SWIM, A STATE OF THE ART MULTI-INCIDENCE BEAMS KU-BAND WAVES SCATTEROMETER TO GO BEYOND CURRENT RADAR SYSTEMS

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The instrument SWIM (Surface Waves Investigation and Monitoring) on the CFOSAT program (Chinese French Oceanographic Satellite) is a state of the art radar for several reasons.

At first, SWIM is the first ever space radar concept that is mainly dedicated to the measurement of ocean waves directional spectra ([1-2]) and surface wind velocities through multi-azimuth and multi-incidence observations. Orbiting on a 500 km sun-synchronous orbit, its multiple Ku-band (13,575 GHz) beams illuminating from nadir to 10° incidence and scanning the whole azimuth angles (0-360°) provide with a 180 km wide swath and a quasi global coverage of the planet between the latitude of –80 and 80° ([3]).

Secondly, such a wide range of observations requiring high range resolution (about 20 m on the ground) have led to design an instrument whose architecture and technology goes beyond what has been done on altimeter and scatterometer systems.
The global coverage and the reduction of telemetry budgets have required performing onboard range compression. The variety of signals at different incidences, the impact of the complex moving geometry of observation and the required real-time signal processing have led to propose onboard complete digital range compression on backscattered 320 MHz bandwidth signals. The design of the onboard compression and processing resulted from a trade-off between the instrument high level performances required, the needed correction for geometrical effects such as range migrations and performance of the acquisition and tracking loops.

Finally, multi-azimuth multi-incidence observations requirements have led to design an ambitious antenna subsystem that rotates at 6 rounds per minute while transmitting high power RF signals towards tunable directions.

Thales Alenia Space started in May 2007 under CNES contract phase A studies on the design of the instrument that are now followed by phase B studies since beginning of 2009. We are currently working on the consolidation of the proposed instrument design and architecture.

This paper aims at giving an overview of the current phase B studies that are performed at Thales Alenia Space. A first section will present SWIM main parameters and operating modes. A second section will then provide with the last update of its architecture, especially stressing the improvements proposed on the Radio Frequency Unit (RFU) and the complex rotating antenna subsystem. A third section will look into the Processing Control Unit (PCU) and the different stages of the onboard processing in order to perform digital pulse compression, range migrations correction and acquisition and tracking loops. Outputs of simulations and performances analysis of these various stages will be shown. Finally, a last section will go into some of the main products coming out of the ground processing and their expected quality. The performances will also be extensively described in a side-paper submitted to the same conference [4].

Keywords: radar, instrument, architecture, RF, onboard processing, rotating antenna, performance, ocean wave,

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