



# GeoSAR Radar Mapping



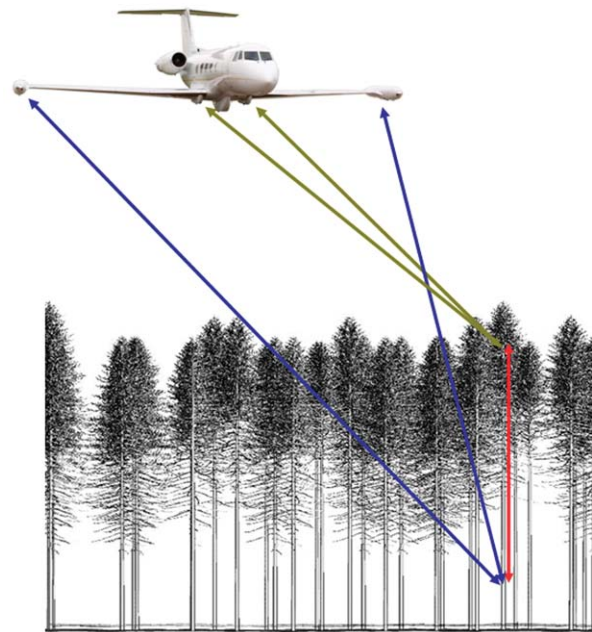
GeoSAR is a dual-band, dual-sided, single-pass interferometric synthetic aperture radar (IFSAR) system integrated into a Gulfstream-II (G-II) jet aircraft. GeoSAR acquires high resolution geospatial data over large and remote areas with unprecedented speed and accuracy.

## The GeoSAR System

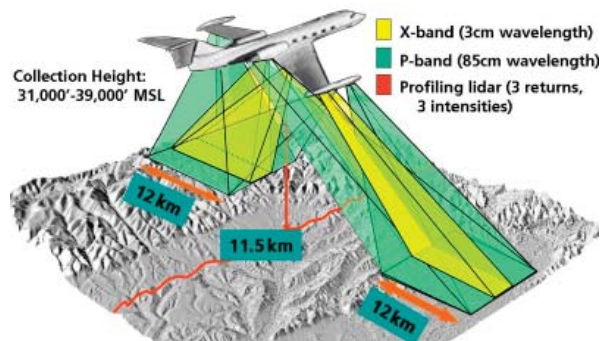
As the G-II traverses a flight line, GeoSAR simultaneously and interferometrically collects X- and P-band data in swaths 10-12 km wide on each side of the aircraft at a data rate of nearly 400 Mb per second. This dual-band, dual-sided antenna configuration allows four or more independent looks for most points on the ground in each frequency band. The 9-11 km nadir coverage gap between the swaths on either side of the G-II is covered by overlapping swaths from adjacent flight lines. Redundant coverage results from the flight-line spacing adjusted to cover the nadir hole. The redundancy results in each ground point being looked at twice from the left and twice from the right, at a steep and a shallow angle. Flight plans are designed to provide from three to seven independent measurements for every map pixel.

## GeoSAR Advantages

- The GeoSAR system operates in cloudy conditions, day or night. This provides flexibility in scheduling with air traffic controllers and amid adverse weather patterns.
- GeoSAR simultaneously and interferometrically maps above and beneath foliage. Whether or not requested, Fugro's GeoSAR collects P-band data to preserve customer options for future beneath-the-foliage processing and feature extraction.
- Multiple looks at each point on the ground ensure near void-free coverage in project areas.
- LiDAR continuous nadir terrain profiles remove residual tilts in individual data swaths while providing high-density ground control and direct foliage density measurement.



GeoSAR's X-band (green) backscatters off of the tree tops, while P-band (blue) penetrates foliage and scatters off substructures.



GeoSAR system profile.

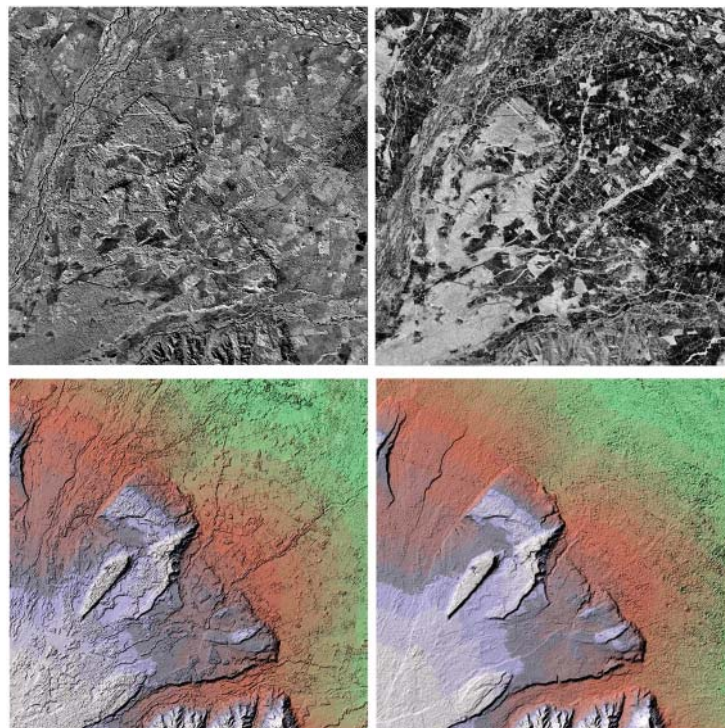
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## GeoSAR Data

GeoSAR's 3 cm wavelength, 3 m posted X-band (9630-9790 MHz) frequency scatters off vegetation and other surfaces, providing excellent resolution for first-surface features and feature height. As a complement to X-band data, the 85 cm wavelength, 5 m posted P-band (270-430 MHz) frequency penetrates vegetation and scatters off substructure, showing surface features hidden beneath foliage.

## GeoSAR Applications

- **Mapping:** image rectification, map updating, 3D visualization
- **Hydrology:** watershed delineation, flood risk mapping
- **Natural Resources:** timber management, agricultural monitoring, water conservation
- **Environmental Stewardship:** deforestation prevention, coastal preservation, carbon counting (biomass)
- **Oil & Gas Exploration/Production:** geological interpretation, seismic mission planning, pipeline routing
- **Mining:** mineral prospecting and extraction
- **Economic Development:** land-use management and planning, urban encroachment studies
- **Public Works:** infrastructure planning and development
- **National Security:** emergency preparedness, response, and relief
- **Tourism and Archaeology:** site exploration, identification, preservation



*Sample Data: X-band scatters off the first surfaces of vegetation, buildings, and bare-earth. The 3 m posted X-band image (top-left) is rich in first surface details. The vegetation is seen in the X-band DEM (bottom-left) along with rivers and fields. P-band penetrates vegetation and scatters off substructure, showing details otherwise hidden beneath the foliage. The P-band image (top-right) reveals road networks, buildings, and features not apparent in the X-band data. Edges of features such as rivers and roads are clearer in the P-band image because the longer wavelength deeply penetrates overhanging vegetation. Absence of vegetation in the P-band DEM (bottom-right) results in a smooth appearance that more closely follows the terrain.*



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