POSITION STATEMENT

SYNTHETIC APERTURE RADAR

Adopted by the IEEE-USA
Board of Directors, 16 Nov 2007

Synthetic Aperture Radar (SAR) and Interferometric Synthetic Aperture Radar (InSAR) are invaluable resources for such critical applications as monitoring tectonic plates movement, measuring glacier shrinkage, tracking ground water depletion, and surveying man-made structures such as dams and levies. However, U.S. researchers are often handicapped by the necessity to contract with foreign agencies to obtain desired data. These data require significant financial resources that are often not available to academic researchers.
To keep pace with growing foreign remote sensing capabilities, the U.S. government should adopt policies that will lead to developing an efficient, internationally competitive, civil remote sensing enterprise that includes SAR and InSAR instruments, and space missions that balance private sector growth with public sector capability.

Towards this end, IEEE-USA recommends the United States begin a federally sponsored SAR/InSAR remote sensing science and technology initiative.

IEEE-USA also specifically recommends that NASA:

- Initiate, strongly support, and reinvigorate dedicated civil (NASA) SAR and InSAR space-borne remote sensing technologies and capabilities, including the planning for a space-based radar system

- Support SAR and InSAR Remote Sensing policies and programs that encourage private investment in U.S. commercial space ventures

- Implement U.S. policies to disseminate civil space-borne SAR and InSAR Remote Sensing data products. Such policies would include negotiating with foreign governments to make data from existing satellites more available to U.S. academic institutions

The Institute of Electrical and Electronics Engineers, Inc. - United States of America
1828 L Street, N.W., Suite 1202, Washington, D.C. 20036-5104 USA
Office: +1 202 785 0017 ■ Fax: +1 202 785 0835 ■ E-mail: ieeeusa@ieee.org ■ Web: http://www.ieeeusa.org

These recommendations correspond closely to the National Research Council's recommendation that "NASA significantly expand existing technology development programs to ensure that new enabling technologies for critical observational capabilities, including interferometric synthetic aperture radar, are available to support potential mission starts over the coming decade."1

This statement was developed by the IEEE-USA's Committee on Transportation and Aerospace Policy, and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of more than 215,000 engineers, scientists and allied professionals who are U.S. members of the IEEE. IEEE-USA is part of the IEEE, the world's largest technical professional society with 370,000 members in 160 countries. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE or its other organizational units.

BACKGROUND

There are many civil radar imaging satellites throughout the world. However, outside of possible radar satellites deployed by the U.S. Defense Department for security and whose data is not available to researchers, there have been no dedicated civil synthetic aperture radar (SAR) satellite programs since the 2002 NASA/National Geospatial-Intelligence Agency Shuttle Radar Topographic Mission (SRTM). The SRTM mission was a short lived mission to provide a 3-dimensional image of 90% of the earth using Interferometric synthetic aperture radar (InSAR) technology.

There are several important applications of advanced forms of InSAR technology for which researchers need data. The technology of interest is the ability to monitor earth movement with accuracies approaching centimeter scales with some measurements approaching millimeters. The important missions include monitoring the movement of tectonic plates. InSAR satellite data available today enables geophysicists to estimate the slip rate of the San Andreas Fault. Geophysical researchers have used the data to estimate to within a 70% probability that the southernmost section of the fault will rupture within the next 3 decades. Further investment to gather and refine the data may be able to dramatically improve this estimation. SAR instruments have mapped local subsidence in residential areas such as Phoenix, Arizona due to ground water depletion. It has verified shrinking of polar glaciers and ice caps that may be the result of global warming. In addition, space borne SAR imagery can monitor tropical hurricanes and cyclones, produce high spatial resolution ocean surface wind maps, monitor ice sheets and glaciers threatening ocean navigation, and survey the health of man-made structures such as levies. These examples illustrate the areas of study requiring SAR/InSAR data not readily available to U.S. investigators.

[1] "Earth Science and Applications from Space: Urgent Needs and Opportunities to Serve the Nation," Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, National Research Council (2005), p. 6. On-line at: http://www.nap.edu/catalog.php?record_id=11281

There are many radar satellites capable of collecting these data. Europeans obtain SAR data from the European Union's ERS 1, ERS-2 and ENVISAT satellites. The Canadians get SAR data from their RADARSAT satellite the Germans have launched, TerraSAR-X, which will have a very high resolution InSAR capability and Italy is building a constellation of x-band SARs in their COSMOSKYMED program. Japan is advancing its SAR technology and applying it to new science applications. U.S. researchers can only get this data by contracting or partnering with foreign providers and they have little or no influence on foreign SAR satellite mission profiles and observational measuring schedules. U.S. researchers are handicapped by the necessity to contract with foreign agencies to obtain desired data. These data require significant financial resources that are often not available to academic researchers.

In 2005 the National Research Council was tasked to conduct a survey to generate consensus recommendations from the Earth and environmental science and applications communities regarding a systems approach to the space based and ancillary observations encompassing the research programs of U.S. agencies. One of the principal observations is that the paucity of missions in active planning mode undercuts the observational capability for which a strong enabling technology base is essential. Of particular concern was the vitality of the field which depends on a robust space program and a vigorous research and analysis program to attract and train scientists and engineers and to provide opportunities to exploit new technology and apply new theoretical understanding in the pursuit of discovery and high-priority societal applications. A cited example is the lack of a program to exploit the use InSAR technology.

Separate from the NRC study, academic personnel have lamented the difficulty of accessing space borne SAR and InSAR data to carry out research and train students in the technology to maintain the US position in the community. This situation is exacerbated by the existence of space-based SAR and InSAR satellites deployed by Canada, Japan and Europe. These systems provide data and facilities that are not readily available to U.S. researchers.