

DARPA Shifts Research Funding Priorities

While the U.S. Defense Advanced Research Projects Agency (DARPA) continues to be a significant supporter of materials-related research, the agency is currently rearranging its funding priorities in a way that could have a direct impact on the materials sector for at least the next several years.

Senior officials at DARPA's Defense Sciences Office (DSO), which oversees most materials research support within the agency, said that the highest funding priority is now being given to technologies that improve defenses against biological warfare. This policy is in response to a perceived increased threat from this type of attack, and DARPA has even created a separate funding category to track its biological warfare defense research activities.

While the reorganization makes it appear that materials-related funding will decline during Fiscal Year 2000—to \$111-million, from \$169-million in FY 1999—DSO officials said that the change is only a matter of bookkeeping. They said that materials research will continue to account for more than half of DARPA's \$300-million annual research funding total.

DARPA's specific materials research needs related to biological warfare defense involve the development of mesoscopic-size devices, or "sugar cube to fist," as DSO officials call them. A new research funding category in FY 2000, with about \$7 million requested for initial funding, these include small, lightweight pumps to power battlefield air and water sensors, highly portable coolers, and air and water purifiers. DARPA is looking for ways to make such devices easily portable by individual soldiers—in effect, making "each soldier a system." The agency is also looking to reduce the weight and improve the portability of such support devices as batteries and antennas.

Another materials area where DARPA still places a high priority, even though FY 2000 requested funding is \$42 million, down from \$62 million in FY 1999—is functional materials. These include both higher sensitivity, higher strength, and higher operating temperature magnetic devices for motors, generators, flywheels, bearings, and actuators. In addition, DARPA-funded research is examining radiation-hardened magnetic memories with such advantages as very high density, short access time, infinite cycle ability, and low power. Magnetic memories are believed to have enormous commercial

potential if they can be perfected because they could result in near-instantaneously bootable personal computers.

Other functional materials research currently being pursued by DARPA includes electroactive polymers for sensing, actuating, and analog processing. Efforts include research of ferrite and ferroelectric oxide materials that could result in tuned filters, oscillators, and antennas.

"There's a huge leverage for defense" in sensors and communications, according to DSO officials. Advances in high-temperature superconductors, which have been made in large part because of DARPA-backed research efforts, will make possible highly efficient telecommunications towers, such as those used to support cellular telephone systems.

The area of high-temperature superconductors has received DARPA funding on an unusually long term—about \$25 million per year since 1990. Few other funding efforts have lasted as long, DSO officials said, because the agency's normal approach is to stimulate research just enough to allow the private sector to take over.

Superconductivity in telecommunications was an exception. "The major telecommunications firms have been aware of the potential of superconducting applications," according to one official; "But while they could put money into it, the private firms have been reluctant to take the lead because the defense need for superconducting technology is greater than current industry needs."

Some of DARPA's funding for structural materials and devices also has been shifted to biological warfare defense activities, resulting in an apparent drop in this category, to about \$20 million in FY 2000 from \$32 million this fiscal year. The agency continues to promote new concepts on two scales.

First, at the individual soldier level, the agency is looking at materials to improve lightweight personnel protection, particularly against anti-personnel mines.

Second, at the weapons platform level, DARPA wants to develop better multifunctional materials that are able to achieve lower weight and detectability and increased performance. These would include smart materials, sensors, and actuators to "control...the aerodynamic and hydrodynamic behavior of military systems," such as aircraft, helicopters, and submarines.

This is an important area of defense research because the military's large platforms, such as naval ships and the Air

Force's B-52 bombers, will need continual upgrading as they proceed through their lengthy operational lifetimes.

At present, the only areas at DARPA where funding actually seems to be declining are in energy and environmental research, which are set to drop to about \$18 million next year from their present level of \$24 million. Here, officials said, several existing programs—high performance fuel cells, electric vehicles, and supercritical water oxidation—are receiving sufficient attention from the private sector.

Officials said, however, that these priorities can be altered quickly if national defense needs shift again. "DARPA is a very opportunistic organization," a top DSO official said; "Any time there's a major breakthrough in a high-priority area, we can respond almost immediately." High-temperature superconductivity was just such an example. When initial research showed promise, funding was channeled into that area within one year.

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CNSR Presents Statement Calling for Increased DoD Funding

The Coalition for National Security Research (CNSR) has issued a statement calling for increased funding—from the Fiscal Year 2000 request of \$7.4 billion to \$8 billion—for the Department of Defense's (DoD) Science and Technology Program (6.1, 6.2, and 6.3). This agrees with the recommendation contained in the 1998 *Report of the Defense Science Board Task Force on Defense Science and Technology Base for the 21st Century*.

The leaders of 19 scientific and engineering organizations, research universities, and industries signed the statement that calls on Congress to address what they see as serious problems in DoD's basic and applied research programs. Richard Powell, Vice President of the Optical Society of America (OSA), said, "OSA is alarmed that reduced funding of research in universities, in-house laboratories, and industries will threaten our [U.S.] military superiority while leading to a diminished workforce of highly trained scientists and engineers in the 21st century."

Organizations that endorsed CNSR's statement include OSA, the Materials Research Society, the American Physical Society, the American Chemical Society, and SPIE—International Society for Optical Engineering. □