National Aeronautics and Space Administration

NASA's Impact in North Dakota: A Tech Transfer Perspective

You know that NASA studies our planet, our sun, the solar system, and the Universe. But did you know about the space program's economic impact here on Earth?

In 2011, NASA invested nearly **$5.5 million** in the state of North Dakota.

Since 2001, NASA's SBIR/STTR Program has invested over **$1.2 billion** in companies across the country.

How NASA's SBIR/STTR Program Benefits the U.S. Economy

NASA is committed to moving technologies and innovations into the mainstream of the U.S. economy, and the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) program helps fulfill this goal.

SBIR/STTR stimulates technological innovation by encouraging small, high-tech companies—particularly minority and disadvantaged businesses—to partner with NASA to help meet its research and development needs in key technology areas. At the same time, this program strengthens small companies by enabling them to bring cutting-edge new products into the U.S. economy.

(Visit http://sbir.nasa.gov for more information on the SBIR/STTR program.)

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How NASA Spinoffs Benefit North Dakota

Precision Farming Aided by Web-Based Tools for Viewing Satellite Images *(Fargo)*

NASA-developed software designed for remote sensing purposes is helping farmers cultivate their land more economically. Agri ImaGIS Technologies partnered with the University of Minnesota to adapt and further develop NASA software for its use in precision farming. The Web-based tools enable Agri ImaGIS to deliver via the Internet satellite images and global positioning system (GPS) information to determine the proper applications of farm chemicals, seeds, and fertilizers for each portion of a field. Farmers primarily employ the Agri ImaGIS tools to control the variable-rate application of fertilizers and herbicides. The technology allows farmers to apply the right product at the right place at the right time, reducing costs as well as the amount of farm chemicals entering the environment.

Other types of geographic information available to Agri ImaGIS customers include maps of road networks, topography, soil classification, and agricultural yields. The applications are accessible from computers, tablets, and smart phones.

Field Instrument Measures Solar Radiance to Permit Weather, Climate Change Insights *(Portland)*

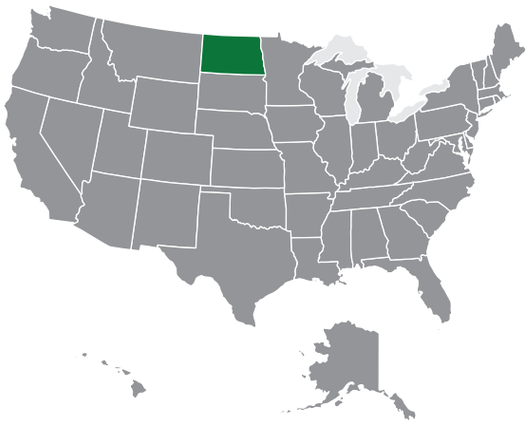
Sensit Technologies, Inc., now Sensit Company, collaborated with NASA to design and build a sphere-scanning radiometer to measure the reflected signature of a variety of Earth surface types. The third-generation Portable Apparatus for Rapid Acquisitions of Bidirectional Observations of Land and Atmosphere (PARABOLA III) rapidly acquires data from rangeland vegetation to ice and snow for almost the complete sky and ground-looking hemispheres to measure direct solar radiance. Easily transportable to remote sites, the battery-powered field instrument operates in eight spectral bands and takes just four minutes to complete one rotating scan.

At NASA, this unique *in situ* instrument validated the surface reflectance of angles measured by the Multi-angle Imaging SpectroRadiometer (MISR), a global imager flown on the Earth Observing System's flagship, Terra. Commercially, it has been deployed to monitor ecosystem interactions in the United States and Canada. Data is helping scientists understand how vegetated land surfaces combine with the lower atmosphere to influence weather and climate change.

Tracking System Enables Real-Time Use of TIROS Weather Satellite Images *(Grand Forks)*

The Television Infrared Observation Satellite (TIROS), first deployed in 1960, obtains high-resolution images of Earth's atmosphere for use in such applications as cloud top temperature monitoring and hazardous weather prediction. The last of the TIROS satellites launched in 2009 and, with its European complement, provides a complete image of Earth every six hours.

Researchers at the Center for Aerospace Sciences at the University of North Dakota (UND) used three NASA computer programs to develop a satellite tracking system to predict the TIROS location at any given time, enabling accurate pointing of ground-based antennas at TIROS transmitters for error-free signal reception. The tracking system enables real-time utilization of TIROS weather information, and would have been costly and time-consuming to develop without the NASA programs. UND researchers can now routinely monitor agricultural and environmental conditions of the Northern Plains.



NASA actively seeks partnerships with U.S. companies that can license NASA innovations and create "spinoffs" in areas such as health and medicine, consumer goods, transportation, renewable energy, and manufacturing. When businesses leverage NASA technologies to develop new products, it not only benefits the regional economy, but significantly strengthens the nation's competitiveness in the global marketplace.

NASA's centers across the country have helped 4 North Dakota companies develop revolutionary spinoff technologies.

Learn more about how NASA innovations benefit the public in *Spinoff*, an annual publication that highlights NASA's most significant technology transfer successes.
(Available at: http://www.sti.nasa.gov/tto)

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