

UND National Security Initiative

The University of North Dakota is investing in a National Security Initiative (NSI) to build on the university's capacity to pursue, secure and execute projects with federal agencies including Department of Defense (DOD) and Department of Homeland Security (DHS). This initiative will enable UND to expand and apply its expertise in UAS/Autonomy and mobility across a cohesive Surface-Air-Space (SAS) domain, integrating ground vehicles, airborne assets, and the satellite architecture under development by the Space Development Agency (SDA) and private industry. The collaboration involves the Vice President of Research & Economic Development, the Research Institute for Autonomous Systems, the John D. Odegard School of Aerospace Sciences, the College of Engineering and Mines, and the College of Arts & Sciences.

One of UND's primary contributions to the US Space Force will center on our capability to enhance space satellite architecture with testing and integration of autonomy and intelligence across the integrated SAS domain. Through the NSI, UND has committed to deepening the personnel expertise needed to support USSF, and we are in the process of hiring eight new research faculty positions.

The NSI focus on Space and the overall investment package are designed to increase federal funding from DoD and DHS. A conservative target is an annual increase of \$3M in research expenditures from these two agencies, building on a baseline established in FY22 (~\$2.5M)—over a 100% increase.

One-time ARPA investments of \$10M in concert along with \$7.5M from UND strategic funding and the \$4M previously authorized by the state of North Dakota for Space Infrastructure, will support crucial hands-on and applied research and training opportunities, provide equipment and technology, and thus enhance UND's ability to recruit, retain, and graduate undergraduate and graduate students and enhance development and deployment of a highly trained high-tech workforce in ND and the region. Further, the NSI will position UND to be a strong partner with the SDA, Grand Forks Air Force Base, numerous potential industry partners, and, significantly, the United States Space Force (USSF).

UND Space Education and Research Infrastructure

Description of Program

Requesting \$10.5M to establish a Center for Space Education and Research, expanding on existing as well as planned investments from the University and the Colleges of Aerospace, Engineering & Mines, and Arts & Sciences. UND is investing in a National Security Initiative (NSI) to build on the university's capacity to pursue, secure and execute projects with federal agencies including Department of Defense (DOD) and Department of Homeland Security (DHS). The NSI will generate extensive opportunities in research, training, and education for a broad range of colleges, schools, programs, faculty, and undergraduate and graduate students. Then NSI targets opportunities in Health, Energy and Space, but the first phase of the NSI focuses on Space. Phase I will enable us to expand and apply our expertise in UAS/Autonomy and mobility across a cohesive Surface-Air-Space (SAS) domain, integrating ground vehicles, airborne assets, and the satellite architecture under development by the Space Development Agency (SDA) and private industry. UND has a 6-year plan in which it has committed to investing \$7.5M in new strategic funding in the Space Phase from FY22-FY27. The Space Phase collaboration involves the Vice President of Research & Economic Development, the Research Institute for Autonomous Systems, the John D. Odegard School of Aerospace Sciences (Space Studies, Aviation departments), the College of Engineering and Mines (Electrical Engineering & Computer Science and Mechanical Engineering departments), and the College of Arts & Sciences (Chemistry, Mathematics, Physics & Astrophysics, Psychology/Human Factors departments). Further, the NSI will position UND to be a strong partner with the SDA, Grand Forks Air Force Base, numerous potential industry partners, and, significantly, the United States Space Force (USSF).

On August 9, 2021, UND became the first of ten universities to join the new Space Force University Partnership Program (UPP). Following the UND visit by Chief of Space Operations, Gen Raymond, the U.S. Space Force explained that it is establishing the University Partnership Program to:

- Fulfill the needs of a technology-focused, 21st century, digital Service.
- Recruit and educate a competent, diverse and inclusive workforce.
- Pursue relevant, state-of-the-art research and technology development.
- Leverage and support the nation's research universities.
- Provide motivation and opportunities for the nation's university students to pursue scientific and technical degrees.
- Establish a USSF UPP for world-class research, advanced academic degree, and leadership development opportunities.
- Identify and pursue research areas of mutual interest with UPP members (bi-lateral and collectively).
- Establish scholarship, internship and mentorship opportunities for university students and cadets.

One of UND's primary contributions to the UPP consortium will center on our capability to enhance the space satellite architecture with testing and integration of autonomy and intelligence across the integrated SAS domain. Through the NSI, UND has committed to deepening the personnel expertise needed to support USSF, and we are in the process of hiring eight new research faculty positions. The state legislature generously allocated \$4M in the 2021-2023 biennium to invest in space-related infrastructure at UND. To ensure success in developing the space-related capacities and to equip our existing and new researchers and students, we are asking for a one-time investment of \$10M to extend our ability to develop infrastructure—primarily through purchasing essential equipment. Collectively, this infrastructure, combined with relevant existing infrastructure, will make up the "Center for Space Education and Research." An additional \$10M will extend UND's capacity for research and workforce training to respond to the needs identified by USSF for the next many years.

Expected Outcome:

The NSI focus on Space and the overall investment package are designed to increase federal funding from DoD and DHS. A conservative target is an annual increase of \$3M in research expenditures from these two agencies, building on a baseline established in FY22 (~\$2.5M)—over a 100% increase. The Center will help attract star research faculty and staff in space-related fields to include graduate students and post-doctoral researchers. While primarily a research initiative, NSI will substantively refresh academic programs

Establishment of this center will deliver more educational opportunities online and on-campus with state-of-the-art technology and research labs. It will foster high-tech workforce development in key emerging areas at both undergraduate and graduate levels, increase opportunities for student engagement in hands-on and applied research and training opportunities, and assist in the growth and diversification of the ND state economy, especially in the high demand, rapidly growing high-tech sector.

Connection to Existing Program:

This project will support existing and growing programs and research in space-related fields in the Colleges of Aerospace, Engineering & Mines, and Arts & Sciences and leverage planned strategic investments from the University. The National Security Initiative supports Goal 4 of the UND Strategic Plan (to Enhance Research) and puts an action to the UND Grand Challenges of Autonomous Systems and Big Data. These two Grand Challenges encompass areas of research and education identified by UND as priorities critical to the state and areas in which we can be nationally competitive. Most of UND’s investment in the NSI will cover salaries for new research faculty and students. One-time ARPA investment in the Center, in concert with UND strategic funding and the \$4M authorized by the state of North Dakota for Space Infrastructure, will support crucial hands-on and applied research and training opportunities, provide equipment and technology, and thus enhance UND’s ability to recruit, retain, and graduate undergraduate and graduate students and enhance development and deployment of a highly trained high-tech workforce in ND and the region.

The original \$4M allocated from the state legislature for CSER will be able to equip the following:

Infrastructure Project	Description	Estimated Cost
Satellite Operation Center	Robin Hall 203 will be reconfigured to have 16 space control stations for education, operations, and research as well as an upgraded instructor station. In addition to teaching classes in orbital mechanics, satellite operations, space domain awareness, and communications, the classroom will be integrated into a campus network to connect with UND colleges and other universities to manage UND’s own and other(s) developed satellites as well as to analyze and manage the data generated through remote sensing.	\$ 1,000,000
Digital Engineering and Big Data Lab	Harrington Hall 109, currently a power electronics lab, will become the Digital Engineering & Big Data Lab. Digital Engineering is the approach to space systems development favored by the DOD. This lab allows us to train students in digital engineering and supply the workforce needed by the DOD and the defense industry. The reconfigured room will host workstations and large monitors to serve both individual and group projects. This space will also be utilized in our new Digital Engineering course, which is being taught in partnership with a major defense contractor.	\$ 300,000
Satellite Design and Engineering Lab	Harrington Hall 120C, currently an undergraduate academic lab, will be become a satellite design and engineering lab. The room will be furnished with instruments and equipment to allow device and component-level integration. Components from this lab will transition into Harrington Hall 120 for integration into subsystems and full satellites.	\$ 300,000
Satellite Fabrication and Assembly Lab, including Clean Room	This will serve as a hub for the fabrication and assembly of satellites and other space-related instruments and equipment. This lab already contains an anechoic chamber, which is essential for the development and testing of antennas for space systems. A cleanroom will be added to further support the development and testing of satellite components, including communication circuitry, optical interconnects, and mechanical structures. It will be equipped to perform all necessary electromechanical and environmental testing needed for satellite development, including vibration, thermal/vacuum, EMI/EMC, and antenna testing.	\$ 2,400,000

An additional \$10.5 million investment would allow us to expand the activities of CSER in the following ways

Infrastructure Project	Description	Estimated Cost
Advanced UAV and Satellite Material Lab	Advances in UAV and space systems will require the development and testing of new materials for batteries, solar cells, thermal management, and lightweight structures. To successfully compete for research grants and perform the research needed by the DOD, UND needs to upgrade its materials fabrication and characterizations facilities. <ul style="list-style-type: none"> -<i>Nanofoundry and associated cleanroom and instruments</i>. \$3,200,000. Facilitates translational research in nanoscience and nanotechnology for applications requiring minimization of weight and size, including space & UAV applications. -<i>High resolution transmission electron microscope (TEM)</i>. \$1,000,000. A critical instrument for materials research, especially for studying particles and structures at the nanoscale. -<i>Other materials characterization instruments</i>. \$1,500,000. A suite of instruments for the characterization of various chemical, mechanical, thermal, and electrical properties of materials important for batteries, solar cells, and other power and structural applications. Instruments include a BET surface area analyzer, Raman spectrometer, X-ray diffractometer, hardness indenter, gel permeation chromatogram, and a thermoelectric measurement system. 	\$ 5,700,000.00
Neutral Buoyancy Tank	A neutral buoyancy tank will enable human spaceflight extra-vehicular activity training to expand UND’s expertise in space suit testing and interplanetary habitability research. Additionally, it will support satellite refueling/repair testing as well as micro-gravity research.	\$ 1,200,000
Sensitive Compartmented Information Facility (SCIF)	This will enable UND to do classified work with DOD and DHS and create opportunities to work with Grand Forks Air Force Base, Cavalier Space Force Station, & Grand Sky (Northrop Grumman and General Atomics). For our initial needs we will acquire a portable SCIF built into a standard container.	\$ 1,500,000
Satellite and Space Debris Tracking	A series of antennas will be installed and used to collect data to track satellites and space debris. This facility will allow for both student projects and faculty research, including the analysis of satellite and space object data, development of advanced tracking software, and the development and testing of new antennas and sensors.	\$ 900,000
Laboratory Configuration	Will be used to configure and adapt laboratory spaces to accommodate the above equipment and research. This includes	