs in areas where we can apply the "defense conversion" concept to our own assets. We expect to survey all personnel about the commercialization applicability of their projects. We also expect to require all presentations to the Commanders to address technology transfer and all external presentations to include a short technology transfer pitch.

Because the center are not a traditional laboratory and does not work on technology demonstrators, etc., it does not expect to have many new "high-tech breakthroughs." (They will have some patentable developments but not on the magnitude of a laboratory.) On the other hand, there will be many opportunities to form CRDA's and to participate in technology transfer activities because of the "world class" assets, facilities and intellectual property that exist in AFDTC. Initially, most of the work will be in the area of helping defense firms to refine and test military products for foreign "commercial" sales. Eventually, some new technology transfer work will be at the request of inventors and companies who need to test, refine, and prove their concepts using AFDTC expertise and facilities. The center will establish itself as a center of excellence for testing in "core" areas. Candidate core areas include transportation systems, instrumentation, flight testing, sensors, environmental, explosives, and electromagnetic radiation. Some work will be in the joint development of marketable products and other work will be in the vein of "gratis" technical assistance.

In addition to evaluating its own projects, AFDTC will determine the markets and industries that can best take advantage of its expertise and facilities. They will then seek to establish appropriate cooperative arrangements. As a member of the Gulf Coast Alliance for Technology Transfer (GCATT) AFDTC will use the resources of the alliance to help assess the center's capabilities.

DISSEMINATION OF INFORMATION

Following the initial assessment of the center's strengths (from a commercial world perspective) they will "market" those strengths to the appropriate audience in a variety of ways. They have already been very active in the area of information dissemination. This includes news releases, technology transfer speeches to community organizations by the Commander and other members of AFDTC, a news conference to announce opening of the GCATT Center, numerous briefings, symposia, and conferences to advertise involvement and commitment to technology transfer and to solicit projects.

Planned projects include development of information brochures (generalized and targeted), mention in all AFDTC briefings off the installation, periodic news releases, continued involvement with economic development councils, participation on radio talk shows, and articles in periodicals like Aviation Week and Space Technology.

The ORTA will develop both general and specific materials for direct mailings. They will attend trade shows and work closely with state and local commerce and economic development activities. In addition, they will enter into several alliances that will help to publicize the center and connect with potential clients.

PARTICIPATION WITH THE FEDERAL LABORATORY CONSORTIUM AND THE NATIONAL TECHNOLOGY TRANSFER CENTER

AFDTC is a member of the FLC and has made presentations and briefed at their functions. They will increase their involvement with both the FLC and the Regional Technology Transfer Center as an additional vehicle to help communicate with the private sector.

TECHNICAL ASSISTANCE TO STATE AND LOCAL GOVERNMENTS

AFDTC is involved with the State of Florida through the University system and through dialogues with the Commerce Department. The state indorsed the Gulf Coast Alliance TRP proposal. The state has also watched establishment of the Gulf Coast Alliance and the center is considering signing a MOU with the commerce departments of the States of Florida and Alabama. AFDTC is also considering working on Governors Science and Technology Advisory Boards when and if such boards are established. In addition, Florida has funded the Graduate Engineering Research Center (GERC) in Northwest Florida. The GERC is a joint program to bring advanced engineering education to this region and to conduct technology transfer research.

PARTICIPATION IN REGIONAL, STATE, AND LOCAL PROGRAMS

The State of Florida has established "Enterprise Florida" to encourage new business, small business, defense conversion, and technology transfer programs. The details are still vague but AFDTC expects to participate. They are also beginning to work with local programs such as the Technology Coast Manufacturing and Engineering Network (TeCMEN) and economic development councils.

TRAINING OF SCIENTISTS AND ENGINEERS

AFDTC is about to embark on a training program that will reach every professional on the installation. This training will be recurring, more detailed for management and mandatory at in-processing. The will use a self-generated program or obtain material from the Army, Navy or FLC/RTTC. Contract for the training is also an option.

INVENTORY OF COMMERCIALIZATION OPPORTUNITIES

The ORTA is identifying patents and any special processes or techniques. AFDTC does not have a large inventory of patents.

MARKETING EFFORTS TO BUSINESSES AND INSTITUTIONS / PROMOTION OF UNIQUE LABORATORY FACILITIES

The ORTA has initiated a "grass roots" outreach program and is developing brochures and other materials. New brochures, literature and presentations will highlight the unique AFDTC national assets that can be made available to the private sector. Unfortunately, there are constraints regarding rates charged to non-DoD customers who buy access to DoD test and evaluation facilities. The only exception is where access is through a CRDA.

AIR FORCE FLIGHT TEST CENTER
TECHNOLOGY TRANSFER IMPROVEMENT PLAN FOR FY 1994

AFFTC is developing some original focused test and evaluation specific tools, most of which use application and integration of existing technologies. This low level dollar expenditure is in the $10M to $20M range. Additionally, the center is in a position to support the nation's industry through their use of AFFTC's unique flight test facilities and flight test expertise as they pursue development of new technology for production. AFFTC is very familiar with this role, for they have been a national flight test facility for years. In the past year, AFFTC established an ORTA with a trained supporting matrix of lawyers and test experts who work CRDAs and other technology efforts as each opportunity arises. The ORTA is deeply involved in the overall development of the center's test program planning and technology needs/development. AFFTC is actively marketing itself to industry.

Section III: Examples of Air Force Commercialized Technologies

SECTION III: EXAMPLES OF AIR FORCE COMMERCIALIZED TECHNOLOGIES

Robust Speech Compression Technique Designed to Provide Reliable, High-Quality Speech Communications While Increasing the Capacity of Narrowband Channels.

Mr. Luigi Spagnuolo
Mr. Terrence G. Champion
Electromagnetics & Reliability Directorate
Rome Lab

This technology has been selected as the land mobile radio standard and will increase channel capacity within a fixed spectrum while providing high-quality, reliable communications. It has been selected by the Association of Public Safety Officers (APCO) as their standard and will provide public-safety officials with four times the channel capacity within their allocated spectrum while maintaining user-acceptable voice quality. It will also enable commercial land-mobile radio users to communicate via the International Maritime Satellite (IMARSAT) using high-quality narrowband digital communications. A spin-off company, DVSI owns the commercial rights and is further commercializing the technology

Reinventing Lightbulbs with Lanthium Hexaboride. Thin films of LaB_6 improve the efficiency of fluorescent lamps and have applications in automobile tail lights.

Dr. Brian S. Ahern
Electromagnetics & Reliability Directorate
Rome Lab

This technology grew out of a phase II SBIR contract with Ultramet Corp, an expert in chemical vapor deposition. GTE Sylvania is collaborating with Rome Lab and Ultramet to enhance the operational characteristics of fluorescent lamps. LaB_6-coated electrodes run cooler and require lower excitation voltages. These features permit the use of neon light technology for automotive applications. LaB_6-based neon tail lights are an integral part of the designing of several manufacturers including Ford, GM, and Chrysler and are expected to dominate the auto industry. A clear tail light that turns red when energized eliminates the need for red lenses needed for incandescent bulbs and eliminates color-matching requirements. In addition, Kimball Physics Corporation is applying the technology to enhance the intensity of medical X-ray sources.

Remaining Useful Lubricant Life Evaluation Rig (RULLER) ("Smart Dipstick")

G.A. Beane IV
Lynne M. Nelson
Wright Lab

The Air Force Materiel Command's Wright Laboratory in Dayton, Ohio, developed a device under contract with the University of Dayton Research Institute (UDRI) to determine accurately the remaining life of lubricants. The Remaining Useful Lubricant Life Evaluation Rig (RULLER) or "smart dipstick" utilizes a cyclic voltammertry technique to determine the extent of antioxidant depletion and thermal brakedown in various organic compounds. The type and concentration of antioxidants present in the product are used to evaluate the oxidation stability of fresh products or to evaluate the remaining oxidation stability of the product after extended periods of storage. The original use of the device was to draw periodic oil samples from turbine engines and analyzed for remaining useful life.

RULLER represents a very simple, efficient method of determining the remaining useful life of several commercial products, which could result in significant cost savings for each commercial application. Ruller allows fleet operators of low-cost equipment (automobiles, trucks, gearboxes, etc) and low-volume operators of high cost equipment (aircraft, steam turbines, trains, etc.) to better predict oil-change intervals and hence, extend lubricant change intervals through correctly timed antioxidant replenishment. If further has the potential to provide substantial savings in labor and maintenance costs by (1) reducing unnecessary equipment downtime for premature lubricant changes, (2) reducing equipment damage due to overextended lubricant use, (3) detecting abnormal equipment conditions prior to component failure, and (4) reducing disposal costs through reduced volumes of waste lubricant.

Looking for additional uses for the smart dipstick, UDRI found that the device was very efficient in continuously analyzing cooking oils while devices are running and determining remaining useful life. In the area of food product monitoring, the RULLER is the only technology capable of determining the concentration of antioxidants and accumulate oxidation products in fresh and used food products, Accordingly, RULLER technology can be used to ensure the freshness of food products during storage, to better predict cooking oil change intervals and to extend cooking oil change intervals through correctly timed antioxidant replenishment.

UDRI has joined with Lanson Enterprises, Inc. and Gem City engineering in a limited partnership called Tritec to produce and market remaining oil life devices for the food producing industries. UDRI, Gem City engineering, and Instrument International have formed a partnership called Fluetic which will concentrate on devices for various industries including transportation and stationary equipment.

Speech Enhancing Technology

Luigi Spagnuolo, Terrence Champion, Brian Ahern
Intelligence and Reconnaissance Directorate
Rome Laboratory

The speech enhancing technology removes noise and interference from voice signals without degrading the voice signal itself and improves voice communications for military and commercial applications. The technology has been demonstrated to several potential users such as the Air Force Intelligence Command, the Federal Bureau of Investigation, the National Transportation Safety Board, and the Federal Aviation Administration. As a result of these successful tests, the technology is being transferred to Motorola and Harris corporation for incorporation in their radio receivers in order to provide increased sensitivity and selectivity at lower prices. Benefits include improved real-time message understanding, reduced operator fatigue, and a factor of two increase in communications range. There is also interest in applying speech enhancing technology to hearing aids to improve communication for the hearing impaired.

Engineering Data Compendium: Human Perception and Performance.

Kenneth R. Boff, PhD
Human Engineering Division
Armstrong Lab

The Engineering Data Compendium is a professional reference too that consolidates human sensory/perceptual and performance date in a form useful to system designers. It provides comprehensive information on the capabilities and limitations of the human operator, with special emphasis on these variables that affect the operator's ability to acquire, process, and make use of task-critical information. The compendium includes three perception and performance data volumes and a separate user's guide, together totalling over 2700 pages.

The Compendium is being marketed and distributed by the Crew Systems Ergonomics Information Analysis Center. Over 1600 copies have been distributed since 1988 to a wide range of users including system designers, engineers, psychologists, and ergonomists from government laboratories, private industry, and academia.

Molecular Sieve Oxygen Generator to Separate Oxygen from Air by Pressure Swing Adsorption.

Maj George Miller and Clarence Theis
Crew Systems Directorate
Armstrong Laboratory

Molecular sieve oxygen generators, adsorbing nitrogen and extracting oxygen from compressed air, are currently capable of producing a maximum oxygen purity of between 93-95 percent. They are limited because they cannot remove argon which constitutes about one percent of ambient air. The subject technology, "99 percent purity molecular sieve oxygen generator," is capable of adsorbing both nitrogen and argon, thereby producing oxygen concentrations of up to 99.7 percent. The technology is being commercialized by Arbor Research Corporation, Ann Arbor, Michigan and On-Site Gas Systems, Inc., New Britain, Connecticut. Potential customers would be users of high purity oxygen in medical, industrial, and aerospace areas. For medical users, this technology would provide a meas of generating high purity oxygen on site instead of purchasing liquid oxygen. In the industrial area, high purity oxygen is used for metal cutting, welding, and chemical processing. The technology has application in aerospace for producing oxygen on board aircraft. An additional benefit of the technology is that it would reduce the need for liquid oxygen, which requires an energy intensive process for its manufacture.

CREW CHIEF Computer-aided Ergonomic Model of Physical Accommodation for System Maintainers.

Joe W. McDaniel, PhD
Crew Systems Directorate
Armstrong Laboratory

CREW CHIEF interfaces with the user's computer-aided design system to identify design-related maintainability problems by analyzing the interaction of a maintenance technician's physical capabilities with the design elements related to specific maintenance tasks. Use of CREW CHIEF reduces the time to develop good designs by identifying and eliminating maintainability problems early in the life cycle. Resulting systems are more effective and easier to maintain. By improving system maintainability, users reduce life cycle costs, increase safety, and increase productivity. Future uses include designing workstations for people with disabilities. The software is distributed to U.S. industry by the Crew System Ergonomics Information Analysis Center for a fee of $200, which covers magnetic media, installation and user instructions, and shipping and handling. Major industry users include McDonnell Douglas, General Dynamics, General Electric, Northrop, Martin Marietta, Lockheed, Rockwell International, Boeing, and LTV.

Methodology to Manufacture Bacterial Identification Media Capable of Luminescently Labeling Pathogenic Bacteria

Dr. David N. Erwin
Dr. Johnathan L. Kiel
Armstrong Laboratory

The methodology is used by microbiologists who are concerned with rapid, precise diagnosis of infectious disease and state of the isolated organisms to determine disease prognosis; by environmental microbiologists who need to know the current metabolic state of organisms used in toxic waste sites for remediation without having to remove the organisms and whether certain sites are contaminated with pathogenic organisms; and food microbiologists who need to know quickly if food items are contaminated with pathogenic or other organisms. The technology had many applications during Desert Storm and won an "R&D 100" award in 1991 from Research & Development Magazine. The product and process is diaxomelanin which has been licensed to a spin-off company--Beam Tech; other companies are also interested.

Force-Reflecting Stick Controllers Applied to Wheel Chair Controls

Dr. Daniel W. Repperger
Biodynamics and Biocommunications Division
Armstrong Laboratory

The Biodynamics and Biocommunications Division of the Air Force Materiel Command's Armstrong Laboratory in Dayton, Ohio has been involved with force reflecting stick controllers since 1981. The usefulness within DoD has been in the development of stick controllers that are resistant to acceleration forces for pilots when they fly fighter aircraft in unusual flight scenarios.

In 1989 it was recognized that the force-reflecting stick technology should be constructed with small electric motors, new computers, and more advanced electronics technology. In 1991 numerous tests showed that this technology was reliable, portable, easier to use, and could easily be transferred to the private sector in a variety of useful applications. As a result of great effort on the part of Dr. Daniel Repperger of Armstrong Lab, the Veterans Administration became interested in the technology for controlling wheel chairs whereby the stick controller could be made "spastic free." The term spastic free means that the stick would exhibit a smooth output response even if the patient were to make a sudden accidental movement. This was found to have great applicability to the VA in which a number of veterans cannot use powered wheelchairs because of spasms. Because of the application of this technology, these individuals and others are at last able to use wheelchairs unassisted, thus significantly improving their quality of life.

Another use for the force-reflecting technology is in the control of forklifts. Caterpillar has found that the technology greatly improves the safety of the forklifts when operated by novices who tend to jerk the controls in response to a dropped load, resulting in the forklift tipping over.

The Dr. Reperger's efforts won an award for excellence in technology transfer by the Federal Laboratory Consortium in 1992.

Intelligent Tutoring System through the Application of Artificial Intelligence Principles to Computer-Based Training

Maj James W. Parlett
Dr. Kurt W. Steuck
Capt Michael J. Slaven
Human Resources Directorate
Armstrong Laboratory

They have been working with the University of Texas at San Antonio, the San Antonio school district, and Lehigh University. Three tutors have been developed: pre-algebra word problems, basic writing skills, and life and earth science. The researchers are also working with the business departments of both universities to develop corporate training. Several investors have expressed interest as have companies such as IBM and DEC

Advanced Electronics Packaging

Capt James C. Lyke
Phillips Laboratory

The technology is based upon a patterned-overlay hybrid wafer scale integration process known as High-Density Interconnect. Capt. Lyke's efforts enabled the UC Berkeley's Lawrence Radiation Lab to package their computer after having failed both with their own in-house technology and with contractor support. The computer in part of the SDIO Brilliant Pebbles program. Under an exclusive license with General Electric, the High-Density Interconnect technology is being transferred to Texas Instruments who is establishing a production facility under a DARPA contract.

High-Power, High-Energy Iodine Laser

Dr. LaVerne A. Schlie PL/LIDD
Mr. Robert D. Rathge
Laser Imaging Directorate
Phillips Laboratory

Recognizing that commercially available laser equipment did not meet energy and beam quality requirements for use in precision metal processing (welding, drilling, and cutting), Schile and Rathge developed a high-power, high-energy iodine laser. The new laser technology is capable of processing superalloy steel used in aircraft turbine engines. The technology is being transferred via a Cooperative R&D Agreement and patent license to United Technologies Research Center (UTRC), East Hartford, CT. UTRC intends to incorporate the laser technology into smart laser machining that will allow previously unfeasible manufacturing and processing of materials with greatly improved precision, speed, and enhanced reliability (less part rejection) with a single machine.

MODRAN model and computer code that calculates the effects of the atmosphere on the transmission of radio and optical beams

Mr. Leonard W. Abreu
Mr. Francis X. Kneizys
Mr. Gail P Anderson
Mr. James H. Chetwynd
Geophysics Directorate
Phillips Laboratory

There is an important requirement to predict accurately atmospheric transmittance and background radiance for any line-of-sight through natural atmospheres in the spectral range of 0.2 micrometers to infinity. As a result, users will be able to predict the accuracy of atmospheric probing under varying environmental conditions and all geographic locations. Abreu, et al. have developed a model and computer code, MODRAN, that calculates the effects of the atmosphere on the transmission of radio and optical beams from microwave through infrared to the near ultraviolet. The software can run on any computer, from main frames to personal computers. The developers are now negotiating a Cooperative R&D Agreement with a private firm to distribute a user-friendly version to the private sector. Based upon current estimates, there are more than 1000 potential users. One result of the use of MODRAN is a more complete understanding of the significance of the world-wide depletion of the ozone as influenced by chloro-fluro-carbons.

Microwave Laser Module

Charles W. Tsacoyeanes
Electromagnetics & Reliability Direcorate
Rome Laboratory

Mr. Tsacoyeanes has developed a Microwave Laser Module to satisfy critical military need for higher fiber optic systems. The Microwave Laser Module enables reliable transmission of microwave signals over single mode optical fibers at frequencies from 10 MHz to 20GHz. The Module is rugged, hermetically sealed and stable over a wide temperature range. It can operate in a harsh environment and can pass stringent military specifications for vibration, shock, and temperature cycling. The SBIR firm, Lasertron, Inc., is now marketing an optical transmitter that incorporates the Module. The transmitter currently has the highest bandwidth of any laser transmitter on the market. Future applications include high-speed optical interconnects for computers, optical signal processing, and optical computing. The Microwave Laser Module was recently selected by Research & Development Magazine for an "R&D 100 Award" for the year 1991.

Application of the Qualified Manufacturer's List for Qualifying Microcircuits

Charles G. Messenger
Reliability Assurance Branch
Rome Laboratory

The Qualified Manufacturer's List (QML) for Integrated Circuit Manufacturing uses process flow certification and qualification in lieu of the classical qualification approach of exhaustively screening each product on a part-by-part basis. The advantage is that all microcircuits designed manufactured, and tested on the qualified flow are thereby qualified for use in DoD systems. As a result, it is no longer necessary to perform time-consuming and costly device-qualification testing on each individual microcircuit. The QML has been successfully transitioned to the industrial base and is now part of the requirements of MIL-I-38535. It has been hailed by the microcircuit manufacturing community and is expected to save the DoD community $500M annually. Further, the commercial sector is considering adopting the QML concept for its own internal quality-control programs.

Waveform and Vector Exchange Specification for Exchanging Information and Data between the Design and Test Communities

Robert G. Hillman
Willis J. Horth
James P. Hanna
Antonette S. Pettinato
Rome Laboratory

Hillman, et al., developed a Waveform and Vector Exchange Specification (WAVES) for military use. Currently, manufacturers of Computer aided design, simulation and automated test systems all use their own proprietary formats for representing stimulus and response information. As a result, information and data are not easily exchanged between the design and test communities. The objective of WAVES was to develop a standard having universal appeal and acceptance for commercial as well as military use. WAVES was developed through IEEE and is managed and maintained by them, thus freeing DOD of these responsibilities. Funding was provided by Rome Laboratory and several industrial firms. Numerous commercial vendors are in various stages of developing tools to support the use of WAVES. Use of this joint military and commercially developed standard by the Air Force will save thousands of dollars throughout the life cycle of any electronic system. The development of WAVES was significant in that the private sector was a partner in the development and will share the benefits.