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Application Potential of L&S band Airborne SAR developed as a Pre-cursor to the Space-borne NISAR Mission

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ISRO in collaboration with NASA-Jet Propulsion Laboratory (JPL), is developing a dual frequency Synthetic Aperture Radar (SAR) mission, named NISAR and planned for launch in early 2022. The mission is a dual L- and S-band polarimetric SAR with a 12-day interferometric orbit that will provide systematic global coverage over all the landmass including cryosphere. As part of this, Space Applications Centre (SAC), ISRO is developing the S-band SAR and NASA-JPL is developing the L-band SAR. In this process, a number of new technologies in digital and RF domains are being developed at SAC. As a pre-cursor to the space-borne SAR development, SAC has developed an airborne SAR in L& S band with several system design aspects similar to the space-borne dual frequency SAR. Development of an airborne L & S band SAR prior to the NISAR mission is crucial for testing of new hardware systems (viz. Synchronized Oscillator and Central Transmitter (SynOT), Transmit Receive Integrated Module (TRiMs) and data formatter etc.), verification of dual-frequency synchronization methodology and development of tools, techniques and methods for applications of NISAR data. Table 1 presents key system specifications of L&S band airborne SAR. In order to expand the application potential of L&S band airborne SAR a large number of scientists / researchers representing more than 45 institutions in India have been engaged, through a Research Announcement (RA) program to develop applications of L&S band SAR data under various themes (viz. ecosystem, coastal and ocean processes, geology and hydrology, urban studies, natural disaster management and cryosphere studies). The dual-frequency SAR has already collected valuable data over various study sites in India through two phases of airborne campaign. Encouraging scientific results have been obtained from analysis of the data. The airborne SAR is expected to make the Indian scientific community well prepared for optimum utilization of future NISAR data.

Table 1. System Specifications of L&S band Airborne SAR

Parameter	**Specification**			
Platform	Beech craft B-200			
Aircraft Height & Platform Velocity	8.0 km & 120 m/s			
Operating Frequency	1.25 GHz (L) & 3.20 GHz (S)			
Chirp Bandwidth	10MHz	25MHz	50MHz	75MHz
Resolution - (Azimuth X Sl Range)	2m X 15m	2m X 6m	2m X 3m	2m X 2m
Sampling Frequency	83.33 MHz			
SAR Mode	Stripmap			
Polarization Modes	Single Pol; Quasi-Quad Pol; Dual Pol; Hybrid Pol ; Quad Pol			
Effective Antenna dimensions	1.0m (Azimuth) x 0.35m (Elevation)			
Antenna Roll Bias	37° - Nominal	51°		64°
Imaging Swath (S+L)	5.9km at 37°	10km at 51°		15km at 64°
Integrated Ambiguities	<-20dB			
Sigma Naught Threshold	<-20dB			
Radiometric Resolution	3dB-Single Look			
RF Power Transmit	40W (L) & 165W (S)			
Incidence Angle Range	24° to 77°			