UAVSAR Program: Initial Results from New Instrument Capabilities

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INTRODUCTION

UAVSAR is an imaging radar instrument suite that serves as NASA's airborne facility instrument to acquire scientific data for Principal Investigators as well as a radar test-bed for new radar observation techniques and radar technology demonstration. Since commencing operational science observations in January 2009, the compact, reconfigurable, pod-based radar has been acquiring L-band fully polarimetric SAR (POLSAR) data with repeat-pass interferometric (RPI) observations underneath NASA Dryden's Gulfstream-III jet to provide measurements for science investigations in solid earth and cryospheric studies, vegetation mapping and land use classification, archaeological research, soil moisture mapping, geology and cold land processes [1,2,3]. In the past year, we have made significant upgrades to add new instrument capabilities and new platform options to accommodate the increasing demand for UAVSAR to support scientific campaigns to measure subsurface soil moisture, acquire data in the polar regions, and for algorithm development, verification, and cross-calibration with other airborne/spaceborne instruments.

METHODOLOGY

With support from NASA Earth Venture-1's AirMOSS project, we are adding P-band polarimetry capability to UAVSAR to study subcanopy and subsurface soil moisture over a 3-year period [4]. We have built a P-band passive antenna, high power amplifier, and associated frequency up/down-conversion electronics to replace the L-band active array antenna. Integration and test of the instrument onboard the newly modified NASA/Johnson Space Center G-III was completed in spring 2012 and we began flight-testing in the summer and science campaigns in September 2012. Initial results from engineering and

science flights demonstrated good gain and phase stability and surprisingly low radio frequency interference.

In addition, NASA's Airborne Technology Demonstration GLISTIN-A project is funding the development and integration of the Ka-band HH-polarization single-pass interferometry capability to UAVSAR [5]. This involves the development and mounting of the Ka-band front-end electronics to the backplane of a newly developed Ka-band antenna. After initial flight-testing in spring 2012, the GLISTIN-A team is working to double the transmit power by adding a second high power amplifier and modifying the antenna mounting to reduce the effect of multipath from the antenna faring.

As a first step towards developing rapid response capabilities with UAVSAR, we have integrated the high fidelity SAR onboard processor developed under NASA's Advanced Information System Technology program with UAVSAR to demonstrate real-time SAR image formation onboard UAVSAR flights and downlinking of geo-rectified quick-look imagery via a Ku-band satellite link to ground terminals from the Global Hawk platform. Polarimetric SAR processing will be added to the onboard processor to generate specific data products for applications such as wild fire monitoring and flood extent detection.

SUMMARY

The addition of two new radar frequencies will enable UAVSAR program to support scientific campaigns to measure subsurface soil moisture, acquire data in the polar regions, and serve as test-bed for future spaceborne missions, as well as conduct cross-calibration with other airborne/spaceborne instruments. The addition of a high fidelity onboard processor will enable us to develop rapid response capabilities for disasters such as wild fires and volcano eruption.

REFERENCES

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