

Development of Through Wall Synthetic Aperture Radar Processing Algorithms

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Project Summary

Defence Research and Development Canada (DRDC) is engaged in research to investigate the feasibility of using synthetic aperture radar (SAR) techniques to perform 3-D stand-off through-wall radar imaging (TWRI). Information of interest includes room layouts, in-wall structure, and the presence of humans and other targets such as arms caches.

A major focus of the DRDC program is the collection and off-line processing of through-wall experimental data to determine the practical capabilities and limitations of this imaging technology. To this end, DRDC has developed a truck-mounted through-wall synthetic aperture radar (TWSAR) data collection testbed, which is shown below. The vertical receive antenna array has eight elements, each of which has its own receive channel. The truck is driven in front of a building of interest to create a synthetic aperture. A Global Positioning System (GPS) integrated with an Inertial Measurement Unit (IMU) provides motion information used to determine the antenna element locations as the vehicle moves.

In the 3-D image formed by off-line processing of the collected radar data, range resolution is achieved through pulse compression of a linear frequency-modulated waveform, azimuth resolution is obtained by virtue of the SAR processing, and elevation (vertical) resolution results from beamforming with the receive array data. A MIMO (multiple input multiple output) approach, whereby the waveform transmission is toggled between the two transmit elements, is used to create a virtual receive array that effectively doubles the achievable elevation resolution. The system can also be manually reconfigured to use of one of the transmit elements as a receive element, thereby providing a limited moving target indication (MTI) capability while simultaneously imaging from the moving vehicle.



Data Collection System