NASA R&D EXPENDITURES, FY2018

| URBANA-CHAMPAIGN: $10.4 MILLION | UIC: $985,000 |

NASA-Supported Projects at Urbana-Champaign

SPACE
The goal of a Phase II NASA-funded project on Advanced Quantum Communication from the International Space Station (ISS) is to develop a quantum communication demonstration from the ISS to a ground station, as an initial step toward a satellite-based quantum network.

NASA Space Technology Research Fellowships (NSTRF) to students support graduate training in areas of national importance, including drone-based quantum cryptography.

Undergraduates benefit from NASA’s CAPSAT project, where we are responsible for one of three payloads on the ‘cubesat’ (a mini-satellite), which launched in fall 2018. Our payload will test techniques to reduce the deleterious effects of background space radiation on single-photon detector noise.

AVIATION
The Urbana campus is a partner in a $9.9M research center for aviation innovation, supported by NASA under its University Leadership Initiative. The goal of this research center is to mature a disruptive airfoil design concept, known as the Slotted Natural Laminar Flow Airfoil, aimed at producing low-drag wing configurations for commercial transport vehicles.

Urbana has been helping to break down technical barriers to hybrid electric propulsion for commercial transport aircraft. Multiple grants from NASA’s AATT and LEARN programs (~$4M over four years) have supported work on high power density electrical machines and drives and system level modeling and analyses.

As part of these efforts, the campus has been helping to bring together the broader electrical and aerospace communities. A NASA supported workshop on Large Electric Machines held in 2016 has now grown into a collaboration between AIAA and IEEE with a joint symposium held in July 2018 in Cincinnati.

NASA has also funded control research to address aviation safety challenges by developing a control reconfiguration architecture to prevent catastrophic crashes, and to integrate UAV’s into national airspace systems.

REMOTE SENSING
Urbana researchers provide critical ongoing support for instruments on NASA’s Terra satellite, the flagship of the Earth Observing System, providing data critical for understanding weather, air pollution, food security, the hydrological cycle, radiation budgets, and the link between aerosol pollutants and health problems. These include the Multi-Angle Imaging SpectroRadiometer and the Moderate Resolution Imaging Spectroradiometer, and will include the Multi-Angle Imager for Aerosols instrument, with a nominal launch date of 2021. Urbana is a key site for the ACCESS to Terra Data Fusion Products project, which aims to harmonize use of the 1.2 PB of data from instruments on the Terra satellite through the use of a common format and grid, and development of needed software tools and cyberinfrastructure.
NASA funds research in the use of novel sensing technology and satellite data to improve monitoring and predictability of the broader U.S. Midwest carbon budget and food productivity. Awards totaling over $1.2M focus on the integration of multi-source satellite data with improved land surface modeling to improve monitoring of the carbon budget for the U.S. Corn Belt, and the use of chlorophyll fluorescence measurement to improve crop modeling from both ground and space.

**SIGNAL PROCESSING**

NASA is funding the development of lithium niobate based photonic integrated circuits to support widely tunable and highly sensitive microwave and millimeter-wave radiometry. These circuits will improve technology for optical frequency data acquisition in NASA science missions, and have many potential applications in obtaining data to improve our understanding of Earth's atmosphere and global change.

**NASA-Supported Projects at UIC**

UIC has received a $1.1M, five-year grant from NASA’s Astrobiology Institute to identify biosignatures of life on Titan — Saturn’s largest moon — from either currently living or long-extinct life.

UIC researchers, with funding from NASA, have shown how the bubbles that form on a heated surface create a tiny recoil when they leave it, like the kick from a gun firing blanks. This miniscule force can be harnessed to mix liquid coolant around high-power microelectronics in space or on Earth.

A researcher at UIC received the prestigious NASA Early Career Faculty grant in 2017, and is using the funding to create miniature systems for easy fluidic sampling in space.

NASA has also recently funded a project at UIC to develop a Piezoelectric Instrument for Precision Exploration Sampling (PIPES), a miniaturized liquid sample acquisition and handling system. The PIPES system seeks to fill a gap in NASA’s current in-flight sensing capabilities.