



Sandia Remote Sensing E-Magazine

*A publication featuring what's new in
Remote Sensing Technology
at Sandia National Laboratories*



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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.





Recent Accomplishments

- **MiniSAR Digital Radar Technologies:** The first 3U-sized, 4"x6" (miniaturized) DRx (digital receiver) was fabricated, assembled, and tested. The boards are fully functional and have successfully completed initial testing. The 3U QDWS (quadrature digital waveform synthesizer) board was successfully iterated to improve the SFDR (spur free dynamic range). Together, the QDWS and DRx are miniaturized, highly agile designs that will serve as the core of MiniSAR and many other future radar designs.
- **MiniSAR Microwave/RF Technologies:** A miniaturized STALO module for miniSAR was designed and fabricated in a multilayer LTCC (low temperature co-fired ceramic) topology, similar to the approach being used for the up/down-converter module). This design represents a 20x miniaturization over previous STALOs. The design is currently in initial testing.
- **GMTI:** A plan is being developed for the methodical investigation and development of new high-performance Ground Moving Target Indicator radar modes and modifications. This effort will initially aim at improved sub-clutter visibility and moving target location techniques using along-track interferometry. Aspects of vibrometry will also be investigated. The ultimate goal will be to maximize information extraction from radar data to provide an integrated SAR image and scene motion analysis capability. It is believed that the latest digital radar techniques and technologies are mature enough to facilitate this.



An Ultra-High Resolution SAR

Unequaled SAR resolution from an airborne platform



The Benefits of Fine Resolution

- More “pixels on target” results in a more optically literate image
- Better facilitates accurate target identification
- Further improves capability of modes such as CCD, which exploit phase change

Key Elements of UHSAR

- Wide-band RF Subsystem and Antenna
- RF Phase Error Correction (PEC) and the Digital Waveform Synthesizer (DWS)
- The Digital Receiver
- Real-Time Motion Measurement and Compensation
- Polar Format Image Formation with Advanced Phase Gradient Autofocus
- Coherent Data Exploitation Algorithms Such as Multi-Pass IFSAR and CCD.

Parameter	Value
Radar Operating Band	28.5 to 38.5 GHz
Data products	Raw Phase Histories and Real-Time Images
Maximum Patch Size for Real-Time Imagery	2k X 2k pixels
Maximum Patch Size for Ground Processed Imagery	8k X 8k pixels
Maximum Transmitter Power	80 Watts Peak
Maximum Range at Finest Resolution	5 km (2.7 nmi)
Equivalent noise reflectivity (σ_N) at finest resolution	< -25 dBsm/m ²
Image Impulse Response Peak Sidelobe Level	-30 dBc
Image Total Multiplicative Noise Ratio	< -18 dB



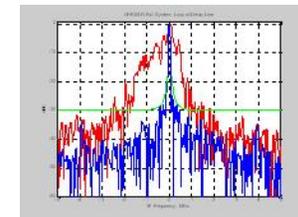
Ultra-Wide Bandwidth Antenna



80W Transmitter



Digital Receiver



Dynamic Phase Error Correction

UHSAR Image of C-130s on Front-line - KAFB, Albuquerque, NM
4-inch Resolution
Data Collected May 10, 2004



UHSAR Image of Display Planes and Helicopter - KAFB, Albuquerque, NM
4-inch Resolution
Data Collected June 17, 2004





Recent Publications

The following technical reports have been published during the last quarter.

- Dale Dubbert, Gilbert Delaplain, Martin Thompson, James Redel, Christopher Wojahn, Graham Smith, "An Ultra-High Resolution, High-Performance Ka-Band Airborne SAR," *50th Annual Tri-Service Radar Symposium*, Albuquerque NM, June 21-25, 2004.
- Bryan Burns, Timothy P. Bielek, Douglas G. Thompson, Mark Dowdican, "Bistatic Data Collection System and Results," *50th Annual Tri-Service Radar Symposium*, Albuquerque NM, June 21-25, 2004.
- Paul Eichel, J.T. Cordaro, Gerald Benitz, Bryan Burns, Doug Bickel, "Bistatic Interferometric SAR and GMTI Results," *50th Annual Tri-Service Radar Symposium*, Albuquerque NM, June 21-25, 2004.



Additional Information

Visit the following link for additional information:

www.sandia.gov/radar/sar.html