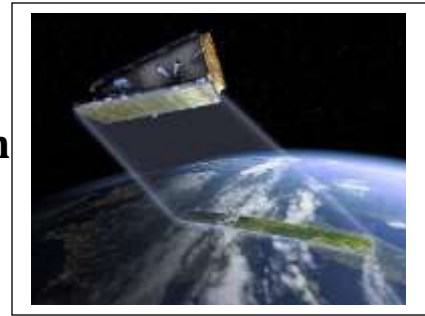# NovaSAR (SSTL) Mission

NovaSAR is a joint technology demonstration initiative of SSTL (Surrey Satellite Technology Ltd.), UK, and Airbus DS funded by the UK Government via UK Space Agency. It was launched on-board PSLV-C42 on 16 September 2018 (16:38 UTC) .

NovaSAR has two payloads on board–S Band Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) .SAR is the primary payload operating in S- band frequency range of 3.1-3.3 GHz. It provides medium resolution SAR data ranging from 6m-45 m resolutions with Single,Dual,Tri and Quad-Polarization capability.AIS communication takes place using two VHF frequencies, 161.975 MHz and 162.025 MHz, using a bandwidth of 25 kHz for vesselidentification in oceans.

The NovaSAR data will be received by NRSC Antenna systems and SSTL supplied RF rack..Stripwise Single Look Complex –SLC and Ground Range data products data products are generated by the SSTL-Image Formation Processor-IFP

NovaSAR acquisitions are planned daily at NRSC using a systematic predefined table/Disasters or specific User Requests using SSTL supplied Tool taking Application and User requirements .Automation is built with SSTL systems for seamless acquisition , monitoring and processing. Software is designed and developed by NRSC to integrate into IMGEOS framework through interface adapters and workflows chains for different modes and processing level products. NRSC has designed and developed scene-based product generation and additional information bands for readyapplication usability. Higher order products are also under development .These products are generated in IMGEOS for supporting and enhancing SAR remote sensing applications.

Application Potential: It is ideal for medium resolution SAR applications like flood monitoring ,agricultural crop assessment,forest monitoring ,land use mapping ,disaster management and maritime applications to name a few.

USERS : ISRO/DOS and global registered users of UOPS/Bhoonidhi, Pricing : As per policy to contact gdndc@nrsc.gov.on .

SAR and AIS Data coverage &availability : Data is acquired over India and surroundings and is available from October 2019 to till date.

NovaSAR Specifications

Parameter	Value
Imaging frequency band	S-band (3.1-3.3 GHz, wavelength of ~ 10 cm)
SAR Antenna	Microstrip patch phased array (3x1 m)
No. of phase centers	18
Peak RF power	1.8 kW
Polarizations	HH, HV, VH, VV
Imaging polarization	Single, dual, tri or quad-polar
Duty cycle	2-3 minutes per orbit (equates to single image 800 km long)
Payload data memory	544 Gbytes
AIS Antenna	2 orthogonal mounted monopole antennas per receiver
Design life for operations	7 years
Design Mass	<440 kg
Optimum orbit	580 km SSO (LTAN 10:30)
Propulsion system	Xenon
Payload data memory	2xHSDR (32 GBytes) + 2xFMMU (512 Gbytes)
Downlink rate	500 Mbps*
TT&C frequency band	S-band (2025-2110 MHz, 2200-2290 MHz)
Downlink frequency band	X-band (8.025-8.4 GHz)

➤ NovaSAR Imaging Modes :

NovaSAR is designed to image in the three basic SAR modes of Stripmap, ScanSAR and Maritime .The imaging modes with the incidence angles range at 580 km altitude with the NESZ specifications are:

ModeType	Ground Range Resolution	Incidence Angle (Deg)	No.of Swaths	Swath Width (Across track) (km)	Worst Case Sensitivity (NESZ) (dB	Worst Case Azimuth Ambiguity Ratio (DTAR)dB	Worst Case Range Ambiguity Ratio (DTAR)dB	No. Of Looks
ScanSAR (HH or VV)	20m	15.0-24.66	1	100	<-20	<-16	<-16	4 (2-Range,2 Azimuth)
ScanSAR (HH or VV)	20m	24.51-28.94	1	50	<-21	<-19	<-14	4 (2-Range,2 Azimuth)
Maritime(HH)	6mrange 13.7m azimuth	34.5-57.3	1	400	<-9.5	N/A	<-15	1 (1Range,1Azimuth)
StripMap(HH or VV)	6m	16-25.38	9	20	<-20	<-18	<-17	3 (1-Range, 3 Azimuth)
StripMap(HH or VV)	6m	21.29-31.2	11	13-20	<-19	<-15	<-14	3 (1-Range,3 Azimuth)
ScanSAR Wide(HH or VV)	30m	11.29-25.93	1	150	<-21	<-19	<-15.5	4 (2-Range,2 Azimuth)
ScanSAR Wide (HH or VV)	30m	27.35-32.01	1	55	<-19.5	<-17.5	<-16	4 (2-Range,2 Azimuth)
Dual Polar(HH&VV)	20m	13.98-30.6	5	50-60	<-20	<-17	<-12	3 (3-Range,1 Azimuth)
Tri-Polar (HH&VV&HV)	30m	15-29.1	3	50-56	<-27	<-17	<-17	4 (2-Range,2 Azimuth)
Tri-Polar (HH&VV&HV)	35m	14.39-29.08	2	100km	<-26dB	<-17	<-8	1
Co+Cross Polar (HH & HV)	40m	12.95-31.18	1	195km	<-21dB	<-15	<-10	4 Co-pol(4 range ,1 azimuth), 1 Cross pol
Co+Cross Polar (HH & HV)	45m	12.95-31.18	1	195km	<-26dB	<-14	<-5	1
ScanSAR Survey	33m	11.82-30.26	1	195km	<-19.5dB	<-17	<-12	3 (3-Range,1 Azimuth)

Reference: SSTL-Airbus Products Specifications

➢ NovaSAR Data Products:

NovaSAR data products are scene-framed from the strip wise data product generated by SSTL processor at NRSC and further processed to Level 2 for ease of data handling and analysis.

Levels of Processing

Level-1 SLC	Scene-Based Geo-Tagged Product (For StripMap Mode only)	Slant Range Product Format-GeoTIFF
Level-1 GND	Scene-Based Geo-Tagged Product (For StripMap Mode)	Ground Range Product Format-GeoTIFF
Level-1 SCD	Scene-Based Geo-Tagged Product (For ScanSAR Mode)	Ground Range Product Format-GeoTIFF
Level-1 Maritime	Strip-Based GeoTagged Product	Ground Range Product Format-GeoTIFF
Level-2 Geo-referenced	Scene-Based Geo-Referenced Product (For Stripmap and ScanSAR modes)	Bundled product containing Map Projected Product with Sigma Naught and Surface Water layer products Format-GeoTIFF

For the maritime mode,strip wise data is provided at present.

** *The overall Turn-Around Time(TAT) forstripmap products is 90mins and for ScanSAR products is 120mins.*

Product specifications :

Radiometric stability*:* 0.41dB

Geometric Accuracy: Better than 2 Km (NovaSAR products are georeferenced based on geometry derived from the orbit and the WGS84 earth ellipsoid model. This includes a correction for estimated height at the centre of the image. The estimated height used is indicated in the "Mean Terrain Height (m)" field of the metadata.)

➢ Scene -sizes as per the imaging mode

S.No	Mode	Ground range resolution | Swath width (across track)	Incidence angles	Standard Level 1/Level-2 Slice Range XAzimuth Extent(KM)
1.	1a ScanSAR	20m | 100 km	15.8-25.38°	100X100
2.	1b ScanSAR	20m | 50 km	25-29.4°	50X50
3.	2 Maritime	6m range 13.7m azimuth | 400 km	34.5-57.3°	As per Acquisition Extent in Azimuth
4.	3a Stripmap	6m | 20 km	16-25.38°	20X20
5.	3b Stripmap	6m | 13-20 km	21.83-31.2°	13-20X20
6.	4a ScanSAR Wide	30m | 140 km	14-27.39°	140X140
7.	4b ScanSAR Wide	30m | 55 km	27.35-32.01°	55X55
8.	ScanSAr_40 Co-Pol+ Cross Pol	40m | 195 km	13.00-31.14°	195X195
9.	Stripmap_6 Single Pol	6m | 18-25 km	13.10-31.22°	18-25X25
10.	Stripmap_6x 20 Cross-Pol	6m | 20 km	13.10-31.22°	20X20
11.	ScanSAR_20 CoPol+Cross Pol	20m | 20-30km	13.00-31.22°	20-30X30
12.	ScanSAR_30 Single-Pol	30m | 195 KM	13.0-31.137°	195X195

> **Data access :** Only Registered users of UOPS/Bhoonidhi can browse and order NovaSAR products
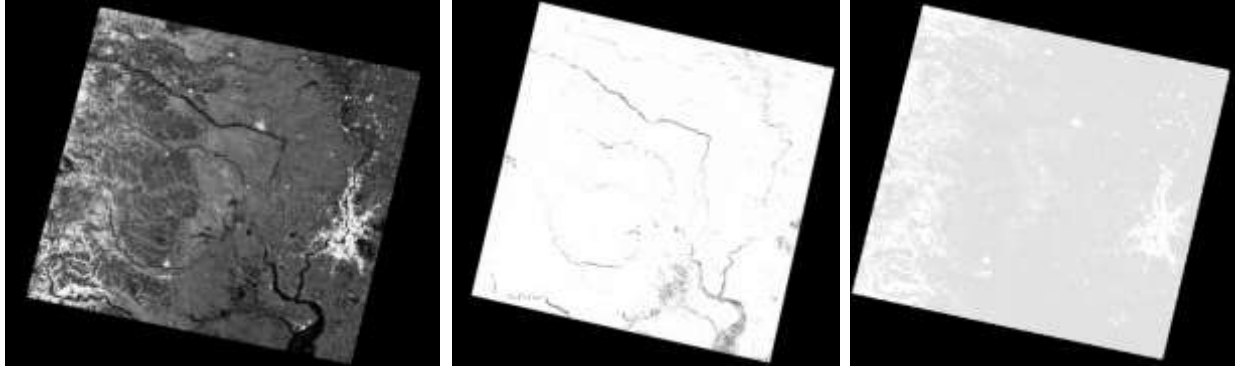
Data can be searched and Ordered from the Bhoonidhi : **https://bhoonidhi.nrsc.gov.in**
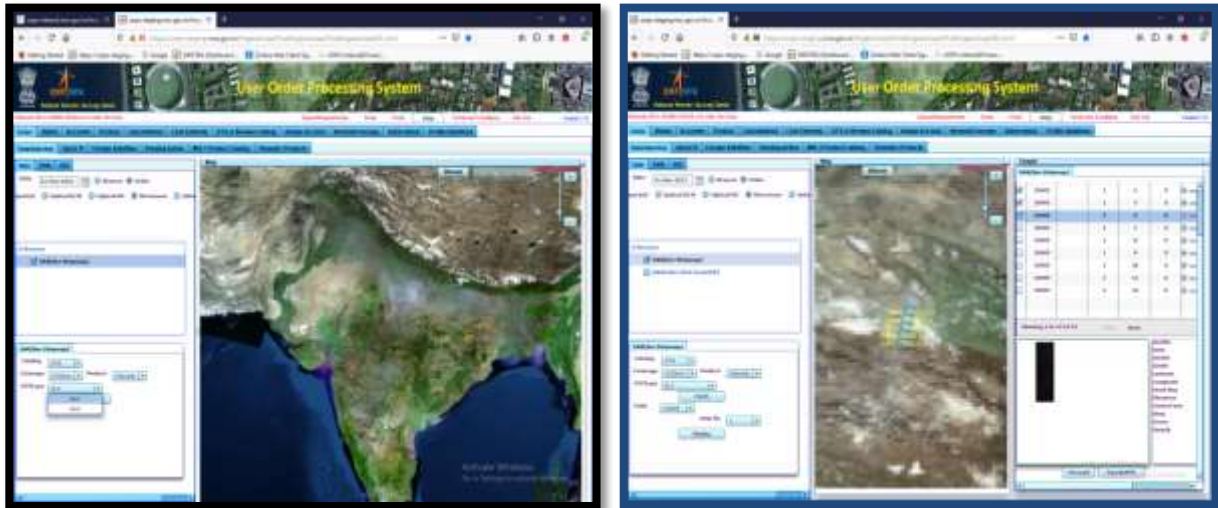
Sample Images:
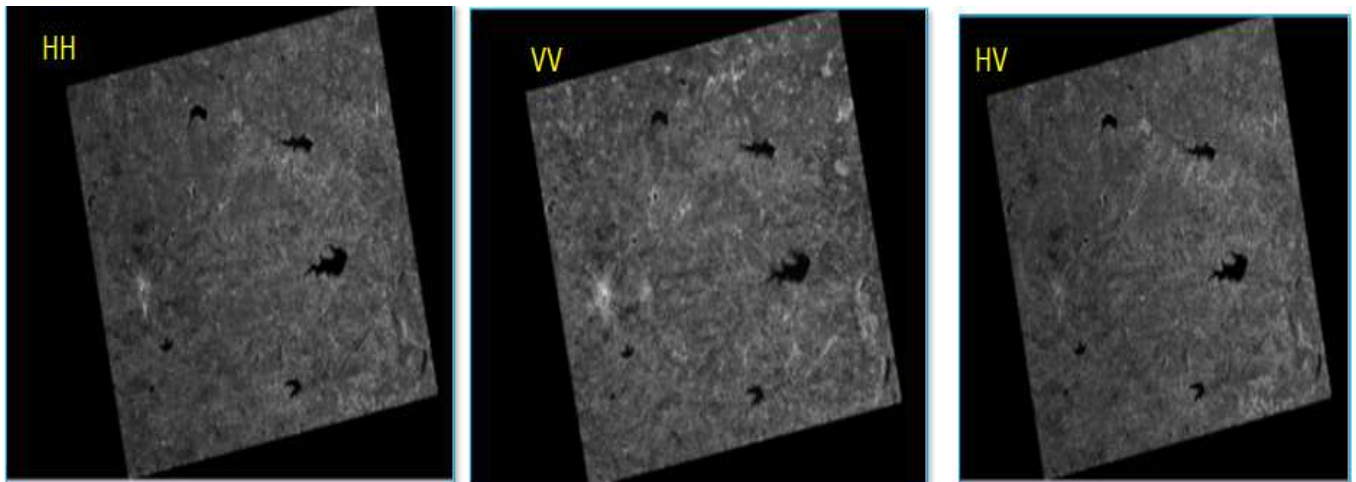
Madya Pradesh, Resolution: 30m, Mode: SacnSar, Pol: VV_HH_HV, Incidence Angle:17.8deg
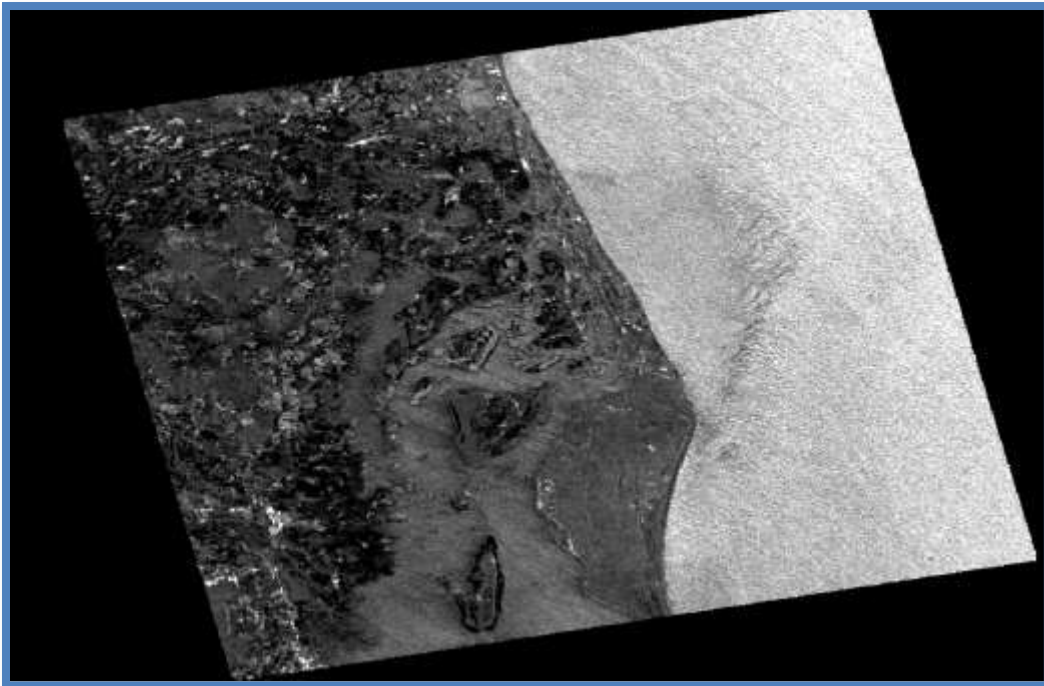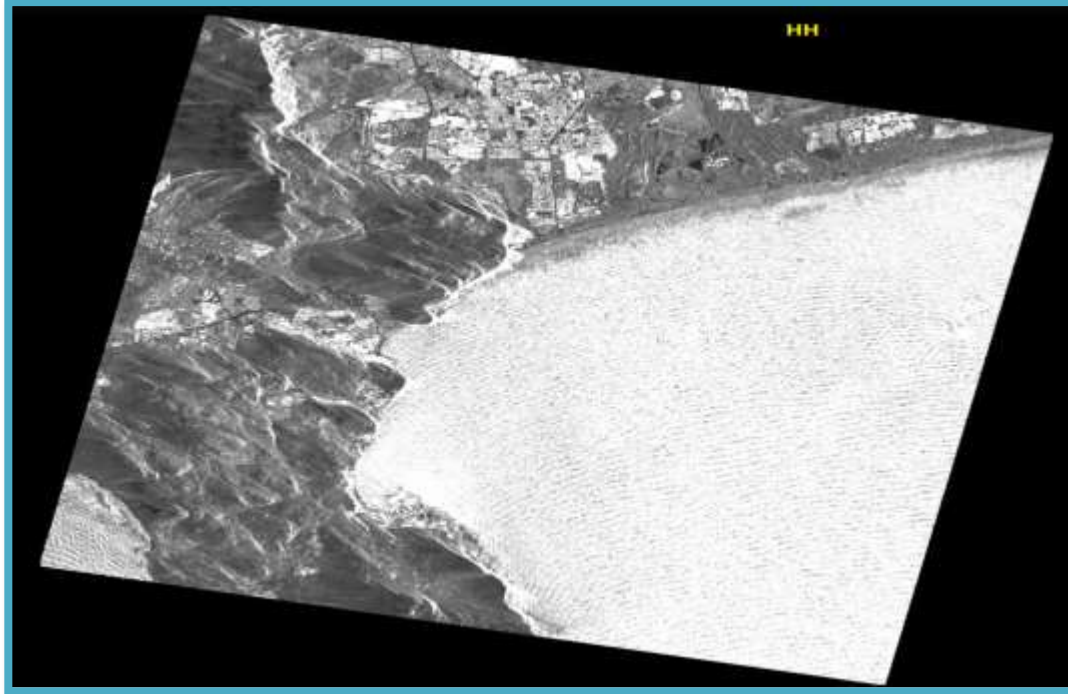
a. Image HH   b. Georef Surface Water Layer   c. Georef Sigma Naught Image

Odisha , Resolution:50m Mode:ScanSAR Pol: HH Incidence Angle:22.7deg

Chennai cost at the time of NIVAR Cyclone, Resolution: 20m,   Mode: ScanSAR,   Pol: HH, Incidence Angle:20.5deg

Capetown, Resolution: 6m, Mode: StripMap, Pol: HH, Incidence Angle: 20deg

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