FARAD: Facility for Advanced RF and Algorithmic Development

Exploratory Radar Systems Capabilities Overview

Dale Dubbert
Sandia National Laboratories
(505) 845-8424
dfdubbe@sandia.gov

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The Purpose of FARAD

- To develop and maintain an in-house, high-performance, multi-mode airborne radar capability for the continued advancement of Sandia’s ISR capabilities.
- FARAD works in accord with R&D efforts, both internal and external, to provide advanced radar airborne data collection and exploitation assets to facilitate specific research goals.
- FARAD provides a “testbed laboratory”/research tool set that can be widely utilized in support of internal R&D, new program development, and collection of customer requested data products.

DeHavilland DHC-6 “Twin Otter” research aircraft operated for Sandia by Twin Otter International
FARAD complies with Sandia Common Architecture Program (CAP)

Subsystems common to all FARAD radars:
- Modular phase history generator (PHG)
- GPU-Based phase history processor(s) (PHP)
- Claw® based radar operator computer and console
- CAP multi-mode radar software
- 3-Axis antenna positioner

Frequency dependent subsystems:
- Antenna
- RF front end
- Frequency translation (Ka-Band)
FARAD Radar Configurations

- **PhoeniX**
  - X-Band (9.6 GHz)
  - Fully polarimetric
  - Fully integrated dual-channel front end

- **Ku-Band**
  - Ku-Band (16.8 GHz)
  - Quad-phase-center antenna
  - CAP PHG/PHP/Claw and Ku-Band MFE/AGA*
  - 4-channel front end, dual RX channel PHG**

- **Ka-Band**
  - Ka-Band (35 GHz), ultra-fine resolution
  - Azimuth monopulse antenna (low-MDV GMTI, VICTR***)
  - All Ka-Band RF, including MPM, integrated on gimbal center axis

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*Modular Front End / Antenna Gimbal Assembly
**Phase History Generator
***Velocity Independent Continuous Tracking Radar
PhoeniX

- 9.6 GHz center frequency
- 3 GHz RF bandwidth
- 4-inch resolution (spot mode)
- 1-foot resolution (contiguous stripmap)
- 300 Watt TWTA
- Single hardware RX channel
- Fully polarimetric (4:1 multiplex)
- 12 km single-pol, 8 km full pol max range at finest resolution*
- Real-time image formation on single polarization

Operating modes:
- SAR (spot circle, straight-line spot, stripmap)
- VideoSAR
- Exoclutter GMTI
- Single or quad-polarization on all modes
- Bistatic modes with ground-based RX/acquisition system

Fully operational: First collect was 6/19-8/1/2013.

*Assumes < -25 dB noise reflectivity maintained at far corners of image with max image size (4k pixels range, 3 dB beamwidth azimuth)
Ku-Band

- 16.8 GHz center frequency
- 3 GHz RF bandwidth
- 70 Watt MPM*
- 4-inch resolution (spot mode and contiguous stripmap)
- Dual hardware RX channels
- 2:1 multiplexing each channel (4 data channels)
- Quad phase center antenna
- 8 km max range at finest resolution
- Real-time image formation on two channels
- Operating modes:
  - SAR (spot circle, straight-line spot, stripmap)
  - VideoSAR
  - Endoclutter GMTI
- Fully operational: First collect was 7/11-8/13/2014

*K-3 Comm Microwave Power Module
Ka-Band

- 35.6 GHz center frequency
- 5 GHz RF bandwidth
- Ultra-fine spot-mode resolution
- 1-foot resolution (contiguous stripmap)
- 50W NanoMPM®
- Single hardware RX channel
- Azimuth monopulse antenna
- 2:1 multiplex (Σ/Δ)
- 6 km max range at finest resolution
- Real-time image formation on single channel

**Operating modes:**
- SAR (spot circle, straight-line spot, stripmap)
- VideoSAR
- Endoclutter GMTI
- VICTR

**Fully operational: First collect in June, 2015.**

Ka-Band 4-inch resolution SAR interleaved stripmap, UNM Golf Course, overlay on Google-Earth.