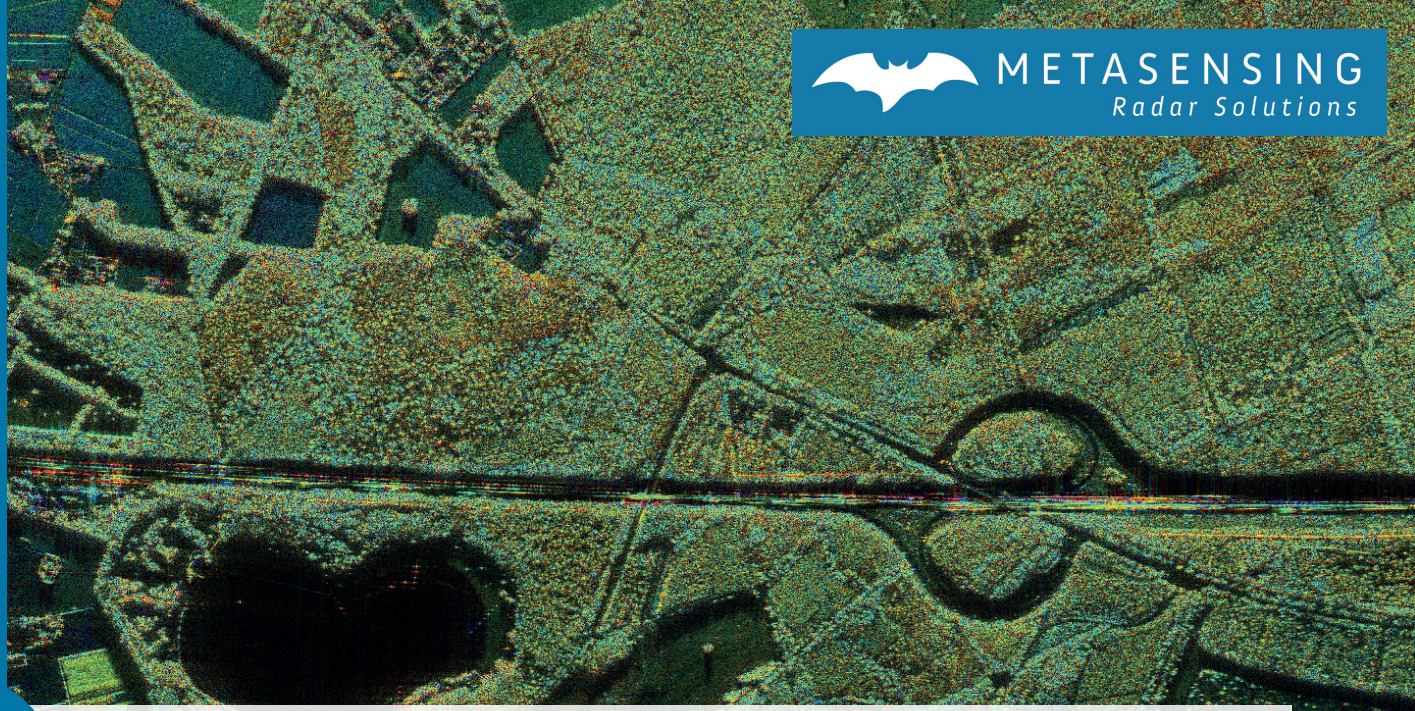
METASENSING
Radar Solutions



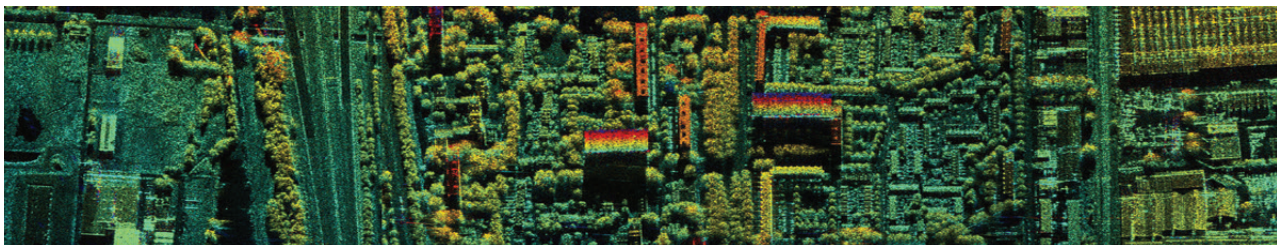
MetaSAR: AIRBORNE SAR PORTFOLIO

MetaSensing offers the MetaSAR family of high-resolution airborne SAR. Airborne SAR has been MetaSensing's core business since its inception in 2008. We offer two lines of products:

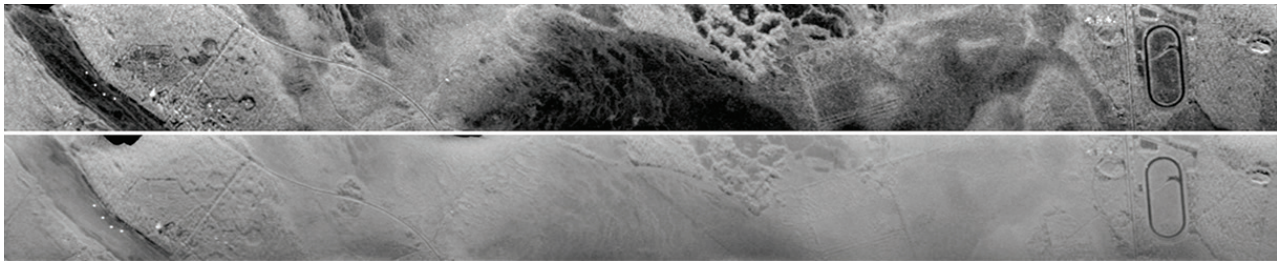
- Light-weight, compact SAR sensors (MetaSAR) and End2End SAR processor (MetaSAR-Pro)
- SAR data acquisition services

MetaSensing has developed airborne SAR systems at multiple frequencies (P-, L-, C-, X-, Ku-, Ka-band) and architectures (cross-track and along-track interferometry, single-pass and repeat-pass interferometry, full polarimetry) for customers like ESA and NASA. Given their small size and low power consumption, MetaSensing radars are particularly suited for UAVs or small aircraft, and can be installed on multiple general aviation platforms.

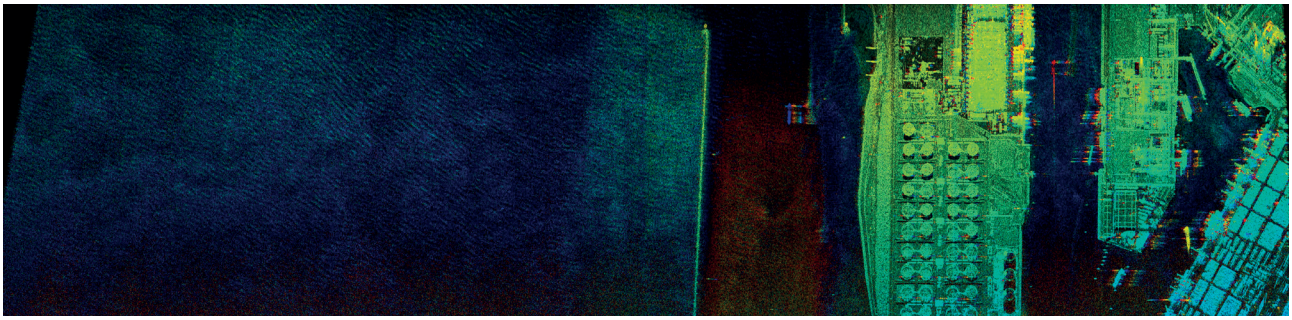
For specific customer needs, MetaSensing also develops prototype SAR sensors with on-demand architectures.



Digital Surface Model (DSM) over Delft, The Netherlands, computed from cross-track interferometric X-band SAR data.

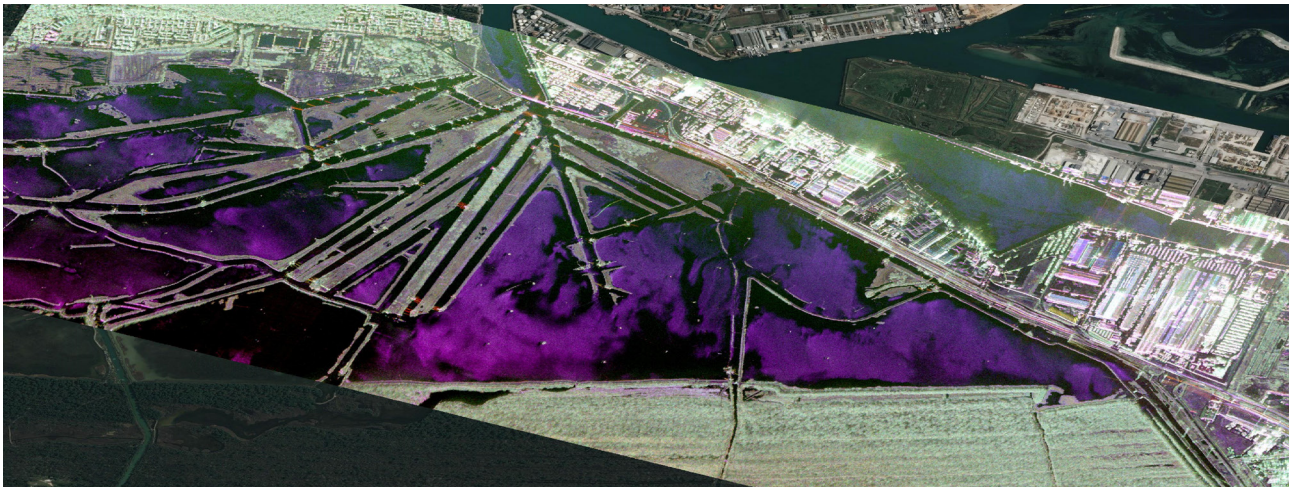


Snow-covered area in Lapland, Finland, simultaneously imaged at X-band (top) and Ku-band (bottom) for the ESA SnowSAR Campaign. The stunning difference is due to different penetration depths of the two frequencies used.



MetaSAR-X image of Rotterdam harbor. Along-track interferometry permits MTI over land (red dots on the right) and measurement of surface current velocities over water (on the left). Note the different surface velocity of water outside (blue) and inside (red) the breakwater (straight vertical green line at the center of the image).

Polarimetric airborne bistatic SAR image obtained with two independent MetaSAR-L on two aircraft flying in formation. Red, green and blue correspond to HH, VV and HV pol channels.

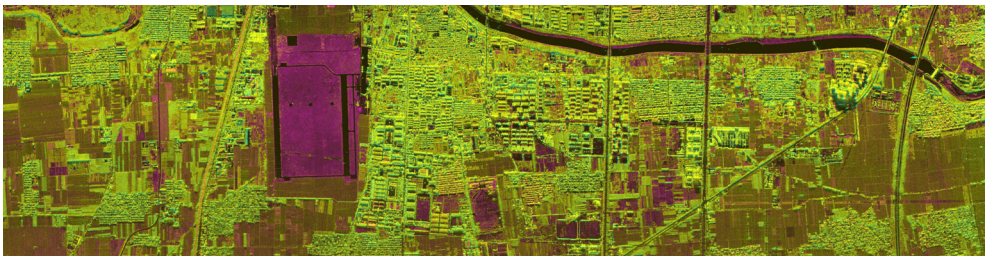


Polarimetric image acquired over a city with lexicographic decomposition. Blue/purple indicates a strong VV component as well as a significant HH component to the total backscatter. Over forested areas, the green color indicates a dominant HV component, generally characteristic of vegetated zones. Over the built-up areas, the dominant colors are white and green, where white pixels correspond to equal amplitude in all polarimetric channels.

MetaSAR-X amplitude SAR image over airport and surrounding area

Color-coded composition of fully polarimetric L-band intensity images acquired with the MetaSAR-XL.
(Red: VV, Green: HH, Blue: VH)

Color-coded composition of fully polarimetric X-band intensity images acquired with the MetaSAR-XL.
(Red: VV, Green: HH, Blue: VH)



Color-coded composition of X- and L-band intensity images simultaneously acquired with the MetaSAR-XL.

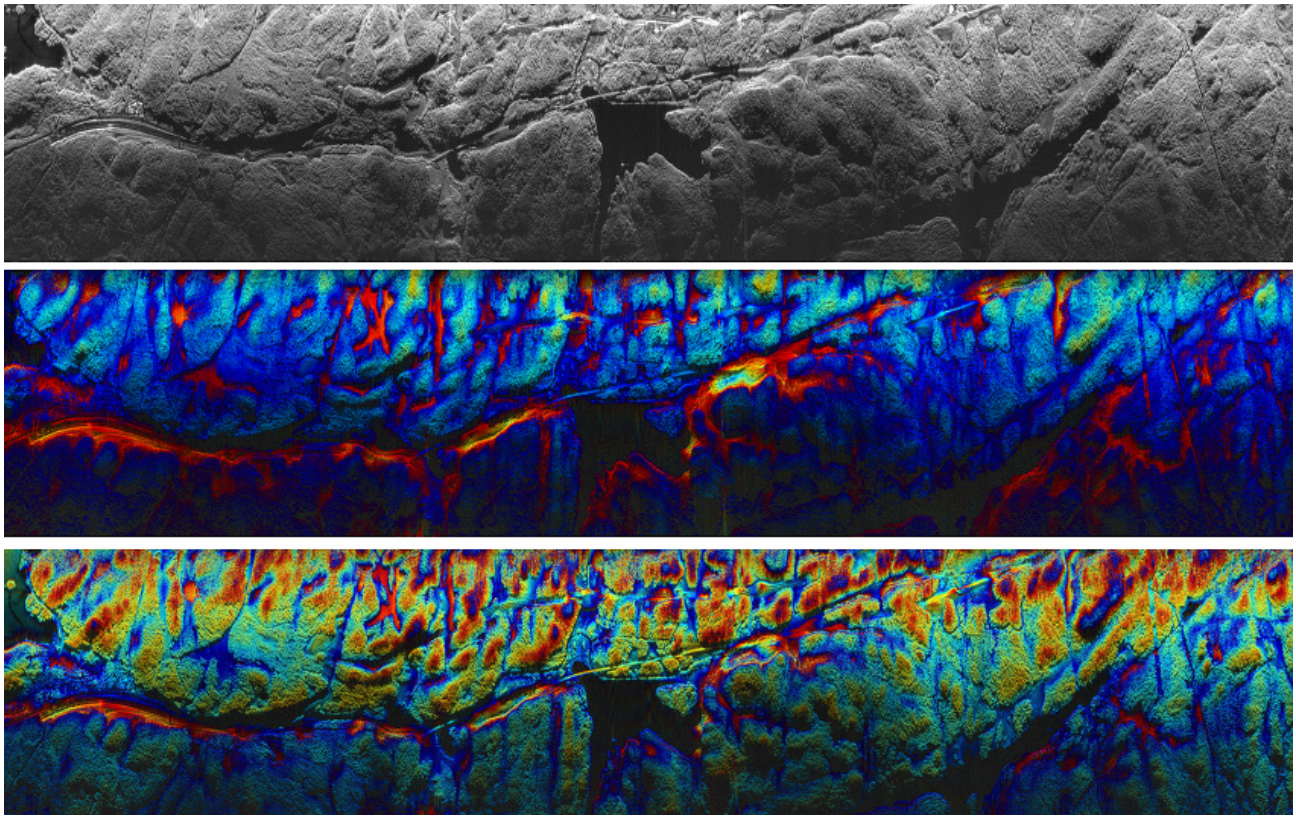
The above images have a ground range of 3.5 km and an azimuth of 10 km.

OVERVIEW OF COMMERCIAL AND SCIENTIFIC APPLICATIONS OF AIRBORNE SAR

- Natural disaster preparedness and response: mapping the extent of oil spills, floods, earthquake devastation, wildfires, and tsunami flooding.
- Geology: terrain type discrimination.
- Forest management: estimation of forest height, biomass, and vertical structure, especially with 3D tomographic SAR imaging.
- Land management: urban development planning.
- Glaciology: large-scale quantitative measurement of glacier flow with differential interferometry, 3D ice structure mapping with SAR tomography, and estimation of snow total and liquid water content.
- Solid earth applications of differential interferometry: earthquake crust deformation, volcanic doming, and land subsidence (aquifer depletion, sinkholes, calderas).
- Cartography: topographic map (DEM) generation with cross-track SAR interferometry.
- Agriculture: crop classification, yield prediction, and soil moisture.
- Oceanography: wave spectra, ocean surface current measurement with along-track interferometry, and wind speed and direction.
- Archeology: subsurface imaging.
- Geo-Intelligence, surveillance and reconnaissance: concealed target detection, change detection, moving target indication, and surface imaging (e.g. underground features).

Sensor	Frequency	Bandwidth	Range Resolution	Main Applications
MetaSAR-P	400 MHz	200 MHz	0.75 m	vegetation penetration, DEM, concealed target detection, geo-intelligence
MetaSAR-L	1.3 GHz	200 MHz	0.75 m	vegetation mapping, land cover classification, DEM, DSM, InSAR, soil moisture, water leak detection
MetaSAR-C	5.3 GHz	300 MHz	0.50 m	sea ice, mapping, snow, forest monitoring
MetaSAR-X	9.6 GHz	600 MHz	0.25 m	imaging, mapping, interferometry, geo-intelligence
MetaSAR-Ku	17.2 GHz	600 MHz	0.25 m	mapping, imaging, snow, ice
MetaSAR-Ka	34.5 GHz	600 MHz	0.25 m	mapping, imaging, InSAR

MetaSAR sensors are configured for interferometry and full polarimetry. They can be configured as single, dual, or multiple frequency systems with any number of channels for interferometric and/or polarimetric acquisitions.



SAR images acquired with the single-pass multi-baseline interferometric MetaSAR-C over forest. The top image is a SAR amplitude image; the middle image is an interferogram with a 33cm baseline flatted with SRTM DEM; the lower image is a flatted interferogram with a 66cm baseline. It is clearly visible that the lower image, with the longer baseline, is more sensitive and two times more fringes appear.

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