



New Mexico Institute of Mining and Technology Capability Statement

Institution: New Mexico Institute of Mining and Technology (NMT)

DUNS: 041358904 **EIN:** 85-6000-411 **Cage Code:** 4B850 **SIC:** 8221, 8733, 8734

NAICS ID(s): 611310 (main), 518210, 541511, 541519, 541690, 541715, 541990, 611420

Certifications, Registrations, Accreditations: Higher Learning Commission (HLC), Accreditation Board for Engineering and Technology (ABET)

POC: Dr. Van Romero, Vice President of Research

Telephone: 575-835-5650

Address: 801 Leroy Place, Socorro NM 87801

Email: van.romero@nmt.edu

OVERVIEW

New Mexico Institute of Mining and Technology serves the state and beyond through education, research, and service, focused in science, technology, engineering, and mathematics. NMT is designated a Hispanic-Serving Institution (HSI) by the U.S. Department of Education and is a member of the Hispanic Association of Colleges and Universities. NMT is classified by Carnegie as a Master's College and University - Small Programs with research expenditures in FY20 of \$55.8M. Undergraduate enrollment at NMT for Fall-2020 was 1,190 degree-seeking students, 30% were female and 28% were Hispanic students. Graduate enrollment for Fall-2020 was 395 degree-seeking students, 18% were Hispanic and 36% were female. In FY20 NMT awarded 655 degrees including 143 graduate degrees and 512 undergraduate degrees.

RESEARCH CAPABILITIES

Biology: antibiotics, climate change, algae and cyanobacteria in caves, microbial survival under extreme conditions, and pathogenicity of microbial communities in surface water

Chemistry and Chemical Engineering: synthesis, characterization, and application of catalysts; targeted drug delivery; high resolution molecular imaging; micro-encapsulation methods; multiscale modeling and simulation of materials; atomistic and mesoscale simulations of metallic alloys for additive manufacturing; surface engineering and catalysis; materials for electronic and thermo-electric devices, solar-electricity and solar-fuel conversion processes; proton transport membranes; sorbent materials; hydrogen storage materials; plasmonic nanomaterials; nanoparticles biomolecules interaction; single molecule microscopy; plasmon enhanced photocatalysis/photovoltaics; functional polymeric materials; conjugated polymers; additive manufacturing; depolymerization for recycling; soft matter surface and colloid; materials and nanotechnology; biomimetics; discovery, design, synthesis and evaluation of novel bioactive molecules; global modes of variability, contaminant transport and air quality; physical and theoretical chemistry; novel materials for solar energy capture, conversion and storage; microfluidics, microfabrication, fluorescence based detection, new fluorophore design, and, surface bio-functionalization

Civil and Environmental Engineering: water and wastewater treatment; groundwater contamination and site remediation; solid and hazardous waste management; water resources engineering; membrane processes for water desalination and waste water reuse; oil and gas produced water treatment and reuse; removal of arsenic and selenium in water and wastewater; biological wastewater treatment; air quality and aerosols; climate change; direct and indirect climate forcing; energy and Environment; earthquake engineering; Structural dynamics and engineering; transportation engineering

Computer Science and Engineering: cybersecurity; mobile data management; document databases and data mining; integrating heterogeneous data sources; information and knowledge systems; theory of computation, complexity, and logic; machine learning; implicit complexity; software engineering; mobile security, mobile HCI, mobile app development; network anomaly detection and visualization; smart grid security and privacy

Earth and Environmental Sciences: economic, structural and sedimentary geology; faults and fluid flow; volcanology; aqueous geochemistry and water quality; geomicrobiology; stable isotopes and dating in hydrology; water-rock interactions with CO₂; hydrocarbon geochemistry; igneous petrology and experimental geochemistry; ore-forming processes and critical mineral deposits; hydrothermal geochemistry; geobiology; seismology; hydrogeophysics; computational geodynamics and tectonophysics; thermal geophysics; groundwater in geologic processes; karst hydrology; watershed hydrology

Electrical Engineering: wireless communications; control systems; soft computing; adaptive control of robotic systems; optics; wavefront sensing; directed energy; imaging; optical interference filters; high voltage electronics; smart sensors and instrumentation; electrical properties of energetic materials; ballistics; non-uniform sampling; time-frequency methods; channel estimation; digital signal processing; compressive sensing; thunderstorms; astronomical optical interferometry methods and instrumentation; space plasma physics and space weather; distributed autonomous sensor networks; visible light communication and positioning; heterogeneous wireless network design and optimization; communication in internet-of-things; machine learning; 5G and microgrid security

Materials, Metallurgical and Mineral Engineering: metals; polymers, soft matter, biomaterials; ceramics; nano and low dimensional materials; surface science; electronic and optical properties; energy and the environment; computational materials science; economic analysis; geostatistics; mine ventilation and systems; applied geomechanics; rock slope stability; tunneling and underground excavation; exploration and field mapping; mineral deposits, economics and exploration; ore petrography; mine waste management and control; soil mechanics; foundation analysis and design; applied geomechanics; computer application in geotechnical engineering; advanced engineering mathematics; ground improvement; occupational health and safety

Mathematics: partial differential equations; global analysis on manifolds, Riemannian geometry and mathematical physics; optimization and applications of optimization techniques in inverse problems; mathematical modeling of processes that emerge from life sciences; diagnostic methods and their applications to reliability and engineering models; analytic solutions of Boundary Value problems; modeling complex multidimensional data; mathematical biology and modeling; partial differential equations and dynamical systems; nonlinear partial differential equations

Mechanical Engineering: acoustic emission, wave propagation, guided ultrasonic waves; aerodynamics, hydrodynamics, aeroelasticity, fluid-structure interaction; analysis and implementation of asynchronous algorithm; artificial intelligence, machine learning, and pattern recognition; atmospheric boundary layer flows; biomimetics, bio-inspired aerial and aquatic robots; computational fluid dynamics, heat transfer and model validation; computer vision, augmented reality, and internet-of-things; design and optimization of robotics applications; design of energetic-mechanical systems; mechanics of detonation gas; design, optimization, and performance enhancement of aerial vehicles; energetic material science/technology/safety; engineering design; flow instability; high strain-rate mechanical testing; impact dynamic

failure/fracture; intelligent systems, structures, and mechanisms; ionic space lubricants; turbulent flows; knowledge transfer; leadership; machine design; mechanical system design; mechanics of fluid-filled multifunctional composites; metamaterials; monitoring of aerospace structures and systems; multi-objective optimization; multiphysics aspect of materials and composites; nanotechnology; non-Newtonian fluid mechanics; optoelectronic nanocomposites; product development; program management; propulsion and power systems; rheology; robotics mechanics of materials; sensors and structural health monitoring; shaped charges; shock and gas dynamics; shock/tension physics; computational modeling; solid mechanics; space systems and structures; structural analysis and dynamics; structural health monitoring and nondestructive evaluation; sustainable infrastructures; technical communication pedagogy; total quality management; turbulence; uncertainty analysis of networked control systems; vibrational and model testing; wind energy

Petroleum and Natural Gas Engineering: Numerical optimization and modeling; reservoir geomechanics; reservoir characterization; geological modeling and upscaling; enhanced oil recovery; multiphase reservoir flow modeling; history matching; reduce order modeling; uncertainty quantification; CO₂ sequestration; fuzzy expert systems, data mining; well testing; reservoir; analytical solution; formation evaluation/petrophysics; naturally fractured reservoirs; unconventional gas recovery; well testing, production and pressure transient; tight gas reservoirs; small production company operations; managed pressure drilling; wellbore integrity, well completion and stimulation; directional and horizontal drilling; horizontal/multilateral wells; artificial lift methods; enhanced oil recovery; unconventional resources; CO₂ flooding and gas injection; reservoir sweep improvement: water, polymer, and chemical flooding; hollow fiber membrane based desalination technologies for oilfield produced water treatment; fluids flow in porous media at high temperature and high pressure; nanoparticle assisted CO₂ foam floods for enhanced oil recovery; hollow fiber membrane based desalination technologies for oilfield produced water treatment; fluids flow in porous media at high temperature and high pressure;

Physics: astrophysics including planetary, stellar and galactic; stellar and galaxy evolution; atmospheric physics including lightning and atmospheric electricity; chemistry of the middle and upper atmosphere; climate, convection and atmospheric dynamics

FACILITIES

Bureau of Geology and Mineral Resources investigates, evaluates, and disseminates information on geology, mineral, water, and energy resources, and extractive metallurgy, with emphasis on aiding the discovery and responsible development of nonrenewable resources for the benefit and well-being of the citizens of this state.

Cybersecurity: Cybersecurity Center of Excellence serves as a catalyst for cybersecurity research and workforce development in NM by coordinating and facilitating collaborations among NM colleges and universities, government agencies and private sector. The Cybersecurity Education Center focuses on cybersecurity education at the undergraduate and graduate levels to educate undergraduate and graduate students in cybersecurity issues and provide them with the knowledge and skills needed to work and lead as cybersecurity professionals.

Energetic Materials Research and Testing Center specializes in the research, development, testing, and analysis of energetic materials focusing on explosives research and testing and has the ability to conduct tests involving over 20,000 pounds of explosives. EMRTC's 40-square-mile field laboratory contains more than 30 test sites, gun ranges, other research facilities and storage areas, allowing for a complete spectrum of research and testing activities.

Institute for Complex Additive Systems Analysis (ICASA) studies the behavior, vulnerabilities, and predictability of complex systems, a process that gathers information-age research and applies this research to real-world problems. ICASA's basic research focus is to understand the additive effects—or unintended consequences—of efficient design in interdependent systems of systems.

IRIS PASSCAL Center works with researchers and students from around the world in hardware/software development and training associated with earthquake, volcano, glaciological, and other seismological research. It handles logistical support and fieldwork for Earth science experiments and maintains the world's largest academic pool of research seismological instrumentation.

Langmuir Laboratory for Atmospheric Research is at an altitude of 10,000 feet. During the summer, isolated thunderstorms form directly over the site allowing scientists to study thunderstorms with instruments at a fixed location. Scientists study thunderstorms using balloons, rockets, Doppler radar, aircraft, lighting instruments and ground-based electric field mills.

National Cave and Karst Research Institute is located in Carlsbad New Mexico and conducts research, education, data management, and stewardship in all fields of speleology including development of caves and karst, characterizing their unique geomicrobiology, and evaluating their hydrogeology.

New Mexico Bureau of Mine Safety promotes the safety of the miners of New Mexico.

Observatories: Magdalena Ridge Observatory (MRO) is located on 1,000 acres at 10,600 feet in the Magdalena Mountains of the Cibola National Forest in Socorro County and consists of two major facilities, an operational 2.4-meter fast-tracking telescope and the Magdalena Ridge Observatory Interferometer (MROI), and a ten-element optical/infrared interferometer, under construction. Mount Erebus Volcano Observatory is a network of scientific instrumentation (seismic, infrasonic, geodetic, and environmental) on the active volcano, Mount Erebus in Antarctica for fundamental research in volcanology. Etscorn Campus Observatory includes a 20-inch Dobsonian telescope inside a 15-foot dome with several additional telescopes available.

Petroleum Recovery Research Center mission is to develop, through theoretical and practical research, improved oil recovery methods to increase oil and natural gas recovery from New Mexico's and the nation's oil and gas reservoirs and to transfer new technology to the industry and to local independents.

Playas Research and Training Center is a township of 400,000 acres of operational space, with high mountainous desert, rural and third world test and training venues, live fire and driving ranges, and a high explosives range. The facility houses multiple classrooms and control rooms with state of the art equipment, live video streaming, and secure high speed interaction. There is a shooting range and an extensive driving range that simulates rough terrain, water traps, boulder and log obstruction fields, and incline and slant hazards for off-road vehicles.

PAST PERFORMANCE

NMT has a long history of externally funded research in the areas listed above. In the past five years, NMT has been awarded more than \$383 million to support research, service, education, and outreach efforts. Over \$303M in awards were received from federal agencies, over \$7M from state and local governments, and over \$65M from private organizations. Federal agencies support was provided by the Department of Defense (\$142M), Department of Homeland Security (\$110M), National Science Foundation (\$13M), Department of Energy (\$9M), NASA (\$3.3M), Department of State (\$2.6M), Department of Education (\$6M) and Department of Interior (\$2M).