Characterizing and Monitoring Suspected Underground Nuclear Sites with VideoSAR

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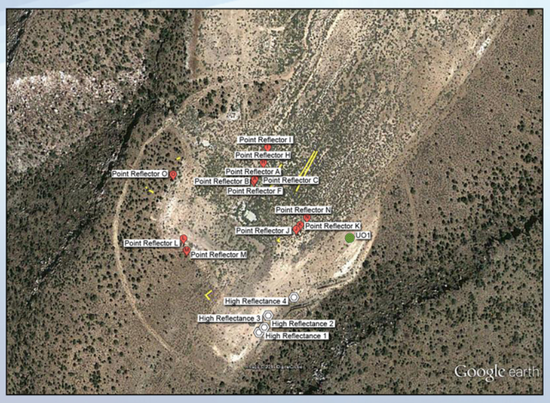
Goals and Objectives

The unique collection modality of VideoSAR, offered by airborne synthetic aperture radar (SAR), can be used to monitor a suspected nuclear test site by detecting polarimetric signatures from man-made objects.

Optical Image of an old Nuclear test site in Nevada.



Optical Image of an old Nuclear test site in Nevada with man-made objects identified with VideoSAR. These findings were verified with ground truth.

Methods

VideoSAR is a measurement technique that utilizes a continuous spotlight collection with a collection path that circumscribes the site of interest.

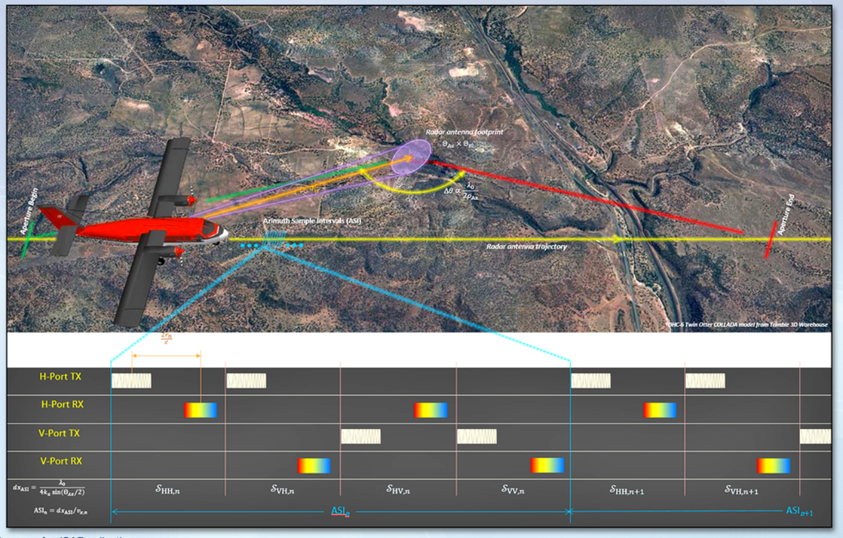
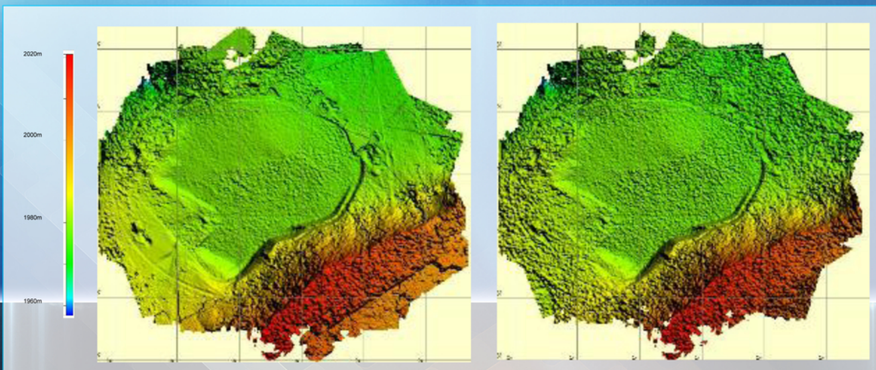


Diagram of polSAR collection

From this collection, the following can be created:

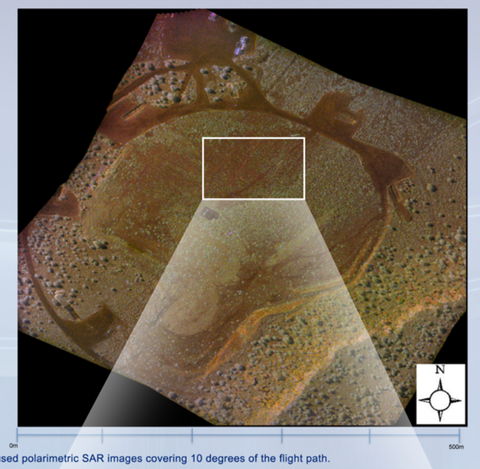
- **DEMs**
  - 1-pass stereo
  - 2-pass InSAR
- **PolSAR Images**
  - Projected onto DEM
  - 10 images fused together
  - Polarimetric decompositions display scatter-type powers



Digital Elevation Models (DEMs) of the scene.

Results or Major Findings

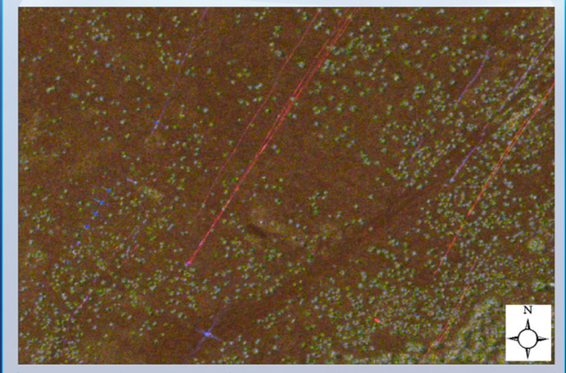
These DEMs are then used to create orthorectified polarimetric SAR images. The colors of these images represent the composition of scatter-types within a resolution cell.



Ten fused polarimetric SAR images covering 10 degrees of the flight path.

Composite PolSAR Images

From these image products, man-made objects that are associated with underground nuclear tests are identified.



Zoomed-in portion of the polSAR image to show highlighted man-made objects.

Sandia National Laboratories

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National Nuclear Security Administration