In the past few months, NSF, DOE and DOD have made awards totaling nearly $40 million to universities for modern scientific instruments. While NASA has no specific program to provide equipment for its academic researchers, the agency allocates about 10% of its university grants and contracts to instrumentation. In fiscal 1984, accordingly, NASA obligated about $22 million for equipment in academic space science. Following is a program sampler of the other agencies:

▶ NSF has made 203 awards from the 1348 proposals received in the first year of its College Science Instrumentation Program for predominantly undergraduate four-year colleges and universities. The awards, totaling about $5 million and requiring matching funds, went to 172 institutions in 40 states and Puerto Rico. Among the awards involving physics equipment: $23 500 for a lasers and electro-optics lab at Western Kentucky University; $29 840 for a solid-state and semiconductor-device lab at the University of North Carolina at Charlotte; $39 609 for computer-controlled instruments at Ohio's Denison University; $27 985 for a laser spectroscopy system at Vermont's Middlebury College and $27 482 for upgrading an experimental physics lab at the University of Tennessee at Chattanooga.

▶ DOE's Office of Energy Research received 160 applications for $4.9 million of scientific instruments and made awards to 22 universities for fiscal 1985. Among these: $216 470 to Columbia University for a low-divergence excimer laser and high-resolution excimer-pumped dye laser; $283 000 to Case Western Reserve University for a high-resolution electron microscope; and $240 000 to the University of Illinois at Urbana–Champaign for a high-power rotating anode x-ray system.

▶ DOD's University Research Instrumentation Program has made 652 awards totaling $90 million in the last three fiscal years through its Office of Naval Research, Air Force Office of Scientific Research and Army Research Office. Though 47 of the leading 50 research universities have received nearly 63% of DOD's instrumentation awards, nearly 13% went to colleges and universities that were not currently funded by the armed forces. Some of this year's winners: $300 000 to the University of Pittsburgh for an FPS-164 attached processor; $60 000 to the University of Southern California for an infrared absorption spectrometer for transmitting parity species; and $122 500 to Harvard University for a cw ring dye-laser system.

Few academics believe such programs can entirely overcome the deficiencies. As Zdanis informed the House committee, "The overall problem is so large ... that it cannot be properly addressed without substantial, sustained investments by all sources—Federal and state governments, universities and the private sector. I would like to emphasize the words 'sustained investment.' Laboratories in most sciences must now be reequipped about every five years to remain competitive in research."

The 237-page report, *Financing and Managing University Research Equipment*, carries numerous recommendations for all. It makes the point that such beleaguered regulations as Office of Management and Budget Circulars A-21 and A-110 and the Federal Acquisition Regulations do not contribute to the problem, but that inconsistent interpretations by agency officials often complicate the purchase, management and use of academic research equipment. As a first step the Zdanis report urges top Federal officials to play up the importance of research under their agency's auspices through policy directives and personal assurances. Before the nation and its universities can attain the scientific and economic goals set out by them, Zdanis told the House members, the agencies must make plain their commitment to academic research, including the efficient acquisition and management of research equipment.

Covering costs. To this end, the report asks Washington to reckon the full costs of buying, operating and maintaining the equipment, which may include funding the full expense of renovating space and installing and servicing research apparatus through regular research-grant procedures. These costs should be covered explicitly, says the report, either by the research grant or contract, or as a condition for making the award. The report goes on to suggest that the agencies adopt procedures for spreading the cost of expensive equipment charged directly to project awards over several years and allow the cost and use to be shared across award and agency lines. It proposes that OMB modify its application of Circular A-21 so that interest payments are considered allowable costs by all agencies.

The report further recommends that states grant public universities and colleges greater flexibility in handling funds, including permission to carry funds forward from one fiscal period to another. Another recommendation sure to evoke outcries of special pleading calls for the states to "examine the use of their taxing powers to foster academic research and modernization of research equipment."

For universities, the report advocates that they "favor research and equipment" in planning how to allocate their money. Moreover, they need to budget realistically for operating and maintaining research equipment, which means including the costs of space renovation, service contracts, technical support and electric power. It also suggests that universities "seek better ways to facilitate the transfer of research equipment from investigators or laboratories that no longer use it to those that could use it."

The report also recommends that universities explore the greater use of debt financing and leasing as ways of acquiring research instruments. It proposes that industry make more use of the Economic Recovery Tax Act of 1981 (ERTA) to donate research equipment to universities and to fund academic research. It calls on Congress to revise ERTA so that it covers computer software, spare parts and service contracts that are not part of original donations and make the R&D tax credit permanent. —Irwin Goodwin

NSF idea: Materials research groups

Among the research programs funded by the Federal agencies, materials science is considered by government officials to be one of the most exciting growth fields. Materials research ranges from improving alloys and ceramics to fundamental studies of the structure and properties of materials on the atomic scale and the universal principles of phase transitions. As such, the field contributes importantly to US economic competitiveness by providing scientific underpinnings for new technologies, increasing productive efficiency and contributing to better products that may possess greater strength, longer durability, corrosion resistance and special electrical characteristics. It also pays off from time to time in new energy and defense technologies.

Accordingly, the Department of Energy plugs into the field about $135 million annually, making it the largest single source of support for materials research in the US. The Defense Department is arming materials studies by $88 million during fiscal 1985 in budget category 6.1 (for basic science) alone. NASA's program for materials processing in space is expected to soar from $27 million this fiscal year to $34 million in fiscal 1986 as part of its "seed money" to attract commercial investment in space manufacturing. The National Science Foundation is spending some $107 million this year on materials research, with the Materials Research Laboratories receiving about $28 million and a new program for materials groups getting $2.5 million.

The new program, announced on 22 August, establishes Materials Research Groups for periods of 32 months to three years at five universities. NSF describes MRGs as a multidisciplinary bunch of scientists and engineers using sophisticated equipment to study a single common problem. As such they are smaller in size and narrower in focus than MRLs, but neither as small nor as narrow as solitary investigations. The five MRGs will receive a total of $8.1 million over the three-year life of the first grants, and NSF is prepared to expand the program to as many as 20 qualified new groups. Indeed, if NSF's proposed 1986 budget is approved by Congress, materials will get a total of $115 million, with the MRLs and MRGs in line for the largest increase—to $30 million and $3.7 million respectively.

Conceived by DARPA. Developed and financed in the 1960s by the Defense Department's Advanced Research Projects Agency, with the idea of providing well-equipped facilities for studying materials of all sorts, MRLs were turned over to the National Science Foundation for care and keeping when Congress passed the 1970 Military Procurement Act, containing the Mansfield Amendment (see page 59). In the late 1970s there were MRLs located on 14 university campuses. When MRLs at the Universities of North Carolina and Maryland were phased out, others were organized at the University of Massachusetts, Carnegie–Mellon University and Case–Western Reserve University. NSF advisory panels hailed the MRL concept as "outstandingly effective" in drawing together researchers with varied and complementary talents. Funded with five-year core grants that might be as much as $3 million to $4 million per year, the centers boasted of equipment costing a total of $100 000 to $1 million. A quintessential byproduct of the MRLs was the training of new scientists and engineers in multidisciplinary settings. What's more, operating in the style of an industrial laboratory, the centers attracted cooperative research projects with industry. Indeed, the MRLs offered a heady experience.

But in the 1980s, the gleam of the MRLs began to fade. The original idea that the productive sum of each MRL would be greater than the combined studies carried out in fragmented ways no longer appealed, by itself, to NSF's advisory boards and peer review groups. NSF worried about complaints that some of the work it supported at MRLs had slipped in quality. Soon it dismantled an MRL at Pennsylvania State University and began to phase out other MRLs at Purdue and Ohio State Universities. To make matters worse, MRLs appeared to some scientists to be threatened by a new interest at NSF—the Engineering Research Centers. Modeled on MRLs, the engineering centers are also block-funded, multidisciplinary and equipped with state-of-the-art instruments. NSF's announcement of the new engineering program attracted 142 proposals representing 3000 investigators at 107 universities. Eight universities were selected to start six centers this year. As many as 20 ERCs may be operating eventually.

Filling a gap. The idea for small groups of materials scientists concentrating on a single problem has been discussed for at least a decade. In November 1983, though, NSF was encouraged by its Materials Research Advisory Committee to set up some groups. The committee chairman, Pierre C. Hohenberg, sent a forceful three-page report to Edward A. Knapp, then NSF's director, urging the foundation to allocate some $15 million per year for materials groups whose collaborative research does "not require the large scale of a full MRL." The new MRGs, said the report, called *Initiatives to Strengthen Interdisciplinary Efforts in Materials Research*, spoke of fostering scientific interactions "that might not otherwise occur." MRGs, it continued, need to support "jointly supervised students and postdoctoral workers and should have a level of equipment support to make this collaborative effort possible."

Hohenberg's report also recommended that MRL programs be strengthened and suggested that NSF establish six or seven new MRLs at universities that now appear to qualify for such centers.

When NSF sounded its call for proposals for MRGs in the summer of 1984, the agency received 20 applications. The criteria for selection were straightforward: a record of scientific accomplishment, a demonstrated need for a group approach to a defined major problem and a workable plan to engage the combined talents of several investigators from various disciplines. NSF's advisory group, led by Samuel Krimm of the University of Michigan, visited six campuses. In the end, the agency funded five centers:

▶ Caltech receives a three-year grant totaling $2.29 million. Its program seeks to determine transient processes in materials—such as rapid quenching, ion radiation damage and damage caused by cooling of metals—as aspects of studies dealing with the motions of atoms and molecules as well as their relationship to the synthesis and characterization of new materials. The director: William A. Goddard.

▶ Pennsylvania State University is funded at $1.49 million over three years for a program centering on the molecular engineering of new, chemically bonded ceramics. The materials will be consolidated without the use of thermal diffusion, relying instead on chemical reactions at relatively low temperatures to cause bonding that would improve structural and electrical properties. The directors: William B. White and Della M. Roy.

▶ Polytechnic Institute of New York is awarded a three-year grant of $1.4 million to gain a better understanding of chemical, physical and processing effects on the aging of new blends of polymers. The directors: Eli M. Pearce and T. K. Kwei.

▶ Rensselaer Polytechnic Institute gets $1.48 million for a 33-month program to investigate the chemical, mechanical and microstructural properties of glass to determine ways of improving glass stability and reducing degradation. In the course of this work, the effects of water and intense pressure will be studied to understand what can happen if bulk glass is used to store radioactive waste. The program also will examine the durability and stability of glass fibers. The director: Minoru Tomozawa.

▶ University of Texas at Austin obtains $1.45 million to support its program for 32 months as it seeks answers to questions associated with the synthesis of new materials for photoelectrochemical devices and the underlying mechanisms of photochemical processes at interfaces. It proposes to develop materials that would eliminate the problem of band gaps in semiconductors. The director: John M. White.

The MRG program has accelerated rumors in the materials sciences community that NSF may drop MRLs altogether. Lewis H. Nosanow, director of the agency's materials research division, insists NSF intends no such thing. "The concerns are unfounded," says Nosanow. "The MRLs are not about to wither and die. They are likely to become stronger and more dynamic with the advent of the MRGs. Some MRGs, in fact, may evolve into MRLs."

This view is shared by J. David Litster, head of MIT's resourceful MRL—whose funding increased 40%, to more than $4 million, this year, when it took on a new project in high-strength steel. "The MRGs are a healthy development," Litster observes. "I usually don't approve of structural solutions to problems. But the MRGs should be competitive with the MRLs, and that's healthy for everyone—the labs, the groups and the entire materials community. We all need some creative tension in our lives."

—Irwin Goodwin □