tinguished from proprietary research and from industrial development, design, production, and product utilization, the results of which ordinarily are restricted for proprietary or national security reasons."

They also state explicitly that university research "normally will be considered fundamental research." While that has pleased many academic research organizations, a subsidiary clause has not. It states that the general freedom to communicate fundamental-research findings may be withdrawn "if a university or its researchers accept specific national security controls on a research project or activity sponsored by the U.S. government." Several academic groups, including the Council on Governmental Relations (an organization of research universities), have objected to that phrase on the grounds that it appears to violate the policy set forth in NSDD 189—that only classified fundamental research is open to export controls.

In a July 15 letter to the agency, Mark Ryan, a senior attorney for Hewlett-Packard Co., objects to another ambiguous clause in the proposed EAR which says that unclassified fundamental research within industry may be freely communicated unless it is subject to proprietary or "national security considerations." What those national-security considerations might entail is never discussed. The Commerce Department is expected to formally address these and other contested EAR provisions later in the year.

**Another Proposal to Limit Confusion**

A proposed DOD directive published February 12 in the *Federal Register* attempts to resolve some of the remaining confusion. Not only does the new directive—expected to be issued in final form before the year's end—formally incorporate NSDD 189 policy, but it also formally states for the first time DOD's functional definition of fundamental research for the purposes of unrestricted scientific and technical communication—6.1 and 6.2 academic research, and 6.1 industrial research. (Until this time, DOD's evolving definition of fundamental research could only be discerned from various pieces of correspondence.) The directive also proposes formal changes to defense acquisition regulations—changes that make identification of fundamental research a contract requirement. Contracts so designated will require—in terms of publication accountability—only the simultaneous submission of papers to DOD when they are submitted to journals.

The new directive also sets target dates by which DOD will attempt to clear for publication papers that have been written by in-house researchers. Moreover, it identifies in broad terms who conference organizers should talk to within DOD when they plan scientific and technical

*Continued*

## Militarily Critical Technologies List

Since 1976, there has been a growing shift away from controlling the export of actual products to a focus on controlling the export (sharing, communication) of what the Defense Department terms "technological know-how." To help those charged with controlling exports determine which technologies warrant control, the Defense Department developed a Militarily Critical Technologies List (MCTL), first published in October 1980. Not all militarily critical technologies are included. For example, those already possessed by or available to Warsaw Pact countries are not listed.

Since 1980, the list has been updated and revised many times. Generally, these changes reflect higher performance characteristics necessary for something to be deemed critical to enhancing the Soviet weapons program or their understanding of U.S. weapons. For example, between 1980 and 1986, the performance requirements of covered oscilloscopes and precision-time-interval measuring equipment have doubled and frequency standards have increased by an order of magnitude. Similarly, microwave-power frequency-measuring technologies have lately been restricted to "above 18 gigaHertz." However, technologies may be deleted when intelligence information confirms that they are already possessed by the Soviet Union, Bloc countries, or other "controlled destinations."

For each heading on the list, there is a general description of the technology, the military rationale for controlling it, and a list of the technology's critical elements, which include:

...manufacturing and design know-how (such as procedures, design criteria, or testing techniques) which are not in the public domain and which are necessary for the significant development, production, or use of this technology;

...equipment necessary for effectively using or applying the information or techniques on the list;

...materials specifically necessary for applying the controlled information or technology; and

...products from which controlled information or techniques can be gleaned—for example by reading a users' manual or by reverse engineering.

As of July 1986, there were 1,657 items on the list, and another 432 proposed for listing. That reflects, for this year, 65 new items, 14 deletions, and 42 revisions. The list is used throughout the federal government as a basic reference for those who make policy decisions regarding technology transfer—or export control. It has been described as the bible for those who review scientific papers or topics for scientific-conference sessions to determine whether specific unclassified but sensitive information can be openly communicated. However, the full list is classified. Only a generic list of the technologies is available to persons without an appropriate security clearance.

The following unclassified subject headings were added between January and July 1986. Most, either directly or indirectly, represent materials-related technologies. Those marked with asterisks are not entirely new: Explains DOD, portions may have been picked up from a category slated for deletion.

Signal Processing Technology
Computer Aided Design Technology
Magnetic Tape Read/Write Head Technology
Magnetic Tape Recording Media Technology
Magnetic Tape Drive Electronics Technology
Magnetic Tape Drive Mechanical Technology
Advanced Graphics Workstation Technology
Alphanumeric and Graphic Controller Technology
Trusted Computer Base Technology
Carbon/Carbon Composites Technology
Direct-Acting Hydraulic Pressing Technology
Coatings and Surface Modification Technology
Coatings for Metallic and Metal Matrix Composite Substrates
*Coatings for Superalloys
Coatings for Titanium Alloys
*Coatings for Metal Matrix Composites
Coatings for Aluminum Alloys
Coatings for Steels
*Coatings for Refractory Alloys
Coatings for Ceramics, Ceramic Matrix Composites, and Carbon-Carbon Composites
*Coatings for Ceramics
*Coatings for Ceramic Matrix Composites
*Coatings for Carbon-Carbon
*Optical Coatings
Coatings Technology for Seals
Coatings Deposition Technology
*High-Current Electron Beam Generation Technology
*Electron Beam Injector Technology
Electron Beam Post-Injection Accelerator Technology
*Electron Beam Short-Term Energy Generation Subsystem Technology
*Electron Beam Pointing and Control System Technology
*Electron Beam Propagation Technology
*Electron Beam Material Interactions Technology
*Electron Beam Target Effects and Countermeasures Technology
*Neutral Particle Beam Systems Technology
Neutral Particle Beam Generation Technology
*Ion Beam Injector Technology
*Ion Beam Post Injection Accelerator Technology
Particle Beam Short-Term Energy Generation Subsystem Technology
*Particle Beam Pointing and Control Subsystem Technology
Kinetic Energy Propulsion Systems Technology
Kinetic Energy Projectiles Technology
Kinetic Energy Target Effects and Countermeasures Technology
Communications Network Control Subsystems Technology
Vehicular Survivability Technology
Survivability Analysis/Threat Characterization Technology
Susceptibility Reduction Technology
Vulnerability Reduction Technology
Ramjet Propulsion Technology
Inlet Technology
Ramjet Fuels and Fuel Delivery Systems Technology
Ramjet Combustor and Nozzle Technology
Ramjet Booster System Technology
Undersea Vehicle Technology
Biological, Chemical and Toxin Materials Technology
Recombinant DNA Technology
Bioprocessing Technology
Biomaterials Technology
Biosensor Technology
Technology for Manufacture and Dissemination of Toxic Substances
*Primary Power System Technology

(List adapted from 7/17/86 DOD MCTL report.)