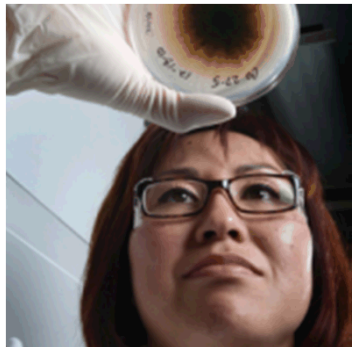
February 27, 2016

SAND2016-1661PE

Exceptional service in the national interest

Sandia National Laboratories



Connections: Sandia National Labs and New Mexico Tech

New Mexico Tech Research Opportunities Workshop

Jim Chavez
Vice President
Campus Executive

Paul Shoemaker
Senior Manager
Deputy Campus Executive

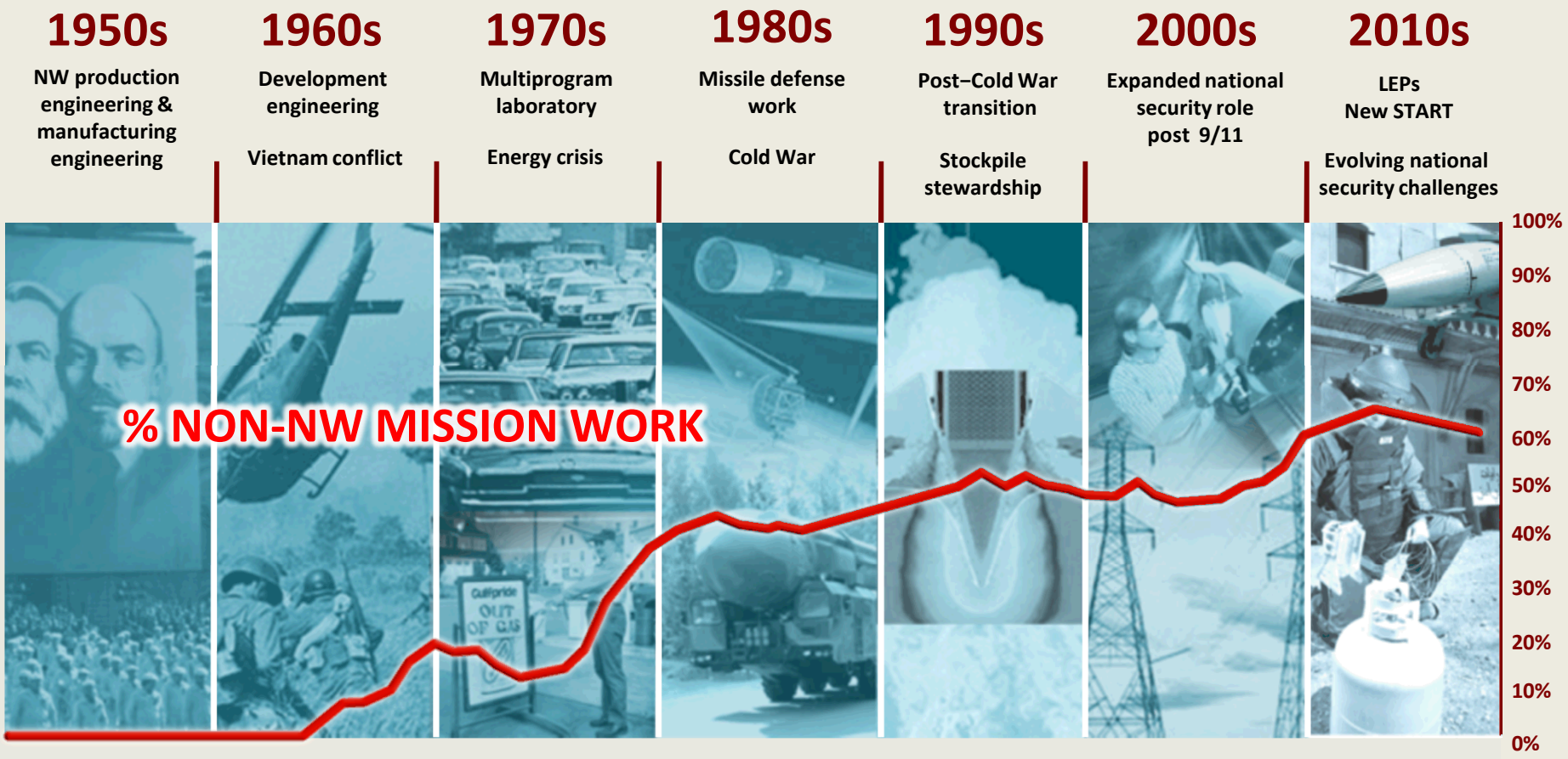
Jerry Stofleth
Distinguished Member of the Technical Staff

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

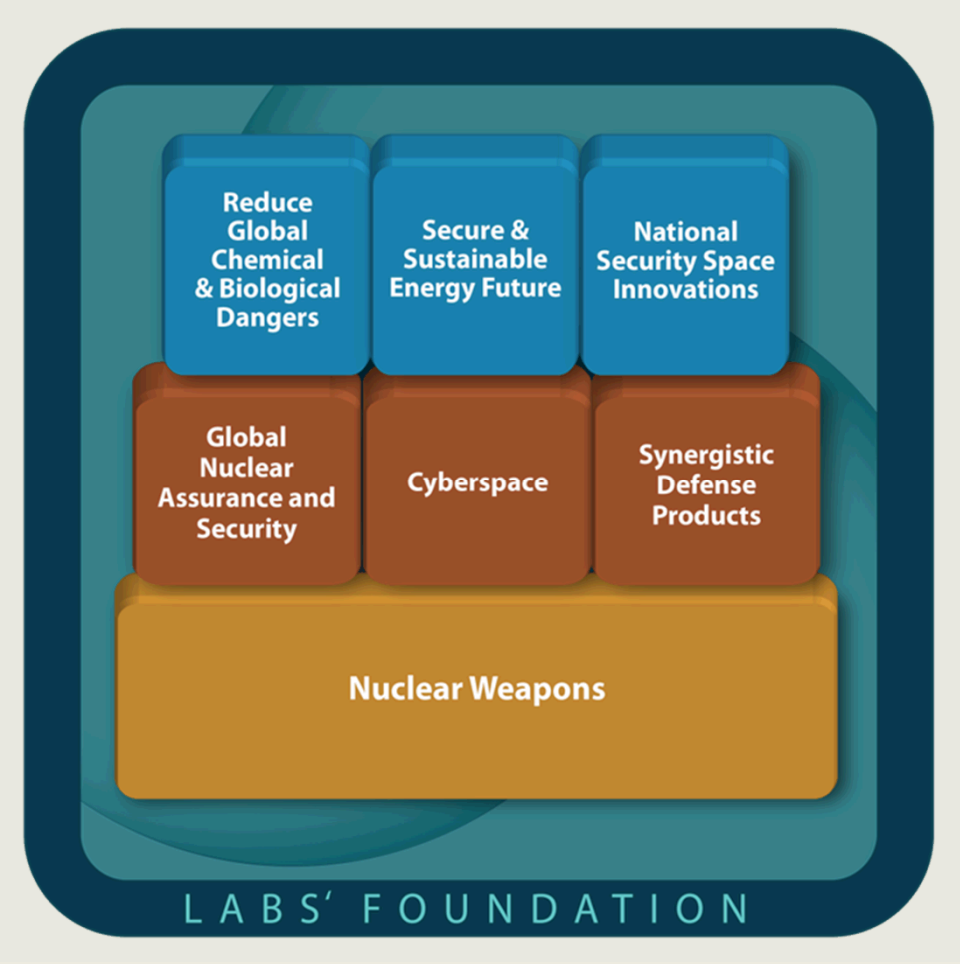
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND No. 2016-XXXXP

Sandia's mission work reflects national security challenges



Sandia's national security missions

- **Top row:** Critical to our national security, these three mission areas leverage, enhance, and advance our capabilities.
- **Middle row:** Strongly interdependent with NW, these three mission areas are essential to sustaining Sandia's ability to fulfill its NW core mission.
- **Bottom row:** Our core mission, nuclear weapons (NW), is enabled by a strong scientific and engineering foundation.



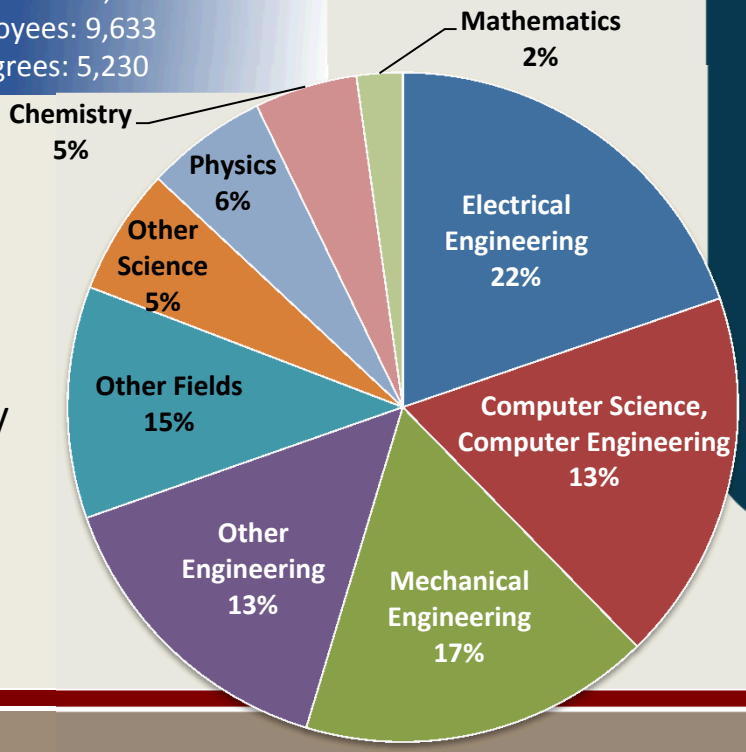
Sandia's people

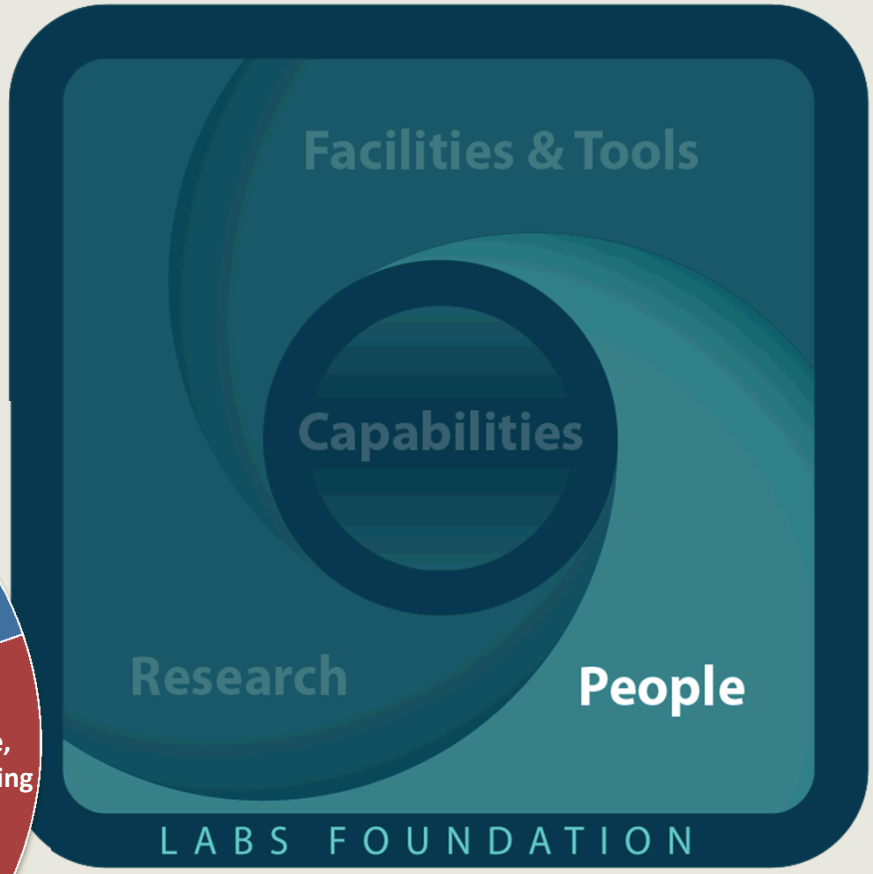
Exceptional talent

- Highly educated workforce
- Strategically managed workforce of diverse skills and competencies
- Modern business practices and operations in support of our missions

- On-site workforce: 12,251
- Regular employees: 9,633
- Advanced degrees: 5,230

R&D staff (4,862) by discipline





Sandia's facilities and tools

Enable differentiated scientific and engineering test and discovery

Sandia has facilities in multiple locations: Albuquerque, NM; Livermore, CA; Carlsbad, NM; Tonopah, NV; Kauai, HI; Amarillo, TX.

Example Facilities and Tools

- Major Environmental Test Facilities
- Microsystems and Engineering Sciences Applications (MESA)
- High-Performance Computing
- Explosive Components Facility
- Weapons Evaluations Test Laboratory (WETL)
- Pulsed-Power Facility
- Center for Integrated Nanotechnologies (CINT)
- Combustion Research Facility (CRF)
- Ion Beam Laboratory
- . . .

Sandia's research

Fundamental to the success of Sandia's national security missions

- Sandia's management framework stimulates innovation and ensures quality in our differentiating products

- Disciplined-based Research Foundations
  - Bioscience
  - Computing & Information Science
  - Engineering Science
  - Geoscience
  - Materials Science
  - Nanodevices & Microsystems
  - Radiation Effects & High Energy Density Science

- Multidisciplinary Research Challenges
  - Detection at the limit
  - Beyond Moore computing
  - Cyber resiliency
  - Data science
  - Trusted systems and communications
  - Power on demand
  - Resiliency in complex systems
  - . . .

- R&D Investments
  - Internal Laboratory-directed R&D
  - Customer-funded R&D

Leveraging core capabilities to solve 21st century national security challenges

- High-reliability engineering
- Sensors and sensing systems
- Cyber technology
- Reverse engineering
- Pathfinders
- Modeling & simulation and experiment
- Natural and engineered materials
- Micro & nano electronics and systems
- Safety, risk, and vulnerability analysis

Sandia's sites

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Kauai, Hawaii

Waste Isolation Pilot Plant, Carlsbad, New Mexico

Pantex Plant, Amarillo, Texas

Tonopah, Nevada

Historic Intersections

Sandia and New Mexico Tech have worked together over many years

- Petroleum engineering, geology, hydrology (collaborations on WIPP – site selection efforts led by George Griswold, who we "borrowed" from Tech)
- Energetic materials testing, development, detection
- Training of Sandia nuclear weapons developers (Weapon Intern Program)

News Releases

Sandia National Laboratories

FOR IMMEDIATE RELEASE
December 10, 2001

Sandia signs two agreements with New Mexico Tech

ALBUQUERQUE, N.M. — In a move to accredit the Weapon Intern Program and advance the state of the art of manufacturing technologies at the Department of Energy's Sandia National Laboratories, officials from Sandia and New Mexico Institute of Mining and Technology will sign two new agreements Tuesday, Dec. 11.

One agreement will establish a master's degree program in engineering mechanics with a specialty in explosive engineering. The degree program was initiated for participants in Sandia's Weapon Intern Program.

The Dec. 11 signing ceremonies will be held at 9 a.m. at the Sandia Cooperative Monitoring Center located just outside the Eubank gate entrance to Kirtland Air Force Base.

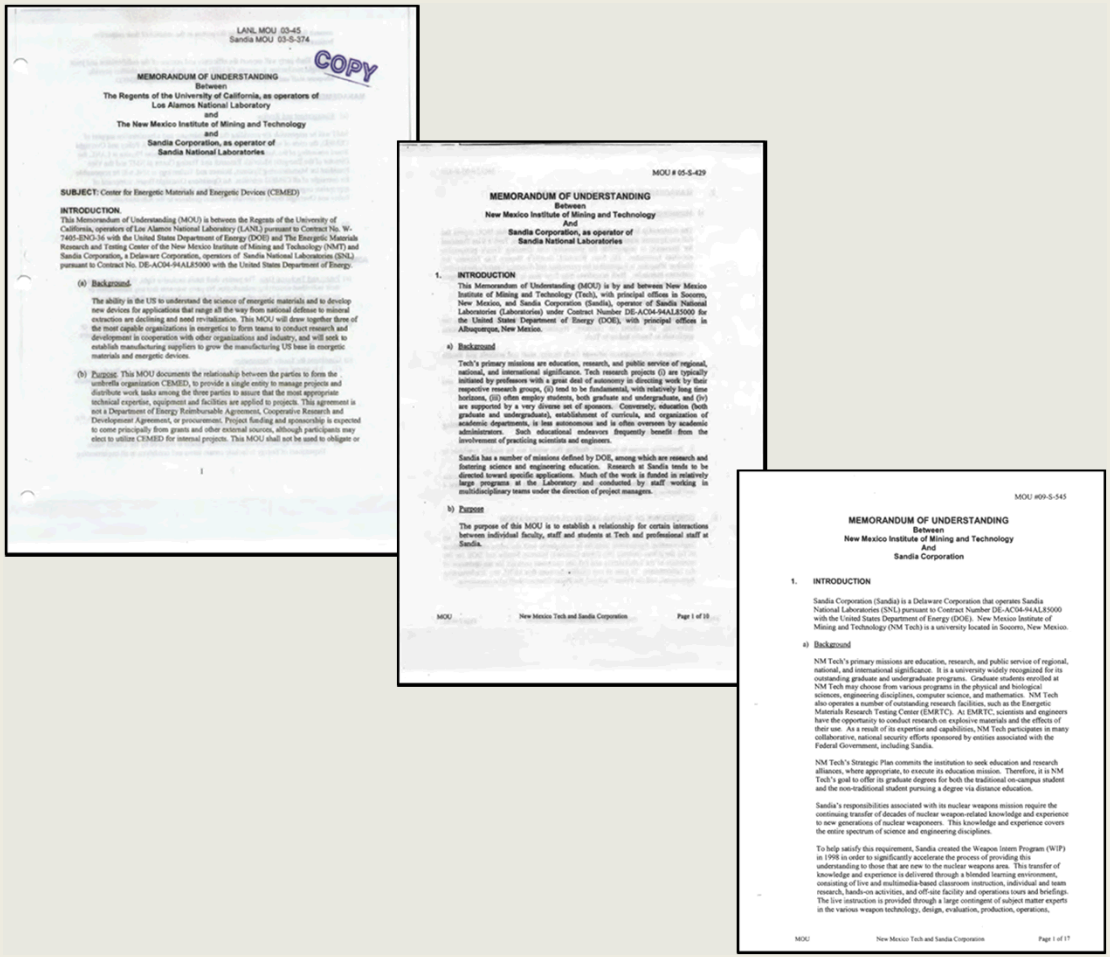
The other agreement allows the university to do new research and development in areas related to power sources manufacturing.

Signing the Weapon Intern Program agreement will be Joan Woodard, Sandia executive vice president, and Dan Lopez, president of New Mexico Tech.

Signing the power sources agreement will be Lenny Martinez, Sandia vice president for manufacturing systems, science and technology; Robert Bickes, manager of Sandia's Power Source Components Department; John Meason, director of the New Mexico Tech's Energetic Materials Research and Testing Center; and President Lopez.

Memoranda of Understanding

There have been at least four MOU's between Sandia and Tech



LANL MOU 03-45
Sandia MOU 03-S-374

COPY

MEMORANDUM OF UNDERSTANDING
Between
The Regents of the University of California, as operators of
Los Alamos National Laboratory
and
The New Mexico Institute of Mining and Technology
and
Sandia Corporation, as operator of
Sandia National Laboratories

SUBJECT: Center for Energetic Materials and Energetic Devices (CEMED)

INTRODUCTION.
This Memorandum of Understanding (MOU) is between the Regents of the University of California, operators of Los Alamos National Laboratory (LANL) pursuant to Contract No. W-7405-ENG-36 with the United States Department of Energy (DOE) and The Energetic Materials Research and Testing Center of the New Mexico Institute of Mining and Technology (NMT) and Sandia Corporation, a Delaware Corporation, operators of Sandia National Laboratories (SNL) pursuant to Contract No. DE-AC04-94AL85000 with the United States Department of Energy.

(a) Background.

The ability in the US to understand the science of energetic materials and to develop new devices for applications that range all the way from national defense to mineral extraction are declining and need revitalization. This MOU will draw together three of the most capable organizations in energetics to form teams to conduct research and development in cooperation with other organizations and industry, and will seek to establish manufacturing suppliers to grow the manufacturing US base in energetic materials and energetic devices.

(b) Purpose. This MOU documents the relationship between the parties to form the umbrella organization CEMED, to provide a single entity to manage projects and distribute work tasks among the three parties to assure that the most appropriate technical expertise, equipment and facilities are applied to projects. This agreement is not a Department of Energy Reimbursable Agreement, Cooperative Research and Development Agreement, or procurement. Project funding and sponsorship is expected to come principally from grants and other external sources, although participants may elect to utilize CEMED for internal projects. This MOU shall not be used to obligate or

MOU # 05-S-429

MEMORANDUM OF UNDERSTANDING
Between
New Mexico Institute of Mining and Technology
And
Sandia Corporation, as operator of
Sandia National Laboratories

1. INTRODUCTION
This Memorandum of Understanding (MOU) is by and between New Mexico Institute of Mining and Technology (Tech), with principal offices in Socorro, New Mexico, and Sandia Corporation (Sandia), operator of Sandia National Laboratories (Laboratories) under Contract Number DE-AC04-94AL85000 for the United States Department of Energy (DOE), with principal offices in Albuquerque, New Mexico.

a) Background

Tech's primary missions are education, research, and public service of regional, national, and international significance. Tech research projects (i) are typically initiated by professors with a great deal of autonomy in directing work by their respective research groups, (ii) tend to be fundamental, with relatively long time horizons, (iii) often employ students, both graduate and undergraduate, and (iv) are supported by a very diverse set of sponsors. Conversely, education (both graduate and undergraduate), establishment of curricula, and organization of academic departments, is less autonomous and is often overseen by academic administrators. Such educational endeavors frequently benefit from the involvement of practicing scientists and engineers.

Sandia has a number of missions defined by DOE, among which are research and fostering science and engineering education. Research at Sandia tends to be directed toward specific applications. Much of the work is funded in relatively large programs at the Laboratory and conducted by staff working in multidisciplinary teams under the direction of project managers.

b) Purpose

The purpose of this MOU is to establish a relationship for certain interactions between individual faculty, staff and students at Tech and professional staff at Sandia.

MOU New Mexico Tech and Sandia Corporation Page 1 of 10

MOU #09-S-545

MEMORANDUM OF UNDERSTANDING
Between
New Mexico Institute of Mining and Technology
And
Sandia Corporation

1. INTRODUCTION

Sandia Corporation (Sandia) is a Delaware Corporation that operates Sandia National Laboratories (SNL) pursuant to Contract Number DE-AC04-94AL85000 with the United States Department of Energy (DOE). New Mexico Institute of Mining and Technology (NM Tech) is a university located in Socorro, New Mexico.

a) Background

NM Tech's primary missions are education, research, and public service of regional, national, and international significance. It is a university widely recognized for its outstanding graduate and undergraduate programs. Graduate students enrolled at NM Tech may choose from various programs in the physical and biological sciences, engineering disciplines, computer science, and mathematics. NM Tech also operates a number of outstanding research facilities, such as the Energetic Materials Research Testing Center (EMRTC). At EMRTC, scientists and engineers have the opportunity to conduct research on explosive materials and the effects of their use. As a result of its expertise and capabilities, NM Tech participates in many collaborative, national security efforts sponsored by entities associated with the Federal Government, including Sandia.

NM Tech's Strategic Plan commits the institution to seek education and research alliances, where appropriate, to execute its education mission. Therefore, it is NM Tech's goal to offer its graduate degrees for both the traditional on-campus student and the non-traditional student pursuing a degree via distance education.

Sandia's responsibilities associated with its nuclear weapons mission require the continuing transfer of decades of nuclear weapon-related knowledge and experience to new generations of nuclear weaponeers. This knowledge and experience covers the entire spectrum of science and engineering disciplines.

To help satisfy this requirement, Sandia created the Weapon Intern Program (WIP) in 1998 in order to significantly accelerate the process of providing this understanding to those that are new to the nuclear weapons area. This transfer of knowledge and experience is delivered through a blended learning environment, consisting of live and multimedia-based classroom instruction, individual and team research, hands-on activities, and off-site facility and operations tours and briefings. The live instruction is provided through a large contingent of subject matter experts in the various weapon technology, design, evaluation, production, operations,

MOU New Mexico Tech and Sandia Corporation Page 1 of 17

- Educational support for Sandia's Weapon Intern Program (2001 – see previous slide)
- Center for Energetic Materials and Energetic Devices (with LANL, 2003)
- General support for educational and research collaborations, including provision for joint appointments (2005)
- Continuation of support for Sandia's Weapon Intern Program (2010)

Sandia University Research Program (SURP)

SNL provided research funds to new faculty at New Mexico universities

- The SURP program began in 1958 – its purpose was twofold:
  - to acquire fundamental knowledge in those technical fields which are of direct concern to Sandia National Laboratories' programs; and
  - to create a stronger technical community at universities in New Mexico with which Sandia National Laboratories can interact through strengthening university faculties in areas of science and engineering important to Sandia National Laboratories
- Program was funded out of a Nuclear Weapons tech base sustainability account
- Toward the end of the program, projects were being funded at $40K per year
- Program discontinued in federal FY 2009 due to reductions in Sandia's NW tech base sustainability funding

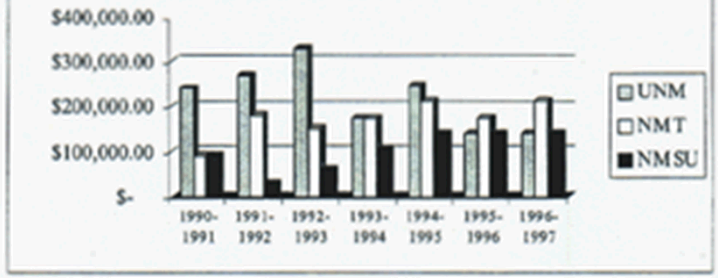
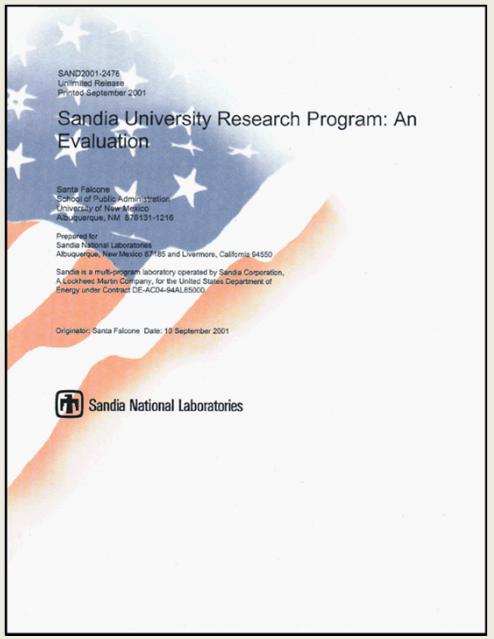


Figure 1. Annual Total SURP Funding 1990-1997



Campus Executive Program

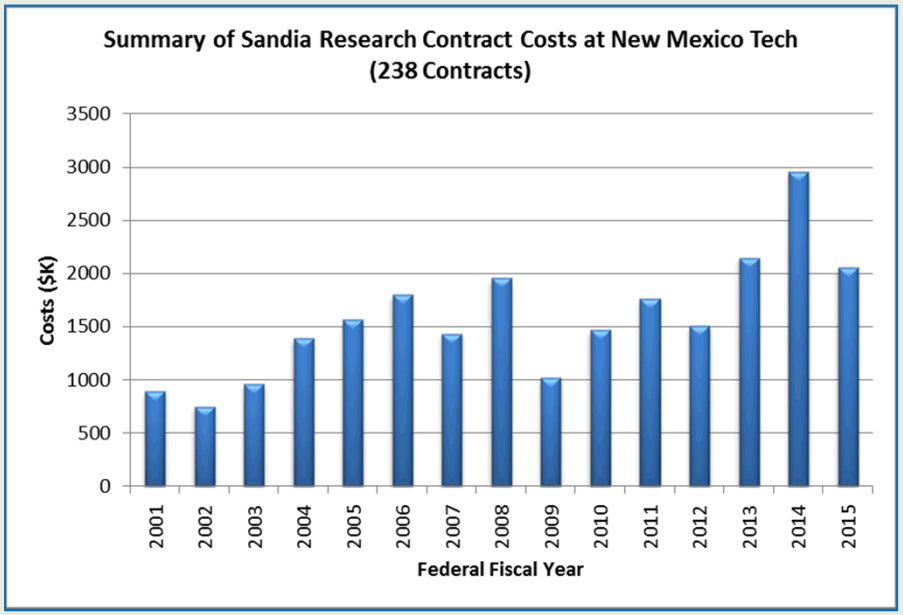
Sandia Executives serving as POCs and advocates for 23 selected universities

- The Campus Executive Program was established in 1997 to partner with universities
  - To conduct leading-edge science
  - Hire the most accomplished scientists and engineers
  - Develop strategic collaborations in focused research areas
- A key element in the past was an investment of ~ $40K in two graduate "fellowships" at each school
- The program is in transition – it may become more faculty focused in the future

Sandia Research Contracts at Tech, 2001-2015

Costs generated by Sandia research contracts at Tech averaged $1.58 M/year

- Many of these contracts have been in the area of energetic materials, but not by no means all
- Two “Campus Executive” projects are presently funded by Sandia’s LDRD program
  - Chemical Vapor into Liquid (CViL) Encapsulation of Micro-Organisms for Hazardous Agent Detection (Tartis)
  - Rocket Engine Test System for Development of Novel Propulsion Technologies (Hargather)

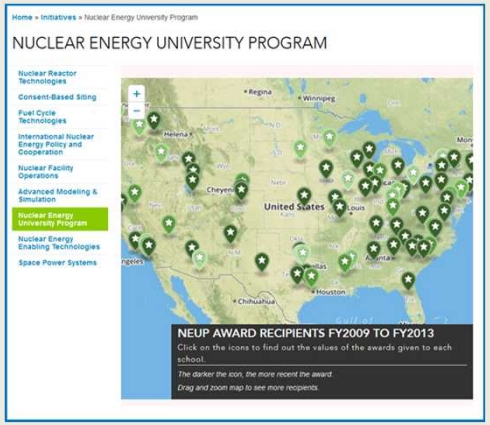


- Similarly funded projects in the past have included:
  - Relating Polymer Dynamics to Molecular Packing
  - Effect of Pressure and Particle Size on Microstructure and Properties of Vacuum-Plasma-Sprayed Yttria-Stabilized-Zirconia Solid Oxide Fuel Cell Electrolytes
  - Catalytic Membrane Development for Micro-Scale Glucose Reforming
  - Self-Assembly of Polymers in Confined Geometries

Other Possible Partnering Mechanisms

These mechanisms benefit faculty, students, and Sandia/university relations

- Faculty appointments at Sandia
  - Scientists conduct short-term, joint research with university faculty on sabbatical or during the summer
  - Faculty are invited by a Sandia sponsor and can have limited-term employment at the Labs from four weeks to one academic year
- Adjunct professorships
  - Sandia staff have the opportunity to serve in various professorship roles at universities
  - The adjunct position allows a Sandia technical expert to teach courses in his/her area of expertise
- Student internships; positions are available in both technical and business areas and offer the following benefits
  - Provides students with research mentoring from top scientists and engineers
  - Offers students training and practical work experience in using state-of-the-art equipment and instruments
  - Identifies outstanding graduates for possible full-time employment
  - Helps students gain academic credit while working as co-op interns
- University-led responses to calls for proposals (e.g., DOE/NE University Partnerships Program – NEUP)



Sandia Contacts

Use these contacts to get information and to answer questions in the future

- Sandia Campus Executive for New Mexico Tech
  - Jim Chavez (jmchave@sandia.gov, 505-844-4485)
- Sandia Deputy Campus Executive for New Mexico Tech
  - Paul Shoemaker (peshoem@sandia.gov, 505-284-2726)
- Chief Technology Officer Programs Office
  - Ben Cook (bkcook@sandia.gov, 505-844-3795)
  - Greg Frye-Mason (gcfrye@sandia.gov, 505-284-9061)
- Chief Technology Officer Programs Support
  - Yolanda Moreno (ymoreno@sandia.gov, 505-284-2106)
- For your expressions of interest in possible collaborations in various technical disciplines
  - Energetic Materials: Jerry Stofleth (jhstofl@sandia.gov, 505-845-7613)
  - Materials Science: Deidre Hirschfeld (dhirsch@sandia.gov, 505-284-5537)
  - Computer Science: David Duggan (dduggan@sandia.gov, 505-845-8100)

Sandia National Laboratories

Questions?