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TECHNOLOGY REINVESTMENT PROJECT

Recent Changes Place More Emphasis on Military Needs

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Mr. Chairman and Members of the Subcommittee:

It is a pleasure to be here today to discuss our work on the Technology Reinvestment Project, known as the TRP. The TRP is an important part of the Department of Defense's (DOD's) dual-use technology strategy, which seeks to maintain technologically superior U.S. military forces at an affordable cost.

With declining defense budgets and rapid advances in commercial technology, DOD considers its traditional approach to technology development and procurement to be less effective and affordable now than it was in the past. DOD believes it must now take advantage of cost-conscious, market-driven, commercial production and leverage the huge investments in leading-edge technologies made by private industry.

DOD's dual-use strategy reflects a significant change in the department's procurement philosophy--to move away from reliance on specialized suppliers serving only the defense market and rely as much as possible on commercial suppliers. Thus, it is also an integral part of DOD's acquisition reform efforts.

Our work, undertaken at the request of this Subcommittee, focused on

-- how the TRP differs from other DOD dual-use programs,
-- the military relevance of selected TRP projects, and
-- changes in the TRP to place more emphasis on military needs.

TRP DIFFERS FROM OTHER DOD DUAL-USE PROGRAMS

Like other dual-use programs, the TRP is designed to increase DOD's access to affordable, leading-edge technology by leveraging commercial know-how, investments, and markets for military use. The TRP has been managed by the Advanced Research Projects Agency (ARPA), in part because of the Agency's larger commitment and experience with implementing a dual-use strategy. Over the last several years, for example, ARPA emphasized advanced computer technology with broad commercial applications, on the grounds that the military would be able to buy improved products at lower prices.

Because the TRP was conceived during a period of defense downsizing that emphasizes integrating defense firms into the commercial market, the key difference we found between it and other DOD dual-use programs is the emphasis that ARPA places on the ability of TRP technologies to result in commercial products that benefit DOD. In the past, DOD was concerned primarily with the military application of a technology leaving subsequent commercial development of the technology to the private sector.

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The approach that DOD is emphasizing now seeks to develop dual-use technologies in a way that actively promotes its development and use simultaneously in both sectors. In soliciting TRP projects for fiscal year 1993, ARPA stated that evidence must be provided that the proposed technology would be commercially sustained within 5 years, without further federal funding.

TRP projects also differ from other ARPA and military service dual-use programs because, by statute, they must be competitively selected, include government-industry cost sharing, and involve industry-led partnerships. The cost-sharing requirement is intended to ensure that the participants are interested in developing products. In addition, TRP projects generally use special, flexible agreements in lieu of traditional contracting instruments to help attract firms that might not otherwise deal with the government.

RELEVANCE OF TRP PROJECTS TO MILITARY NEEDS

In creating the TRP, the Congress established a policy that the national technology and industrial base be capable of meeting the following national security objectives:[1]

-- supplying and equipping the armed forces;
-- sustaining production, maintenance, repair, and logistics for operations;
-- maintaining advanced military research and development activities; and
-- reconstituting a capability to develop and produce military supplies and equipment, including technologically advanced systems.

Congress further provided that programs that support these objectives promote economic growth in high-wage, high-technology industries and preserve the industrial and technical skill base; bolster the national technology base; retrain displaced military, civilian, and defense industry personnel; support state and local efforts aimed at defense reinvestment, conversion, adjustment, and diversification; and assist small business affected by defense spending reductions.

ARPA did not attempt to solicit and evaluate TRP proposals specifically against the national security objectives. Rather, it designed a program that solicited and evaluated proposals against these objectives in an aggregate manner. Accordingly, the TRP selection process provides no way to determine direct linkages between the projects selected and any specific statutory objective.

[1]These statutory objectives are set out in 10 U.S.C. 2501.

Because ARPA did not evaluate TRP proposals against specific statutory objectives, we evaluated a sample of TRP projects to determine whether they directly or indirectly meet military needs. We examined 11 randomly-selected projects. We reviewed project documentation, interviewed ARPA project managers, and visited companies involved in the projects. We also interviewed military service and DOD science and technology experts.

The 11 randomly selected projects involved

-- light-weight, mobile, power generators;
-- uncooled infrared sensors (used in night vision devices);
-- computer simulations for surgical training;
-- wearable computers to assist in manufacturing and maintenance operations;
-- national health information network linking military and civilian sectors;
-- a new gear design for helicopter transmissions;
-- pyrotechnics emergency rescue equipment;
-- technologies to enhance the competitiveness of the U.S. ship repair industry;
-- specialized optics technology used in inspection systems to ensure high quality manufacturing;
-- electronic commerce for DOD business applications; and
-- preparation of engineers for 21st century manufacturing.

A detailed description of each project is included in attachment I.

In analyzing these projects, we found that they had either direct or indirect benefits. If a project addressed a specific military need, including a weapon system or the manufacture of that system, the benefits are direct. If the project was intended to expand commercial markets to reduce the cost of DOD products, or preserve an element of the industrial base, the benefits are indirect. ARPA officials acknowledged that deployment and education projects, by their nature, indirectly benefit DOD.

Our review of the 11 projects revealed that 6 were clearly aimed at military needs while 5 were indirectly linked. (See attachment II.)

An example of a project directly meeting a military need is the light-weight, mobile, power generator project. It is intended to be used in a variety of military roles such as (1) a system to support military operations in remote areas, (2) auxiliary power units for military vehicles like the Abrams tank, and (3) lightweight engines for reconnaissance vehicles.

Another project directly aimed at meeting military needs is the uncooled infrared sensors project that is intended to reduce manufacturing costs and leverage a commercial market for this technology and thereby allow broader use by U.S. troops. Current military sensors require cooling units that are too expensive to

issue to those that may need them. With the development of a commercial market and the anticipated reductions in costs, infrared technology will be affordable for support vehicles and individual soldiers rather than being restricted to equipment like tanks and helicopters.

On the other hand, the emergency rescue equipment project indirectly meets defense needs by preserving work for a firm involved in military pyrotechnic work, an important element of the defense industrial base. With a reduced demand for space and defense pyrotechnics, this project was intended to demonstrate the commercial viability of using pyrotechnic technologies in commercial rescue equipment. However, as the project evolved, the firm decided to use a different technology in one of their commercial products and, as a result, the intended benefit of supporting pyrotechnics was decreased. Subsequently, ARPA reduced funding for the project by $254,000 in February 1995.

Another project providing an indirect benefit is the electronic commerce project. It is intended to reduce transaction costs and lead-times. The Defense Logistics Agency is participating with the expectation that procurement cycles and costs will be reduced and supply options will be increased. Smaller defense firms will be able to respond to a greater number of solicitations thus becoming less dependent on prime contractors.

RECENT CHANGES PLACE MORE EMPHASIS ON MILITARY NEEDS

Because of the growing concerns about the defense relevance of TRP projects, the Congress required more involvement of the military services to ensure that ARPA, when selecting future TRP projects, places more emphasis on meeting military needs.

During selection of 1993 and 1994 TRP projects, the military services were not (1) represented on the Defense Technology Conversion Council, a multi-agency council responsible for conducting the TRP competitions or (2) allowed to select the technology focus areas used to solicit the TRP proposals.[2]

[2]Technology focus areas refer to broad areas identified as key dual-use technologies. Within these broad areas, specific topics are identified that are judged to meet critical defense needs as well as having significant potential to stimulate commercial product development.

In September 1994, Congress mandated (P.L. 103-335) that fiscal year 1995 TRP funds were not to be obligated until the Secretary of Defense ensured that

-- the service Assistant Secretaries for Research, Development, and Acquisition were full members of the Defense Technology and Conversion Council and

-- the services were fully involved in selecting focus areas and evaluating proposals for funding.

Last month, the Congress (P.L. 104-6) added further conditions to ensure the military relevance of 1995 TRP projects. DOD is prohibited from obligating 1995 TRP funds until

-- the Under Secretary of Defense for Acquisition and Technology certifies to the Congress that representatives of the military services constituted a majority of the membership on TRP selection panels and

-- the Under Secretary submits a report to the Congress describing each new TRP project or award and the military needs that the project addresses.

In response to these conditions, reduced funding for 1995 projects, and experience from the earlier TRP competitions, ARPA has made a number of changes in the way it will manage the 1995 TRP competition. For example, the military service assistant secretaries, through senior science and technology official designees, are now represented on the Defense Technology Conversion Council. Further, ARPA is not soliciting technology deployment and manufacturing education and training projects because they were considered to be less defense relevant. Instead, ARPA will be soliciting technology development projects only. And, the number of focus areas has been reduced from 13 to 8. In 6 of the 8 focus areas, ARPA and military representatives have been paired to manage the projects.

Military service officials we interviewed believe these changes will help ensure that TRP projects are more focused on meeting military needs.

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Mr. Chairman and members of the Subcommittee, that concludes my statement. I will be pleased to answer any questions you have.

ATTACHMENT I

TRP PROJECTS EXAMINED

We randomly selected eleven TRP projects. Seven projects were selected from the 1993 technology development area, representing about 10 percent of the proposals funded in that area in 1993. Two additional technology development projects were selected from the fiscal year 1994 TRP competition. We also selected one project each from the technology deployment and manufacturing education and training areas.

Dollar figures shown in the following TRP project descriptions represent the total of government-industry cost sharing.

TECHNOLOGY DEVELOPMENT

"Power Pak" Mobile Electric Power System--This is a $1,460,675 project that will exploit emerging rotary engine and electro-magnetic technologies using diesel fuel to achieve size, weight, safety, and logistic advantages over existing electric generation systems. The system's reduced size and weight should allow it to be used as (1) a system to support operations in remote areas, (2) an auxiliary power unit for existing weapon systems like the Abrams tank, and (3) a light-weight engine for reconnaissance vehicles.

Lockheed Martin Ordinance Systems is leading a partnership that includes two other commercial firms, two interested service organizations, one university, and one state government entity. Commercial applications for the project include power generation systems for recreational vehicles, homes in remote areas of the world, and back-up generators in hospitals and office buildings.

Uncooled Infrared Sensor Cost Reduction Program--This $11,520,670 project seeks to develop low cost, uncooled infrared sensors by reducing the manufacturing cost of such sensors and developing a commercial market for uncooled infrared sensor products. Military applications, which would be made possible through cost reductions and the affordability provided by the commercial market, include night driving aids, rifle scopes, perimeter surveillance systems, helmet-mounted night vision goggles, and mine detection devices.

Loral Infrared & Imaging Systems leads this partnership that includes six other commercial firms. The Army Night Vision Laboratory is the technical monitor. Potential commercial applications include industrial process and equipment surveillance, traffic monitoring, and equipment allowing firemen to see through smoke.

ATTACHMENT I

Surgical Simulation for Limb Trauma Management--This $1,211,787 project seeks to develop the first anatomically correct, three-dimensional computer visual model of a human limb for surgical training. Development of this technology will permit surgical training of medics and military physicians on battlefield-type wounds using simulation rather than animals.

MusculoGraphics, Inc., leads a partnership that includes another commercial business and the medical centers of two rehabilitation hospitals. This technology will be tested at the Fort Bragg Medical Training Center. Commercial applications beyond battlefield training include repairing knee ligaments.

Wearable Computer Systems with Transparent Head-mounted Displays for Manufacturing, Maintenance, and Training Applications--This $11,128,860 project will develop two types of wearable computer systems with headmounted displays for manufacturing, maintenance, and related training. The first type will have a position sensing system that superimposes images directly on surfaces such as engines or wire assembly boards. The second type projects text or images onto a miniature TV screen in eyeglasses and is expected to be useful where the user must be mobile, have free hands, and see technical data while performing a job. The military could use these systems in equipment maintenance and repair.

Boeing Computer Services leads this project that includes Honeywell and a university. McClellan Air Force Base will test this equipment in aircraft maintenance. In the civil sector, the partners expect the systems to be used by factory workers, aircraft mechanics, police, firefighters, warehouse workers, and medical professionals.

National Information Infrastructure for a Health Information Network--This $15.4 million project will design and develop a standardized medical emergency data system and its supporting systems to assist health care providers in quickly getting needed patient information. Compatibility between military and civilian health care systems would allow direct access to patient's health care records through networks so that information is available in both battlefield and civilian emergency care environments.

Rockwell International Corporation leads a consortium of 12 organizations that includes universities, health care groups, and other technology companies. Hospitals from Wright Patterson Air Force Base and Fort Gordon are also participating. Potential commercial products and services include data access and networking services, software analysis tools, and patient management systems.

Completion of Technology for Face Gearing Concept--This is a $1.5 million project to develop gears for transmissions that have teeth on their face rather than their edges. The expected military benefit is principally on helicopters where projected savings include a 40 percent weight reduction that would translate into increased payload or performance. The Army may use face gear technology for the Advanced Apache helicopter, which is estimated to be fielded in about 2010.

McDonnell Douglas Helicopter Company leads a partnership that includes another commercial firm, a university, and a DOD/NASA laboratory.

Pyrotechnic-Actuated Vehicle Rescue Equipment--This $1.6 million project was funded to develop existing space and defense pyrotechnic technology into emergency rescue equipment for rapidly freeing trapped victims of automobile collisions and collapsed structures. This equipment was to be lighter, more portable, and less expensive than current rescue equipment. According to project officials, the project benefits the defense industry by providing work for pyrotechnic experts and machine shops.

Hi-Shear Technology Corporation led the project, which also included the City of Torrance Fire Department. In February 1995, the project's funding was reduced because of a decision by the firm to abandon use of pyrotechnic technology in developing one piece of the rescue equipment. During the project, Hi-Shear developed two metal cutting tools that it is currently manufacturing and selling. According to Hi-Shear officials, the potential commercial market for these tools consists of the 32,000 fire departments in the United States as well as those located in other countries.

Center for Advanced Ship Repair and Maintenance--The Center is a $2.4 million project that plans to develop technologies to enhance the competitiveness of the U.S. ship repair industry. Efforts are underway to develop (1) a more cost-effective and environmentally benign technology for stripping paint, (2) technologies to reduce fouling of seawater intake valves by biological organisms, and (3) a model for testing pollution in stormwater runoffs from dry docks.

Key project partners include the South Tidewater Association of Ship Repairers, the State of Virginia and City of Norfolk, and a university. Center officials believe that a market for paint stripping exists that has not been tapped by U.S. shipyards because of higher labor costs and more stringent environmental regulations. They also believe that a market exists for antifouling technology at shore facilities, such as powerplants.

Extrapolation of Adaptive Optics Technology to Manufacture of Electronics and Next Generation Information Display Systems--This $945,700 project uses optics technology developed for military surveillance applications to provide quality in the visual inspection and manufacturing of printed circuit boards and flat panel displays.

This project is led by AOI International and includes Optical Research Associates. Successful development of an inspection tool will reduce manufacturing costs of printed circuit boards and flat panel displays. The civilian market for flat panel displays is estimated at 20 times the military market.

TECHNOLOGY DEPLOYMENT

Smart Valley CommerceNet--This is a $12.0 million project to facilitate the use of an Internet-based marketplace for electronic commerce that would reduce transaction costs and lead-times. The Defense Logistics Agency is participating with the expectation that procurement cycles and costs will be reduced and supply options will be increased. Smaller defense firms will be able to respond to a greater number of solicitations thus becoming less dependent on prime contractors.

Project partners include Enterprise Integration Technologies Corporation, a university, and the Bay Area Regional Research Network. About 100 organizations currently participate in CommerceNet. CommerceNet is conducting several pilots addressing issues such as standards for security, connectivity, cataloging, and electronic data interchange.

MANUFACTURING EDUCATION AND TRAINING

Preparing Engineers for Manufacturing in the 21st Century--This is a $2.8 million project to introduce manufacturing education across the undergraduate engineering curriculum and provide practical experience in product design and manufacture on two national priority areas, new engineering materials and electronic devices and packaging. The Army Research Lab and the Army Materiel Systems Analysis Activity are involved in this project by participating in the development of the new curriculum and providing opportunities for students to be involved in military-related research.

The University of Maryland leads the project that includes Westinghouse, IBM, the Maryland Industrial Partnerships, and the Computer Aided Life Cycle Engineering Center, whose members include more than 20 defense-related electronic and aerospace firms. Participants expect significant increases in productivity by hiring students educated in the new manufacturing program.

ATTACHMENT II

CHARACTERIZATIONS OF DEFENSE-RELEVANCE FOR THE TRP PROJECTS

No.	Project	Direct	Indirect
1	Light-Weight, Mobile, Power Generators	X	
2	Uncooled Infrared Sensors	X	
3	Surgical Training Computer Simulation	X	
4	Wearable Computers	X	
5	National Health Information Network	X	
6	New Gear Design for Transmissions[a]	X	
7	Pyrotechnic Rescue Equipment[b]		X
8	Center for U.S. Ship Repair[c]		X
9	Specialized Optics Technology[d]		X
10	Electronic Commerce for DOD		X
11	Engineering Training		X

[a]According to DOD and project officials, the first likely use of this technology would not occur until the Army procures a new version of the Apache helicopter, probably around 2010.

[b]In February 1995, the project's funding was reduced because of a decision by the firm to abandon use of pyrotechnic technology in developing one piece of the rescue equipment.

[c]If a part of the project is to succeed, the Navy will have to change its specifications for paint removal. Current regulations do not allow using recyclable steel pellets for paint stripping, which this project is testing. In addition, the equipment being tested works best on flat surfaces of commercial ships and will need to be modified to address the unique contour of Navy ships.

[d]Technologies for producing advanced optics to make them less costly is of direct importance to meeting military requirements. The adaptive optics program provides an effective approach for enabling flexible production of complex lenses that are used in a wide range of defense sensing applications.

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