EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

Author: Mr. Umberto Bruno
Leonardo Spa, Italy

Mr. Franco Boldrini
Leonardo Spa, Italy
Mr. Carmine Mastrandrea
Leonardo Spa, Italy
Mr. Paolo Mosciarello
Leonardo Spa, Italy
Mr. Riccardo Gabrieli
Leonardo Spa, Italy
Mr. Massimiliano Porciani
ESA - European Space Agency, The Netherlands
Mrs. Marie-Noelle LANGEVIN
Airbus Defence & Space, France

3MI: MULTI-VIEWING, MULTI-CHANNEL, MULTI-POLARIZATION IMAGING FOR METOP SECOND GENERATION

Abstract

In the frame of Metop Second Generation Leonardo is leading a large Industrial Team - including more than 10 SubContractors - for developing an imaging radiometer called 3MI (Multi-viewing, Multi-channel, Multi-polarization Imaging). The 3MI is designed to collect global observations of polarized and directional solar radiation reflected by the Earth-atmosphere system for climate and global change studies. With respect to previous imaging spectrometers or radiometers designed for climate studies, the 3MI instrument features a wider spectral range, an increased number of spectral and polarized channels, and improved minimum spatial resolution, field of view and area coverage. The 3MI Instrument main science objectives are to collect Earth imagery and to provide a measurement of the top-of-atmosphere radiance; the collected data is used to derive information concerning the Bidirectional Reflectance Distribution Function (BRDF) and Bidirectional Polarized Reflectance Function (BPRF). The image data is ultimately used to study changes in the Earth tropospheric aerosol distribution, the Earth radiance budget, land surface and ocean color. 3MI is a complex optical instrument that combines sequential views of the same ground target with multi-channel spectral acquisitions in both polarized and un-polarized channels. The basic design concept is based on the following:

•

A multi-angle acquisition performed by forward, nadir and backward observations of the same on-ground target at different instants using a very wide-field optical design, a two-dimensional focal plane and use of the push-broom scanning concept in which the satellite orbital motion provides the along-track scanning.

•

Successive acquisitions of polarized and un-polarized spectral bands are performed using a rotating filter wheel located in front of the focal plane that enables the changing of the polarizing filters. The instrument

consists mainly of two electro-optical imagers: a VNIR optical assembly and a SWIR optical assembly both of which are integrated with their respective focal plane arrays. These are mounted onto mechanical metering and support structures that are thermally monitored and controlled. Flight software to control filter wheel operations, focal plane operations and instrument thermal control is envisioned. The 3MI Contract was initiated in June 2014. The team completed the PDR in October 2015 and is currently moving toward a CDR scheduled in January 2018. This paper will discuss the 3MI Instrument design and challenges, focusing on the instrument flexibility and capability for being implemented in a variety of other Remote Sensing missions requiring a high performing polarimeter.