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Advanced Weather Surveillance Algorithms and Techniques using a Rapid Scanning X-Band Radar—First Results

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The Naval Postgraduate School°s Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS) in collaboration with ProSensing Inc. recently modified a phased array X-band tactical radar system to add a weather surveillance mode. The modified system, reconfigured for mobile operation from a heavy duty truck, is shown in Figure 1.

The new system was named MWR-05XP (Mobile Weather Radar, 2005 X-band, Phased Array) and is the first mobile electronically scanned phased array radar developed for weather sensing applications. The most important feature of the MWR-05XP is its ability to rapidly scan the antenna beam in both elevation (maximum of 73 deg scanning sector) and azimuth (maximum of 45 deg scanning sector).

This weather radar serves both as a mobile weather research instrument and as a test-bed for exploration of the integration of weather display modes into tactical military radars. The rapid scan capability of this radar presents new challenges with regards to calibration, clutter removal, radar control and data processing. As part of the modification, ProSensing developed a state-of-the-art PC-based Weather Radar Processor (WRP), which provides radar control, data acquisition and signal processing for 3-D weather radar measurements. The WRP system consists of a data acquisition subsystem and auxiliary hardware necessary for operation of the radars as complex as phased array systems.

Initial experiments with the mobile radar system were carried out in March, 2005 in Marina, CA. High power transmitter and large aperture antenna give the radar ability to detect light rain in ranges up to 100 km. Longer ranges are possible at a reduced pulse repetition frequency. The rapid scanning capability of the radar system allowed a sector scan of 0-55 degrees in elevation and 45 degrees in azimuth at one degree steps (220 beams) to be sampled in 70 milliseconds.

In our paper we will describe the radar and showcase its capabilities, describe the parameters of different scanning patterns used in weather surveillance mode and present the results from the system calibration and first weather surveillance experiments.

Figure 1 MWR-05XP installed on a heavy-duty truck. The 1.2 m phased array antenna provides electronic beam scanning in elevation and combines electronic back-scanning with mechanical scanning in azimuth.

Extended Abstract (88K)

Supplementary URL: http://www.prosensing.com

Poster Session 12R, New Radar Technologies
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