CSSTEAP Newsletter

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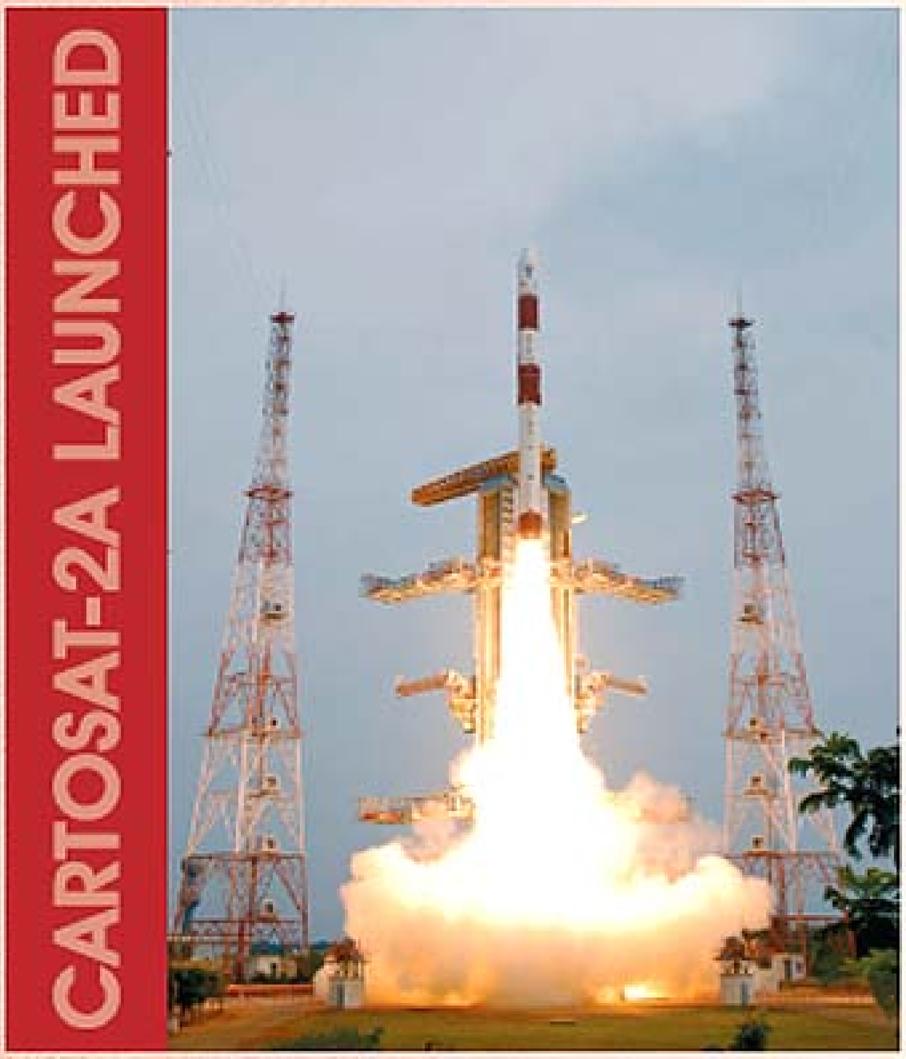
..... on a mission of capacity building, under the initiative of the United Nations, for Asia and the Pacific Region in Space Science and Technology, through Excellence in Education, Training, and Research.

ISRO Creates History



On April 28, 2008, the Indian Space Research Organization (ISRO) created a world record by successfully launching 10 satellites in one go.

In its thirteenth Polar Satellite Launch Vehicle (PSLV) flight conducted from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota, the PSLV in its 'core alone' configuration launched into a 637 km polar Sun Synchronous Orbit (SSO) ten satellites with a total weight of about 820 kg, which included the 690 kg Indian remote sensing satellite CARTOSAT-2A, the 83 kg Indian Mini Satellite (IMS-I) and eight nano satellites for international customers.

Inside this issue ......

ISRO's PSLV LAUNCHES 10 SATELLITES INTO ORBIT

In its thirteenth flight conducted from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota, on April 28, 2008, ISRO's Polar Satellite Launch Vehicle, PSLV-C9, successfully launched the 690 kg Indian remote sensing satellite CARTOSAT-2A, the 83 kg Indian Mini Satellite (IMS-1) and eight nanosatellites for international customers into a 637 km polar Sun Synchronous Orbit (SSO).

CARTOSAT-2A is a state-of-the art remote sensing satellite carrying a panchromatic camera (PAN) capable of taking black-and-white pictures in the visible region of electromagnetic spectrum with a spatial resolution of about one metre and swath of 9.6 km. The highly agile CARTOSAT-2A is steerable along as well as across the direction of its movement to facilitate imaging of any area more frequently. High-resolution data from CARTOSAT-2A will be invaluable in urban and rural development applications calling for large scale mapping.

Part of Bangkok city (Cartosat- 2A, 21 May, 2008)

Indian Mini Satellite (IMS-1), flown as an auxiliary payload on board PSLV-C9, it carries two remote sensing payloads - A Multi-spectral camera (Mx Payload) and a Hyper-spectral camera (HySI Payload), operating in the visible and near infrared regions of the electromagnetic spectrum. The spatial resolution of Mx camera is 37 metre with a swath of 151 km while that of HySI is about 506 metre with a swath of about 130 km. The data from this mission will be made available to interested space agencies and student community from developing countries to provide necessary impetus to capacity building in using satellite data.

Eight Nanosatellites from abroad are carried as auxiliary payloads besides IMS-1 as well as CARTOSAT-2A. The total weight of these Nanosatellite payloads is about 50 Kg. The satellites are developed by various universities/institutions from Canada, Denmark, Germany, Japan, and The Netherlands.

With its twelve consecutively successful flights so far, PSLV has repeatedly proved itself as a reliable and versatile workhorse launch vehicle.

Source : www.isro.gov.in

SIXTH POST GRADUATE COURSE IN SATELLITE COMMUNICATIONS

The sixth Post Graduate course on SATCOM was conducted at Space Applications Centre, Ahmedabad from August 1, 2007 to April 30, 2008. Twenty participants from 10 countries of Asia-Pacific region participated in the course. The Passing out ceremony and the valedictory function for this course was held on 30th April, 2008. Chief Guest, former Director CSSTEAP Prof. B.L Deekshatulu gave away the PG Diploma certificates to the participants. Fifteen of total participants passed with Distinction and five were placed in First Class. The first three Rank holders received Medals from Director SAC. On this occasion Director CSSTEAP released a Technical Compendium written by the participants and also released the CD containing the syllabus and the course materials of SATCOM-6. A 'Memoirs' of this course was released by the Chief Guest.

On the occasion of Valedictory function, Director SAC welcomed all the participants, invitees, faculty and Prof. G.S.N. Raju from Andhra University. Director CSSTEAP in his address asked the participants to pursue the project work after they go back to their own organisations and also offered limited financial assistance to the meritorious candidates to complete the project work leading to M.Tech Degree. The Chief Guest in his address mentioned about how the communication technology is helping in the development of society and its culture. He spoke about the past and present technologies and gave a broad overview of what is expected in coming days.

Course Director in his report mentioned a total of 92 participants from 16 different countries have been benefited from the course. This 39 week course which started on August 1, 2007 had ten modules each having lectures, practical, tutorials etc. Several technical tours were conducted to important SATCOM and Space technology facilities and infrastructure across India. Along with the technical tours, visits were also conducted to give the participants a glimpse of Indian heritage and culture. The Course Director also briefly mentioned about the continued effort by the organizers to enhance the smooth conduct of the course. Some of them are, introduction of semester system, video recording of the lecture proceedings, and access to the archival of all the past and present course materials, creation of question bank, creation of CSSTEAP network and extension of the network to the hostel rooms to access course material from the archival any time of the day, introduction of seminars on societal application of satcom in different countries etc.

SATCOM Course participants with dignitaries on dias

On behalf of the participants two students gave their feedback on the conduct of the course. They felt that the overall conduct of the course was extremely good with good quality teaching, practical and educational tours, classroom arrangements and hostel stay was comfortable.

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TWELFTH POST GRADUATE COURSE ON REMOTE SENSING & GIS

The Twelfth Post-Graduate Course on " Remote Sensing and Geographic Information System (RS&GIS)" of CSSTEAP, was commenced on October 1, 2007 at Indian Institute of Remote Sensing (IIRS), National Remote Sensing Agency (NRSA), Dehradun, one of the host institutions of CSSTEAP and completed on June 30, 2008. Total 18 participants from 11 countries of Asia-Pacific Region viz. Azerbaijan-2; India-1; Kyrgyz Republic -2; Mongolia- 3; Myanmar - 2; Nepal - 1; Philippines-1; Sri Lanka- 2; Thailand- 1; Uzbekistan- 1 and Vietnam - 2 attended this course.

The entire course was divided into three modules. The third and the final module with duration of three months started from April 01, 2008 and completed on June 27 2008 with valedictory function. This module is basically designed for carrying out pilot project work by the course participants. The objective of this module is to make the course participants capable to carry out research on their own towards natural resources inventory, monitoring and management using RS & GIS techniques. The broad topics of the pilot projects under taken by the course participants during Module III were- Assessing sustainable use of land resources in watershed using RS & GIS; Geospatial multi criteria decision making approach to forest conservation, DEM generation using cartosat-1 stereo data for aeroplane flight analysis; spatial decision making for urban planning; high resolution spatial and spectral data fusion for automated road extraction; estimation of regional evapotranspiration; soil erosion modeling for conservation planning using RS & GIS; forest cover and land use change assessment; growing stock and biomass estimation; biodiversity characteriszation at landscape level; water quality parameters retrieval, Hydrological modelling; Geo- neotectonic study using multi-resolution satellite data; Urban physical facilities inventory using high

Valedictory function of 12th RS & GIS course resolution satellite data; Urban spatial pattern analysis using high resolution data; Performance evaluation of irrigation command; Geo-statistical analysis for avalanches related disaster; and Terrain deformation study using SAR interferrometry.

The valedictory function of the Course was held on June 27, 2008. Dr. V.K. Dadhwal, Dean IIRS welcome the Chief Guest and other dignitaries. Dr. George Joseph, Director CSSTEAP presented the brief outline of the CSSTEAP. The Course report was presented by Course Director, Dr. S.K. Saha. The post graduate diploma certificates were awarded to the Course participants by Chief Guest Dr. K.N. Shankara, Former Director, SAC and ISAC, ISRO, Bangalore. He also delivered valedictory address on this auspicious occasion. To mark the occasion a memoir was also released by Chief Guest. The function ended with vote of thanks proposed by Dr. S.P. Aggarwal, Course Coordinator.

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REPORT ON CSSTEAP SHORT COURSE ON SATELLITE NAVIGATION AND LOCATION BASED SERVICES

The International Training Course on Satellite Navigation and Location Based Services, a short course of CSSTEAP, is being organized at SAC Campus, Bopal from June 18, 2008 to July 18, 2008. 18 participants from 10 countries are attending the course. The inaugural function of the course was held on June 18, 2008 at Bopal campus, SAC, Ahmedabad. Prof. Hans Joachim Haubold Senior Programme Officer OOSA, UN was the Chief Guest.

Chief Guest Dr. Haubold addressing the gathering

Director, SAC welcomed the Chief Guest and the participants. He described the activities of Space Applications Centre ISRO also talked about the Satellite Navigation Systems in the world including Indian initiative. Director, CSSTEAP briefly talked about CSSTEAP activities. Course Director Dr. K. Bandyopadhyay introduced the course structure and the profile of the students and faculties. Each of the participants introduced themselves with a brief introduction of their organization and nature of work carried out by them. The Chief Guest, Dr. Haubold mentioned that the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) held in 1999, in its resolution 54/68, the United Nations General Assembly endorsed the Vienna Declaration: Space Millennium for Human Development. The Vienna Declaration called for action, among other matters, to improve the efficiency and security of transport, search and rescue, geodesy and other activities by promoting the enhancement of, universal access to and compatibility of, space-based navigation and positioning systems. In response to that call, in 2001 the Committee on the Peaceful Uses of Outer Space (COPUOS) established the Action Team on GNSS to carry out those actions under the chairmanship of Italy and the United States of America. The action team on GNSS, consisting of 38 member States and 15 intergovernmental and nongovernmental organizations, recommended that an international committee on GNSS (ICG) should be established. After six years of deliberations and regional workshops, the United Nations has fostered the creation of ICG to promote the benefits of space-based positioning, navigation, and timing particularly in developing nations. The members of the ICG will be representatives of the GNSS and augmentation system providers and representatives of intergovernmental and nongovernmental organizations, representing important international scientific development and user groups of the capabilities of GNSS. The ICG hopes to encourage compatibility and interoperability among GNSS systems, while increasing their use to support sustainable development, particularly in the developing nations. The function was concluded with a vote of thanks by the course coordinator.

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FROM UN-ESCAP

SPACE-BASE INFORMATION FOR SOCIOECONOMIC DEVELOPMENT: THE ROLE OF UN ESCAP

CONTRIBUTION OF UNESCAP TO CSSTEAP

Since the inception of the Centre in 1995, CSSTEAP has organized 28 Post Graduate courses and 19 short term/workshops in various disciplines of Space Science, technology and applications. Over the years, UNESCAP has been supporting the Centre's educational programs and has been contributing towards the objective of CSSTEAP of capacity building in the application of space science and technology in the Asia-Pacific region. Every year, UNESCAP has been providing financial support in the form of international travel (to-and fro) to several of the CSSTEAP participants of the region. Till date UNESCAP has provided financial support to around 100 participants of various CSSTEAP courses. We are extremely grateful to UNESCAP for their esteemed recognition for the academic activities of the Centre. More details on the role of UNESCAP in supporting the space applications programme for sustainable development for Asia-Pacific region is brought out in the following article by Mr. Siva Thampi, Director, Information Communication & Space Technology Division UN/ESCAP, Bangkok, Thailand.

Over the past 25 years, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) has helped countries in the region to derive benefit from advances in space technology applications for their sustainable development. ESCAP efforts resulted in the convening of the Regional Space Applications Programme for Sustainable Development in Asia and the Pacific (RESAP[1]) in 1994, involving a wide spectrum of space technology applications including remote sensing, geographical information system, satellite communication, satellite-based positioning and satellite meteorology. By providing a multilateral regional approach to cooperation, and an approach emphasizing developmental benefits of space even for lesser-developed countries and marginalized communities, RESAP has complemented approaches such as the Asia-Pacific Multilateral Cooperation in Space Technology Applications (AP-MCSTA), the Asia-Pacific Regional Space Agency Forum (APRSAF), the Asia-Pacific Satellite Communication Council (APSCC) and other such bodies active in space technology applications in the Asia-Pacific region.

Through RESAP, ESCAP has helped to catalyze enhanced regional cooperation and the building of national capacities. ESCAP established a three-tier network[2] of space technology professionals for regional cooperation in different themes of space applications. The network includes the RESAP Intergovernmental Consultative Committee (ICC)[3], the regional working groups in major space applications fields, and the regional training and education network, which has been supported by China, Indonesia and India, including the training activities hosted by the CSSTEAP.

ESCAP has conducted policy studies and implemented technical cooperation projects to promote operational uses of space technology for achieving major development objectives in the areas of disaster management, environment and natural resources management, education and health. These activities have had a substantial and beneficial impact in the region. For example, the feasibility study conducted in 1995 for the establishment of an Earth space information network in Asia and the Pacific outlined the framework and functions of a cooperative multi-node regional information network for sharing Earth observation data products, such as processed imagery for use in disaster response and for natural resources management.

Similarly, meetings convened in 2002 and policy studies conducted in 2004 and 2005 on regional cooperation on space technology supported disaster management and on space information products and services for disaster management emphasized the necessity of a scientifically sound, diplomatically acceptable and politically relevant harmonized regional platform to support disaster reduction efforts of less capable countries, and the importance of proper space information products and services to be provided through the platform for less capable countries' easy access to and effective use of space information tools. Indeed, it has been found that all countries have been impacted sufficiently by certain disasters to benefit from regional and global cooperation in preparation, risk mitigation, early warning as well as response to disasters. These studies have provided policy options for relevant regional initiatives in development of such cooperative mechanisms, among which the Sentinel Asia initiative, which was initiated by APRSAF, has achieved substantive progress and has been supported by Japan, India, Thailand and the Republic of Korea with their existing and planned satellite missions.

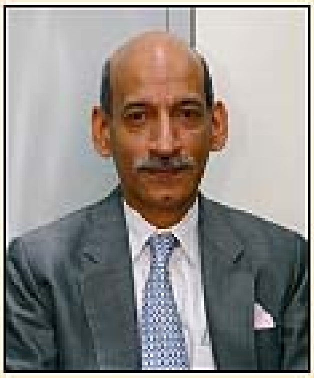
ESCAP has also supported regional cooperation initiatives on space technology and applications towards more permanent institutional arrangements, and has made efforts to synergize and harmonize such arrangements. For example, AP-MCSTA has been evolving towards the Asia-Pacific Space Cooperation Organization (APSCO), which may provide space application resources to other non-member countries through the RESAP network. ESCAP is also working closely with APRSAF and JAXA to develop a network of national disaster management authorities to benefit from the Sentinel-Asia and other relevant initiatives covering the Asia-Pacific region.

Since the establishment of CSSTEAP in 1995, ESCAP has kept close cooperation with CSSTEAP to build the capacity of ESCAP member countries on the use of space technology to achieve sustainable development goals. ESCAP has provided air-tickets to around 100 participants from developing countries, particularly least developed countries, to attend the training courses of CSSTEAP.

Along with the reforming process of the United Nations system, ESCAP has recognized disaster risk reduction as one of its priority areas. In light of that, operational access and use of technical tools based on space technologies and on information and communication technologies will be a major effort field for the ESCAP secretariat. While it poses a challenging task to fully harness space technology applications for disaster risk reduction especially in least-developed, land-locked, or small-island developing countries, and economies in transition there are scope for much progress to be made. ESCAP is committed to ensure that developing countries, as well as regional and international organizations, have access to space-based solutions to support activities in the area of hazards and disaster management. It is also committed to partnering with organizations in the region to develop win-win situations to the benefit of the region.

Through RESAP, ESCAP nurtured the concept of regional cooperative mechanisms for disaster management, including through the use of space technology. This effort aims to provide common platforms to major space information providers, local service providers and disaster management authorities for a harmonized and affordable access to relevant information and technical resources. Regional space-faring countries such as China, India and Japan have taken concrete steps towards establishment of such mechanisms, and other countries in the region also have expressed their strong desire to contribute to and benefit from such approaches.

There are challenges for less capable countries to operationally access and utilize these tools, not only in technical aspects, but also at policy and institutional levels. In the process to strengthen the capacity of national institutions of the countries in the region, we believe that cooperation between ESCAP and CSSTEAP will be further enhanced. ESCAP looks forward to many more years of mutually beneficial cooperation with CSSTEAP, and with other organizations that seek to promote training and capacity development in the region.



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[1] http://www.unescap.org/icstd/SPACE/resap/resap_main.asp
[2] http://www.unescap.org/icstd/SPACE/resap/resap.asp
[3] http://www.unescap.org/icstd/SPACE/resap/icc/icc.asp

FROM MEMBER COUNTRIES

THEOS - THAILAND'S FIRST EARTH OBSERVATION SATELLITE

Thailand has been actively engaged in space-borne Earth observation for several decades. The country has operated a satellite ground receiving station in Lad Krabang, Bangkok since 1981. The Ground Receiving Station has been in operation under Thailand Remote Sensing Center, which was later transformed into the Geo-Informatics and Space Technology Development Agency (Public Organization): GISTDA. The Ground Station has acquired imageries from a number of satellites such as LANDSAT, ERS, NOAA, JERS, IRS, RADARSAT and SPOT -2, -4 and -5 over the past 20 years. Its footprint extends over 2500 km in radius covering 17 countries in Asia.

More than 20 years of experiences in acquiring, processing, disseminating and developing applications of satellite data, Thailand had decided to become owner and operator of its own Earth observation satellite. In 2003, the Thai Cabinet approved the Thailand Earth Observation System: THEOS Satellite Project, and GISTDA has been assigned as the operating agency of the project. The THEOS Project was officially started in July 2004 with EADS Astrium as the Project's prime contractor. THEOS is the first Earth observation satellite of Thailand designed to function at operational level. The satellite is envisioned to fulfill a number of Earth observation requirements including fast access to area of interest, high revisiting capacity, routine monitoring and updating for local, regional, and worldwide observations.

The THEOS satellite consists of two main parts, the platform and the optical instrument payloads (Figure 1). THEOS carries two imaging instruments (i) a panchromatic camera having nadir spatial resolution of 2m with 22 km swath (ii) a multispectral camera operating in four spectral bands (blue, green, red and near infrared) having nadir spatial resolution of 15m with 90 km swath. Both cameras operate in the push broom mode, using linear CCDs as the detector. The image video data is digitized to 12 bits, of which 8 will be transmitted. The digital image data is compressed using JPEG algorithm. Onboard 50 Gbit, solid-state memory enables recording of the data collected in any part of the globe and transmitting at the Thailand data reception station. Thus THEOS can provide global coverage.

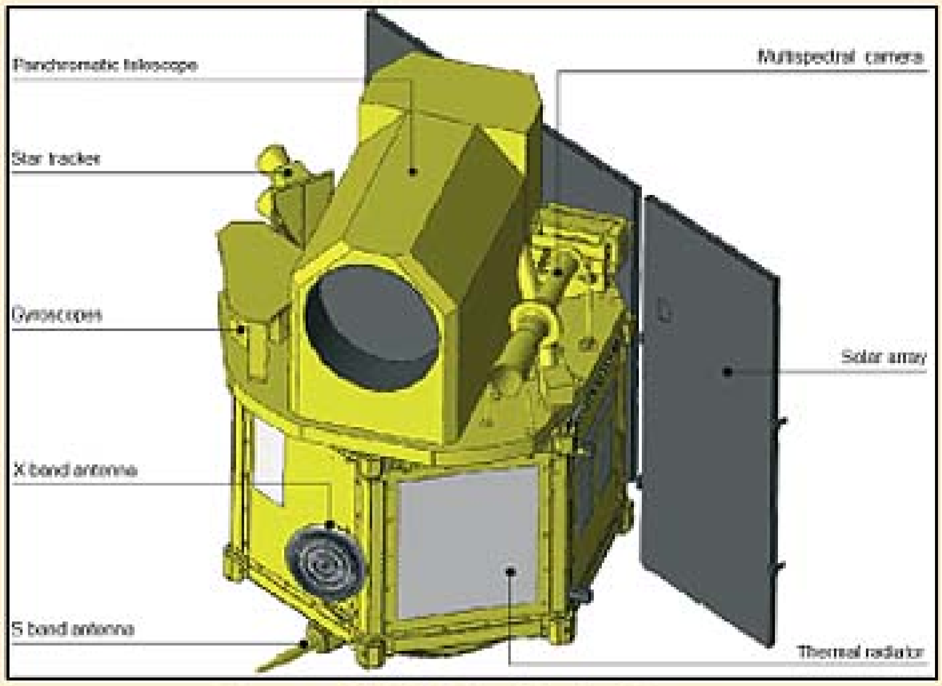


Figure 1. THEOS Satellite Architecture

The THEOS satellite is very agile so that the satellite can be tilted in the roll and pitch axis. The tilt about the roll axis allows off nadir viewing, thus increasing the revisit capability. With tilting to ± at 30° any portion of the earth surface can be revisited within 5 days and at the maximum possible tilt angle at 50°, THEOS can access 90% of the earth surface in 1 day. The roll and pitch tilt capability also allows across track and along track stereo imaging.

The satellite weighs 750 kg, with fixed solar array capable of producing about 850w. The satellite is three axis stabilized. The satellite will be placed at 822 km in sun synchronous orbit with equatorial crossing time of 10:00 am on a descending node.

The Image Ground Segment receives downlinked data from the satellite via 13-m X-Band station. It processes and archives the transmitted data through image processing chain to produce standard and value added products corresponding to user's requests. The THEOS Control Ground Segment is located in Sri Racha, 100 kilometers away from Bangkok. The Thailand ground station covers several parts of Asian countries as shown in Figure 2.

The different THEOS image products available in both PAN and Multispectral formats include: level 1A products are those with radiometric correction for distortions due to non-uniformities of optical instruments; level 2A products with geometric correction

Figure 2. THEOS visibility from Thailand ground station

for systematic effects such as panoramic, Earth curvature and rotation and internal distortion and are projected with a standard cartographic projection; level 2B are image products with geometric correction that come in a map projection with ground control points; and Digital Terrain Model products obtain through correlation process of THEOS stereo pairs. PAN sharpened multispectral image is another product.

With the availability of various products and capability of taking images according to user requirements, THEOS products can be applied for observations in various fields including cartography, land use, agriculture, forestry, irrigation, geology, education, etc. THEOS system routine operational activities are organized on a daily basis with flexibility enabling to the urgent requests. Furthermore, THEOS is capable of serving high-resolution imagery to international user community via the S/X-band near polar station and the X-band international ground stations, as well as distributing data through the Regional THEOS Data Distribution Partners.

Scheduled to be launched by 2008, THEOS is expected not only to provide an opportunity for Thailand to strengthen its space technology and applications but also allow GISTDA to play a significant role in data delivery service to earth observation users nationally and internationally.

No doubt THEOS shall bring a new dimension to remote sensing and space technology development of Thailand.

With inputs from GISTDA

EVOLUTION OF METEOROLOGY WITH SPECIAL REFERENCE TO THE ROLE OF SATELLITES

Knowing future weather is of interest to all sections of society, since it impacts every activity, either on land or ocean. Ancient weather forecasting methods usually relied on observed patterns of events. However, not all these predictions prove reliable. Shifting from the realm of 'guess' work to science was possible with the invention of a number of instruments to measure various atmospheric parameters which are highly variable. The improvements in weather forecasting have been due to scientific and technological progress such as measuring instruments, physics and mathematics, computers, satellites, communications and not the least the information technology. In the following article Dr. Pranav Desai unravels the story of weather forecasting from ancient observational techniques to the satellite era.

Weather and Climate have always affected mankind and it is not surprising, that weather-related folklore developed in every civilization many of the sayings provide practical thumb-rules on the expected weather so that response can be adjusted. Arab sailors knew the wind reversals and accordingly adjusted voyage to and from India. The modern term monsoon derives from Arabic `Mausim' (season). In ancient times, weather phenomenon was understood purely based on visual observations. Ancients attempted weather forecasting based on studying patterns of past events, and the accumulated local knowledge of weather 'signs' were passed down from generation to generation. Thus, for example, imminent dark clouds on the horizon do alert us to arrival of rains. Primitive forecasts have also been made based on the behaviour of animals and insects. However, the qualitative approach has limitations to predict the impending nature of atmosphere. To appreciate this, let us first understand the basic steps involved in cloud formation.

A highly humid parcel of air gets cooled as it ascends. Since the moisture-holding capacity falls at lower temperature, some of the moisture content of the ascending parcel of air condenses. This results in cloud formation and precipitation. This phenomenon is dependent on atmospheric quantities like temperature, humidity, pressure, winds, etc. Thus weather is the state of the atmosphere at a given time and place, with respect to the above variables. Therefore quantitative measurements of these atmospheric parameters and analysis are called for, to progress beyond qualitative alerts. Thus study of meteorology as a science started with the invention of instruments to measure the atmospheric parameters.

In 1450, the Italian architect Leone Battista Alberti (1404-1472) developed the first known anemometer to measure wind speed. During the same period hygrometer, which gives a measure of water vapour in the atmosphere was invented by a German philosopher Nicholas de Cusa (1400-1464). In 1643 the Italian physicist Evangelista Torricelli (1608-1647) invented the barometer to measure atmospheric pressure. Another important invention for meteorologists was the thermoscope in 1607 by the Italian physicist Galileo Galilei (1564-1642) which indicated changes in temperature. However, its practical application was limited since it has no scale and only gave a qualitative idea of change in temperature. A major milestone in using thermometer for systematic studies was possible only after temperature scales were developed by German scientist Gabriel Daniel Fahrenheit (1686-1736), in 1724. The invention of rain gauge in 1639 is generally attributed to the Italian scientist Benedetto Castelli (1578-1643). Though we mentioned above those who invented the instruments, many subsequently contributed immensely to improve upon the first concepts and perfected as scientific tools. With these and several other instruments in place, scientists had adequate tools to quantitatively understand the atmospheric phenomenon, and meteorological observatories were set up to record the weather parameters. Over the Indian subcontinent, the first (Asian) observatory was established in 1792 at Madras, now called Chennai. Several others followed during 1820-1855.

The atmospheric phenomenon in a region arises, essentially from the spatio-temporal interactions of the weather situations over different neighbouring regions. Differing heating patterns generate atmospheric churning. Though air-motion (wind) takes place from a high-pressure centre to a neighbouring low-pressure centre, the actual motion suffers deflection due to the earth's rotation (called `Coriolis' tendency), so that flows of wind settle parallel to isobars (equi-pressure lines). Further, the entire system may be gradually shifted. A totally distinct air-mass can arrive also, at a given place from far away, and change weather rapidly. Thus, the initial old-fashioned method of monitoring the weather at a place, by merely examining a local barometer to get an indication of cloudy weather suffers from too narrow a view. But if one wants forewarning and insight into the phenomena, one needs instant knowledge of the regional pattern of meteorological parameters. Hence one needs multiple point observatories along with the capability for rapid communication.

Italy is probably the first country to establish about a dozen (surface) meteorological stations, around 1650. A century later, a sizable network of 40 observatories was finally implemented by the German Meteorological Society, spread over several European countries. However, the data from the network of meteorological stations could be used for making weather charts only post-facto, since the data collected from different stations, were not immediately available in a central place for analysis as communication was limited to ship, horse or rail. It was only after Morse's telegraphic coded technique of communication was invented in 1843 that nearly instant data based charts could be prepared.

Mere surface observation network, no matter how dense, cannot inform us important processes occurring in the different layers of the atmosphere. As a simple example, the lowest layer's thermal and humidity structure determines its instability or simply put, its capacity to sustain cloud formation. Since the pressure falls with height an uplifted parcel of moist air cools by expansion; whether it will result in the formation of a cloud depends on the vertical temperature profile of the surrounding atmosphere. This shows the importance of the vertical profiles of temperature and humidity. The vertical profile of winds plays a critical role in the tropical cyclone. If the environmental winds have a large difference in magnitude or direction between lower and upper layers, the top of the cyclone gets 'blown off' away from its bottom and so the cyclone cannot survive. Thus, wind profile is one of the important parameters for sustainability of cyclones. This realization that the atmosphere is a three dimensional 'volume', made meteorologists to find out ways to get the instruments 'off the ground'. The effort to make upper air measurement started as early as 1749, when a kite was used to carry aloft a thermometer. The early method to obtain regularly the vertical profile of the atmospheric parameters was to place pressure, temperature, and humidity sensors on a small balloon (radiosonde) and launch it, and the data from the sensors are received through telemetry. Further, tracking the motion of the balloon gives us the horizontal winds at different levels. Today, coordinated balloonsondes are launched from many countries. In the early 20th century, balloonsonde stations started getting established widely enabling meteorologists to get actual picture of upper air circulation and thermal states. While there are large number of surface stations and a fewer number of full-fledged weather stations in many parts of the globe, they are only over the land. Over the seas, such upper air measurements are practically non-existent, barring a few limited scientific expeditions. Aircrafts provided one more platform for upper-air observations.

Advances in radar technology, primarily motivated by world wars, were later effectively used for cyclone warning. Cyclone warning radars were established at many coastal stations during the post war era. However, their effective range is only about 250 km, so warning time is quite short, as most cyclones arrive from seas. Ships and ocean-buoy observations are quite sparse, and even these only provide surface observations.

The situation regarding meteorological observation upto about the mid-twentieth century could be summarized as-: a fairly dense network of surface and upper-air regular observations on land areas, and surface meteorological observations from merchant ships, and data from commercial aircraft. Timely receipt of nearly all data, specially the land stations' data, was ensured at certain World Meteorological Organisation (WMO) hubs. However, even with all these facilities, something was missing. Many systems such as tropical cyclones/hurricanes are of oceanic origin. Even normal weather over land is influenced by the atmosphere over oceans, for example by moisture front or moist air-mass from seas. Thus, upper-air and cloud observation over oceans was essential to have a better understanding of weather systems the satellites turned out to be the answer. The first method of weather forecasting, based on charts, is called 'synoptic analysis/prognosis'.

With the launch of SPUTNIK, the first artificial satellite by the USSR on 4th October, 1957, dawned a new era in observing earth from space. The first dedicated satellite for meteorological observation was TIROS-1 launched on April 1, 1960, by the USA. It carried an imaging sensor, with which for the first time the meteorologist got a systematic view of clouds from above. This was followed by a number of experimental and operational meteorological satellites from low earth orbit, typically around 1000km altitude. These satellites provide apart from cloud cover, important information on vertical profiles of temperature, humidity and information on the concentration of minor constituents of the atmosphere. However, a satellite from such low orbit while providing global coverage, gives relatively infrequent observation at any given place. This limitation of large time-gap between successive measurements prevents monitoring of dynamic features like winds, cyclones etc.

Geosynchronous satellite, which appears stationary at a longitude over the equator, not only permits frequent (upto 48 images/day) view but, using cloud as tracers in successive images, helps to obtain upper-air winds; this is especially important in the tropics where temperature profiles can not be used to infer winds. In addition such a platform also enables to monitor continuously other atmospheric parameters and phenomena of importance to meteorologists. For example, the central eye of a cyclone and other features can be tracked to forewarn coastal areas likely to be hit by the cyclone. The global nature of weather becomes evident in the imagery from such satellite exemplified in Figure 1.

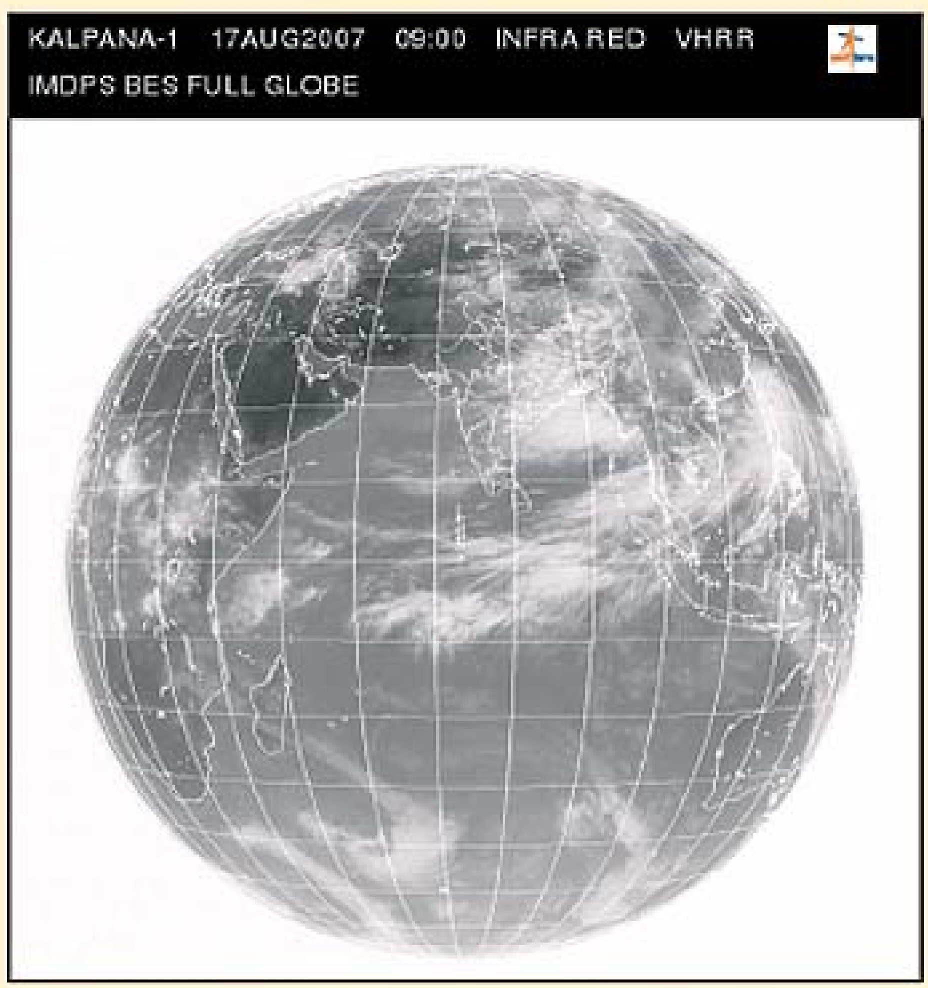


Fig. 1 : A typical image from geosynchronous satellite radiometer - in this case Indian Satellite Kalpana-1 on August 17, 2007 - shows the global nature of weather: a quasi-equotorial cloud-band and a northern active zone over the Bay of Bengal are seen.

The standard parameters that `operational' meteorological satellites (polar and geosynchronous together) provide, nearly globally at least 4 times a day, include: sea surface temperature, cloud top temperature, cloud cover and type, vertical `soundings' i.e. temperature and humidity profiles, horizontal components of winds at certain preferred levels, and aerosol optical depth. However, the data are desirable at finer horizontal and vertical spacings and better accuracies are also desirable. Experimental outputs like radiation, snow-cover, also are available. Rain rate in a spatial average sense (as opposed to point data of rain gauges) is another useful experimental output. Such observations were found valuable in synoptic analysis.

If we consider the whole globe, we notice that the temperate zone of the Northern Hemisphere and some parts of the tropics have the densest network of weather stations. The Southern Hemisphere is relatively data sparse. It is estimated that the optimal inter-station distance is 400 km. Thus, any new observational platform (such as satellites) is more critical in the Southern Hemisphere. However, even in the otherwise data-rich zones, satellites can be valuable if they give new type of information, or data at higher temporal frequency for example, rainfall over river basins. Dynamics of clouds, like rising columns, merging bands, etc. plays a role in floods, which satellites can observe, whereas conventional point data of fractional cloud-cover can not capture it. Secondly the oceanic regions even in the Northern Hemisphere are data-sparse, so satellites can fill these crucial data gaps. Detailed sea surface temperature patterns from satellites improve weather forecast. The vertical structure of clouds, which plays significant role especially in the tropics, can be observed from suitable satellite sensors. Further, large areas can be covered uniformly in a short time by satellites. As an example, it is known that monsoon rainfall over South Asia is inversely linked to pre-monsoon snow-cover over Eurasia which can be efficiently mapped by satellites. The extreme Asian Cold Wave is generated by a stationary Central Asian high-pressure ridge (area) which is revealed in satellite soundings. Also the `La-Nina' (warming around Indonesia) that facilitates the ridge is sensed by satellites.

Pre-monsoon snow-cover and ocean thermal patterns are utilized in a `statistical' method for `long-range' weather forecast that is, whether `this year will be excessively wet or cold'. Such seasonal forecast formulae are in the nature of multiple regression analysis with global factors, usually of the type that can have long `memory' (e.g. ocean with high specific-heat is slow in releasing heat). However, the problem with such relations is that regressions can change, i.e. developed equations can weaken with passage of years. Further, when so many parameters are used, some may be mutually correlated and redundant, giving numerical instability. Such statistical models work fairly well during normal monsoon conditions, but the accuracy of prediction is substantially low during years having extreme deviations from normal. This is the second prevalent method of weather forecast.

A third approach to weather forecast is called numerical weather prediction. In numerical weather model, the physical processes of the atmosphere are represented by mathematical equations, generally derived from fluid dynamics. Running these models on a computer requires initial conditions like temperature, humidity and winds at different pressure levels. Such information is generated from satellites in combination with in-situ data. Since the atmospheric motion is primarily caused by the solar heat input to carry forward the solution of the equations, the information on solar radiation falling on earth, along with surface parameters like temperature, moisture, etc. are also required.

In all these aspects, satellites can provide valuable (almost indispensable) inputs for example, vertical profiles of temperature and humidity over oceans (at the initial stage), boundary conditions (like sea-surface temperatures over oceans and snow cover, vegetation cover/type over land), and forcing terms (like radiative heating profile). However it is also admitted that there still are gaps: e.g. wind at all vertical levels is not available, soil moisture is not yet operationally available, etc. Models are not fully successful in accurate predictions, particularly in the tropics, partly due to lack of such data and partly by simplified representation of `processes in the models'.

For short and medium range prediction of the tropical cyclone, being mathematically complex, generally separate or special models are developed to forecast their development (intensity changes) and path (particularly landfall point and time). Satellites afford initiation of such models well in advance. Therefore, after the advent of satellites and the availability of high speed computers, the notice period of tropical cyclone, hitting the coast, as well as the precision of its location, improved considerably. This resulted in relatively limited loss of lives even in super cyclone `Sidr', which struck Bangladesh in November 2007 (figure 2).

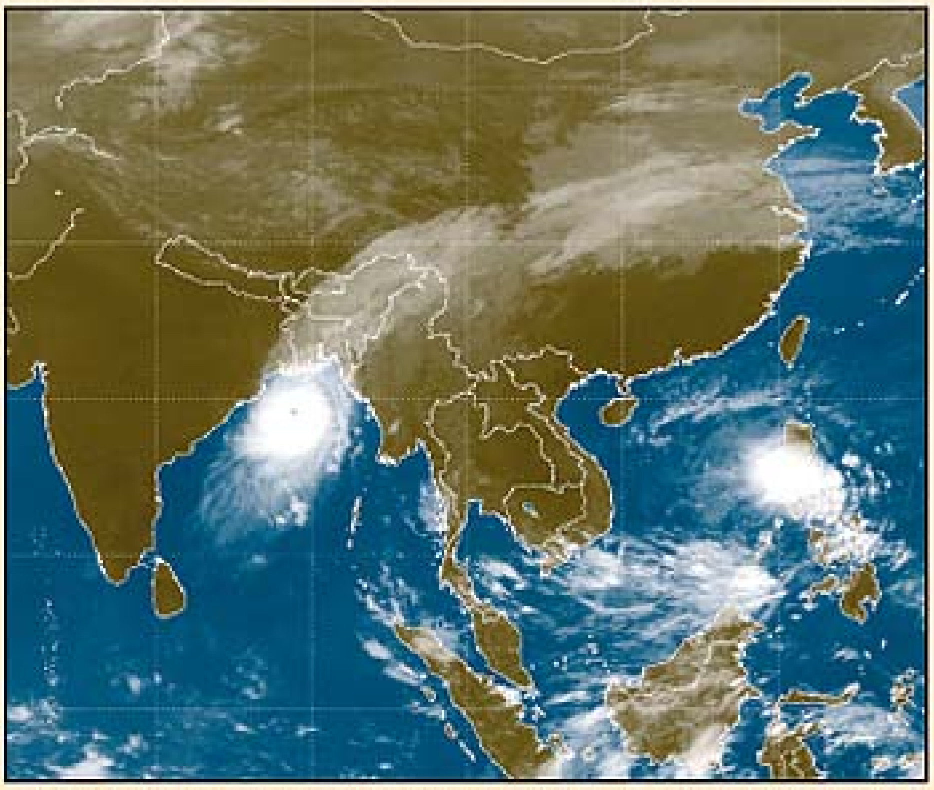
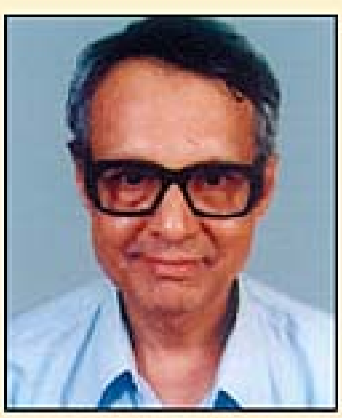


Fig 2: A view the super-cyclone side showing the eye, just before landfall at Bangladesh on Nov. 15, 2007; Japanese satellite MTSAT's image

Among recent satellite-based developments, the Global Positioning System of Satellites provides tropospheric humidity at high vertical resolution via refractive effect of the lower atmosphere. Finally, mention must also be made of `climate' oriented satellites and long record of inter-calibrated multiple satellite datasets for climate.

The study and prediction of weather have come a long way from the early times, wherein the visual observations of the skies (particularly clouds) were the only means. Currently we have multiple techniques of observation, wherein satellites look at (and even inside) clouds and atmosphere from above, and ground based radars also look for reflections from within clouds from below, besides balloonborne, aircraft and surface (including ships and buoys) based measurements. In terms of prediction techniques, we have evolved from qualitative thumb-rules of associations to physical principles represented in mathematical equations which are integrated numerically on fast computers supported by rapid communications. We still have, however, a long way to go in both observational and modeling aspects, to achieve better accuracies of forecasts and warnings.



Dr. **Pranav Desai** was with Space Applications Centre, Ahmedabad since 1977. He was heading the Meteorology and Oceanography division. He has made significant contributions in applying satellite derived parameters to understand the atmosphere. He retired from SAC as Chief Scientist in 2004. Currently he is one of the members of the faculty for teaching CSSTEAP 9 month PG Diploma course in Satellite Meteorology.

............And how the poet sees the cloud.........

I am the daughter of Earth and Water,
And the nursling of the sky;
I pass through the pores of the ocean and shores;
I change, but cannot die.
(P.B. Shelly 1792-1822)

ALUMNI SPEAKS

Ms. Kanayim Teshebaeva from Kyrgystan was a student of CSSTEAP during 2003-04 RS & GIS PG course. After completing her PG course, she was one of the scholars who was given opportunity and fellowship by CSSTEAP to work at Dehradun towards her research work on a"Remote Sensing and GIS approach for facility planning of Osh city, Kyrgystan". Based on the research work she was awarded Master of Technology

Ms. Kanayim Teshebaeva

It was an excellent opportunity to attend the Remote Sensing and GIS PG Course in 2003-2004 under the CSSTEAP program in India, where I was exposed to an international perspective on professional growth opportunities. After the successful completion of the diploma course, I was further offered to pursue this program into the M. Tech course. I worked on research titled "Remote Sensing and GIS approach for facility location planning of Osh city, Kyrgyzstan" and was awarded the M.Tech degree in October 2005.

After returning to my home country, I was appointed as faculty in the Department of Computer Sciences of Osh State University. It provided a great opportunity, not only to share the knowledge and technical skills I gained in the field of remote sensing and Geographic Information Systems from CSSTEAP with students and other faculty members, but also to other government organizations in Osh city.

Later, I was selected as an RS and GIS Scientist in the Central Asian Institute for Applied Geosciences (CAIAG), Bishkek, Kyrgyzstan; a collaborative organization established in 2004 by the Government of the Kyrgyz Republic and the GeoForschungsZentrum Potsdam (GFZ), Germany. RS and GIS play a key role in the project undertaken by CAIAG. I am involved in various ongoing projects at CAIAG related to forest inventory, climatologic and hydrologic conditions of Glacier and application of Synthetic Aperture Radar Interferometry. I am serving as a RS and GIS expert on two projects undertaken by my Institute, one is on 'Studying and monitoring of the INYLCHEK glacier with the goal of defining the glacier balance, its morphological and dynamic characteristics and its climatologic and hydrological conditions' and other is on 'The study of runoff regularities in southern Kyrgyzstan in connection with climate change for assessing the intensity of erosive processes and precipitation transfer into the basin of the TOKTOGUL reservoir'.

I attended a two week course on Synthetic Aperture Radar Interferometry at the GeoForschungsZentrum Potsdam in Germany in October 2007, and one week LIDAR training program at the Indian Institute of Technology at Kanpur in April 2008. Furthermore, I am sharing my knowledge with other organizations and various departments in my country in the form of lectures and presentations.

At last, I feel that the knowledge and technical skills I gained at CSSTEAP are not only an asset to my professional growth but also beneficial to growth and development of my organization and country.

Kanayim O. Teshebaeva
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Kyrgyz Republic,
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CSSTEAP Website

The Centre's website has been providing updated information about the Centre's activities and a linkage with the CSSTEAP alumni. There have been many features incorporated for Alumni interaction. Towards this, Discussion Forum has been activated in the website. Those who have already registered and are using Alumni Forum, can use the same username and password for 'Discussion Forum' also. For new users they have to get registered for using Alumni or Discussion Forum.

The Discussion Forum is open to all Alumni and every registered alumni will have their panel for posting or sharing a topic of interest with fellow colleagues. One will have option to share an information or post any query to all alumni or a group of alumni. Posting replies to a query is possible and all topics and their replies will be displayed on the panel date wise. Any research material, article can also be attached as attachment (pdf format, max. size 1 MB).

FORTHCOMING SYMPOSIUM/WORKSHOP IN AREA OF SPACE SCIENCE & TECHNOLOGY

S. No.	Theme	Duration	Location	Web address
1.	29th Asian Conference on Remote Sensing (ACRS) 2008	November 10-14, 2008	Colombo, Sri Lanka	http://220.247.235.243/acrs2008/index.html
2.	XXI congress, The International Society for Photogrammetry and Remote Sensing	July 3-11, 2008	Beijing, China	http://www.isprs2008-beijing.org/
3.	COSPAR 2008, 37th Scientific Assembly of the Committee on Space Research and Associated Events -"50th Anniversary Assembly.	July 13-20, 2008.	Montreal, Canada	http://www.cospar2008.org/ or http://www.cospar-assembly.org
4.	IEEE International Geoscience and Remote Sensing Symposium (IGARSS)	July 7-11, 2008	Boston, MA USA	http://www.grss-ieee.org/igarss08.htm
5.	7th Annual international conference and exhibition on Geographical information technology and Applications- MAP ASIA 2008	August 18-20, 2008	Kuala Lumpur, Malaysia.	http://www.mapasia.org/
6.	Geospatial Information & Technology Association GITA 2008	August 25-27, 2008	Sydney, Australia	http://www.gita.org.au
7.	4th World Urban Forum	September 1, 2008	Nanjing, China	http://www.unhabitat.org/categories.asp?catid=535
8.	10th International Symposium on High Mountain Remote Sensing Cartography (HMRSC X)	September 8-11, 2008	Kathmandu, Nepal	http://menris.icimod.net/HMRSC-X/index.html
9.	7th International Conference on ASIA GIS 2008	September 26-27, 2008	Busna, Korea	http://www.asiagis2008.com/
10.	59th International Astronautical Congress	29 September – 3 October, 2008	Glasgow, Scotland.	http://www.iac2008.co.uk/
11.	14th Australasian Remote Sensing and Photogrammetry Conference (ARSPC)	29 September – 03 October, 2008	Darwin, Australia	http://www.14arspc.com/
12.	4th Asian Space Conference 2008	October 1-3, 2008	Taipei, Taiwan	http://www2.nspo.org.tw/ASC2008/index.html
13.	3rd IAASS conference International Association for the Advancement of Space safety 'Building a safer space together'	October 21-23, 2008	Rome, Italy	http://www.congrex.nl/08a11
14.	International conference on Management of Landslide hazard in the Asia-Pacific region	November 11-12, 2008	Sendai, Miyagi Prefecture, Japan	http://www.landslide-soc.org/division/kokusai/2008ConferenceSecondCircular.pdf
15.	International Symposium on Global Navigation Satellite Systems	November 11-14, 2008	Berlin, Germany	http://www.unoosa.org/oosa/en/SAP/gnss/icg.html
16.	Digital Earth Summit on Geoinformatics: Tools for Global Change Research	November 12-14, 2008	Potsdam/Berlin Germany	http://ifgi.uni-muenster.de/gfgi/isde.php
17.	3rd International Workshop on 3D Geo-Information : Requirements, Acquisition, Modeling, Analysis, Visualization	November 13-14, 2008	Seoul, Korea Republic	http://3dgeoinfo.uos.ac.kr/
18.	SPIE Asia-Pacific Remote Sensing Conference	November 17-21, 2008.	Noumea, New Caledonia	http://spie.org/asia-pacific-remote-sensing.xml
19.	2nd International Conference on Geoinformation Technology for Natural Disaster Management and Rehabilitation	December 2-3, 2008	Bangkok, Thailand	http://e-geoinfo.net/git4ndm.html
20.	Pacific Island Countries GIS & RS User Conference	December 2-5, 2008	Suva, Fiji.	http://www.picisoc.org/tiki-index.php?page=PacGISRS2008

Inviting Contributions from CSSTEAP Alumni

CSSTEAP Newsletter is published every January and July of the year. We will be very happy to include professional achievements of our alumni. Please send us your current assignment, publications or any other activity you are doing in the area of space science and technology for the development of your country. We also invite case studies giving success stories of how space input has helped decision makers. The inputs for publications in the Newsletter will be selected by the editorial committee and will be properly edited.

Please send the inputs:

(for January issue of Newsletter) : latest by November of the previous year

(for July issue of Newsletter) : latest by April of the year.

E-mail: cssteap@iirs.gov.in

-Editor

Congratulations !!

CSSTEAP congratulates Mr. U Kyaw Lwin (Myanmar); Mr. Ramesh J Doshi (India); Ms. Rupal Ramesh Chandra Yagnik (India) for having completed and been awarded Master of Technology (M.Tech) degree during first half of 2008.

Mr. U Kyaw Lwin (Myanmar, RS & GIS course 2005-06) has been awarded M.Tech on "Analysis & Modeling of Land Use/ Land cover change by integrated use of Satellite Remote Sensing & GIS - A Case study", Mr. Ramesh J Doshi (India, SATCOM PG course 2001-02) has been awarded on "Design & Development of SSPA using dynamic biasing approach" and Ms. Rupal Yagnik (India, SATCOM PG course 2001-02) on "Design of Ka-band Electronic Beam Squint (EBS) tracking system".

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)

CSSTEAP Hqrs. at Dehradun

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

1) Short Course on Satellite Navigation and Location based services at SAC, Ahmedabad during June 18 to July 18, 2008.

FUTURE COURSES

1) Short Course on Disaster Management for Drought at IIRS, Dehradun during July14 - August 8, 2008.
2) Sixth 9 month Post Graduate course in Space & Atmospheric Science at PRL, Ahmedabad from August 1, 2008 to April 30, 2009.
3) Sixth 9 month Post Graduate course in Satellite Meteorology & Global climate at SAC Ahmedabad from August 1, 2008 to April 30, 2009.
4) Thirteenth 9 month Post Graduate course in RS & GIS at IIRS, Dehradun from October 1, 2008 to June 30, 2009.

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.