



# ❖ CSSTEAP Newsletter ❖

Quarterly Newsletter of Centre for Space Science and Technology Education in Asia and the Pacific (Affiliated to UN)

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## REMOTE SENSING OF THE MOON

There are several bodies in the universe with diameter of the order of 3000-50000 km, which represents the terminal size of planetesimals the building blocks of the planets, Moon, with a 3476 km dia, is a link in the formation of the planetary system.

Moon is the only natural satellite of the Earth. It is pristine, and can be a monitor of the early Earth. Lunar cataclysm, which occurred 4.2-3.8 billion years ago, could also be an indicator of the effect of evolution of life of Earth, which is believed to have happened 3.5 - 3.8 billion years ago.

Based on the temperatures on its surface and its 'visibility' from the Earth, the moon has been divided into the so-called Near-side and Far-side and Far-side. The Near-side contains many large mare basins while the far-side is mostly highland crust.

There are several hypotheses regarding the formation of the moon, main among them being the Giant impact Hypothesis. If the physical parameters are seen, the density of moon is 3.34 g/cm<sup>3</sup> when compared to 5.52

g/cm<sup>3</sup> of Earth, which prove that Earth and Moon are not made of the same material. However, comparing the chemical composition reveals that the Oxygen isotope Ratios are same as those on Earth.

These are only few of the several ambiguities that exist in the various theories regarding the formation of moon.

There are three options for studying the moon - an Orbiting mission which gives a synoptic view of a large area and helps in studying the topography, chemistry and mineralogy, a landing mission, which is local and aids in seismic experiments to study internal structure and core, and a Sample return mission, which is also local and studies dating, minor and trace element chemistry and isotopic effects.

There have been several missions to the moon The Apollo and Luna missions are the Landing and Sample return Missions. The Orbiting Missions Clementine and Lunar Prospector helped in mineral and chemical mapping.

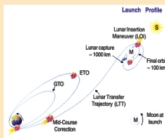
India's mission to Moon has been named Chandrayan or the 'moon-vehicle'.

A low altitude (~ 100 km) Polar Orbiter has been planned for global imaging mineralogy and chemical mapping with high spatial

- Prof. Narendra Bhandari, PRL, Ahmedabad

Payload Configuration of Chandrayan-1

Payload	Resolution	Objective
Hyper Spectral Imager (HySI)	Spatial - 80 m Spectral - 15 nm	Mineralogical mapping
Terrain Mapping Camera (TMC)	Spatial - 5 m Vertical - 5 m	Prepare high res Atlas of moon
Laser ranging (LLRI)	Vertical - 10 m or better	Gravity model and topography
Low energy X-ray spectrometer (LEX)	10 km	Elemental mapping: Si, Al, Mg, Ca, Fe, Ti
High energy X-ray spectrometer (HEX)	20 km	<sup>238</sup> Pu, U, Th
Solar X-ray Monitor (SXM)	-	Solar X-ray flux monitoring



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and spectra resolution sensors. The South Pole Aitken Region on far side and north and south polar regions will be specially studied. Distribution of several stable and radioactive elements will be obtained to understand origin and evolutionary history of Moon. The observation period would be 2 years. Simultaneous mineralogical, chemical and photo-geological mapping will be carried out.

With several Moon missions already underway and being planned, India's mission aims to focus in a slightly different way. The payloads and their configuration are seen in the table. This would be the first attempt to study the energy region of 10-200 keV (X-ray region).

(Source: Updates@nrsa, vol-1, Issue 2, April 2004)

- Excerpts from talk delivered by **Prof. Narendra Bhandari**, Senior Professor at PRL, Ahmedabad.

## EIGHTH REMOTE SENSING & GIS PG COURSE

The eighth Post Graduate Course on Remote Sensing & GIS (RS & GIS) of CSSTEAP which started at Indian Institute of Remote Sensing, Dehradun on October 01, 2003, is being attended by 21 participants from 16 countries of Asia-Pacific region including India.

The course is now running Module - II and this Module started on January 01, 2004. This module consisted of RS & GIS Applications - Thematic optional stream and also a common stream. The Thematic optional stream covers several disciplines such as Agriculture and Soils; Forestry and Ecology; Geosciences; Marine Science, Human settlement and Urban Analysis; and Water Resources. Advances in RS & GIS; Satellite Meteorology; Earth Processes; Natural Disaster Monitoring and Management; Sustainable Development and Integrated Natural Resource Management; and Environmental Analysis, Monitoring and Management. Each of the course participants has chosen one optional thematic application discipline based on his academic qualification, professional experience, and



*Students with Director, NRSA at Shadnagar near Hyderabad*

requirements of their parent organisations. The course curriculum of this module was covered by the faculty of IIRS and additional guest lectures on specialised topics were also arranged for the academic benefit of course participants. The guest lecturers were from various Indian Organisations/Institutes/Universities such as Andhra University, Vishakapatnam, SAC, Ahmedabad; NRSA, Hyderabad; IIT (Roorkee) and NIH, Roorkee, FSI, WII and WIH, Dehra Dun; NSP, New Delhi etc. One international guest faculty Dr. Vernon Singh Roy from Canadian Centre for Remote Sensing, Canada, delivered series of lectures on Physics and Applications of Microwave Remote Sensing; Principles and Applications of SAR Interferometry, Polarimetry; Hyperspectral Remote Sensing and its applications. The performance of course participant was evaluated through periodic theory and practical examinations and tutorial assessment. In this module each student gave technical presentation in the form of seminar on the problems; prospects of natural resource management and potential of RS & GIS application in their respective home countries. During this module the course participants also



*Students with Chairman CSSTEAP GB during educational visit to ISRO Hqrs.*



attended International Conference "Map India-2004" at New Delhi, during January 28 to 30, 2004. An educational visit to two weeks duration to various centres/organisations of Department of Space/ISRO viz. NRSA, Hyderabad, ISAC and ISRO Head Quarter, Bangalore and to Vishakapatnam was also organised during this module. During this visit, the

students got opportunity to meet and listen to Mr. G. Madhavan Nair, Chariman ISRO and Chairman, GB, CSSTEAP, at ISRO Head Quarter, Bangalore. The course participants also got opportunity to experience Indian rich historic, cultural and social heritage during the visits to various Indian cities such as Hyderabad, Bangalore, Mysore and Vishakapatam.

## **FOURTH POST GRADUATE COURSE ON SATELLITE COMMUNICATIONS**

**P**articipants after having visited North India and the famous Taj Mahal at Agra were spell bound by the beauty, variety of cultures and the varied range of climate the country possess. Especially the participants from the cold country were happy to experience the low temperatures after a long gap.

The participants by now have learnt about the essential aspects of Satellite communications. The module No. 7 dealing with various Operational Communications Satellite Systems was introduced. Mr. R.N. Wadhwa, Head DES/SAC, and Focal point for the module invited a variety of experts from INSAT, INMARSAT, World Space, INTELSAT, PANAMSAT and ESSEL - Shyam. Experts from SAC and WPC, Ministry of Communications gave the details of ITU and the importance of International Regulations. Mr. B.V. Kanade, Group Director, Programme Planning/MCF, Hassan described the aspects of THAICOM and ASIASAT.

Dr. K.S. Dasgupta, Group Director, ADCTG/SITAA and Focal point Module No.1 introduced the participants to Digital Signal Processing (DSP) fundamentals and the techniques. Prof. Manoj Sarvanan, of Indian Institute of Sciences, Bangalore was invited to deliver lectures on Transform Coding

Techniques. While, the experts from SAC described the finer aspects of the applications of DSPs. This was supported with excellent lab experiments demonstrated by the Engineers of ADCTG.

Mr. B.S. Bhatia, Director, DECU Focal point for the Module on Satellite Communication for Development, Education and Training highlighted the needs and the impact of developmental communications. The module was well worked out and was made interesting by devising to be highly interactive. The presentations were highly appreciated since, the faculty was drawn from a variety of experts which included in addition to the experts from SAC, DECU and RESECO Gujarat, GNFC/ NSI, World Space, Doordarshan and Information Technology and Communications Department Andhra Pradesh Government. At the end of the Module each participant made a presentation about their country. The presentations were highly appreciated by the panel of experts who not only evaluated but also gave valuable suggestions for development.

The participants also enjoyed the festival of colours by actively participating in the Holi celebrations organized by the course management team in the Residential complex. Participants confronted the problem of identifying their one year project with the help of the Course Director and the other experts at SAC. The suitability and feasibility studies were carried out and discussed and individual project selection was finalized. The Pilot project work is in progress with the help of local guides at SAC. Preliminary presentations on the pilot project work were made in a limited group. This was required to review and suggest necessary improvements. The course will come to an end on the 30<sup>th</sup> April 2004.



*Students enjoying the Holi festival*



## BACKGROUND OF CSSTEAP

In response to the UN General Assembly Resolution (45/72 of 11th December, 1990) endorsing the recommendations of UNISPACE-82 the United Nations Office for Outer Space Affairs (UN-OOSA) prepared a project document (A/AC.105/534) envisaging the establishment of Centres for Space Science & Technology Education in the developing countries. The Objective of the Centres is to enhance the capabilities of the member states in different areas of space science and technology that can advance their social and economic development. The first of such centres, named as Centre for Space Science & Technology Education in Asia & the Pacific (CSSTEAP) was established in India in November 1995. Department of Space, Government of India has made available appropriate facilities and expertise to the Centre through the Indian Institute of Remote Sensing (IIRS) Dehradun, Space Applications Centre (SAC) & Physical Research Laboratory (PRL) Ahmedabad. The Centre is an education and training institution that is capable of high attainments in the development and transfer of knowledge in the fields of space science & technology. The emphasis of the Centre is on in-depth education, training and application programmes, linkage to global programmes / databases; execution of pilot projects, continuing education and awareness and appraisal programmes. The Centre offers Post Graduate level and short courses in the fields of (a) Remote Sensing and Geographic Information System, (b) Satellite Communications and GPS, (c) Satellite Meteorology and Global Climate, (d) Space and Atmospheric Sciences. A set of standard curricula developed by the United Nations is adapted for the educational programmes.

The Centre is affiliated to the United Nations and its education programmes are recognised by Andhra University, Visakhapatnam, India for awarding M.Tech degree. (after completion of 1 year project).

### Ongoing Courses

- Fourth 9 month Post Graduate course in Satellite Communications at SAC, Ahmedabad from August 1, 2003.
- Eighth 9 month Post Graduate course in RS & GIS at IIRS, Dehradun from October 1, 2003.

### Forthcoming Courses

- Fourth 9 month Post Graduate course in Satellite Meteorology and Global Climate at SAC, Ahmedabad from August 2, 2004.
- Fourth 9 month Post Graduate course in Space Science, PRL, Ahmedabad from August 2, 2004.
- International Training course on Geoinformatics for Disaster Management at IIRS, Dehradun from Aug 16 - Sept 10, 2004
- Ninth 9 month Post Graduate course in RS & GIS, IIRS Dehradun from October 1, 2004.

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CSSTEAP welcomes the views and opinions of the readers of Newsletter. Short Communications on space science and technology education which may be relevant to Asia Pacific Region are also welcome. Views expressed in the articles of the newsletter are those of the authors.