PLEIADES-HR IMAGING SYSTEM: GROUND PROCESSING AND PRODUCTS PERFORMANCES, FEW MONTHS BEFORE LAUNCH

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Technical Commission VII Symposium 2010

KEY WORDS: High Resolution, Sensor, Optical, Orthoimage, Mosaic

ABSTRACT:

PLEIADES-HR is the highest resolution civilian earth observing system ever developed in Europe. This optical imaging project is conducted by the French National Space Agency, CNES. It will operate two agile satellites designed to provide optical images to civilian and defense users. The first satellite will be launched from the Guyana launch pad by the end of 2010, the second 18 months later. Images will be simultaneously acquired in Panchromatic (PA) and Multi-Spectral (XS) modes. It will allow, in Nadir acquisition condition, to deliver 20 km wide, false or natural colored scenes with a 70 cm ground sampling distance (after PA+XS fusion). Imaging capabilities have been highly optimized in order to acquire, in the same pass, along-track mosaics, stereo pairs and triplets, and multi-targets. To fulfill the operational requirements and ensure quick access to information, ground processing has to automatically perform the radiometric and geometric corrections. Since ground processing capabilities have been taken into account very early in the mission development, it has been possible to relax some costly on-board components requirements, in order to achieve a cost effective on-board/ground compromise. Starting from the PLEAIDES system and on board characteristics (agility, stability, location accuracy…), this paper presents an overview of ground segment functional breakdown and focuses more precisely on the image production processing. A definition of each level of image product (level 1, perfect sensor, ortho-image and ortho-mosaic) is done with the main processing steps. Then it shows how images product performance is a result of the satellite performance followed by an appropriate ground processing (radiometric and geometric processing). The complexity of the PLEAIDES focal plane makes the classical level 1 product difficult to use. A new product level called "Perfect Sensor" or more simply "Sensor Level" had been proposed. This "Sensor Level" is described: a basic product specially designed for the photogrammetric community and delivered with a physical model and a rational function model. The high geometric accuracy of the rational function model is assessed and compared to the physical model. The automatic "ortho-image" and "ortho-mosaic" production process is also described. PLEIADES-HR ortho-mosaic product will provide end-users with an image of larger size, as being the result of a seamless ortho-rectified patchwork of individual strips. The output coverage may reach up to 10000 km² and even more, according to the length of the neighboring strips and the tolerated stereo effect between acquisitions. This product represents the successful realization of the PLEIADES mission since it takes advantage of the main characteristics of the system: agility and high location precision. The automatic mosaicking process relies on automatic tie point selection and geometric models refining phases followed by local radiometric corrections and stitching phases. The geometric accuracy and the overall radiometric quality are evaluated from simulated Pleiades acquisitions (aerial images) and the excellent results obtained are presented. Finally the paper presents the ground segment architecture dimensioned to handle this "heavy" processing. It describes the associated configuration set-up in CNES, Spot-Image and Defenses premises and ready few months before satellite launch.

TOPIC: New earth observation satellites
ALTERNATIVE TOPIC: Geometric modeling