RADARSAT-2 MOVING OBJECT DETECTION EXPERIMENT (MODEX)

Shen Chiu, Chuck Livingstone, Isha Sikaneta, Christoph Gierull, and Pete Beaulne

Defence R&D Canada, Radar Systems Section
3701 Carling Avenue, Ottawa, Ontario, Canada K1A 0Z4

1. INTRODUCTION

Canada’s next-generation commercial radar satellite RADARSAT-2 was successfully launched on December 14, 2007 [1]. RADARSAT-2 MODEX is a scientific project aimed at developing, validating, and demonstrating an experimental space-based ground moving target indication (GMTI) mode to routinely detect, measure, and monitor vehicles moving on the Earth’s surface [2]. MODEX has been implemented through collaboration between DND, the Canadian Space Agency, and the satellite builder, MDA Corporation, Ltd. The RADARSAT-2 SAR antenna can be partitioned into two sub-apertures aligned along the direction of flight, thus permitting successive scene observations. Comparison of the observations reveals objects that have moved or changed in the intervening time.

2. MODEX PROCESSORS

Several moving target detection and estimation algorithms have been implemented for the planned MODEX. Among the detectors implemented are Displaced Phase Center Antenna (DPCA) [3], Histogram Along-Track Interferometry (HATI) [4], and Hyperbolic Detector [3]. The estimators that were implemented include Matched-Filter Bank (MFB) [5], Along-Track Interferometry (ATI) [5], and Fractrum Estimator [6] (see Fig. 1).

![Processor MODEX-1](image)

The MODEX processor development through contract with MDA was completed in May 2007. In this contract, MDA created the world’s first satellite-based CFAR GMTI detector and estimator using algorithms developed at Defence R&D Canada (DRDC) – Ottawa. Due to budget and time constraints, MDA only implemented what we call a MODEX-1 processor, which includes a pre-processor to prepare the data for GMTI processing as well as two-antenna techniques to detect and estimate moving target parameters. The processor upgrade (or MODEX-2) is currently underway to implement toggle mode data processing and waveform diversity processing as well as three-antenna detectors and estimation methods (e.g. STAP).
3. POST LAUNCH TRIALS

Due to RADARSAT-2’s orbit coverage and revisit rates, MODEX is not expected to provide significant operational military capability in its current incarnation. Rather, it is primarily intended to assess the potential of space-based GMTI and to provide information and recommendations for the conception and design of future operational space based GMTI systems. As such, a series of post launch tests and experiments will be necessary to explore the performance of the entire RADARSAT-2 GMTI system. The aim of the post launch trials will be to investigate, in differing clutter environments, the most promising configurations of the R2-GMTI system for military use.

4. PURPOSE OF THE PAPER

This paper will present an overview of various detection and estimation algorithms that have been implemented for the planned MODEX as well as experimental plans for the validation and demonstration of the space-based GMTI mode. Preliminary RADARSAT-2 GMTI results will also be presented.

5. REFERENCES


