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FROM PRISMA LEONARDO DERIVES A COMPACT HYPERSPECTRAL PAYLOAD "BEST-IN-CLASS" FOR ENVIRONMENTAL AND COMMERCIAL APPLICATIONS

Abstract

Leonardo has developments on-going towards low size, weight and power Earth Observation payloads, funded by the Italian Space Agency (ASI) under the "Platino" multi-satellite constellation program. Platino-3 and 4 satellites will see Leonardo develop and fly compact Hyperspectral and Very-High Resolution Optical instruments for Earth Observation. Proto-flight models of these instruments will be completed by 2024. Leonardo has decades of heritage in EO payloads design and production. In 2019

Leonardo launched the PRISMA instrument and from this baseline is developing, within an ASI contract, a new "best-in-class" compact Hyperspectral payload that offers the same performance of its larger predecessor in a size and mass that can be adapted to multiple platforms in the small size range. HYP-PL is a ¡100Kg, ¡0.8 square-meter single imaging spectrometer devoted to measure the spectral signature across the wavelength range 400-2500nm by means of a diffraction grating as dispersing element. This spectral range matches many end-user requirements for environmental and commercial applications, such as water quality monitoring, oil spills, forest fire, soil protection, agriculture. HYP-PL instrument functioning is based on a pushbroom system with matrix detectors: the swath in across-track direction is imaged along the rows of the detector, the spectrum along the columns. The direction of the satellite motion is exploited to build the ALong-Track (ALT) spectral image of the target by subsequent acquisitions. This system provides the user with a hyperspectral cube of 3D Earth scene data where the on-ground target is decomposed in several images, each one relevant to a specific spectral band of less than 10nm bandwidth. This classical spectrometer scheme offers the best compromise between high spatial resolution and SNR because of the spectral resolution. As a commercial application, it offers high duty cycle, and depending on platform it is fitted on, virtually continuous. The HYP-PL typical orbit is sun-synchronous at 515Km altitude. The HYP-PL, integrated on a platform suitable to provide the required agility, can operate in two imaging modes with two different Ground Sampling Distances: STRIPMAP and SPOTLIGHT. In STRIPMAP the HYP-PL is Nadir pointing and can acquire 30m GSD images, while in SPOTLIGHT the satellite performs a pitch manoeuvre to slow down the ground track and increase the dwell time enhancing SNR performances. HYP-PL also includes a Panchromatic Camera to improve the image acquisition capability by covering the full swath with a synchronous 5m ground resolution. HYP-PL design challenges and performance are described in the paper.