

PLIS : Polarimetric L-band Imaging Scatterometer

Funded by ARC Linkage grant

Doug Gray, Heath Yardley, Marian Viola, Jeff Walker, Rocco Panciera, Jorg Hacker, Andrew McGrath, Bevan Bates, Nick Stacy

University of Adelaide

University of Melbourne

ARA Australia, Flinders University

DSTO

Background

Soil moisture, through evaporation and transpiration, plays a major role in the evolution of weather and climate. NASA plans to deploy a satellite with both an active L band scatterometer and a passive L band radiometer for simultaneous collection of global soil moisture data. The project is termed SMAP (Soil Moisture Active Passive). Higher spatial resolution by fusing radiometer data with that of the scatterometer. Deployment is currently scheduled for around 2015. To allow pre-deployment validation of the SMAP concepts Australia will deploy an airborne L band radiometer (PLMR : Passive L-band Microwave Radiometer) and an L- band scatterometer (PLIS : a Polarimetric L-Band Imaging SAR).

PLIS Overview

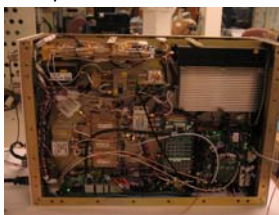
A polarimetric L- band (1.26GHz) airborne synthetic aperture digital radar which digitally generates LFM chirps with bandwidths up to 30MHz using microstrip antennas to radiate and receive.

Measures surface backscatter at HH,VV, HV and VH.

Illuminates ground swaths either side of the aircraft.

Secondary antennas used for single pass interferometry.

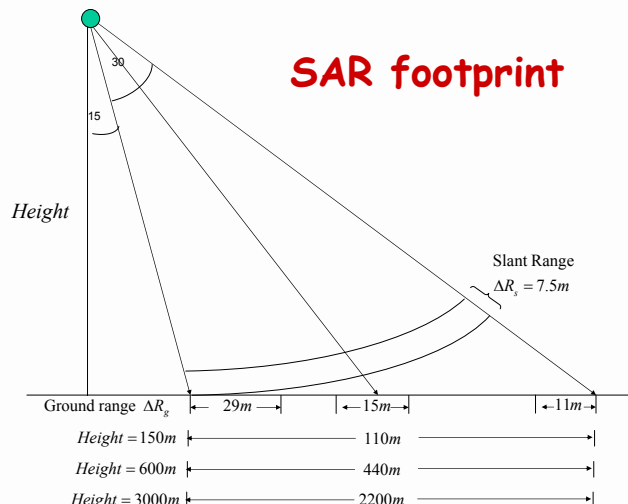
Built by Prosensing USA



Radar Specifications

Radar Specification	Value
Antenna type	2x2 patch array
Antenna gain	9 dBi \pm 2 dB
Cross-polarisation isolation	>20 dB over $\pm 15^\circ$ off peak
RF/Bandwidth	1.26 GHz/Variable to 30MHz (20MHz ideal)
Peak transmit power/duty cycle	30W/ 4%
Pulse repetition frequency	Variable to 20kHz
Pulse width	100ns to 10 μ sec
Transmit Polarisation	Linear H or V (interleaved)
Receive Polarisation	Linear H and V (simultaneous)

SAR footprint



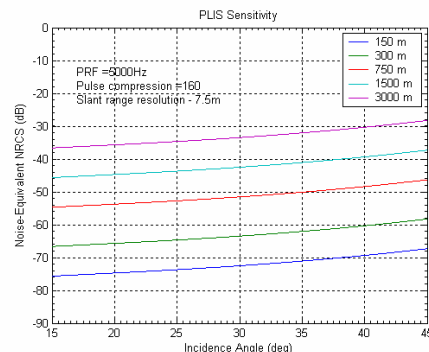
Sensitivity

Noise equivalent normalised radar cross-section

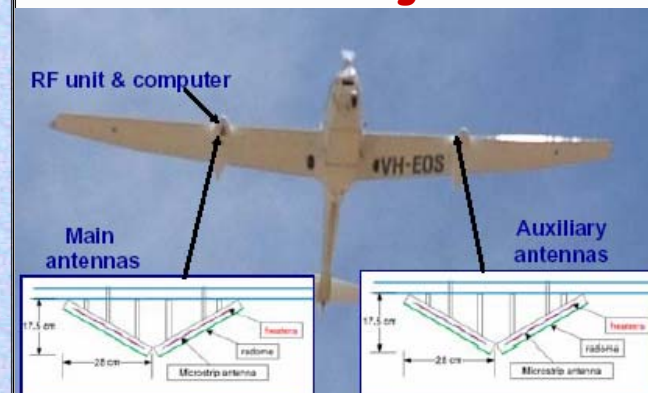
Minimum when received backscatter power (with SAR gains) equals thermal noise

$$(NRCS)_{\min} = \frac{256 \pi^3 R^3 k T B F \sin \phi v_y}{PRF \cdot P_t G^2 \lambda^3 c \tau}$$

Indicative plot

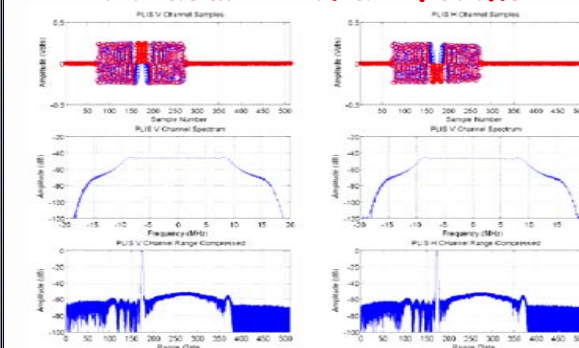


Aircraft configuration



PLIS installation on the Dimona of Airborne Research Australia

Measured Waveforms



Trials Program

Acceptance and calibration tests

Trihedrals and PARCs
Buckland Park
April/May 2010

Soil measurement trials

PLIS and L band radiometer
Murrumbidgee area
July - 2010

