IAF-00-B.4.10

## EVALUATION OF OPTICAL AND MICROWAVE REMOTE SENSING DATA TO STUDY THE LANDSCAPE DYNAMICS OF THE NE-SECTOR FROM MARANHÃO ISLAND, BRAZIL

Hermann J. H. Kux
Mauricio E. S. Rangel
Gil M. Sales
INPE – Instituto Nacional de Pesquisas Espaciais

**ABSTRACT**

In the last years, the continuous interest for geographical information on global changes led to a large number of studies on the exploration and monitoring of natural resources, urban and regional planning, agriculture, among others Using data from both optical and radar sensor systems, there were many studies on land use/land occupation. In tropical regions, due to the high percentage of cloud coverage, microwave remote sensors, such as radar, have been widely used, producing sharp images of the surface In this paper we present and discuss the results of a study on the results of the evaluation of combined ERS-1/SAR and TM-Landsat-5 data to map the dynamics of land use/land cover changes, at the northeastern section of Maranhão Island, in Brazil The area under study includes a variety of land use/land cover features, such as urban areas, mangroves, wetlands, open fields, beaches and dunes. We used TM-Landsat-5 data from June'84 and June'99 as well as an ERS-1/SAR scene from September 1996 Initially the SAR scene was converted from 16 to 8 bits and a speckle reduction filter (enhanced Frost 7x7 window) was applied, to improve the discrimination of features of interest An IHS transform as well as a principal component analysis were applied to this data set. So it was possible to generate land use/land cover maps using a maximum likelihood classifier The accuracy of the classification made was evaluated based on the results obtained from an error matrix, using *Kappa* statistics The results were compared with thematic maps based on orbital imagery and field survey data From the data analysis one concludes that the integration of both optical and microwave data improved the distinction of the features of interest, showing the synergism among multispectral and textural information

IAF-00-B.5.02

## COMMERCIALISATION OF REMOTE SENSING - ISSUES AND PERSPECTIVES

Mukund Rao, P Subba Rao*, V Jayaraman and K R Sridhara Murthi
Indian Space Research Organisation
Antariksh Bhavan, New BEL Road
Bangalore, India
* IN-RIMT, Hyderabad, India

**ABSTRACT**

Today, Remote Sensing (RS) technology has reached a level of operationalisation and is transitioning from an era of promotion to opportunities for commercial development of the space segment and application services The post-liberalisation scenario in India, when government down-sizing efforts have led to a larger playing field for the private sector and their increased involvement in developmental activities, particularly infrastructure development, has opened up a "demand" for information - not only the developmental data but also map data of natural resources, as combinedly they provide a valuable tool for planning and implementation of developmental activities

The need of the hour is looking forward now towards how the RS technology can adapt itself to the changing scenario and the steps to be taken to sustain it in the future Orientation needs to change from a "facility concept", which was the adage for the "promotional" era, to "Services concept" for the RS technology The orientation also needs to change from RS data to Spatial information and GIS databases Demand for information would increase with a larger involvement of players in the developmental activities and catering to the information needs is what would be the driver for the commercial development. The thrust has to be towards developing an independent sector for Spatial Information with the active involvement of users, private entrepreneurs and other agencies to develop space-based RS market segments

The technology of space segment, the ground segment and the applications segment needs to be addressed in terms of their costs and benefits to society The space segment characterizes "public-good" services and ensures continued availability for future observation needs, the ground segment could transition into a commercial profit-domain and the applications value-added services has to emerge as a commercial activity This "triad" defines the totality of EO technology

This paper discusses the policy adjustments that will be required to be done for developing a viable and effective commercial RS programme in the country with a major thrust of initial government and industry partnership ultimately leading to a true industry sector for Spatial Information services

IAF-00-B.5.04

## IN-ORBIT RESULTS FROM UOSAT-12 EO MISSION AND PLANS FOR FUTURE SURREY HIGH RESOLUTION EO MISSIONS

Dr Valerie Chu
Dr Marc Fouquet
Dr Wei Sun
Prof Martin Sweeting

**Surrey Space Centre**
**University of Surrey**
Guildford, Surrey GU2 5XH, UK
Tel +44 1483 259278 Fax +44 1483 259503
internet m sweeting@ee surrey ac uk
WWW http://www sstl co uk

**ABSTRACT**

Surrey's experimental UoSAT-12 325kg minisatellite was successfully launched into low Earth orbit in April 1999 to demonstrate the feasibility of low-cost state-of-the-art small satellite technologies This paper will describe in detail Surrey's outstanding accomplishment in dramatically reducing the cost of Earth observation satellites through adopting an affordable rapid response approach and commercial off-the-shelf (COTS) technologies for small satellites

Since the launch of UoSAT-12 hundreds of images around the world have been gathered, downloaded and analysed. This represents a significant breakthrough in providing timely data for Earth observation applications based on the remarkable images obtained from both multispectral and panchromatic cameras These images are comparable to data from existing LANDSAT TM and SPOT Earth Observation satellites but attainable at a tiny fraction of conventional satellite cost Such remarkable results have highlighted the possibilities and many benefits in employing COTS technologies in small inexpensive satellites

Mounted on the Earth facing facet of UoSAT-12 are two 32m ground sampling distance multi-spectral cameras in tandem to provide larger swath widths and system redundancy Each camera comprises a 1000 by 1000 pixel Kodak CCD staring area sensor with a rotating filter wheel in 4 LANDSAT-compatible (G,B,R,NIR) spectral bands The rotating wheel was an experimental design for comparison with the three-camera concept previously adopted successfully on the Thai-Paht microsatellite launched in 1998 A consequence of the rotating filter wheel design is, the various multi-spectral images need to be aligned due to time differences between each image capture and this can be a labour extensive process The in-orbit results have thus enabled SSTL to perform necessary trade-offs and comparison for different camera designs Due to the non sun-synchronous orbit of UoSAT-12 and wide excursions in temperature, variations were observed for the 10m panchromatic camera Nevertheless, both camera designs have been proven to be highly successful and are the basis for commercial missions in the very near future

For illustration purposes, three sets of images taken from the 32m and 10m cameras and their corresponding descriptions will be described in the main paper Each image is carefully selected to highlight the spatial details and spectral differentiation of land usage

A great deal of experience have been acquired by Surrey from flying COTS sensors in-orbit over sixteen years on ten missions The UoSAT-12 in-orbit results and Surrey's heritage will be applied indirectly to enhance future Surrey Earth observation missions, e g the BiltenSAT enhanced microsatellite for Turkey, which is under construction at SSTL

Future missions will also incorporate the panchromatic camera with enhanced designs for thermal compensation, new 2000 by 2000 pixel staring arrays and push-broom linear arrays Current research is looking towards a new generation of higher resolution 5m panchromatic and 15m multispectral cameras on board future Surrey minisatellites. SSTL is also currently working in collaboration with DERA (UK) for future 2 5m high-resolution imaging All these missions will be detailed in the paper

IAF-00-B.5.09

## HRS: An enhanced mission capability for SPOT5

L. Maggiori (ASTRIUM), C. Rouziès (CNES), M. Bernard (Spot Image), Toulouse, France

In 1998, the implementation of a new mission onboard SPOT5 was decided HRS (Haute Résolution Stéréoscopique) will provide the next French Earth Observation satellite, to be launched late 2001, with an innovative along the track stereoscopic imaging capability HRS is developed under a commercial and technical partnership between CNES, SPOT IMAGE and ASTRIUM

1) Business studies have revealed a significant market for elevation data in the near future An entirely new sensor, viewing fore and aft along the track, is currently developed and accommodated on SPOT5 to achieve this mission HRS will allow SPOT IMAGE to substantially increase its offer in this domain, by providing versatile, 10-20-meter posting, high accuracy Digital Terrain Models

2) The 3 partners bring their core expertise to drive the technical development of HRS
- CNES is responsible for the overall system integration and for the control ground segment adaptation,
- ASTRIUM leads the construction of the HRS instrument and its accommodation on board SPOT5
- SPOT IMAGE will adapt the SPOT 5 distribution ground segment (currently under development) and enhance the existing commercial distribution network to market HRS products
HRS shares on board data processing and telemetry resources with the two HRG instruments (Haute Résolution Géométrique SPOT 5 main optical payload) The development chart has been successfully reengineered to meet the challenging deadline
Overall system concept is very similar to the HRG payload, regarding operation modes and image telemetry data Thus, the number of specific functions (programming facilities, receiving and pre-processing data, ) to be added to the ground segment has been minimized Dedicated ground system development is therefore consistent with overall SPOT5 development timescale

3) HRS is funded via a private-public consortium The partnership is based on mutual risk-sharing during development phases After the launch, investment return is regulated by a business agreement directly based upon actual revenues