

Chapter 32

Federal Research and Development in New Mexico

- Approximately \$2.3 billion of federal R&D funds are spent each year in New Mexico.
 - New Mexico ranks 13th among the 50 states, District of Columbia, and Puerto Rico in terms of the amount of federal R&D dollars received annually.
 - Approximately 29 percent of all federal funds spent in New Mexico each year on matters other than the direct support of individuals (i.e., such entitlements as retirement, disability, and housing assistance) is spent on R&D.
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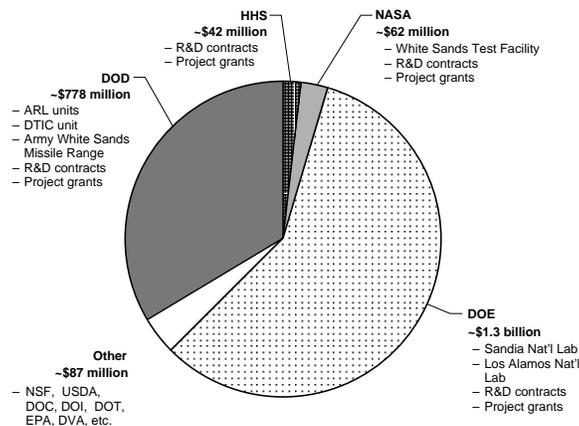


Figure 32.1 – Sources of Federal R&D Dollars Spent in New Mexico
(Total Federal R&D ~\$2.3 billion)

BACKGROUND

In recent years, the federal government has spent in the neighborhood of \$2.3 billion annually in New Mexico on research and development (R&D) activities. On average, federal R&D dollars account for approximately 29 percent of all federal funds spent in New Mexico each year on matters other than the direct support of individuals (i.e., such entitlements as retirement, disability, and housing assistance).

Most major federal agencies that currently support federal R&D efforts fund significant R&D activities in New Mexico. Foremost among these agencies is the Department of Energy (DOE), which accounts for 58 percent of all federal R&D dollars spent in the state. The Department of Defense (DOD) accounts for an additional 34 percent of the federal R&D dollars spent in New Mexico. The remaining federal R&D dollars come collectively from the National Aeronautics and Space Administration (NASA), the Department of Health and Human Services (HHS), the National Science Foundation (NSF), and other federal agencies.³²

All federal R&D dollars spent in New Mexico either cover the costs of operating federal R&D units in the state, including paying the salaries of federal R&D personnel working at these units, or are awarded as grants, contracts, or cooperative agreements to entities in the state. The following is an overview of what becomes of these federal R&D dollars once they arrive in New Mexico.

FEDERAL R&D UNITS IN NEW MEXICO

Albuquerque, New Mexico, is home to a part of DOD's Air Force Research Laboratory Space Vehicles Directorate and Air Force Research Laboratory Directed Energy Directorate, and the Southwestern Regional Office of the Defense Technical Information Center; DOE's Sandia National Laboratories; the U.S. Department of Agriculture's (USDA's) Albuquerque Forestry Sciences Laboratory; Department of Interior's (DOI's) Arid Lands Field Station, Seismological Laboratory, and

³² For a complete agency-by-agency breakdown of these R&D dollars, see Appendix C.

New Mexico District Office of Water Resources; and a Department of Veterans Affairs (DVA) R&D unit.

- The Space Vehicles Directorate is a unit of DOD's Air Force Research Laboratory. It is headquartered at Kirtland Air Force Base in New Mexico, with an additional site in Boston, Massachusetts. It develops technologies to control and exploit space. The primary research areas focus on the battlespace environment, protection of space assets, space vehicle control, space-based sensing, space vehicle technologies, and wargaming. This federal unit annually receives approximately \$149 million of federal R&D funds, only about 10 percent of which is spent on in-house R&D activities, and has about 295 civilian personnel, only a portion of whom are involved in R&D activities. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.
- The Directed Energy Directorate is a unit of DOD's Air Force Research Laboratory. It is responsible for the development of photonics and directed energy technologies for air and space applications. The main focus of this unit is on technologies related to the generation and propagation of high-power microwaves, lasers, precision adaptive optics, and remote target imaging and identification. This federal unit annually receives approximately \$88 million of federal R&D funds, only about 10 percent of which is spent on in-house R&D activities, and has about 408 civilian personnel, only a portion of whom are involved in R&D activities. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.
- The Southwestern Regional Office of the Defense Technical Information Center (DTIC) contributes to the R&D efforts by providing access to and facilitating the exchange of scientific and technical information. Specifically, DTIC concentrates on providing information on planned, ongoing, and completed DOD-related R&D to federal agencies and their contractors. This fed-

eral unit annually receives approximately \$150,000 of federal R&D funds and employs about two people.

- The Sandia National Laboratories are a federally funded research and development center (FFRDC) sponsored by DOE and operated by the Sandia Corporation, a subsidiary of Lockheed Martin. Most of the laboratories' activities focus on implementing the nation's nuclear weapons policies by conducting R&D on nuclear weapons, arms control, and weapon surety. Other R&D activities focus on the safe storage, processing, transport, and disposal of hazardous wastes (including radioactive waste), and increasing the efficiency and supply of energy. The laboratories maintain a small facility in Livermore, California, in addition to their large headquarters facility in Albuquerque. These federally owned and contractor-operated laboratories annually receive approximately \$1 billion of core funding, all of which is spent on specific R&D projects, and employ 6,600 people in Albuquerque and 890 people in Livermore, California. A portion of the laboratories' funds is spent on the maintenance and operation of R&D equipment and facilities.
- The Albuquerque Forestry Sciences Laboratory is a unit of the Rocky Mountain Research Station inside USDA's Forest Service. It conducts research on ecosystems and wildlife sustainability. Specific research activities of this lab include developing new methods and knowledge to restore damaged systems and recover sensitive and endangered species, maintaining the sustainability of grassland and riparian ecosystems in the Southwest, and research cultural heritage of Northern New Mexico. This federal R&D unit annually receives approximately \$1.5 million in federal R&D funds and has about 14 employees.
- The Arid Lands Field Station is a unit of the Mid-Continent Ecological Science Center inside DOI's U.S. Geological Survey (USGS). It is on the campus of the University of New Mexico. It conducts research on natural resource and wildlife issues in the Southwest and provides baseline inventory and survey information for federal lands, including national parks and

wildlife refuges. Specific research activities of this unit include species and population studies on southwestern amphibians, reptiles, birds, and mammals (especially bats). This federal R&D unit annually receives approximately \$202,000 of federal R&D funds and has about five FTEs.

- The Seismological Laboratory, a unit of DOI's USGS, develops, tests, and evaluates a variety of seismic instrumentation. It also installs and maintains a global network of seismograph stations, collecting and distributing the data produced by these stations. The instruments developed by this laboratory include seismograph instruments, such as strong-motion recorders; portable field equipment for recording explosions and aftershocks; test facilities, such as shaking tables; tsunami-warning systems for Alaska, Hawaii, and the Pacific; local telemetered seismograph networks; and digital data systems for global and regional networks. This federally owned and operated facility annually receives approximately \$4 million of federal R&D funds and has a staff of about 40 people.
- The New Mexico District Office of Water Resources is a unit of DOI's USGS. It oversees the R&D activities of USGS's National Water-Quality Assessment (NAWQA), Ground-Water Resources Assessment, Toxic Substances Hydrology, and Federal State Cooperatives programs. The NAWQA program conducts research on the nation's surface and groundwater resources to better understand the effect of pesticides, erosion, and bacterial contamination on water quality. The Ground-Water Resources Assessment program studies groundwater systems to develop models and simulations to better understand the workings of these systems. The Toxic Substances Hydrology program studies the behavior of toxic substances in hydrologic environments. These research activities investigate subsurface contamination at local releases and aquatic ecosystem contamination on a watershed and regional scale. The Federal State Cooperatives program studies the effects of agricultural chemicals, floods, droughts, and waste disposal on water supply and groundwater quality. This federal unit annually receives approximately \$1.4 million in federal R&D funds.

- While the principal focus of the New Mexico VA Health Care System Facility, the VA Medical Center in Albuquerque, is providing medical care to veterans, it is also the location of a number of research activities. In a recent year, this federally owned and operated facility was the site of 236 projects with total funding of approximately \$600,000. These R&D activities focus on a wide range of topics, including schizophrenia, magnetic resonance imaging (MRI), and cerebrovascular disorders. In addition, the center has joined with Los Alamos National Laboratory to pioneer the development and clinical application of the magnetoencephalography unit.

Las Cruces, New Mexico, is home to NASA's White Sands Test Facility, USDA's Jornada Experimental Range, and DOI's New Mexico Cooperative Fish and Wildlife Research Unit.

- White Sands Test Facility is part of NASA's Johnson Space Center in Houston, Texas. It conducts research on the properties and behavior of metallic and nonmetallic materials under aerospace conditions and evaluates the behavior of rocket propulsion systems under simulated space-vacuum conditions. The facility has extensive capabilities for creating space-simulated vacuum conditions for use in research and testing. As a result, it has also played a major role in developing the components and systems used in the Apollo, Skylab, Viking, and Space Shuttle Programs. This federal facility annually receives a total of approximately \$40 million and has a staff of about 550 people. As with the Johnson Space Center, only a portion of the facility's funding and staff are directly involved in R&D activities. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.
- The Jornada Experimental Range (JER) is a unit of USDA's ARS located on the campus of New Mexico State University. Its Range Management Research Laboratory conducts research on rangeland management, with an emphasis on understanding basic ecological processes in desert environments. Specific re-

search activities of this unit include determining the effects of stressors on ecosystem processes, developing new knowledge to enhance survival and dispersal of native plants used for remediation of degraded rangeland, identifying chemical attributes of shrubs that contribute to their landscape dominance, and creating innovative methods that manipulate livestock foraging and associated behaviors. This federal R&D unit, in combination with USDA's nearby Southwestern Cotton Ginning Research Laboratory described below, annually receives approximately \$2.3 million of federal R&D funds and has about 23 FTEs.

- The New Mexico Cooperative Fish and Wildlife Research Unit is part of DOI's USGS. It is on the campus of New Mexico State University. It conducts research on avian ecology with emphasis on colonial waterbirds and neotropical migrants, large-scale ecological databases for geographic information system (GIS) application to landscape-level conservation planning in the southwest, and fish physiology with emphasis on impacts of environmental stressors. Specific research activities of this unit include studying habitat suitability for Aplomado falcons; fires management; species at risk; ecological context at Fort Bliss; developing biochemical, physiological, and organismal indices of contaminant effects in aquatic ecosystems (particularly mercury); and other national cooperative research and education programs addressing a variety of questions involving fish, other wildlife, and their habitats. This federal R&D unit annually receives approximately \$229,000 of federal R&D funds and has about two FTEs.

Los Alamos, New Mexico, is home to DOE's Los Alamos National Laboratory and DOI's Jemez Mountains Field Station.

- The Los Alamos National Laboratory is an FFRDC operated for DOE by the University of California. The laboratory's central research focus has been and continues to be on nuclear weapons to help ensure the viability of the nation's nuclear deterrent.

Other R&D activities include high-performance computing; arms control, verification, and safeguards; strategic defense; conventional defense technology; nuclear and nonnuclear energy technology; environmental science and technology; international economic development; basic defense and energy-related disciplines; and the human genome. This federally owned and contractor-operated laboratory annually receives approximately \$1.2 billion of core funding and conducts an estimated \$531 million of specific R&D projects. The laboratory has about 10,000 employees. A substantial portion of the laboratory's funds is spent on the maintenance and operation of R&D equipment and facilities.

- The Jemez Mountains Field Station is a unit of the Mid-Continent Ecological Science Center inside DOI's USGS. It conducts research to develop and maintain ecological research and monitoring information needed to support management actions in the Jemez Mountains region, most especially Bandelier National Monument. Specific research activities of this unit include determining ecological conditions and restoration techniques in piñon-juniper woodlands, studying landscape-level fire histories and effects of fire across ecological gradients in the Jemez and Sangre de Cristo Mountains, and conducting environmental history research on the patterns and causes of ecological changes. This federal R&D unit annually receives approximately \$195,000 of federal R&D funds and has about two FTEs.

Mesilla Park, New Mexico, is home to USDA's Southwestern Cotton Ginning Research Laboratory.

- The Southwestern Cotton Ginning Research Laboratory is a unit of ARS's Jornada Experimental Range inside USDA. It conducts research to develop improved methods for ginning cotton in the irrigated west. The laboratory's research programs in saw and roller ginning cover all major stages of the ginning process, from seed-cotton conditioning and cleaning to ginning and lint

cleaning. Specific research activities of this lab include increasing lint production and its value, preserving the quality of the cotton fiber, and reducing or eliminating the air pollution associated with cotton ginning. The funding and staffing figures for this federal R&D unit are included in the Jornada Experimental Range description.

Socorro, New Mexico, is home to a portion of NSF's National Radio Astronomy Observatory.

- The National Radio Astronomy Observatory (NRAO) is an FFRDC sponsored by the National Science Foundation and operated by Associated Universities, Inc. It is headquartered in Charlottesville, Virginia, with observing sites in Green Bank, West Virginia; Tucson, Arizona; and Socorro, New Mexico. NRAO was established to ensure that all qualified scientists have access to radio astronomy facilities. NRAO's Very Large Array (VLA) and the Very Large Baseline Array (VLBA) are located west of Socorro, New Mexico. The VLA consists of 27 antennas arranged in a huge Y pattern that produce images of the radio sky at a wide range of frequencies and resolutions. The VLBA uses 10 parabolic antennas located across the continental United States and on Mauna Kea, Hawaii, and St. Croix in the U.S. Virgin Islands. Both VLA and VLBA are designed to produce images of celestial bodies. Both instruments provide valuable new capabilities to the scientific community. For example, VLA has been used to observe objects as near as the Moon and near-Earth asteroids, as far away as quasars at the edge of the observable universe, and nearly everything in between. Each year the four sites of this federally owned and consortium-operated unit collectively receive approximately \$44 million of federal R&D funds to conduct operations. The Socorro site alone annually receives approximately \$14 million of federal R&D funds and has about 200 employees. A portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

Sunspot, New Mexico, is home to a portion of NSF's National Optical Astronomy Observatories.

- The National Optical Astronomy Observatories (NOAO) is an FFRDC sponsored by the NSF and operated by the Association of Universities for Research in Astronomy, Inc. Headquartered in Tucson, NOAO consists of an observatory on Kitt Peak, southwest of Tucson; an observatory north of Santiago, Chile, on the western slopes of the Andes; and a solar observatory co-located on Kitt Peak and Sunspot, New Mexico. Together, NOAO's observatories constitute the national center for ground-based optical and infrared astronomy and solar physics. The collective parts of this federal federally owned and consortium-operated unit annually receive approximately \$35 million of federal R&D funds and have about 300 employees. Only a small portion of these funds are spent in New Mexico.

White Sands, New Mexico, is home to DOD's White Sands Missile Range.

- White Sands Missile Range is a unit of DOD. It is a multiservice test range that supports the development of missiles for the Army, Navy, Air Force, NASA, other government agencies, and private industry. It works with all aspects of missiles, testing both developmental systems and production units to ensure continuing quality. The range is under the operational control of the U.S. Army Test and Evaluation Command at Aberdeen Proving Ground, Maryland. This federal facility annually receives about \$166 million of federal R&D funds for in-house R&D activities and has about 1,855 civilian personnel, most of whom are directly involved in R&D activities. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

FEDERAL R&D GRANTS TO NEW MEXICO ENTITIES

Every major institution of higher education in New Mexico is the recipient of significant federal R&D dollars each year through grants made by federal agencies to faculty, graduate students, and research centers. The vast majority of the R&D grants are made by HHS, DOD, DOE, and NSF to individual faculty members and therefore ultimately inure to the benefit of such institutions as the University of New Mexico (UNM), New Mexico State University (NMSU), New Mexico Highlands University (NMHU), and the New Mexico Institute of Mining and Technology (NM Tech). The table below shows the total number of R&D grants active in FY 1998, highlighting those made by HHS, DOD, DOE, and NSF to parties at the various institutions and estimates of the total dollars transferred to them in FY 1998 pursuant to the terms of these grants. Most of the grants in the “Other Agencies” category going to UNM and NMHU are from NASA, while those going to NMSU are from USDA.

Table 32.1 – Sources of Federal R&D Grants to Higher Education in New Mexico

Institution	HHS		DOD		DOE		NSF		Other Agencies		Total	
	Amount	#	Amount	#	Amount	#	Amount	#	Amount	#	Amount	#
UNM	\$27M	115	\$9M	23	\$5M	21	\$5M	118	\$4M	31	\$51M	308
NMSU	\$2M	9	\$1M	10	\$1M	8	\$3M	44	\$5M	155	\$11M	226
NMHU	\$1M	1	\$1M	5	\$2M	2	<\$1M	2	\$1M	6	\$5M	16
NM Tech	<\$1M	1	<\$1M	4	<\$1M	6	\$1M	33	<\$1M	8	\$2M	52
Other	<\$1M	6	<\$1M	1	<\$1M	1	<\$1M	2	<\$1M	6	\$1M	16
Total	\$29M	132	\$11M	43	\$9M	38	\$9M	199	\$11M	206	\$70M	618

These activities are particularly significant because they fund much of the “basic research” so critical to expanding our knowledge and understanding of fundamental scientific phenomena. In addition, these funds account for a portion of the dollars available each year to various academic departments within these institutions. Included among these grants are ones from NASA, NSF, and DOD supporting the

Manuel Lujan, Jr., Space Tele-Engineering Program at NMSU, a telecommunications unit that conducts research in advanced communication systems and telemetering for deep space and the Space Station Freedom. Another grant from NASA supports the Earth Data Analysis Center (EDAC), previously known as the Technology Applications Center, at UNM. EDAC's mission is devoted entirely to researching, developing, and transferring remote sensing technology to observe Earth from space.

Several other nonacademic institutions in New Mexico also receive a significant amount of federal R&D grants each year. Foremost among these institutions that received R&D grants in FY 1998 are the Lovelace Respiratory Research Institute in Albuquerque (\$7 million), Los Alamos National Laboratory/University of California (\$6 million), the Santa Fe Institute of Science (\$2 million), the Coulston Foundation at Holloman Air Force Base (\$1 million), TPL, Inc., in Albuquerque (\$1 million), and New Mexico State Hospital in Las Vegas, New Mexico (\$1 million).

Scattered among these grants, as well as among the contracts discussed in the section below, are small business innovative research (SBIR) awards. These are special awards made by the SBIR programs supported by the 10 federal agencies with annual budgets for extramural R&D of more than \$100 million. In a recent year, small businesses in New Mexico received 77 SBIR awards totaling \$17 million. Examples include a \$700,000 award from the Air Force to Science and Engineering Associates, Inc., in Albuquerque to develop a fieldable laser diode wound stabilization system and a \$600,000 award from NASA to Environmental Technology and Education in Albuquerque for work on a high-performance environmentally safe refrigerant.

Also included among these grants are formula grants from federal agencies. Formula grants differ from the much more common project grants in that the money transmitted through formula grants is allocated to a state or one of its subdivisions in accordance with a distribution formula prescribed by law or regulation. Among the formula grants benefiting New Mexico are ones valued at more than \$1.7 million from USDA's Cooperative State Research, Education, and Extension Service (CSREES) to State Agricultural Experiment Stations,

forestry schools, and veterinary colleges for the support of research in agriculture, forestry, and animal health and disease. Similarly, a modest formula grant goes from DOI's USGS to the Water Resources Research Institute in New Mexico every year to foster research in water and water-related problems.

OTHER FEDERAL R&D ACTIVITIES IN NEW MEXICO

Several entities in New Mexico also receive notable sums in the form of contracts or cooperative agreements from federal agencies for specific R&D efforts. The majority of these funds go to Applied Research Associates, which in FY 1998 received close to \$34 million in DOD contracts for R&D work in such areas as fire technology research, environmental science, and weapons effect. In addition, Boeing Company (\$18 million), BDM International (\$11 million), Voss Scientific (\$10 million), Maxwell Technologies (\$8 million), and Kaman Sciences Corp. (\$6 million) received large R&D contracts from federal agencies in FY 1998. UNM (\$13 million) and NM Tech (\$4 million) also received contracts from various federal agencies to conduct R&D for the federal government. Although these amounts are notable, they do not come close to eclipsing the funds that these institutions receive from federal R&D grants.

A total of \$16 million of federal R&D dollars in the form of cooperative agreements was also received in FY 1998 by entities in New Mexico. One of the largest of these cooperative agreements (\$2 million) came from DOE to the National Center for Genome Resources in Santa Fe for the establishment and operation of a genome database. Other federal agencies awarding cooperative agreements to New Mexico-based entities include NSF and DOC.

