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MAP prize at Nishulk School, Hyderabad. L - R : Gayathri, coordinator; ; Prize winner; Karunakar Reddy, HM; GS Kumar

Joe Biden takes over as President of USA in January 2021

Drone photography for mapping

Content

Editorial

January 2021 has been an eventful year. India produced two vaccines for Corona. New president of USA. Andhra Pradesh government entered into MoU with Survey of India for cadastral mapping using drone surveys. Readers will find how India has been successful in establishing its own Navigation System like GPS. Read its advantages.

An article on using drone surveys for cadastral surveys with better than one cm accuracy is included in this issue.

Supreme Court gave directions for resurvey of Survey No. 80 near Hafeezpet, Hyderabad. Concerned authorities have not taken up (Eenadu dated 14.01.2021) This is not an isolated case. This British legacy of decades in dispensing justice is frustrating. It takes decades of time, lot of effort and money, for a case to reach SC. Even then there is no guarantee of implementation. There are some other such legacies made by British to suit their interests.
Brig JS Ahuja's article based on Digital India Land Records Modernisation

(DILRM) Programme mentions about non-implementation !!

Resurveys in Telangana and AP (Cont'd)

Report on GeoMap Society Webinar held on 16 Jan 2021

Topic : Resurveys in Telangana and Andhra Pradesh (Cont'd).

The previous webinar on same topic was held on 18 Decemeber 2020 the report of which was published in Maps Today, December 2020

As with the previous one, this was organised/coordinated by Prof IV Murali Krishna (IVM) from Texas, USA. Experts like Ch Subba Rao, GS Kumar, KK Pappan, JNA Murthy and IVM, .. took active part. Brig JS Ahuja attended through audio. Maj Gen Siva Kumar from US missed out but joined in post webinar discussion on Whatsapp. Mr Hanuman Rao added value by his comments about Drone. IVM's interview in online— E-Magazine Drones World also came up for discussion.

Nizamabad & Angul-Nalco….past projects were discussed.

All participants expressed valuable opinions based on their experience.

IVM co-ordinated the discussions resulting in following Resolution :

"GS Kumar & IVM will draft a letter within 10 days to Chief Secretary, Govt.of Telangana for sharing results of Nizamabad project giving reference of Govt policy to bring out a detailed paper."

Discussion may have to continue in next webinar in Feb. 2021 in view of the following points

i) New Surveyor General of SOI, Shri Naveen Tomar
ii) Need for accurate (5 cm accuracy) control points for cadastral surveys and other large scale surveys
iii) ~~Which~~ Selection of platform for cadastral surveys in view of ~~Drone~~ availability of Drones
iv) Demarcation of boundaries on ground

Points from post-webinar email chats/discussion. By the following Participants, all experienced professionals:

IVM, JSA, KK Pappan, GSK, Ch Subba Rao, SP Goel, R Siva Kumar,

1. Why no official paper on completed piot projects ?
2. AP CM, YSR visited BhuBharati project in Nizamabad. He announced adoting it in other districts. But din'r ?

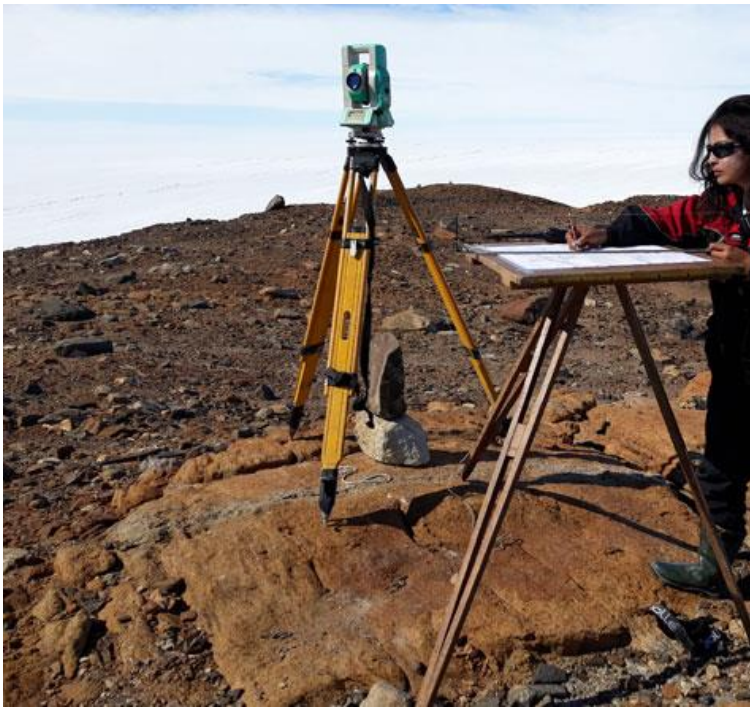
3. Every pilot project should be taken to its logical end.
4. Why not file PILs against non-implementation of successful pilot projects ?
5. The main issue is with implementation of results
6. To know is to bear responsibility(Quoted by Ch Subba Rao)
7. Transparency needed
8. Legal process is the only way
9. If knowledgeable people don't act, then who will ?
10. We need to be optimistic. Changes are taking place though slow
11. Ortho rectified photos only are suitable for cadastral surveys
12. Cost of LIS is less than Rs 500 per acre, whereas the cost of land per acre is lakhs of rupees. Therefore cost of survey (LIS) is not significant considering cost and huge benefits.
13. Land related litigations provide income and employment to many
14. About a year back, Telangana govt undertook purification of land records and declared 80% pure. In AP 98% are declared pure. These claims are not true.

Mapping India

New generation of cartographers combine traditional knowledge & technology

By Sneha

Bhura December 27, 2020



Sagar Gurung, a senior surveyor with the Survey of India (SoI) in Dehradun, has worked through landslides, 3,000m above mean sea level. Carrying his high-precision levelling instruments weighing over 10kg, apart

from a barcoded staff and iron shoe that stabilises it, he has evaded rocks from heights on the Uttarkashi-Gangotri route, all the while praying that bears do not hound his survey party at night. “I have also seen snow leopards while doing my work,” he says. When THE WEEK spoke to him, the 28-year-old was in Port Blair, working on a geoid model project in the Andaman and Nicobar Islands.

Border areas are difficult to map. I am the last person to blame anyone for any dispute. It is all created by circumstance and we need to improve and work with our neighbours- Lt General Girish Kumar, Surveyor General of India

But his most dangerous assignment, recalls Gurung, was in 2018 for the National Mission for Clean Ganga at Jamui district on the Bihar-Jharkhand border. The district sits in the red corridor that sees significant Maoist activity. The CRPF personnel were amazed at the presence of Gurung and his team of field surveyors. They refused to offer any help directly. “But I had to finish my work. I was the team leader and I could not betray any nervousness or cowardice,” says Gurung. He recounts an incident when a Naxal came charging at his team, with an arrow nocked into his bow. “We were six of us, and I was the most vulnerable being the leader,” he says. “I stayed calm and mumbled something like we do not work for the government of India. We had removed the sticker from our vehicles, too. He stared into my eyes for a few seconds, but it seemed like a minute. I have never been more scared in my life.” His local help in the team had all but given up. “He said, ‘Sir, why don’t you just drop out of this? What kind of work is this?’” says Gurung.

The adventures of surveyors make for fascinating thrillers. After the Battle of Plassey in 1757, Robert Clive, governor of the Bengal, wanted a general map of the areas under his administration. He chose 24-year-old James Rennell for the task. Clive wrote to the Court of Directors, the executive body of the East India Company, around 1767, “We have appointed Captain Rennell, a young man of distinguished merit in this branch, to be Surveyor General, and directed him to form one general chart from those already madeì. This though attended with great labour does not prevent him from prosecuting his own surveys, the fatigue of which, with the desperate wounds he has lately received in one of them, have already left him but a shattered constitutionì.”

The “wounds” had been inflicted on Rennell while fighting off a band of robbers in the dense jungles of north Bengal. After a leopard killed five men from his survey party, Rennell stabbed

the rampaging animal through its mouth when it was his turn. A 1968 academic writing for the Royal Geographical Society, thus opined, “In fact, in those days a survey assignment in some areas was virtually equivalent to a sentence of death.”

In a telephonic chat from Dehradun, Surveyor General of India Lt General Girish Kumar laughs at the suggestion of punishing fieldwork “for our robust surveyors”. He talks about his own walk across the flat and featureless Rann of Kutch with a magnetic compass on an assignment in the 1980s when there was no GPS. And how he found his way out of a quicksand. But any further border area survey talk is always met with a genial “no comment”.

When asked about his views on how post-colonial border disputes in India invariably get attributed to the “cartographic aggression” of the British Raj, Kumar shares another laugh. “We have been continuously improving our positioning infrastructure,” he says. “When the Great Trigonometric Survey started, how many millions of people died because the terrain was difficult? Border areas are difficult to map. I am the last person to blame anyone for any dispute. It is all created by circumstance and we need to improve and work with our neighbours. Where is the problem? I never blame my predecessors for anything. Any decision has to be taken at that particular moment.”

Kumar names William Lambton (1753-1823) and George Everest (1790-1866) as the two most crucial names in the history of Indian map-making. The duo was responsible for conceiving and completing The Great Indian Arc of The Meridian, which began in 1802 with Lambton. Officially called The Great Trigonometrical Survey, it covered the length of the country with a colossal web of triangulations over a distance of 2,400km in the north-south direction. Using theodolites (a 50kg instrument with a rotating telescope to measure horizontal and vertical angles) and 100ft-long chains, the English surveyors mapped British India with a scientific precision unknown at the time, making cartography in the subcontinent the most advanced in the world then. “The contributions of these two are remarkable,” says Kumar. “They laid the groundwork. If the framework is not there, then no other ground survey can commence.” Even till the 1990s, says Kumar, theodolites and star observations from the ground were much in use to determine latitudes and longitudes, until GPS technology came into the picture. But such is the astounding science of

precision behind triangulation, which uses three mutually visible reference points on prominent hills or buildings to measure distances and angles using trigonometry, that even GPS often fails to account for minute differences. “GPS does not give real-time, accurate coordinates,” says Kumar. “It has to be processed to get those accurate coordinates.”

As we enter 2021, Kumar says that the triangulation method will be phased out in the next two-three years, except in the northeast. “We are now moving to the third stage of Continuously Operating Reference Stations (CORS),” he says. “These stations are very accurate and provide a virtual base station. CORS has given us a new dimension, how the positioning infrastructure has to be created within a country. We created Great Trigonometrical stations, then we converted them into GPS stations and now we are converting them into CORS. They will be like mobile towers.”

Kumar says that they have already started establishing CORS in Uttar Pradesh, Karnataka and Maharashtra, and it will soon be a pan-India thing. While we wait for CORS to take over the length and breadth of the country, intrepid field surveyors recount their own dramatic tales and travails of mapping India. As Kumar proudly declares, “Sovereignty of a country is defined by three actionable objects—its flag, its currency and its map. As surveyors, we uphold the sovereignty of the country.”

Payal Arya specialises in marine geodesy. The 28-year-old surveyor, based in Dehradun, makes advanced tidal predictions from water level monitoring stations to help shipping companies, navies and coast guards. In 2018, on a whim, she filled in a form for the 38th scientific expedition to Antarctica for a contour mapping exercise. Little did she know then that she would become the first female surveyor in the history of SoI to work in the coldest, windiest and driest continent. She underwent rigorous physical training imparted by the Indo-Tibetan Border Police at Auli in Uttarakhand, had counselling sessions for psychological preparedness at the All India Institute of Medical Sciences in New Delhi and attended discipline and fire-fighting classes at the National Centre for Polar and Ocean Research in Goa. But none of these could give her a fair grasp of the polar terrain for her “summer” sojourn to Antarctica from December to March, with normal temperatures at -10 degree Celsius.

Suitability of Unmanned Aerial Vehicles for Cadastral Surveys*

1S. Mantey and 1N. D. Tagoe
1University of Mines and Technology, Box 237, Tarkwa, Ghana

Mantey, S. and Tagoe, N. D., (2019), “Suitability of Unmanned Aerial Vehicles for Cadastral Surveys”, *Ghana Mining Journal,* Vol. 19, No. 1, pp. 1 - 8. *Vol. **19, No.1, June, 2019***

Total Station and GNSS receivers are widely accepted and are still in use for data acquisition for cadastral mapping purposes

Ground Sampling Distance (GSD). GSD is the dimension of a square on the ground covered by one pixel (p) in the image and is a function of the resolution of the camera sensor, the focal length (f) of the camera and the flying height (H = the distance between camera and ground). From simple geometry the following ratio holds: GSD/p= H/f or H = GSD (f/p). The pixel size (p) of the camera sensor is usually computed from the technical specifications of the camera. Commonly, the dimensions of the sensor are specified both in linear units (*e.g*. 17.3 x 13.0 mm) as well as in number of pixels (*e.g.* 4000 x 3000 pixels). Pixel size is simply determined by dividing the linear units by the number of pixels. In UAV surveys

The GNSS receiver was also used to survey all the boundary of the land parcel. The GNSS unit has static horizontal and vertical accuracies of 3mm+0.5ppm Root Mean Square (RMS) and 5mm+0.5ppm RMS respectively. The centering position of the GNSS receiver was given an error margin of ±2 cm due to the fact that error of the exact centre is not the same as that of the UAV.

Table 5 Discrepancies of GCPs as Measured with GNSS and UAV Points

	Northings	Eastings
BP1/DP1	+0.211	+0.191
BP2/DP2	+0.007	-0.082
BP3/DP3	-0.076	-0.037
BP4/DP4	-0.089	-0.041

4.2 Recommendations

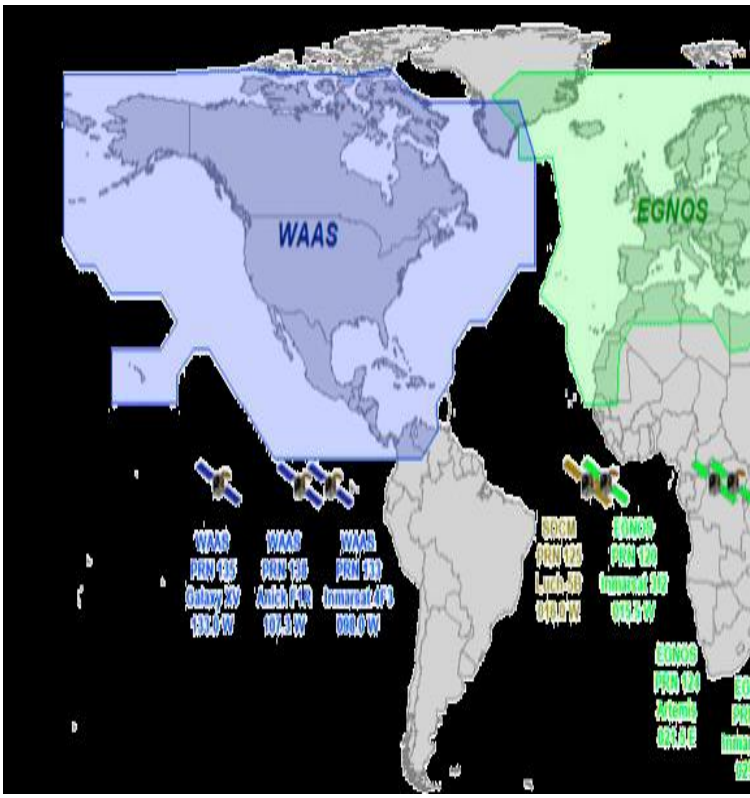
For large areas where it is expensive and time consuming to apply Total Station or GNSS survey techniques, the UAV could be deployed to achieve the same results. Also, when safety of surveyors is at risk the use of UAV is suitable.

Navigation with Indian Constellation (NavIC)

Advantage of Navigation with Indian Constellation (NavIC),the Indian Global Navigation Satellite Systems (GNSS)

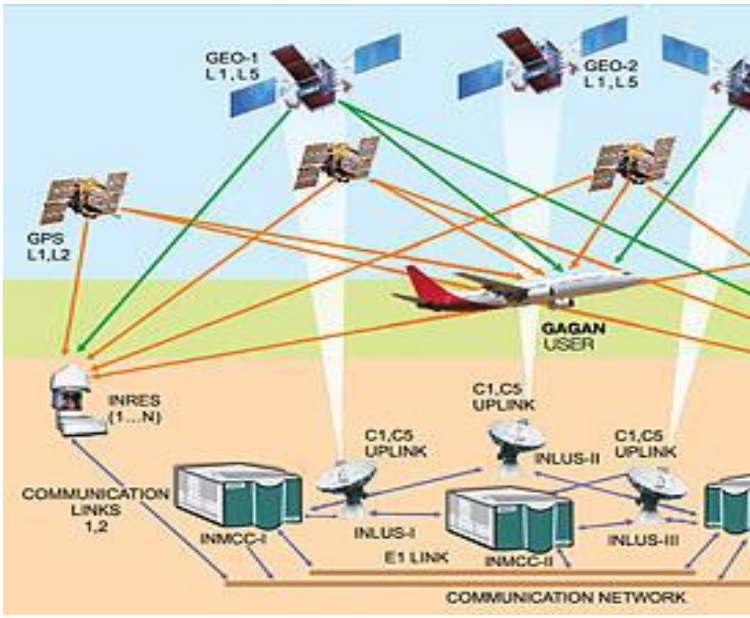
Issues with GPS

- No Assurance, is owned by USA Air Force.
- Their service has been denied many times to users outside US. This includes KargilWar.
- Precision Positioning Service not given to India.
- Very Less Availability, Low Accuracy, No Reliability, Doubtful Integrity.
- Prone to Jamming.
- Orbital characteristics necessitates continuous corrections.
- Very less no of satellites visible over India.
- Dilution of Precision (DOP) is very high.



From the above picture it is clearly seen that all GNSS except IRNSS

are in Temperate region. In this the ionospheric is very stable and can be modelled. Along the equatorial region, the Ionosphere disturbance are very large and cannot be modelled. ISRO put up our systems,GAGAN and IRNSS (togethercalledNavic) afteraround15Yrsofresearchtoovercomethisissue.



NavIC is the answer to all the problems stated earlier.

- Navic is a very sophisticated system.
- Installation commenced in 2008 with the GAGAN system.
- Fully functional from Jun 2019.
- It is the best of its kind in service and utility.

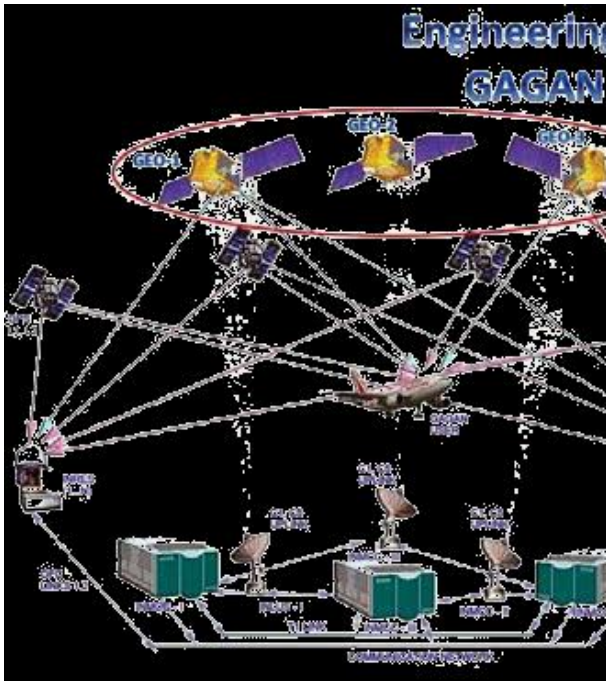
India put up which augment the GPS satellites to give better accuracy GAGAN which consists of three satellites,.This is used by civil aviation. This is fully functional since 2015.

Similar to GAGAN thereare MSAS, EGNOS and WAAS which help flights to fly around the globe.

This is the full GAGAN network. More than 30 stations have been established by ISRO to support this initiative.

Commencing from 2016, India Launched IRNSS which consists of 11 Satellites.

- Seven are fully functional as of 2019.
- The system has been cleared for use from June 2019.
- Four more will go up in 2020-21.
- This system uses different way of calculating own position, and the signal is completely different.
- Its end signals in L5 and S Bands as against GPS which uses L1 and L2 bands.
- Hence same electronic solution cannot be used for both GPS and Navic.



Navic Advantages

Assured for Indian Public, Specially created for the Equatorial Region.

High Availability, Accuracy, Reliability, Integrity.

S Band suited for Indian Terrain, especially the mountains and the seas.

Restricted Services for Defence Forces.

In the earlier study by Prof AB oseetal, Burdwan university, when IRNSS is included, the Indianregiondoesnothaveanylossincoverageallthroughtheday.Henceusingthiswecannowputup24/7monitoringsystem

GAGAN Messaging Service (GMS) can be used for Disaster Management and to flash news to all in the Indian region within a second. IRNSS Messaging Service, in addition to GMS, gives more flexibility.

One point time reference for all Indian users. All operations can be synchronized using accurate time data from Navic Atomic Clock which is the most stable than any other GNSS

This study shows that the IRNSS full coverage is possible even when the view cone above head is very small. This is very much required for Himalayan region where mountain slopes masks the satellite signals.

There commended model for Navic Solutions involves optimising all components for Navic. Only this model can provide good solution in Indian region.

Currently solution providers integrate equipment from different systems to give a GPS only solution over India. In this the errors are very large.

Navic will cover all solutions required for GNSS applications. We can have an integrated solution based only on Navic.

STATUS OF IMPLIMENTATION

of

NATIONAL LAND RECORDS

MODERNIZATION PROGRAM

renamed as

DIGITAL INDIA LAND RECORDS MODERNIZATION PROGRAM

by

Brig J S Ahuja (Retd)

Past Director , Survey of India

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Background

The original survey of land in India was under taken by and large by the British and to some extent by the princely States during different periods of their rule with the main objective of updating Cadastres to facilitate collection of land revenue and demarcating the boundaries on the ground . Since the original surveys are very old, the cadastres prepared at that time do not reflect the present ground realities. There may also be some parts of the States where the survey was not done at all due to various reasons . Though it was envisaged that re-survey would be done every 30 years, but for various reasons no large scale fresh surveys or re-surveys have been carried out Further the surveys were carried out by the conventional survey techniques of which the most popular was diagonal and offset using chains for measurements available at that time.. Now with the passage of time , the papers of survey records have become old, fragile and mutilated and in addition that a large number of Cadastres might have been lost .

Technological Developments

There have been a lot of developments during the last 50 to 60 years in the Surveying and Mapping technologies all over the world . Electronic Instruments for measuring distances accurately, Aerial Photography, Satellite Imageries and Photogrammetry for generating base maps for ground truthing have come to stay even for large scale Cadastral Surveys . But States have been hesitant to take up the survey/ re-survey of land using these modern technology due to lack of technical capabilities of their staff used to the conventional methods and above all lack of political and administrative will.

Updating and maintenance of

Land Records in the form of Cadastres has been a very complex process involving multiple government agencies mentioned above . Department of Land Resources , Government of India had launched the National Land Records Modernization Program (NLRMP)in the year 2008 to modernize land records to enhance transparency in the land records maintenance system. The program was subsequently renamed as Digital India Land Records Modernization Program (DLRMP). This program was very much required with the increasing pressure on the land and to find some way out to reduce land disputes and to ensure settlement of litigation cases piling up in the courts of law for number of years for want of proper documents .

The aim and objects spelled out by the Department was to improve the quality of land records in the country and to make them more accessible to the stakeholders. To aptly address such issues, this Programme was launched to computerize the existing land records , both textual and graphic data to develop a uniformly centralised land record management system in the entire country with the aim to move towards government-guaranteed titles. The following were the major components of this program

- Computerization of Land Records
- Survey/Re-Survey and Updating of the Survey & Settlement Records
- Computerization of Registration

The Survey / Re- Survey including ground control network and ground truthing using the following modern technology had the following options:

a. Pure ground method using electronic total station (ETS) and global positioning system (GPS)

b. Hybrid methodology using aerial photography and ground truthing by ETS and GPS

c. High Resolution Satellite Imagery (HRSI) and ground truthing by ETS and GPS

This programmed envisaged to update and integrate the following components of Land Records maintained by different departments of the State .The prominent government agencies of the States involved are-

Survey , Settlement and Land Records Department – Survey/ Re-Survey

Revenue Department - ROR

Registration Department - an integral part of the Revenue System of the states, which leads to registration of deed, mutation and updating of land records.

Land Owners - Maintains his documents of ownership

Land Users Departments such as PWD, Irrigation ,Roads , Forest , Mining , Agriculture and many others

Home Department to maintain law and order during Field operations

Best Practices

Department of Land Resources , as a follow up , have now published a book in two parts on the Best Practices being followed by nine States mentioned below under DILRM Program . The rest of the States may not have responded their status so far .

Karnataka

Andhra Pradesh

Gujarat

Haryana

Maharashtra

Tripura

Himachal Pradesh

Rajasthan

Jharkhand

Only two states attempted to undertake Survey / Re-Survey using the following method -

- Gujarat – Pure ground method using electronic total station (ETS) and global positioning system (GPS)

Haryana - High Resolution Satellite Imagery (HRSI) and ground truthing by ETS and GPS

The remaining seven States did not undertake the Survey /Re-Survey work to update the Cadastres though it was the core object of this program . Realizing that the assessment of Stamp Duty as per the Indian Stamp Act, 1899 or the State Stamp Acts is the core function in the registration process .they gave importance to the registration system treating it as an integral part of the Revenue System of the states which ultimately lead to generate revenue through registration of deeds, mutation and to some extent updating of land records.

In order to computerize the process of Registration, these states had developed their own software suiting local conditions and their

language based on software mostly developed in house by NIC under DILRMP knowing that their software needs to be upgraded using modern technologies and hosted centrally for interoperability with the state Land Records System and easy, reliable, cost effective maintenance. NIC is ldeveloping a single application centrally for the use of all state governments on the similar lines of application of Maharashtra government.

Conclusion

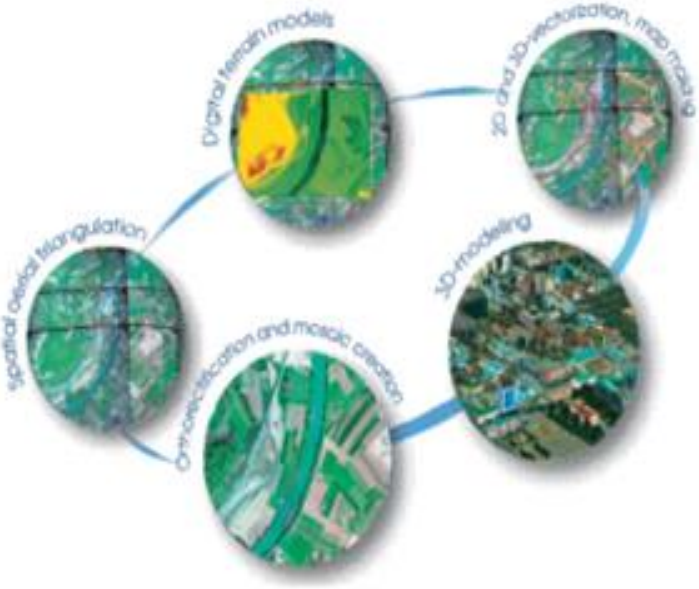
The very purpose of issuing guidelines under DILRMP has been defeated as the States have not shown any interest to update the Cadastres by undertaking Survey / Re-Survey work defeating the following objectives set forth in the DILRMP –

"The ultimate goal of the DILRMP is to replace the present manual presumptive land-title system into digital conclusive land titling system. The present manual land records are old, insufficient, not duly updated, not agreeing among and within the corresponding records. The manual system of record keeping has become cumbersome, opaque, susceptible to manipulations and hard to administer by the administration. Further the present system of registration of deeds and documents as provided for in the Registration Act, the titles to property are merely presumptive and the State does not give guarantee for such titles. Once some substantial progress is made in implementing the programme, the country can switch to the system of "Conclusive Titles" as followed in most advanced and some of the developing countries."

Overview

PHOTOMOD®

RACURS, Russia



The PHOTOMOD software family comprises a wide range of products for the remote sensing data photogrammetric processing. This state-of-the-art software allows the extraction of geometrically accurate spatial information from almost all commercially available types of imagery, whether obtained by film or digital cameras, UAS, high resolution satellite scanners.

PHOTOMOD's flexible modular architecture and powerful import/export tools permit a variety of configurations: **Complete Digital Photogrammetric Workstation** (standalone configuration), high productivity distributed network environment for accomplishing large projects, complementary workplaces that can be used along with third-party systems to increase the overall productivity during the most time-consuming and labor-intensive operations like feature extraction and DTM creation.

Today PHOTOMOD is the most popular digital photogrammetric software in Russia and is also used in 70 countries all over the world. PHOTOMOD is the only digital photogrammetric system with the Russian Federation Ministry of Defense certificate and also the main digital photogrammetric software for the Federal Space agency of the Russian Federation (ROSCOSMOS) and Russian Federal Service for State Registration, Cadastre and Cartography (ROSREESTR)

General questions: info@racurs.ru