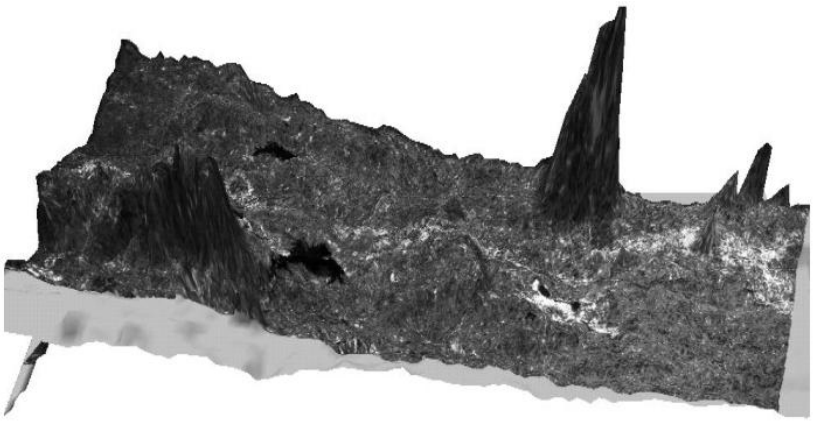
SIGNATURES

ISRS *Newsletter of the Indian Society of Remote Sensing – Ahmedabad Chapter*

Volume- 17 No. 2 Month- July Year- 2004



A 3D view of Parasntha, Jharkhand through SAR Interferometry

In this Issue

EDITORS COLUMN

Dear Members,

The first issue from the new committee is in your hand. As you would immediately discern, the effort is towards making the newsletter more news and column oriented than article oriented. There would be one or two lead articles but of short and popular nature. The idea is to leave the practice of publishing full-fledged research findings to the main journal of Society and other forums. We invite your comments on the structuring and modifications needed, if any. Please feel free to communicate by email. And of course contribute to any of the columns by interest and opportunity!

We look forward to your active involvement in dissemination of latest findings through a process of informal communication – like tipping any of the editorial members on the new developments worth reporting in the newsletter.

Wish you a happy browsing!

Editor

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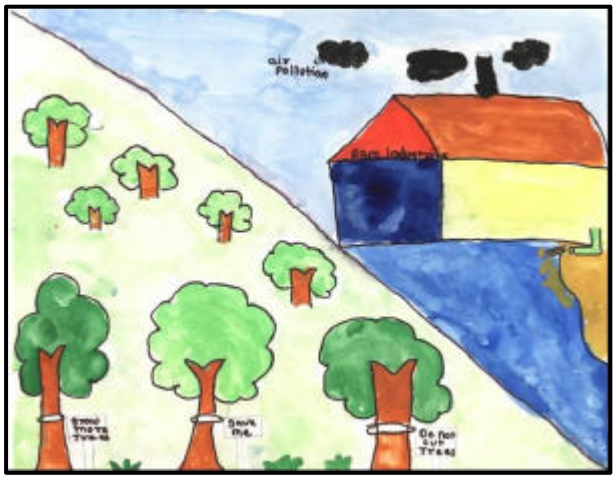
World Environment Day Celebration (June 05, 2004)
Painting Competition
Van Chetna Kendra, Vastrapur, Ahmedabad

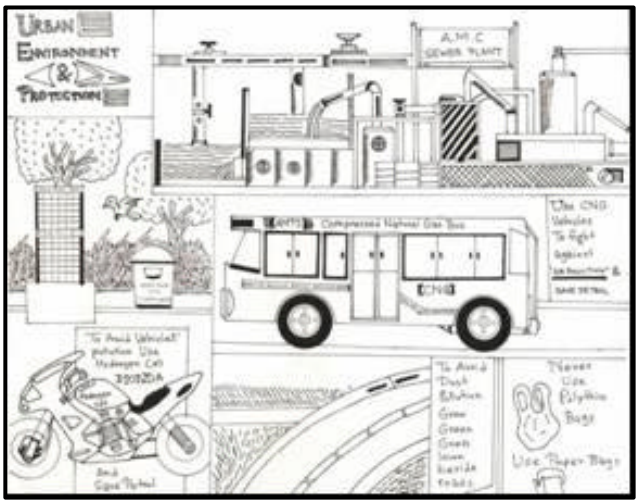
6 – 10 years category

First Prize – Ivans Bharucha

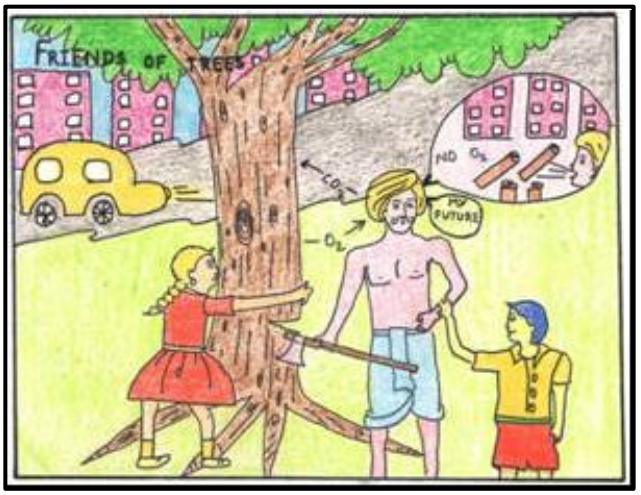
Second Prize – Shivani Avadodariya



First Prize – Ashish Panchal



Second Prize – Aditi Rajawat



Above 10 years category

Glimpses of ISRS-AC Activities:

Popular Lecture by Dr. Pranav Desai at Vikram Hall, SAC (May 26, 2004) organized jointly by

World Environment Day Celebrations organized on June 05, 2004 at Van Chetna Kendra, Vastrapur, Ahmedabad

INTERVIEW

The grand old man granted us this interview with a smile. We met him in his PRL Office where he continues to lead an active life with no visible dent of years gone by. He spoke in his characteristic inimitable style of presentation with humourous touch, ample gesticulation and forceful, demystifying logic – the qualities which have endeared him to so many spell – bound audiences.

Q. Could you tell us how remote sensing technology was introduced in India ?

A. It began with a very small observation when the Indian Ocean Experiment was done _ we had a revelation in 1963-64 that the ocean surface temperature of the Arabian Sea off Bombay was about 30^{o}C – sometimes higher than land temperature during the monsoon. This was subjected to a lot of doubt. I always believe that an observation is correct. There is a tendency amongst scientists to have an hypothesis and not accept anything that is not in confirmation with that hypothesis. That is wrong. So, we had the feeling that the monsoon had got a large dependence on the sea surface temperature (SST),. Particularly off the west coast of India. When I came to PRL, in 1966 after retirement, this was uppermost in my mind and Prof. Sarabhai asked as to what could be done in Monsoon studies. I said that the sea surface temperature has to be measured and it is not possible to make it using thermometers in ships. This has to be done using an aircraft making use of infrared (IR) techniques. That was the beginning.

Prof. Sarabhai said that's fine. Let us do it. I told him that the equipment for this will be costly and we have to develop it and it may cost $ 25,000. Please bear in mind that the total budget for space activities was less than a crore of rupees. He agreed readily and said if 8% returns can be invested. He found that a French Laboratory was taking an IR scanner for measuring SST from aircraft. He had contacts with those people and suggested that we make a similar one by doing a collaborative development effort based on the same lines. The technique was to duplicate the efforts on the scanner to have one ready for ourselves and thus a duplicate is being developed along with the original. Dr. T. A. Hariharan and one more Engineer was recruited and sent to Paris. They developed the scanner and brought it to India. This was all in 1971.

Q. That is all about the first technical development. How did the idea of land applications originate ?

A. It was around the same time (1968) that there was an UN Conference on "Peaceful Uses of Outer Space" in Vienna of which Prof. Sarabhai was the Scientific Chairman. In that conference there were 2 papers on Remote Sensing. That was mainly connected with aerial photographs of vegetative cover and to discriminate soldiers in green khakhi uniform moving about in the Vietnam green forests. The IR reflectance of the vegetation is different from the IR reflectance of green khakhi. Both are visibly green but the IR reflectances differ and thus are registered differently in IR photograph. The green khakhi has low reflectance and vegetation a high reflectance.

These two – IR for SST and IR for vegetation were found to be of use and we found that this could be applied in our country also.

From January 1, 1990 issue of ISRS-AC Newsletter

Did you know?

Remote Sensing and the elephant trail

The following excerpt from OIL website aptly explains why oil companies were the first commercial users of remote sensing data:

"The discoverer of this Digboi oilfield was the Assam Railways & Trading Company Limited (AR&T Co. Ltd.), a registered company of London in 1881,with objectives to explore the rich natural resources of Upper Assam,

The earliest recorded reference of oil in Assam can be traced to Lieut. R Wilcox of the 46th Regiment Native Infantry who saw it as ***"… rising to the surface at Supkhong with great bubbling of gas and green petroleum…"*** *in* ***" Memoir of a survey of Assam and the Neighboring Countries executed in 1825-6-7-8." Asiatic Researches Vol.XVII, pp. 314–467.***

Legend has it that an elephant working for the AR&T Co. Ltd. returned with distinct traces of oil on its trail. The excited owners of the elephant tracked its footprints and found seepage of oil bubbling to the surface.

*"Dig! Boy! Dig! ", cried the Englishman to his men, hence the name "**Digboi**". Thus this day, a tiny hamlet tucked amidst lush greeneries over rolling hills found a place in the map of the world's petroleum industry. Albeit very low production, Digboi still retains the distinction of being the world's oldest continuously producing oilfield."*

Later on oil companies realized the need for eye in the sky to explore oil in vast areas – often inaccessible and difficult. No wonder that oil companies became the first commercial users of RS data.

Ref : http://www.oilindia.nic.in/lookback.htm

Technical advancements

Technology Corner

Interferometric Cartwheel: Interferometric Cartwheel is a concept involving a constellation of passive (receiver-only) micro satellites that will capture pulses transmitted by Envisat enabling single-pass SAR interferometry. This not only avoids scene decorrelation, but also supports flexible and selectable baseline - a feature that was not achieved even through SRTM (Shuttle Radar Topography Mission). Moreover, it provides an opportunity to detect forward scattering.

Gravity Recovery and Climate Experiment (GRACE) Mission: GRACE is a mission to Gravity comprising of a pair of satellites in low earth (300-500 km) near-polar orbit one following the other at a distance of 220 km. Both the satellites track the range to the other at accuracy better than 10 μm at a rate better than 0.1 Hz. The orbits of the satellite are measured at an absolute accuracy of 5 cm and relative accuracy of 0.2 mm. The range variation between the satellites is a result of both

gravitational and non-gravitational forces. The non-gravitational acceleration acting upon the satellite is measured precisely using accelerometers. The final products of GRACE mission are monthly average of Gravity with accuracy 100 times better than existing ones. The mission carters a wide range of application that includes Atmospheric, Hydrology, Geodesy and Oceanography.
GRACE is joint NASA and German programme. CHAMP (Challenging Minisatellite Payload) was a forerunner of GRACE, while European GOCE (Global Ocean Circulation Experiment) will be a follow-up of GRACE.

Geoscience Laser Altimeter System (GLAS): GLAS is the first polar-orbiting space Lidar on-board ICESat (Ice, Cloud, and Land Elevation Satellite) launched by NASA on Jan 12, 2003. GLAS has three lasers operating at 1064nm and 532nm wavelengths at a rate of 40 pulses per second. GLAS provides global information on ice sheet elevations, dynamic changes in elevation, height profiles of cloud and aerosols, land elevations and vegetation covers, and sea-ice thickness.

Galileo: Galileo will be Europe's own global navigation satellite system, which will interoperate with GLONASS and GPS. The system when fully deployed will comprise of 30 satellites (27 operational + 3 active spares) positioned in three circular medium orbit planes in 23616km altitude above earth at an inclination of 56^{o}. The first experimental satellite of the system is scheduled for mid-2005 and full operational capability is targeted in 2008.

Forth-Coming Events

XXIV INCA International Congress, Science City, Kolkata, India, Oct. 6-9, 2004, Organised by National Atlas and Thematic Mapping Organisation (NATMO) and National Cartographic Association.
http://www.cartography.org.uk/Pages/Lates/circular.pdf

2nd International Conference on Microwaves, Antenna, Propagation and Remote Sensing (ICMARS-2004), 23-25 Nov. 2004 at Jodhpur. Organised by International Centre for Radio Science, Jodhpur. (email: icrs2003@sancharnet.in).

ISRS Annual Convention and National Symposium on Converging Space Technologies for National Development, Nov. 3-5, 2004, Birla Auditorium, Jaipur.
http://www.isrs2004.com

Twelfth International Conference on Advanced Computing & Communication (ADCOM 2004)
15-18 December 2004
Ahmedabad.

Map Asia 2004
26-29 August
Beijing International convention Centre, Beijing, China

24th ISRS Annual Convention and National Symposium
November 3-5, 2004, Jaipur

International Conference on Coastal Hazards
February 9-11, 2005
SASTRA Deemed University
Thanjavur-613 402

Coming up in Space

Satellite News

i) CNES Micro-satellite Series

The French Space Agency, CNES, is preparing to launch a new generation of micro satellites, the Myriade series. The first micro satellite, Demeter, was launched on 29 June 2004, and will study electromagnetic perturbations created by earthquakes. The second satellite, PARASOL, should be launched in October 2004. PARASOL will carry an instrument very similar to the POLDER-II. The PARASOL mission will focus on characterisation of clouds and aerosols and for ocean-colour use, as a follow on to POLDER-II.

ii) A "Swarm" Of Satellites for a Unique look Inside the Earth

ESA's will be launching an Earth Explorer Opportunity Mission called Swarm. This is a constellation of satellites which will study the Earth's magnetic field. The objective of the Swarm mission is to provide the best ever survey of the geomagnetic field and its temporal evolution, in order to gain new insights into the Earth system by improving our understanding of the Earth's interior and climate.

The mission is scheduled for launch in 2009. After release from a single launcher, a side-by-side flying lower pair of satellites at an initial altitude of 450 km and a single higher satellite at 530 km will form the Swarm constellation.

iii) Calipso climate monitoring satellite

A joint venture of CNES, NASA and NOAA the Calipso mission will use a laser radar, or Lidar, for studying t he interaction of aerosols and clouds in the atmosphere. This will be accompanying the US/CANADA joint venture called CloudSat.

iv) Aura satellite to study air quality

NASA's next EOS generation satellite Aura also being called as a "Chemistry Lab in space" likely to be launched in July 2004. This will provide valuable inputs on air quality including observations of smoke, aerosols and other pollutants that affect air quality.

v) GSLV launch in August 2004 will carry Edusat

Next GSLV flight is scheduled in first half of August 2004. The rocket will loft India's first educational communication satellite Edusat. The satellite will carry five Ku-band transponders for applications like linking class rooms across the country for interactive learning.

vi) CARTOSAT-I launch is likely in October 2004

Cartosat- I will be launched in early October 2004 using PSLV launch vehicle. Cartosat-I will take pictures to distinguish the ground object as small as 2.5 m and will have stereo capability to provide digital elevation information for Cartographic applications.

Interesting Readings

Scientists Look At Moon to Shed Light On Earth's Climate

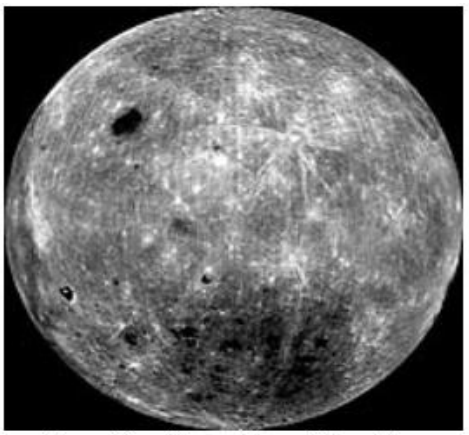


Fig: The far side of the Moon

According to a new NASA-funded study, insights into Earth's climate may come from an unlikely place: the moon. Scientists looked at the ghostly glow of light reflected from Earth onto the moon's dark side. During the 1980s and 1990s, Earth bounced less sunlight out to space. The trend reversed during the past three years, as the Earth appears to reflect more light toward space.

Though not fully understood, the shifts may indicate a natural variability of clouds, which can reflect the sun's heat and light away from Earth.

The apparent change in the amount of sunlight reaching Earth in the 1980s and 1990s is comparable to taking the effects of greenhouse gas warming since 1850 and doubling them. Increased reflectance since 2001 suggests change of a similar magnitude in the opposite direction.

Researchers from the New Jersey Institute of Technology and California Institute of Technology (Caltech), combined NASA cloud data from satellites with records of Earth's reflectance off the moon, called earthshine. The study, funded by NASA's Living with a Star Program, appears May 28, 2004 in the journal *Science*.

Recent news reports suggested sunshine reaching Earth declined from the late 1950s to the early 1990s. This new study suggests the opposite. Earth's surface may have been sunnier, or less cloudy, in the 1980s and 1990s. The research team improved upon an old method for monitoring earthshine. They compared earthshine measurements from 1999 to mid-2001 with overlapping satellite observations of global cloud properties.

The cloud satellite record from 1983 to 2001 came from the NASA-managed International Satellite Cloud Climatology Project. By matching these two records, the researchers used the cloud data to extend the record and construct a substitute measure of Earth's albedo, the fraction of light reflected by a body or surface.

The data showed a steady decrease in Earth's albedo from 1984 to 2000. Between 1995 and 1996, Earth dimmed even more sharply. The data were consistent with satellite measurements of changing global properties. From 1997 to 2000, Earth continued to dim.

The researchers suggest, during this time period, the decreases in Earth's reflectance may be related to an observed accelerated increase in mean global surface temperatures. From 2001 to 2003, Earth brightened to pre-1995 values. The researchers attributed the brightening to changes in cloud properties.

A few relevant websites related to Remote Sensing and Environment

http://www.spie.org/info/ae/

- Remote Sensing of the Atmosphere, Environment, and Space

http://ice.ucdavis.edu/echo/remote_sensing.html

- The Information Center for the Environment

http://www.frf.usace.army.mil/duck94/exp7.html

- Airborne Remote Sensing of the Environment in the Littoral Zone

http://rouge.engr.wisc.edu/cee/courses/cee352.html

- Remote Sensing and Forest Monitoring

Disaster Management Support (DMS) Programme

ISRO/DOS Centers have been providing valuable inputs to the disaster management support activity in the country for more than a decade. This was achieved by providing information on different disasters to user agencies in the country besides participation in many high level committees of central government. Realizing the need for perusing such an important activity the disaster management support (DMS) has been identified as one of the programme in the 10th Five Year Plan of ISRO. The activities under DMSP were revamped through collaborative arrangements of ISRO across the DOS Centres in March 2003.

The DMS Programme (DMSP) will address (1) creation of data base at appropriate scale for hazard zonation, damage assessment in disaster prone area/ s; (ii) development of remote sensing and GIS based decision support tools and techniques and demonstrations catering to the information needs at different levels; (iii) acquisition of close-contour information and (iv) strengthening the communications backbone for addressing the issues for the real time/ near real time information transfer needs. One of the key elements identified as the capacity building measure for operational handling support of disasters under DMS is establishment of a Decision Support Center (DSC) within ISRO DOS as a single window service provider interfacing with national/state disaster management agencies. This is getting established at NRSA and will act as the main hub for providing services in disaster management. SAC has been entrusted with technology development and R&D support. Similarly RRSSC, Nagpur will be responsible for data base creation/ updating information on critically hazard prone areas and in association with Advanced Data Processing Research Institute (ADRIN) will be carrying out the decision support tool development. This will be jointly implemented at the DSC. As part of R&D support, SAC will be responsible for development of concept towards disaster management support, conducting pilot scale studies and its validation. The work will be done in close liaison with DSC so that the

development effort could be subsequently used for operational purposes. Besides the other capacity building measures is development of an improvised airborne SAR system for Disaster Management (DM-SAR), acquisition of an Airborne Laser Terrain Mapping (ALTM) System at NRSA for close contour terrain mapping for use in flood control/ planning measure. Similarly the various communication systems developed at SAC namely Mobile communication terminal, VSATs-, WLL, CWDS will help in handling the requirement of on the site 'Communication Support/ Backbone' in the event of disaster. The efficacy of such systems in the recent years has been effectively demonstrated.

ISRO is also a signatory to the International Charter on "Space and Major Disasters" (http://www.disasterscharter.org/) besides other Space agencies/ organizations viz. CNES, ESA, NOAA, CSA and CONAE (Space Agency of Argentina). The main objective is to use the space technology in disaster management through a long term working relation between civil protection committee and concerned space agencies. In the event of a disaster the charter is activated by an authorized agency for providing the value added information to the concerned almost free of cost.

** A. Narain, PD (R&D), DMSP

Tutorial

Remote Sensing of Elevation

K.K. Mohanty

Elevation of earth commonly represented now-a-days in digital form, is a critical input for many applications. Remote Sensing has traditionally played a vital role in generating digital elevation models (DEM) of the earth. There have been a number of dedicated missions for this purpose, *e.g.* Topographic SAR (TOPSAR), Shuttle Radar Topography Mission (SRTM), Modular Opto-Mechanical Sensor (MOMS) *etc*. GTOPO30, a 1 km or 30 sec global DEM is currently the best freely available global DEM. Ready availability of larger scale and more accurate DEM are restricted to developed nations such as USA and Europe. A suite of remote sensing technologies *namely*, *Photogrammetry, Radargrammetry, Radar Interferometry* and *Lidar* have been deployed for generation of DEM. GPS (Global Positioning System) strictly doesn't qualify as a remote sensing technique as it requires physical measurement at the site of interest. Nevertheless, it is the most effective point measurement technique that can provide coordinates at unmatched accuracy anywhere on the earth. This column introduces a series of articles that will attempt to explain the remote sensing technologies for DEM generation in a lucid manner. This issue begins with Photogrammetry, which means "science of measuring of photos".

Concept of Photogrammetry: An optical remote sensing sensor is analogous to an unmanned telescope put in an orbiting satellite. Heart of a telescope is a powerful lens; of course we need a detection mechanism since our satellite is unmanned. Traditional aerial photography uses a film to

capture a complete frame in a single snap; the modern satellites deploy a series of detectors to image an elongated region of earth called 'scan line'. The detectors are placed at the focal plane of the lens. The projection of optical center of the lens on to the detector is called the focal point. Basic difference between a aerial photo and satellite image is that the entire aerial photo has a single focal point, while for a satellite scanner each scan line has a principal point and the satellite image has a principal line.

Consider a sensor looking absolutely in the nadir direction on to a perfectly flat terrain (*Fig. 1a*). The image formed by the sensor is free from any scale distortion and can use it as a map for any planimetric purpose. Once the sensor is tilted we get an image suffered by tilt distortion (*Fig. 1b*). Similarly, even in case of a nadir-looking sensor, terrain relief variation introduces a relief displacement (*Fig. 1c*). Photogammetry makes use of relief displacement captured by a pair of tilted or nadir-looking sensors to derive terrain relief.

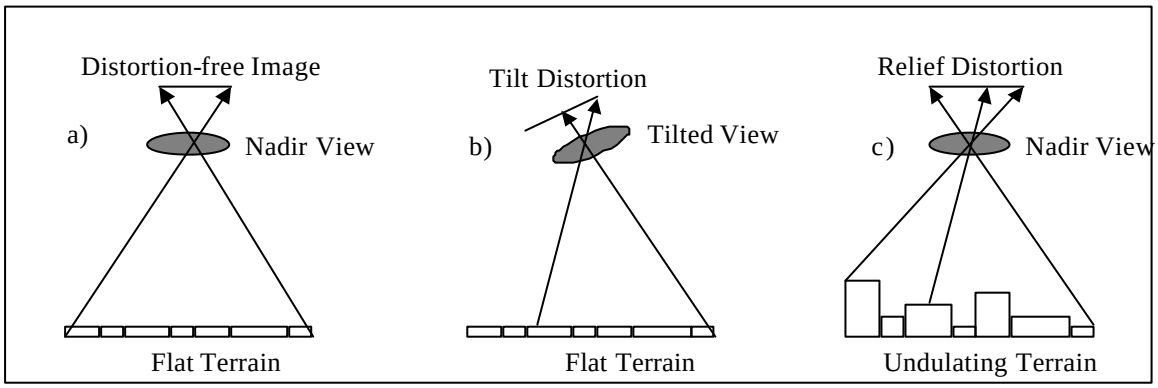


Figure 1: Effect of tilt and terrain undulation in an image

Figure 2. a) single oriented image, b) a pair of oriented images. A single oriented image can only give image coordinate for known object coordinates and direction of light for all image points. For a pair of oriented images, intersection of light rays from common object results in object coordinate.

Let's now try to construct a scaled-down model of our imaging system including the earth it is looking at. In order to do it, we will need to know exact coordinates and orientation of our sensor or lens. In 3D space, it amounts to determining six unknown parameters involving camera/sensor- three positional and three rotational. In theory, these can come from a precise satellite orbit and attitude parameters. If we succeed in creating such a model what can be its use! Well, using this model for any point on the earth, *say* P, we will able to compute its image coordinate (I) by extending a straight line from the object (P) through the optical centre (O) and making it intersect the image plane (*Fig. 2a*). However, we will not be able to predict the object / ground coordinate of any image point. All that we can say is the direction in which the object lies- a feature practically of no use, by extending a straight line from the image point through the optical centre. Suppose we have two independent images each of which have captured the common objects on ground, we

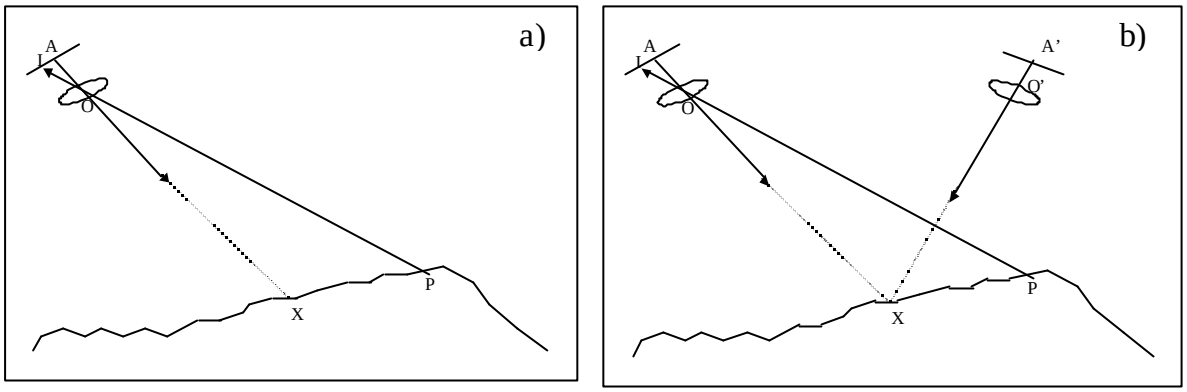


Figure 2. a) single oriented image, b) a pair of oriented images

can prepare geometrical models for both the imaging system (*Fig. 2b*). Now, we can extend the light rays from the two images (A and A′) of the common object (X) through their respective optical centers (O and O′). If our model is accurate enough, the two light rays AO and A′O′ will intersect at object X. This overall concept of deploying a pair of overlapping images to arrive at object coordinate is in essence photogammetry. The specific concept of making light rays of known orientation intersect is called *space intersection*, while the process of model formation using orbital data is termed as *space resection*. In our discussion, we have used a fundamental principle from physics of light traveling in a straight line, to conclude that AOX and A′O′X each form a straight line. The principle of image point, object point and optical centre forming a straight line is known as the *co-linearity condition*. Extending this further A, A′, O, O′ and X all fall on a single plane. The condition of image points, object point and optical centres lying on a plane is called *co-planarity condition*. Earlier, we talked of using orbit and attitude parameters for creating the geometric model. However, in reality, one may not get sufficiently accurate orbit-attitude parameter to arrive at such parameters. The approach in such situation is to use a minimum of three control points (GCP). Each of this control points work as a stand to support our image. Orientation of lens with respect to image is very well known from the knowledge of focal length. It is obvious that the GCPs can be judiciously chosen to work for both the images. Moreover, to get a stable model control points must be well-distributed in the image, preferably at image corners.

[To be continued]

SCRAMBLE

MLTROFAP

ERXREUTT

IASLNYSA

LGIDTIA

DARRA

(Arrange letters from shaded boxes to form the word as suggested. Answers at the end)

Is this what you are trying to create?

REDEFINITIONS

Image : What you analyze to create for yourself

Pixel : The tiniest unit which can seal your fate if addressed wrongly

SAR : Simply Anonymous Reflectance

FCC : Faulty Concoction of Colours

PCA : Partial Cheating of Analysis

GIS : Grumpy Instructional Software

MXL : Master eXterminator of Loopholes

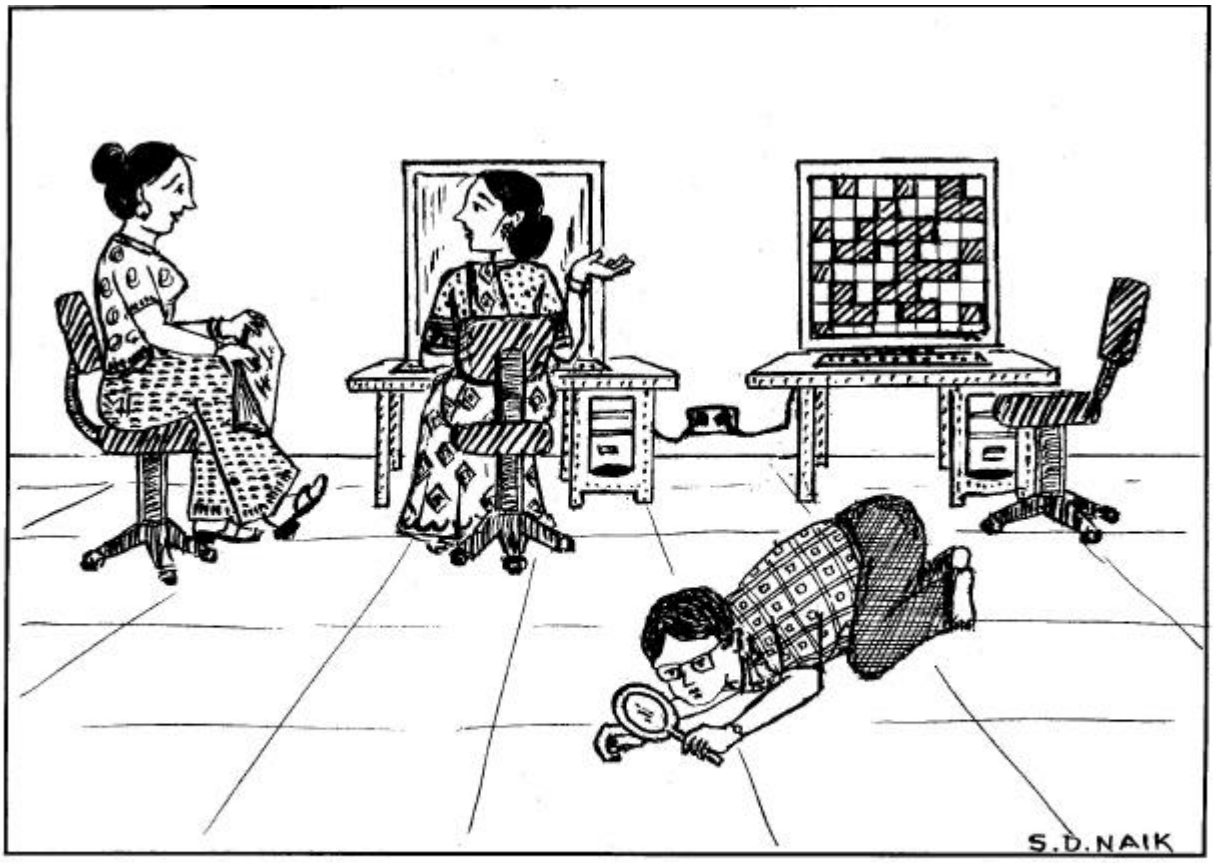
CCD : Charged Couple's Disenchantment

GPS : Goofing Position System

PLATFORM TEXTURE ANALYSIS DIGITAL RADAR IMAGE

Lighter moment

(By Dr. S.D. Naik, MWRG, Space Applications Centre)



I THINK HE IS SEARCHING FOR ONE PIXEL HE LOST DURING IMAGE ANALYSIS

BOOK POST

SIGNATURES

Newsletter of the Indian Society of Remote Sensing – Ahmedabad Chapter

To,

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