# IMAGING SPECTRAL SIGNATURE INSTRUMENT AIRBORNE CAMPAIGN

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Poster session.

The outcome of an ESA GSTP contract was an aircraft compatible breadboard of a programmable line imaging correlation spectrometer, named the Imaging Spectral Signature Instrument (ISSI)[i]. ISSI is implemented with a front objective, two spectrographs, a liquid crystal display (LCD) spatial light modulator (SLM) and a line sensor. A line imaged by the front objective is dispersed by the first spectrograph on the LCD. Any two dimensional transmission pattern can be programmed on the LCD. The modulated image is then re-gathered by the second spectrograph to a line on the CCD line detector.

The goal of the instrument is to find targets with an a priori known spectral signature from a more or less known background. A possible remote sensing application is to find oil spills mixed with ice from sea. The advantage of the ISSI concept is the hyperspectral strength augmented with real time results and the reduction of the data amount in all stages of the processing chain. The signal to noise ratio (SNR) is potentially better than for a conventional hyperspectral imager if the SLM function can be implemented with an efficient throughput. Using the programmable spatial light modulator ISSI performs a spectral correlation operation in real time and stores only the end result. ISSI approximates the spectral angle mapper (SAM) algorithm used in hyperspectral data processing. The breadboard has demonstrated that the operating principle works under laboratory conditions. The next step was to determine how well ISSI performs in remote sensing applications in the visible and near infrared domain with all the environmental uncertainties present.

Therefore in the present activity, potential applications were gathered and analyzed. Targets to determine the feasibility of detection were selected for a flight test campaign. Two flights with the ISSI instrument and an AisaEAGLE hyperspectral imager were performed over the cities of Lahti and Pori in September 2008. With this setup the ground was observed both with ISSI and the Eagle under the same environmental conditions. The target signatures were determined from a priori hyperspectral data and from the acquired Eagle data of the first flight. The source signatures are converted using atmospheric radiative transfer software and instrument calibration to the actual filter profile on the spatial light modulator. The aim is to assess the ISSI technical performance and compare the quality of the data extracted with the ISSI concept vs having the full hyperspectral data set available for hyperspectral processing.

[i] Kantojärvi et al “Performance of the imaging spectral signature instrument breadboard”, SPIE Europe Remote Sensing conference, SPIE Vol. 6744 (2007)