Chapter 31
Federal Research and Development in New Jersey

- Approximately $1.5 billion of federal R&D funds are spent each year in New Jersey.
- New Jersey ranks 14th among the 50 states, District of Columbia, and Puerto Rico in terms of the amount of federal R&D dollars received annually.
- Approximately 10 percent of all federal funds spent in New Jersey 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.

Figure 31.1 – Sources of Federal R&D Dollars Spent in New Jersey (Total Federal R&D ~$1.5 billion)
BACKGROUND

In recent years, the federal government has spent in the neighborhood of $1.5 billion annually in New Jersey on research and development (R&D) activities. On average, federal R&D dollars account for approximately 10 percent of all federal funds spent in New Jersey 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 provide funding for R&D activities in New Jersey. Foremost among these agencies is the Department of Defense (DOD), which accounts for about 60 percent of all federal R&D dollars spent in the state. The National Aeronautics and Space Administration (NASA) and the Departments of Energy (DOE), Health and Human Services (HHS), Transportation (DOT), and the National Science Foundation (NSF), account for an additional 8, 8, 7, 7, and 4 percent of the federal R&D dollars spent in New Jersey, respectively. The remaining federal R&D dollars come collectively from the Departments of Agriculture (USDA) and Commerce (DOC) and several other federal agencies.31

All federal R&D dollars spent in New Jersey 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 located in the state. The following is an overview of what becomes of these federal R&D dollars once they arrive in New Jersey.

FEDERAL R&D UNITS IN NEW JERSEY
Atlantic City, New Jersey, is home to DOT’s William J. Hughes Technical Center.

- The William J. Hughes Technical Center is a unit inside DOT’s Federal Aviation Administration (FAA). The center maintains and operates the FAA’s laboratories that conduct R&D to reduce the number of airplane accidents, improve airspace design, in-

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31 For a complete agency-by-agency breakdown of these R&D dollars, see Appendix C.
crease airport capacity, and reduce airplane delays caused by weather and system outages. The center also develops and tests aviation software systems and equipment and evaluates existing systems. This federal unit annually receives approximately $11 million in federal R&D funds and has about 1,500 employees, about 15 percent of whom are directly involved in R&D activities.

East Orange, New Jersey, is home to a Department of Veterans Affairs (DVA) R&D unit.

- While the principal focus of the East Orange campus of the VA New Jersey Health Care System facility, the VA Medical Center in East Orange, 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 351 projects with total funding of approximately $2.3 million. These R&D activities focus on a wide range of topics, including drug therapy, neoplasms, radiotherapy, HIV, schizophrenia, and substance dependence.

Eatontown, New Jersey, is home to the headquarters and three directorates of DOD's Army Communications-Electronics Command Research, Development, and Engineering Center, a small portion of DOD's Command, Control, Communications, and Intelligence Federally Funded Research and Development Center (FFRDC), and a unit of the Army Research Laboratory.

- The Headquarters of the Army’s Communications-Electronics Command (CECOM) Research, Development, and Engineering Center is a unit of DOD. It oversees and coordinates all the R&D activities of CECOM, which focus on information technologies and integrated systems for U.S. warfighters. This federal unit annually receives about $23 million of federal R&D funds, approximately $7.3 million of which is spent on in-house activities, and has about 91 FTEs, only a portion of whom are directly involved in R&D activities.
• The Space and Terrestrial Communications Directorate is a unit of the Army’s Communications-Electronics Command Research, Development, and Engineering Center inside DOD. The center conducts R&D on information technologies and integrated systems for U.S. warfighters. It is headquartered in Fort Monmouth, New Jersey, with an additional location in Fort Belvoir, Virginia. The Space and Terrestrial Communications Directorate R&D activities include developing and integrating secure seamless tactical communications for the digitized battlefield, providing technical support to program executive officers and project managers for communications systems development and fielding, and acting as a focal point for space-dependent/space-based communications systems. This federal unit annually receives approximately $48.6 million of federal R&D funds, approximately $15.3 million of which is spent on in-house activities, and has about 272 FTEs, only a portion of whom are directly involved in R&D activities. A portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

• The Intelligence and Information Warfare Directorate is a unit of the Army’s Communications-Electronics Command Research, Development, and Engineering Center inside DOD. The center conducts R&D on information technologies and integrated systems for U.S. warfighters. It is headquartered in Fort Monmouth, with an additional location in Fort Belvoir, Virginia. The Intelligence and Information Warfare Directorate R&D activities include development, production, and fielding of specified equipment in support of Army and national intelligence requirements and law enforcement agencies. This federal unit annually receives about $33.9 million of federal R&D funds, approximately $6.4 million of which is spent on in-house activities, and has about 201 FTEs, only a portion of whom are directly involved in R&D activities. A portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.
• The Command and Control Directorate is a unit of the Army’s Communications-Electronics Command Research, Development, and Engineering Center inside DOD. This unit serves as the lead directorate within the CECOM Research, Development and Engineering Center. The center conducts R&D on information technologies and integrated systems for U.S. warfighters. It is headquartered in Fort Monmouth, with an additional location in Fort Belvoir, Virginia. The Command and Control Directorate develops, integrates, and demonstrates advanced command and control systems and related enabling technologies. Research activities include prototype development and development of battlefield visualization, navigation, power generation, and environmental control technologies. The research areas extend to a variety of aircraft, shelter, vehicular, and soldier platforms. This federal unit annually receives about $55.5 million of federal R&D funds, approximately $16 million of which is spent in-house, and has about 385 FTEs, only a portion of whom are directly involved in R&D activities. A portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

• The Command, Control, Communications, and Intelligence Federally Funded Research and Development Center (FFRDC) is sponsored by the Office of the Secretary of Defense and operated by the MITRE Corporation. It conducts R&D on command, control, communications, and intelligence systems for DOD and the intelligence community. The center has three divisions, the Center for Air Force Integrated Intelligence Systems, the Center for Integrated Intelligence Systems, and the C3 Center. This latter division is in McLean, Virginia. The first division provides the Air Force, most especially the Electronic Systems Center, with comprehensive command and control knowledge, expertise, and experience. The R&D of the second division focuses on developing concepts for intelligence activities, enhancing architectures for information management, and engineering intelligence systems. The combined divisions of this federally owned and contractor-operated facility annually
receive about $180 million of federal R&D funds and employ approximately 1,450 people. About 100 of these employees are at MITRE’s Fort Monmouth facility.

- The Fort Monmouth Facility is a unit of DOD’s Army Research Laboratory. The laboratory is headquartered in Adelphi, Maryland, with additional sites in Aberdeen, Maryland; White Sands, New Mexico; Cleveland, Ohio; Hampton, Virginia; and Atlanta, Georgia. This specific unit conducts research on information warfare. This federal unit annually receives about $3.7 million of federal R&D funds, approximately $2.6 million of which is spent on in-house activities, and has about 18 civilians personnel.

Highlands, New Jersey, is home to the DOC’s Sandy Hook Laboratory.

- The Sandy Hook Laboratory, also known as the James J. Howard Marine Science Laboratory, is a unit of the Northeast Fisheries Science Center inside DOC's NOAA. It conducts research in ecology with subdivisions in fishery ecology, environmental chemistry, and aquaculture. This federal unit annually receives approximately $3.7 million of federal R&D funds and has about 54 FTEs, only a portion of whom are involved in R&D activities.

Lakehurst, New Jersey, is home to DOD’s Naval Air Warfare Center Aircraft Division at Lakehurst.

- The Naval Air Warfare Center Aircraft Division at Lakehurst is a unit of DOD. The center is headquartered in Patuxent, Maryland. This unit designs, evaluates, and engineers the aircraft platform interfaces that enable aircraft to operate from aircraft carriers, helicopters from aviation ships, and Marine aircraft from expeditionary airfields. The R&D activities of the center focus on electromagnetic aircraft launch systems, virtual imaging systems for approach and landing, infrared aircraft tracking, and aircraft recognition systems. This federal unit annually receives approximately $71 million of federal R&D funds and has about 1,800 civilian personnel, only a portion of whom are
FEDERAL RESEARCH AND DEVELOPMENT IN NEW JERSEY

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.

Picatinny, New Jersey, is home to DOD’s Armament Research, Development, and Engineering Center.

• The Armament Research, Development, and Engineering Center is a unit of DOD. It is the research center within the U.S. Army Tank-Automotive and Armaments Command responsible for armaments. It is headquartered in Picatinny with subordinate research activities in Rock Island, Illinois; Watervliet, New York; and Aberdeen, Maryland. It is the center for integrating complex armament technologies into guns, ammunition, and fire control systems through research, development, acquisition, and sustainment. The center conducts research into direct and indirect fire lethality, rapid force projection initiatives, rapid digitized fire missions, innovative weapon concepts, sustainment and survivability, enabling technologies, such environmental technologies as “green” ammunition, and dual-use technologies. This federal unit annually receives approximately $131 million of federal R&D funds and has about 2,704 civilian personnel, only a portion of whom are directly involved in R&D activities. A portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

Princeton, New Jersey, is home to a unit of DOD’s Institute for Defense Analyses Communications and Computing FFRDC, DOE’s Princeton Plasma Physics Laboratory, and DOC’s Geophysical Fluid Dynamics Laboratory.

• The Center for Communications Research is one of three units constituting the Institute for Defense Analyses Communications and Computing FFRDC. This FFRDC, which is nominally headquartered in Alexandria, Virginia, is sponsored by the National Security Agency and operated by the Institute for Defense Analyses (IDA). The Center for Communications Research in Princeton works closely with its sister unit in La Jolla, Califor-
nia, to conduct mathematical research to support cryptography and cryptoanalysis. These two units also conduct R&D on speech and special signals-processing techniques. Together with the Center for Computing Sciences in Bowie, Maryland, the three units of this federally owned and contractor-operated R&D center annually receive approximately $35 million of core funding, all of which is federal R&D funds, and have about 150 employees. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

• The Princeton Plasma Physics Laboratory is an FFRDC sponsored by DOE and operated by Princeton University. It conducts magnetic confinement experiments utilizing the tokamak approach. The laboratory’s researchers investigate advanced fusion devices, such as the National Spherical Torus Experiment, and apply knowledge gained in fusion research to a number of theoretical and experimental areas, including materials science, solar physics, chemistry, and manufacturing. This federally owned and contractor-operated laboratory annually receives approximately $55 million of core funding and conducts an estimated $47 million of specific R&D projects. The laboratory has about 400 employees. A substantial portion of these funds is spent on the maintenance and operation of R&D equipment and facilities.

• The Geophysical Fluid Dynamics Laboratory is a unit of DOC’s National Oceanic and Atmospheric Administration (NOAA). It conducts research to expand the scientific understanding of the physical processes that govern the behavior of the atmosphere and the oceans as complex fluid systems. The laboratory conducts research on the predictability of weather patterns, the stability of regional and global climate, and the interaction between the atmosphere and the oceans. This federal unit annually receives approximately $13.6 million of federal R&D funds and has about 84 FTEs.
West Trenton, New Jersey, is home to the Department of Interior’s (DOI’s) New Jersey District Office of Water Resources.

- The New Jersey District Office of Water Resources is a unit of DOI’s U.S. Geological Survey (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 $2.7 million in federal R&D funds.

Federal R&D Grants to New Jersey Entities

Every major institution of higher education in New Jersey 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, NSF, and DOD to individual faculty members and therefore ultimately inure to the benefit of such institutions as Rutgers University, Princeton University, the University of Medicine and Dentistry of New Jersey (UMDNJ), New Jersey Institute of Technology (NJIT), and Stevens Institute of Technology (SIT). The table below shows the total number of R&D grants active in FY 1998, highlighting those made by HHS,
NSF, and DOD 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. Among the grants in the “Other Agencies” category going to Rutgers are $6 million from USDA and close to $2 million each from DOC, DOE, and NASA. The comparable grants going to Princeton include $7 million from DOE and $3 million from NASA. Both UMDNJ and NJIT receive most of the grants included in this category from the Environmental Protection Agency (EPA).

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Table 31.1 – Sources of Federal R&D Grants to Higher Education in New Jersey

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 substantial portion of the dollars available each year to various academic departments within these institutions, such as UMDNJ’s Robert Wood Johnson Medical School.

Several other nonacademic institutions in New Jersey also receive a significant amount of federal R&D grants each year. Foremost among the institutions that received R&D grants in FY 1998 are the Center for Molecular Medicine and Immunology (now Garden State Cancer Center) in Belleville ($6 million); the Institute for Advanced Study in Princeton ($6 million); the New Jersey State Department of Health and Senior Services in Trenton ($5 million); Mathematica Policy Research, Inc., in Princeton ($5 million); and the Coriell Institute for Medical Research in Camden ($3 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 Jersey received 119 SBIR awards totaling $29 million. Examples include a $1 million award from DOD (Ballistic Missile Defense Organization) to Skion Corp. in Hoboken to develop a superhigh-brightness cold cathode field emitter for flat panel display applications and a $200,000 award from the U.S. Department of Agriculture (USDA) to Continuum Dynamics, Inc., in Princeton for work on smart helicopter buckets for fire fighting.

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 Jersey are ones valued at more than $2.7 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 the USGS inside DOI to the Water Resources Research Institute in New Jersey every year to foster research in water and water-related problems.

**Other Federal R&D Activities in New Jersey**

Several entities in New Jersey also receive notable sums in the form of contracts or cooperative agreements from federal agencies for specific R&D efforts. By far the majority of these funds go to Lockheed Martin Corporation for work that includes development of communications and experimental spacecraft for NASA and support for the DOD Roving Sands exercise (a total of $141 million in FY 1998). In addition, Computer Sciences Corporation ($33 million), Sarnoff Corporation ($32 million), MacGregor Inc. ($17 million), and ITT In-
Industries ($16 million) received large R&D contracts from federal agencies in FY 1998. Princeton University ($5 million), UMDNJ ($4 million), Rutgers University ($2 million), and SIT ($2 million), also received contracts from various federal agencies in FY 1998 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 $20 million of federal R&D dollars in the form of cooperative agreements was also received in FY 1998 by entities in New Jersey. The largest of these cooperative agreements ($4 million) came from DOE to UMDNJ. The next-largest cooperative agreement ($3 million) came from NSF to Princeton University to support the Borexino solar neutrino experiment. Other federal agencies awarding cooperative agreements to New Jersey–based entities include NSF, DOC, and DOD. Among these latter cooperative agreements are awards supporting one of NSF’s Science and Technology Centers—the Center for Discrete Mathematics and Theoretical Computer Science at Rutgers University. In addition, New Jersey is home to one of the NSF’s Materials Research Science and Engineering Centers—the Center for Complex Materials at Princeton University.