

V, it was convenient to design the radar using a constant PRF/V ratio which fully satisfied the Nyquist criterion for the main lobe of the antenna. Because of antenna sidelobe illumination, some power will be received by the radar with large Doppler frequencies and these are aliased and observed with a Doppler history equal to their true frequency minus the PRF. Consequently, a very strong target can produce antenna sidelobe images on either side of the real image which correspond to these aliases.

In a VV-polarization image from the RTSP (using a PRF/V=2.32), ambiguities were estimated to be -14 and -19 dB below the levels from the unambiguous beam. With the narrower H-pol antenna beam, azimuth ambiguities were too small to measure accurately.

The addition of a second PRF/V ratio (2.57) with slightly overlapping looks reduces the ambiguities for most applications at both polarizations to levels which are now acceptable. In the future (April, 1988), the antenna azimuth beamwidths for both C-band antennas will be narrowed to 3° which will allow work at lower PRF/V ratios. The antenna was contracted by CCRS to Antech Engineering of Montreal⁴, and will be modified by this company to the new specification.

With the swath and sampling used, range ambiguities are negligible.

3.6 Imagery Examples.

Three RTSP images are shown in Figs. 8, 9, and 10. They are each from the Ottawa test line taken on May 8, 1987 and demonstrate the three imaging modes of the radar: narrow, nadir, and wide swath at 7 nominal looks using the LAND STC. In each case, the radar was operating in test transmitter mode at 1/10th maximum power with a PRF/V of 2.57. Despite the reduced power, the overall impression is that the radar imagery is excellent with good focus across the entire swath showing the motion compensation system is performing well.

The Ottawa river is centred across the swath. The lake portion of the river is Lac Deschênes with the town of Aylmer, Quebec bordering it in the north and the cities of Nepean and Ottawa in the east. To the west of Lac Deschênes, is an L-shaped array of corner reflectors used for calibration. It is apparent that the combination of urban and agriculture development as well as the calm river is a difficult imaging situation because of the large dynamic range. Consequently, some cultural targets are saturated; however, the optimum gain strategy is still under investigation and this should be further reduced.

The nadir and narrow swath images are in VV-pol while the wide swath image is in HH-polarization. Subtle differences can be seen in between polarizations. For instance, the marshy shoal regions appear brighter at HH than at VV-polarization. The wide swath image gives a panoramic view of the area from which the geological fea-

tures are more easily discerned. In wide swath, at the far edge, the radar emphasizes the roughness features (fence rows, shrub boundaries etc.) and radiometric contrasts seem reduced.

4 SUMMARY

The CCRS C-band SAR system commissioning on the CV-580 represents an exciting first stage in the development of a flexible, multichannel research facility. A companion, dual-channel, X-band system has recently been completed and is scheduled for installation. It is hoped ultimately to add an L-band system as well.

Extensive use of digital technology has ensured that the system can be well characterized, will operate linearly over a relatively wide dynamic range and, therefore, is calibratable. The accuracy to which a SAR can be calibrated is in general unknown, but we have begun SAR-scatterometer comparison experiments as well as using a calibration site equipped with corner reflectors of known cross section and an active reflector.

Under consideration for the future are plans which include acquisition of a fast ferrite switch for polarimetric mode research, the addition of a second offset antenna to create an interferometric mode, and comparison of this approach with stereo SAR for digital terrain model research in a study of SAR data for mapping purposes.

In summary, a very versatile SAR system has been developed with exciting performance characteristics offering a wide range of imaging and research opportunities.

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