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Press Note

GALILEO AVIONICA PRESENTING THE DEVELOPMENT AND FIRST RESULTS OF THE MODULAR AVIONIC HYPERSPECTRAL SYSTEM SIM-GA

The very first presentation of the SIM.GA (*Sistema Iperspettrale Multisensoriale – Galileo Avionica*) **was made at Farnborough 2006.**
At this year Paris AirShow, Galileo Avionica is presenting the development and the first results of the latest flight campaigns of the modular avionic hyperspectral system.

Introduction: The multisensor hyperspectral camera is originated from Galileo Avionica long experience in the field of electro optical environmental control. The hyperspectral technology is applied to military fields for intelligence operations, to national security for monitoring sensitive sites and to the field of civil and environmental protection for pollution control.

The main applications include:

- Detection of hidden and/or camouflaged targets
- Detection of underwater hazards
- Bathimetry of coastal waters
- Detection of dangerous contaminants and chemical agents in water and land
- Monitoring of land and sea resources
- Monitoring of natural hazards (fires, floods, slides)
- Preparation of thematic maps

The “Hyper” suffix refers to the great number of spectral bands with which an image is acquired. The information contained in the hyperspectral data allows to determine the “spectral signature” of objects present in the scene thanks to identification of the chemical-physical composition of the different materials and substances included in the target area. Therefore it is possible to distinguish objects of the same shape but made of different components which in conventional images would seem alike. This can be achieved because of the different reflectivity of elements with respect to the solar irradiance wavelengths.

At Le Bourget 2007, the camera is installed on board the Vulcanair Viator of the Italian agency AGEA- Agenzia per le Erogazioni in Agricoltura, present in the static area.

Flight campaigns:

In April 2007 a flight campaign, with the SIM-GA embarked on an ultralight plane, was performed for the Italian MoD, on the CEPOLISPE Technical centre in Montelibretti, under the coordination of the CISAM (Centro Interforze Sperimentazione Applicazioni Militari). The recorded images analysis is in progress, in cooperation with Italian Universities and research centres, as part of a program for “Feasibility study of an IR/Hyperspectral images database, for the automatic target recognition”.

Other campaigns (the third and the fourth in chronological order) were performed on 2007 in the frame of ESA CEFLES2 campaigns, focused to the specification and products’ simulation of Sentinel-2 superspectral mission, for terrestrial applications.

The second flight campaign with the SIM-GA was performed during summer 2006, in the frame of ESA AIRFIRE program, where the instrument has been embarked on an ultralight plane.
In this case the objective was to provide support to both validation of fire monitoring system, based on satellite data, and to the definition of GMES IR Element technical concept, for high temperature event monitoring capability. During this campaign the instrument has been operated for about 30 hours with 300 Gbyte of acquired data. These data are currently under processing by INGV research staff.

The system has been already embarked on a CASA 212 plane, with mechanical interfaces adapted to one of the existing bay door. **The first flight of the system was made on 15 Dec. 2005**. The flight was successfully and about 200 Gbyte of data were acquired.
The flight plan included the coastal region of Tuscany, where some areas were arranged with reference targets, or selected for their morphological and geological characteristics. Contemporary on-ground reference measurements (e.g.: radiance) have been made for post-flight data verification and calibration.

Technical information on the SIM-GA:
SIM. GA is mainly composed of two electrooptical heads (EOH) in VNIR and SWIR spectral range (from 0.4 μm to 2.5 μm) and a digital acquisition system. In this "modular" approach the two EOHs are physically separated but co-aligned on a common plate. This concept allows a flexible application-specific configuration of the instrument and therefore the possibility of its use on different platforms (including UAVs and ultralight aircrafts).

The first step of the development has been the realisation of a "demonstrator version", including both EOHs and mostly based on COTS, to be embarked on small airplanes.
Its main scope was the validation of technological choices and the acquisition of images useful for definition and "tuning" of analysis algorithms. The system utilises the pushbroom concept to acquire images at Nadir.

A rigidly mounted GPS/INS unit (inertial system) follows the platform movements and therefore allows deriving co-registered and geo-referenced images, by means of suitable data post-processing. The GPS/INS unit avoids the use of heavy stabilized platform, that prevent the embarkment on very light platforms.

Further Developments: A "ground system", that utilises the same optical head, has been also realised. In this modality, using a scanning platform synchronised with the image acquisition, the instrument can be used as a "static" camera, for applications in which the linear platform movement, needed for pushbroom mode, is not allowed or guaranteed.
Flights and ground campaigns with the current system and with a new improved version (including a high resolution panchromatic camera) are currently under preparation.
The analysis of the whole data set acquired is currently going on, together with the definition of a suite of processing algorithms able to satisfy the needs of a large range of users.

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