

# MAPS TO DAY

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Volume 2 Issue 5

July 2020



## Overview



RACURS, Russia

The PHOTOMOD software family comprises a wide range of products for the remote sensing data

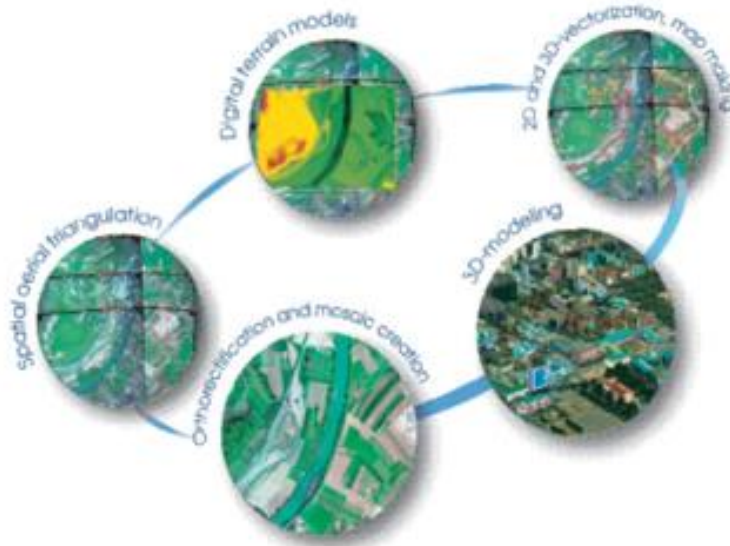
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PHOTOMOD's flexible modular architecture and powerful import/export tools permit a variety of configurations: **Complete Digital Photogrammetric Workstation** (standalone configuration), high productivity distributed network environment for accomplishing 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.

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# PHOTOMOD®



# Maps Today



(Formerly GIS India since 1992 ) **On Line Journal sponsored by GeoMap Society (GEMS)**

**Volume 2 Issue 5**

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## Why geospatial technologies will be at forefront as the world reopens

By

**Anusuya Datta** 06/08/2020

If “lockdown” was one of the top trends on Google in the past few months, it must be the word “reopening” now. After being brought to a grinding halt since March, the world seems to be getting ready to live with the virus, as it takes baby steps towards reopening. The Covid-19 pandemic has infected about 7 million people globally and killed around 400,000 already, including more than 100,000 deaths in the US alone, according to [Johns Hopkins University](#) Coronavirus Resource Center.

**If geospatial data and technologies played an important role in managing the pandemic since its outbreak, its role will be paramount as the world reopens**

But the world seems to have also realized that it can't permanently live locked down, crippled with the fear of the virus. And some form of economic activity must begin to sustain. Even in countries which are yet to the touch peak, such as the United States or India, governments are talking about turning a new leaf in the pandemic response — moving from crisis mode to sustained mitigation and management.

If geospatial data and technologies played an important role in managing the pandemic since its outbreak, its role will be paramount as the world reopens. More so because the danger isn't over yet and lurks in every corner. As Dr Este Geraghty, Chief Medical Officer, Esri underlines in this [blog](#), “Leaders at all levels of government and business can use geospatial technology to help monitor and safeguard public health. Building on response efforts — where GIS technology supported clear steps to take action — the same capabilities can guide safe reopening strategies.”

For full details visit  
[www.geospatialworld.net](http://www.geospatialworld.net) > Blogs

## **If IN-SPACe Is the Answer, What Is the Question, and Why Should You Care?**

<https://science.thewire.in/space/isro-in-space-commercial-space-regulations-satcom-policy/>

Consider a famous, even clichéd, proverb: “A journey of a thousand miles begins with a single step.” It indicates that the size of the first step matters less than its ceremonial significance, and that the latter should inspire optimism and hope.

The Government of India’s recent announcement to set up the Indian National Space Promotion and Authorisation Centre (IN-SPACe) is a milestone in the history and progression of India’s space programme. However, if the government is to achieve its stated goal of indigenising the space sector and creating an economic enterprise around it, IN-SPACe must also initiate significant changes in both policy and the sector’s culture. Only then can it enable a private space economy of global interest and significance.

For the purpose of our analysis, all commercial space activities can be broadly classified into two categories: upstream space activities, involving building and launching satellites and other space-intended payloads, and downstream space activities, including bringing the dividends of assets in space to consumers on the ground.

Global connectivity, the information revolution and a slate of other broadcasting and telecommunication utilities all owe themselves to progress in the satellite industry, thus securing the latter’s place in humankind’s pursuit of the final frontier.

### **Confidence in India**

However, India’s history with private enterprises involved in space and telecommunications activities hasn’t exactly been smooth – to say the least. The Antrix-Devas issue, which concluded with India being held responsible for violating a bilateral investment treaty, suffices to tell us that we need to address bureaucratic processes involved in managing contracts between the state and the private sector.

The court’s cancellation of 2G spectrum licenses for corruption – no matter how well-intended – also dealt a body blow to India’s efforts to project itself as an investment-friendly telecommunications and satellite communication market. The persons charged with the corruption haven’t been convicted

either, further undermining India's position in proceedings initiated against it by investors aggrieved by the cancellations.

This tension between the satellite communications, or SATCOM, industry and the Indian government arises out of a complex regulatory regime that consists of the following instruments:

- "The norms, guidelines and procedures for implementation of the policy frame-work as approved by the Government in 2000", a.k.a. SATCOM Norms
- The Indian Telegraph Act 1885
- The National Frequency Allocation Plan 2018



## Space Law

### **Before ISRO Can Go Onward and Upward, India Needs a Good Space Law**

<https://science.thewire.in/law/before-isro-can-go-onward-and-upward-india-needs-a-good-space-law/>



ASHOK G.V.

**One hopes that the needs of the future and the spirit of adventure will drive Indian space policy as opposed to – in the words of V from ‘V for Vendetta’ – the security of the familiar and the tranquillity of repetition.**

**.....Commercial Space Launch Act, 1984 (USA), which enabled the private sector to assume operations in space and left NASA to focus on what it does best: research and development**

One of the most challenging and interesting areas of law is the jurisprudence of space activities. Space, as a subject, a domain and a paradigm, fundamentally challenges collective human consensus worth several hundreds of years on subjects as elemental as sovereignty and ownership. What compounds the problem is that addressing space from a policy-making perspective involves not just domestic in-house legislative and executive exercises but also that such exercises must constantly engage, influence and ratify international regulations and processes. And as a space lawyer, one must constantly unlearn and let go of the limiting influences of conventional legal training while also retaining the fundamental enablers of conventional jurisprudence that makes a space-law perspective possible.

The US has adopted a new law that recognises mining of space bodies by private players. In many ways, this is an extension of a vision that dates back to the Commercial Space Launch Act, 1984, which enabled the private sector to assume operations in space and left NASA to focus on what it does best: research and development. Elon Musk's SpaceX and similar success stories are a byproduct of a robust relationship that the Americans built with the private sector to leverage opportunities in space. This is in stark contrast to the pre-infantile state of play for the private sector in India.

The Indian Space Research Organisation (ISRO) has done a phenomenal job of putting India on the roster of elite space faring nations. ISRO itself is a testament to perseverance and ingenuity, a fact borne out by the growth the organisation has achieved despite the limiting effects of international sanctions. Today, it deserves the independence that it enjoys – bolstered by the success of its Polar Satellite Launch Vehicle (PSLV). In fact, there would be no private sector in space in India at all without an ISRO that inspired the youth of this country to look skyward and beyond. So the context is simply this: how can the private sector now participate and enhance the greatness of ISRO?

### **Only pessimism for the private sector**

While ISRO remains the central player in this scenario, the story remains incomplete until we understand that technology and space-based services have now taken centerstage in achieving better governance and quality of life on Earth. Take for example, the proposed Goods and Services Tax regime that aims to translate the entire tax collection, compliance and filing systems to an electronic and Internet-enabled system. When the system rolls out, India will need to ensure rapid percolation of the Internet into every nook and corner, an effort that can be made easier with high-throughput satellites, which are a hot trend elsewhere but not yet in India for unknown reasons. From healthcare to education, satellites will define India's growth in the Information Age. But the need for such space based services is growing faster than the pace at which our government seems able to sate it, thus necessitating a larger collaborative effort.

The regulatory framework for space activities is defined by a combination of policies, procedures and guidelines of the Government of India. The salient ones among them are:

1. A policy framework for satellite communications in India (a SATCOM policy for short)

2. Norms, guidelines and procedures concerning allowing Indian parties to provide services, including uplinking of TV signals with Indian satellites (SATCOM norms)
3. Remote Sensing Data Policy, 2011
4. The technology transfer policy of ISRO

What these policies and guidelines show is that between Antrix, ISRO and the Department of Space, the government appears to be an operator as well as a regulator, resulting in a virtual monopoly. This obvious conflict of interest was left unnoticed for a while as space wasn't an area of focus for the private sector. But now, with the emergence of private players, this is a concern. The discretion vested with the committees and bodies under the SATCOM norms don't come with deadlines prescribed for authorising the launch of satellite systems, nor is there an explicit policy framework for the exercise of such discretion – which potentially violates Article 14 of the Constitution. This has led to poor investor confidence and very little traction for a lot of space startups in the country (which do exist, by the way). And let's not even get started about spectrum and orbital-slot allocations, which will likely continue to be victims of domestic and international bureaucracy. In short, pessimism is the order of the day for the industry.

While that's the implication for the private sector, there's an identifiable implication for the nation as a whole. A lack of rationalisation in transponder leasing (a byproduct of the conflict of interest mentioned above); poor governance in the geographical information domain (or no governance, considering we've no known geographical information policy); the monopoly over remote sensing data generated by Indian satellites; and rigid tech. transfer policies pose not just financial losses to the government but also losses on the optimisation front – from the way education is delivered to the masses to better urban planning. And this is besides the fact that we could generate employment and retain talent in India if we can ensure a lucrative space for the private sector in this area. Last but not the least, NASA and the European Space Agency have both demonstrated that innovation is better achieved through a robust engagement with the private sector, which hopefully will provide much needed fodder for our collective thought processes on the subject.

## **A revolutionary road ahead**

So how can a space legislation address these issues? To begin with, a legislation – in the form of a law enacted by the Parliament – enjoys a level of stability that a policy or guideline can never achieve. That by itself will demonstrate the fact that the country has the vision to back up its capacity.

It will of course have to answer whether or not we are serious about giving opportunities to entrepreneurs who were provoked into dreaming about opportunities in space by our own space agency's achievements.

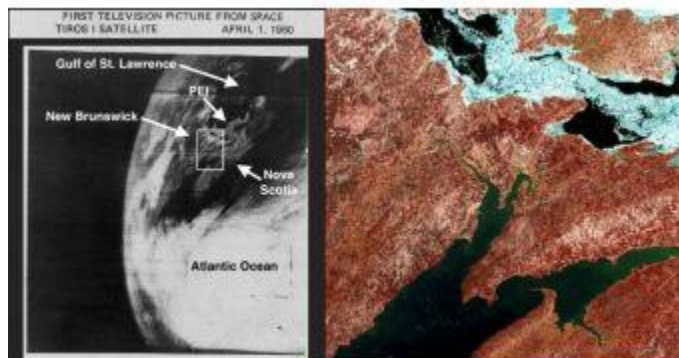
Should we intend to respond positively, then the legislation will have to make some radical changes. First, it must separate the regulatory functions of the Department of Space and ISRO, and vest the functions with an independent body. And this body must not only determine applications for launch of space assets but also the management of derivatives of the Indian space program and its initiatives. It must provoke the question of whether ISRO must focus exclusively on what its key strengths are – research and innovation – and leave the burden of day-to-day operations for the private sector to leverage. The need to address these topics is urgent as a legislation either enabling or disabling private participation of space activities will, if nothing else, provide closure to the young people dreaming about making a livelihood by taking India to infinity and beyond.

Finally, there are some ancillary issues: liability for space debris, national responsibilities for monitoring space activities arising out of its territory or its mandate, cross waivers in case of failures during launch of payloads into space, and so forth. These questions must be addressed parallel to the question of whether we must allow an industry to surface in the Indian space domain at all. Then again, we must also remember that as more of Earth's resources are depleted, and as we struggle to figure out how to address the problems of the future, the answer lies with a good space law. Falling behind in this race could threaten the country's prestige as well as our ability to safeguard the security of our descendants in a way that our current *Weltanschauung* cannot fathom. As our Parliament enters into its next session, one hopes that the needs of the future and the spirit of adventure will drive space policy as opposed to – in the words of V from *V for Vendetta* – the security of the familiar and the tranquillity of repetition.

*Ashok G.V. is an advocate and partner at TMT Law Practice, Bengaluru.*

## Landsat: the Cornerstone of Global Land Imaging - 20/02/2019 Advancing the Understanding of Planet Earth

Ginger Butcher, Linda Owen, Christopher Barnes



The use of data from Landsat satellites has become a cornerstone of global land imaging with broad societal benefits. More real-time monitoring capability in the future will further our understanding of a changing Earth.

The Landsat satellites provide an uninterrupted space-based data record of the Earth's land surface to help advance scientific research towards understanding our changing planet. In this article, the authors look at how the use of data from Landsat satellites has evolved over time to become a cornerstone of global land imaging with broad societal benefits. They conclude that the Landsat archive is poised to shift into a more real-time monitoring capability to help further our understanding of a changing Earth.

Since 1972, the Landsat satellites have provided an uninterrupted space-based data record of the Earth's land surface to help advance scientific research towards understanding our changing planet. Early Landsat satellites generated a wealth of new data that improved mapping of remote areas and geological features along with digital analysis of vegetation. Landsat's spatial and spectral resolutions have advanced its use for broader societal benefits such as global crop forecasting, forest monitoring, water use, carbon assessments and as the basis for Google Maps. Landsat's long-term data record provides an unrivalled resource for observing land cover and land-use change over a time scale of decades. The free and open Landsat data policy announced in 2008 unleashed global-level research without the onus of data cost, while evolving analytical and computing capabilities make it possible to tackle complex world problems in search of a solution.

For more details { <https://www.gim-international.com/content/article/landsat-the-cornerstone-of-global-land-imaging>

## **Extracts**

### **GIS for public health : A study of Andhra Pradesh**

B. Shrinagesh<sup>1</sup> , Markandey Kalpana<sup>2</sup> , Baktula Kiran<sup>3</sup>

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The main objectives are to study the prevalent diseases in Andhra Pradesh, to study the infrastructural facilities available in A.P. The methodology includes the Spatial Database, which will be mostly in the form of digitized format. The Non-Spatial Database includes both secondary data as well as the primary data.

For more details please visit

<https://iopscience.iop.org/article/10.1088/1755-1315/20/1/012024>

## **Urban Transportation Planning, Challenges And Policy Initiatives Ways For Hyderabad City – A GIS Approach**

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M.Anji Reddy Centre for Environment, IST, J.N.T.University Hyderabad

### **Abstract**

Transportation and communication system is recognized as the backbone of the economy of a country and hence its cities. India is emerging as a fast growing economy around the globe. Transportation and communication system has been the key player in trade, domestic or international. Lot has been done in the communication sector to match the international standards but serious and rigorous efforts are required to be made in the transportation sector to match the international standards. Indian cities are facing various transportation challenges in different proportions for which transportation policies have been framed from time to time, National Urban Transport Policy 2006 being the latest. But the results are sluggish and world class transportation system in the cities seems to be still a distant dream. With the efforts of the Government by introducing Jawaharlal Nehru National Urban Renewal Mission and preparation of Urban Mobility Plans in the recent past, attempts have started to improve the transportation systems of the cities. But its fruits will take some time, which are again doubtful keeping note of the present socio-economic, cultural, legal, administrative, financial and technical setup of the country.

The present paper is an attempt to understand the severity of the Hyderabad city transportation problems, examine the policy initiatives and suggest directions where efforts need to be taken care of to develop the Hyderabad city as Smart Cities.

**Source:** International Journal of Environmental Research and Development. ISSN 2249-3131 Volume 4, Number 4 (2014), pp. 309-316 © Research India Publications <http://www.ripublication.com>

## UAV Spectral Image Mapping of Shoreline Vegetation - 04/07/2018 Identification Based on Visible Spectral Bands

Jitka Komárková, Pavel Sedlák



*An affordable DJI Phantom 3 drone with built-in camera, which collects data only in the visible spectral bands, has been used to identify shoreline, vegetation and water.*

Rapid identification of a clear water surface, shoreline and vegetation can serve as a means of water-level monitoring and as an important indicator of changes. In cases when a high level of detail or on-demand data collection is required, **unmanned aerial vehicles (UAVs or 'drones')** can provide a good service. It is important to think about the costs of the UAV and the connected sensors as well. Multispectral and thermal cameras are still very expensive in comparison to visible cameras. This article shows how a commercially available middle-class drone (DJI Phantom 3 with built-in camera), which collects data only in the visible spectral bands and is affordable even for individuals, can be easily used to calculate colour spectral indices to identify shoreline, vegetation and water.

An area lying to the north of the city of Pardubice in the Czech Republic is very rich in ponds. The area of interest is flat, lying approximately 220 metres above sea level. It comprises clear water surfaces, seasonally flooded greenery, vegetation including treetops, dry reeds (including dry grass) and dry trees (see Figure 1).

### Flight Planning and Data Collection

The dataset was captured on 20 April 2018, i.e. in spring. The flight was planned in advance in DJI GO and then sent to the drone. The drone automatically flew according to the plan. It took approximately 15 minutes to cover the area of 0.0285km<sup>2</sup> so no break in the flight was necessary. The total length of the flight was 1,545m, and it was planned in seven main lines consisting of 64 waypoints in total. Front and side overlap were both 60%.



Average speed was 2.2m/s, altitude was 39.6m and resolution was 1.7cm per pixel.



Figure 1: Area of interest – shoreline of the Skrin pond.

### **Data Processing to Calculate Vegetation Indices**

Two software tools were used: **Pix4Dmapper** 4.2.27 trial and ArcGIS for Desktop 10.5.1. **Pix4Dmapper** was used for a mosaic building and calculating all indices. ArcGIS was used for visualisation of the resulting indices. WGS 84 – UTM zone 33N was used as a coordinate system.

The final mosaic was created from 33 images, covering 0.012km<sup>2</sup>. Certain types of land cover require a higher overlap, so images showing only treetops were not aligned because of the lack of common points.

Nevertheless, the final mosaic covered the whole shoreline so it was perfectly usable for the next step.

The survey team calculated various colour-based vegetation indices, which are based only on red, green and blue bands: CIVE, ExG, ExR, GRVI, NDI, TGI, VARI and VDVI. Several colour band combinations and combinations of particular indices were calculated as well to include different approaches described in the literature.

ArcGIS was used for visualisation of the results because it provides more visualisation methods and better tools for map creation. The “Pink to

YellowGreen Diverging, Bright” colour ramp was used for all indices, which helped to visually distinguish between particular land cover types. The other settings were: stretched visualisation, percent clip stretch (both min. and max. 0.5). Green colour represents the highest values, dark pink represents the lowest values, and yellow represents medium values in all cases to simplify comparison of the results. An inverted scale would be more natural in some cases, e.g. for displaying vegetation with the green colour.

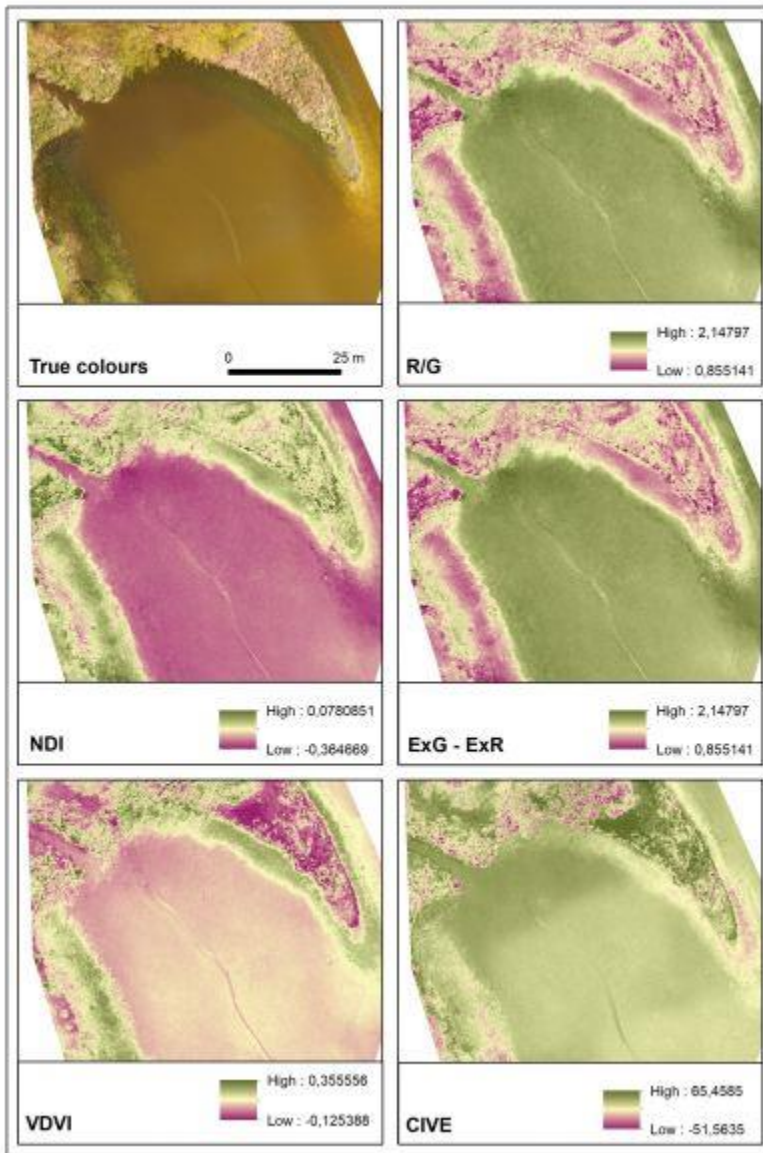


Figure 2: Area of

interest and calculated vegetation indices.

### Results and Interpretation

Based on the visual interpretation and literature, the following colour indices were chosen as the most suitable ones: CIVE, ExG – ExR, NDI, Red/Green

ratio and VDVI (see Figure 2 for results and Figure 3 for calculating algorithms).

The clear water surface is highlighted by R/G, ExG – ExR (dark green in both cases) and NDI (dark pink). The water surface can be easily distinguished from the seasonally flooded greenery. The borderline between the clear water surface and seasonally flooded greenery is indicated by the yellow line. Green vegetation is highlighted by all indices. VDVI and CIVE clearly highlight treetops, displaying green and dry vegetation in dark colours so that these two types of land cover can be easily distinguished. Seasonally flooded greenery is well visible with R/G, NDI, ExG – ExR and VDVI because it is bordered by a yellow line. The best result is provided by VDVI (green colour). Dry reeds and dry trees are well highlighted by VDVI (dark pink) and CIVE (dark green).

CIVE	Colour Index of Vegetation Extraction	$0.441 * \text{Red} - 0.81 * \text{Green} + 0.385 * \text{Blue} + 18.78745$
ExG	Excess Green	$2 * g - r - b$
ExR	Excess Red	$1.3 * r - g$
NDI	Normalised Difference Index	$(\text{Green} - \text{Red}) / (\text{Green} + \text{Red})$
VDVI	Visible-band Difference Vegetation Index	$(2 * \text{Green} - \text{Red} - \text{Blue}) / (2 * \text{Green} + \text{Red} + \text{Blue})$

Figure 3: Calculation formulas used to calculate vegetation indices.

### Comments on the Indices

VDVI is very useful for differentiating green vegetation from dry vegetation. R/G (and its opposite G/R) makes it easy to distinguish between vegetation and the clear water surface. The ExG – ExR difference makes it possible to distinguish all vegetation from the clear water surface. NDI makes it possible to distinguish all vegetation from the clear water surface. CIVE clearly highlights green vegetation, which can be easily distinguished from dry vegetation (both trees and reeds). The clear water surface cannot be easily distinguished because it is visualised in a similar way as dry vegetation.

### Conclusion

Shoreline, vegetation and the clear water surface can be easily monitored by a **middle-class UAV** equipped with a camera recording only in the visible spectral bands. It provides data with a very high spatial resolution on demand and at acceptable costs. It can significantly help with monitoring of less accessible areas such as overgrown or waterlogged terrain, as in this case. Particular land cover types can be easily distinguished by a visual interpretation as the first step. Vegetation indices based on visible spectral bands appropriately complement the visual interpretation. They can quickly highlight vegetation, seasonally flooded vegetation and the clear water

surface to enable identification of the shoreline as well. Each index emphasises different types of land cover so it is beneficial to combine multiple indices.

### **Acknowledgement**

This research was supported by the University of Pardubice, Project SGS\_2018\_19.

### **Further Reading**

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Last updated: 12/07/2020

## **Report by Dr.V Raghav Swamy**

### **Launching India to New Heights in Space : *IN-SPACE & NSIL***

Indian space research organization (ISRO) is one of the important flagship department of government of India. India's contribution in the \$360 billion space economy is only 3%. With the implementation of the government's digital programs, the demand for space based applications & services have increased. To expand further more effectively and efficiently, on 25th,June,2020 the union cabinet initiated and announced its decision on reforms in space sector to boost private sector industry participation in the entire range of space activities, to result in accelerated growth, opportunity for large scale employment and transform India into next stage of self reliant and technologically advanced nation. This will also enable Indian companies in private sector to be an important player in global space economy. The proposed reforms will bring big changes in the space sector. It will enable technological advancement & expansion of country's industrial base. It will enhance improved access to space assets, data and facilities.



YouTube Live

## Launching India to New Heights in Space

Panel Discussion By:



**Dr. K Kasturirangan**  
Ex-Chairman  
ISRO



**Dr. K Sivan**  
Chairman, ISRO  
Secretary, DOS



**Lt Gen PJS Pannu**  
PVSM AVSM VSM (Retd)



**Dr. Bidushi Bhattacharya**  
Ex-NASA scientist & CEO  
AstroHub



**Rohan M Ganapathy**  
CEO & CTO  
Bellatrix Aerospace Pvt Ltd



**Parthsarathi Trivedi**  
CEO & co-founder  
Skylo

Concluding  
Remarks By:



**Prof K Vijay Raghavan**  
Principal Scientific Advisor  
Government of India

26<sup>th</sup> June 2020 04:30 PM IST

In this background the newly created '**Indian National Space Promotion and Authorization Centre**' (**IN-SPACe**) will help private companies to use Indian space infrastructure, hand hold and promote them through encouraging policies and a friendly regulatory environment. The public sector enterprise, '**New Space India Ltd**' (**NSIL**) will endeavor to re-orient space activities from a 'supply driven' to a 'demand driven' model, thereby ensuring optimum utilization of space assets. The New Space India Ltd (NSIL) will (work with IN-SPACe) enable industry consortia on some of the activities of ISRO, like launch vehicles, satellite production, launch & space based services. It will be independent system, outside Isro.

It will allow ISRO to focus more on research & development activities, new & advanced technologies, exploration missions and human space flight program. Some of the planetary exploration missions will also be opened to private sector through an, 'announcement of opportunity'.

Under, Atal Innovation Mission (AIM), Niti Ayog, New Delhi organized a Webinar on, "**Launching India to New Heights in Space**". It was held live on Youtube on 26th June, 2020. The panelists included were, Dr K Sivan, Chairman ISRO & Secretary DOS, Dr K Kasturirangan, former Chairman ISRO, Lt Gen PJS Pannu, PVSM, AVSM, VSM (Retd), Dr Bidushi Bhattacharya, Ex.NASA Scientist & CEO AstroHub, Mr Rohan M Ganapathy, CEO & CTO, Bellatrix Aerospace Pvt.Ltd, and Mr Parthasarathi Trivedi, CEO & Co-founder Skylo and Mr Ramanathan Ramanan, Director, Atal Innovation Mission. The concluding remarks were given by Prof K Vijaya Raghavan, Principal Scientific Advisor, Govt. of India, New Delhi. Mr Mudit Narayan from Niti Ayog moderated the discussion. Around 800 audience registered & participated.

### **Highlights of the Discussion :**

**Dr K Sivan :** There is a larger vision of transforming Indian space sector. It is seen as one important sector to get reformed. Space based applications in recent times increased exponentially. Isro alone cannot meet the requirement of applications. Isro may have to grow 10 to 20 times bigger than now. There are young entrepreneurs who are coming forward to take-up space activities like building rockets & satellites, launching of satellites, ground equipment and providing services. **Isro has reached point of 'inflection'. Our share is only 3% in the global \$360 billion space economy. We have to increase and maximize our share.** In space activities, 2% is spent on launch vehicles, 5% on satellites, 48% for ground equipment and 45% for satellite applications. Without 7%, we cannot achieve 93%. Till now, private companies had been making and supplying components of rockets and satellites to Isro. As part of proposed policy for space activities of "open and inclusive", the new IN-SPACE (autonomous agency and a 4th vertical under DOS) will regulate and promote building of satellites, rockets & commercial launch services through private industry and start-ups to undertake end-to-end space activities. It will ensure, " a level playing field for industry in a fast growing global space sector " It will have its own directorate & cadre, promotion activities, technical, legal, security, quality and monitoring mechanisms. It is a great opportunity to industry and young startups to work together and make India a great technological powerhouse in space sector. It

would be possible to create a number of jobs. We are positive. It will be in place in 3 to 6 months.

Space business is of high investment and risky. To reduce burden private investors will be allowed to use Isro facilities on cost basis. A satellite Navigation Policy is being proposed and the (older) Remote Sensing Data Policy & SatCom Policy of 2000 are being revised.

### **How can partnering with private sector help India to reach new heights in space ?**

Dr K Kasturirangan : It is an extraordinary initiative, timely by the government for space reforms activities. It is a logical evolution of growth model for space activities in which space industry becomes a significant contributor in risk investment; second it becomes an instrument for multiplier effect in public investments which are already there; third space indirectly provides increased capacities. We have certain level of meeting the aspirations of the users. We need to increase this. This is where space industry can play a role and address the gaps in the ecosystem, namely, 'end-to-end' industry capability in, rocket-satellite-applications or own its total risk responding to the market opportunity.

The policy now addresses a global regulatory setup, investments, some of the concerns not been thought getting an industry in a big way. I am sure it will work out with all details on intellectual, technological, infrastructural and procurement support from Isro and other government institutions/departments in the country. It will be also give a R&D challenge to the industry. Million people are engaged in space activities all over the world; will be able to create 1 to 1.25 lakh jobs in foreseeable future.

### **What's your experiences with defense based agencies and how you see the changes recently to serve the purpose ?**

**Lt. Gen. PJS Pannu** : We start to live with walking the terrain to see what exists behind ridge line ; space is god's eye - the ultimate high ground. **Technology has taken everything from ground to space** - it sees and connects the world which has become one global village. Synergy that is now going to be created between ISRO, DRDO and startups will bring lot of value in demand based possibility, enable IR 4.0; space is a big enabler in digital platforms, AI surveillance etc. I am confident IN-SPACE policies will be favorable to youngsters, provide projects and a formidable road ahead.



How, India can benefit from these changes ?

**Dr Bidushi Bhattacharya** : I am very excited about IN-SPACe and what Isro is doing in general. I really see a lot of talent sitting in India right now. The world economy is expected to raise to \$ 2 trillion by 2040. Only way to get there is to engage young talent from private sector and create jobs, upfront. Space play a unique position. **Space based data with services and ground based technologies must synthesize to come up with unique solutions** - food security, supply chain management etc.

**What are your thoughts on the reforms and your experiences wish to share ?**

**Rohan M Ganapathy** : It's a new space ecosystem and many I am sure will many will come forward ; **space industry is like software industry** and it will create lot of jobs in near future. As we all move to IR 4.0, where, machines are going to take the jobs, but still you need people to give solutions. We have talent in the country and everybody is ready to step-in and offer what we can; we have ability to face risks.

**Parthsarathi Trivedi** : From earliest days Isro has been inspiring science & technology. The present reforms is beginning and a historic step to move forward. Many of us would like to apply our knowledge in the development of space sector as entrepreneurs and move forward. **Globally, space industry is going through rapid evolution at the moment.** New constellation of satellites are bringing 28 terabits/sec. bandwidths online. Rapid miniaturization, reduction in costs extended limits of space platform challenges, for example, a satellite inside a 'sodacan', which led to the invention of 'cubesat' at stanford university. Satellites can now be manufactured on an assembly lines, like smart phones and constellations can be upgraded as software releases, demonstrated by private sector. Up-scaling would be possible by public sector. **Both, private and public sector can contribute to national & international markets**, example, New Zealand did not have a space agency till 2016. It created space policy and agency in 18 months. A home grown private company called, ' Rocket labs' successfully developed launch vehicle. India can become a global hub for space activities. Talent and companies will come forward to India to produce world class products and services. Space is required everywhere, in education, curriculum; farmers and fishermen can produce greater yield using space based sensors, ML derived predictions. In summary, a predictable policy is a prerequisite in building a robust space sector; need a greater market awareness in emerging services, investor awareness, need companies, financial institutions who can buy and sell risk in space sector.

**What should India do to inspire as level playing to produce & attract companies like SpaceX and others ?**

**Dr Bidushi Bhattacharya** : Create own SpaceX for next generation. Shift from multi-billion dollar space machines to build and launch handheld satellites like, 'cubesats', which cost few hundred thousand dollars. Tap, India's huge young human resource, who are excited, motivated into astronomy & space sciences. Access this sector to people who think it is difficult and there are no jobs. **Key here is provide a structural adjustments in educational & training program, to students in engineering, technology and other groups**; top it with ground testing technologies, commercial services, bring people from finance and start-ups. There are 1700 start-ups in world today in space sector. India's contribution to the pool is less than 5%. We need to increase this number by bringing more start-ups, along with people from social sciences, education, skilled young professionals who can think non-linearly and offer solutions.

**Prof K Vijay Raghavan** : We have seen over the last few years a pert in the number of entrepreneurs, innovators in sectors, where they can have impact on society, using technologies which are readily available, for example in e-commerce. **Now the challenge is how much more we bring innovators in 'deep-tech' sector.** This poses a problem because that relies on decades of investment and experience. Technologies in last of years changed towards miniaturization. This allows the deep tech to come in a big way, to a scale it has to be innovative & competitive. **Opening of space allows ideas, technologies & competitive globally**; the demand on the technologies are so high in quality, that they use more terrestrial applications becomes easier to succeed in space. So, the inspiration space brings will allow technologies to test in scale and quality, allowing them to be deployed.

**Rohan M Ganapathy** : There is less clarity in common public, what is the contribution of space to the economy. It requires a lot of outreach to public. I suggest to include in the IN-SPACE portfolio, a framework which would comprise social scientists, economists. This will enable them to come together with space technologists and inspire more youth to this exciting area.

**Dr K Kasturirangan** : There are several low hanging points today in the space activity, whether it is remote sensing applications, innovative use of navigational system, communication satellites, tele-medicine, tele-education in context of connectivity and level to which we can bring in AI, Expert systems and so on. There is a tremendous scope in area of EOS data that can be handled and provided as a service on a scale which is currently inadequate and this needs to be expanded; investments are not large, risk elements are less, but demands are going to be high. Second : there are a number of technologies **Isro has developed for various purposes related to engine, rocket & satellite development, ground system development - they are all part of spin off technologies available.** Now, assessment of this kind of activities to other areas is yet to be done in exhaustive way. This area

we can help the entrepreneurs, that we come out with suggestions, proposals and they pick-up some from them / choices can be made available. There can be several examples, but the current effort itself can produce, eg : image processing, artificial art for early detection of certain diseases. NASA has a special group, which identifies all these spin-offs in areas like medicine, health, education so on. Many companies come out and take it out and upscale some of them. **We must encourage entrepreneurs to adopt such technologies.** Entrepreneurs can be given fairly assured direction of investment which is not as risky, putting rocket or satellite in orbit.

### **How can India as a Nation focus on developing capacity and capability of space science among students and researchers before they become entrepreneurs ?**

**Dr K Sivan :** There is already a system in Isro called, 'Respond'. Other provision is AO for developing cutting edge technologies by academia. Now as part of proposed reform a formal AO for the technologies required to be developed will be extended to the students from academia, before they decide to become entrepreneurs. Funds will also be provided towards the technology development. The facilities in Isro will be open for them to carry testing. We need their brains, rest we will encourage and support. **We want to see entrepreneurs to grow and do more work , for that the system of reforms is being put in place.**

**Dr K Kasturirangan :** I will specifically **focus on one area of space on astronomy & astrophysics which will have tremendous excitement on younger minds.** Why I am bringing this because we have a program for example, inter-planetary missions, chandrayaan to venus to mars, asteroids, sun & its evolution. We can enthuse on one side in studying and move to research to understand the space programs better in overall context. **It will create thinkers of tomorrow and they can work in space.** This exercise has not been done; astronomy & astrophysics is done with universities and at centre for astronomy and astrophysics. This is one connection one need to bring in a larger context of , 'academia-Isro' interface. Second aspect it can be done with industry. We tried to do it with IIST & IIT's. I think technology n other areas where we need to create, Isro is expanding funding large amount of programs in space areas like robotics for lunar missions etc. Third aspect is question of leadership, which is need to be grown & this has a role both within the institution, as well as in the specialization institute separately. Prof Vijay is facing not only in space, but also in S&T; we need to have mechanism to create visionaries, thinkers & thought leaders and people who will have a broad picture of role of S&T in the context of socio-economic, strategic and many other dimensions; need to address when we introduce with industry; many youngsters will be working will through up alternate leaders even from govt. system, like Isro.

**Mr Ramanathan Ramanan :** We are partnering with Isro, specially in 'Atal Tinkering Lab', which are more than 5000 in the country. In many of the labs we going to introduce modules on space technology. Besides, space labs which are going to be created will also be integrated with them. Second is the launching of specific challenges that Isro & Industry needs to stimulate innovation from start-ups. This will **leverage private industry & start ups take on space applications for betterment of community**. This should inspire young students to join industry. We recently launched, 'Tinker-from-Home' space module for school students through a webinar. One of the talented student has shown the, 'cubesat' and its making. There is a tremendous interest and motivation among young students in the country.

**As a young startup how these reforms are going to create a positive impact, particularly on Skylo business ? How it will lead to faster improvement in applications like disaster management, agriculture so on ? How we can bring more private players to make a huge impact ?**

**Parthsarathi Trivedi :** Space contributes in a meaningful way to farming, fisheries, navigation, weather etc. The work we are carrying soil moisture from sensors can help to digitize the soil health program, which will benefit the farmers. Connecting fishermen to markets for auction of fish catch, access to digital e-commerce platforms even one is 300 nautical miles away and that's the power of space. **Space is completely going to transform industries to become tech.** enable. Challenge is to penetrate data transfer to remotest areas. Reforms in space sector will allow me and my peers to do meaningful work to the country.

**Rohan M Ganapathy :** I started the company at the age of 19 and registered as a company in 2015. I could get the first order from Isro. There are 30 space companies in India. Youngsters are coming forward and offering solutions to various rocket & satellite propulsion systems to complement to what Isro is providing. There are startups who can complement in upstream needs of space activities. **There should be startup representation in IN-SPACE along with technologists, academicians, scientists & experts from industry.** They will help to propel the space activities. Space reforms has to give thrust on export regulations. We are confident and can offer world class products and an develop edge over SpaceX in US.

**How the expansion of services from both govt. and private will help or this change will effect the service provider ?**

**Lt. Gen. PJS Pannu :** There has been a lot of specialization in strategic, encryption, cyber systems of space activities. **Once we get entrepreneurship in the form of startups or by industry, then it will contribute to the growth of the technology and would bring an edge**

**to us.** Indigenization will increase exports and will give more value to our products outside eg chip design & making using nano-technology. Space technology brings in "Hemoglobin" to the digital warfare platforms; Application of data transfer using AI, 5G, IOT's, possible because space supports it, unlike fixed terrestrial networks. As part of self reliance, home grown products & technology must be encouraged and supported. **Space is a great enabler for growth of indigenous industry.**

**Is it correct to assume that the recent reforms will allow private players a license to launch own rockets and satellites into orbit, is that the correct understanding ?**

**Dr K Sivan :** Yes, the understanding is right. **By this reforms the private players will be allowed to build and launch the vehicles.** I am happy some entrepreneurs are thinking of building own launch vehicles and launch them too. I welcome to SDSC facility to launch at the earliest.

**How will reorganization of space assets affect the future launch vehicles and Isro programs of Chandrayaan, Mangalayaan, Gaganyaan and others in line ?**

**Dr K Sivan :** None of the Isro activities going to be affected. All unified launch vehicles, advanced missions & their capacity building will be continuing as planned. Apart from this huge potential for space applications as mentioned by Dr Parthasarathi, this huge potential is untapped, to unlock Isro need extra hands. Instead of depending upon own 17k people, **we need private players to participate and carry space activities** They will have openings to develop new technologies in advanced missions and in projects.

**What kind of encouragement, financial support will be extended by Isro & others to startups ?**

**Dr Bidushi Bhattacharya :** During last 5 to 10 years **space has become a big identity with Indians and now they think can participate in big way is the key;** Of course we need funding - govt. suggest industries to come forward - we have young and also experienced people watching; there is a big knowledge gap. What is important is to create a structured knowledge base among young talent and strengthen engineering curriculum down the line.

**What kind of support the private sector need from outcome of reforms ?**

**Parthasarathi Trivedi :** First, contributions from both public & private sector would boost indian capability in space. Second, Isro's amazing launch pad capability has given a big impact to the world in many ways - launching of 104 satellites simultaneously in 2017 was the biggest moment - 88 satellites belonged to my peer company, 'planet labs' in California, which get good

funding from govt. being its customer. **Procurement policies of govt. have to ensure startups to have easy access to govt. as well as customer.** Talent of Isro along with that in private sector, together can become a force to reckon, both domestically and internationally.

**Concluding Remarks by Mr Ramanathan Ramanan :** Dr Sivan and Dr Kasturirangan symbolize a long tradition of quality of Isro, now and for its future. What Dr Vikram Sarabai and Prof Satish Dhavan said about Isro, it is deeply at its foundation tied to the society, that very few organisations in the world are today. The new partnership with industry must keep in this in mind. The reason, I say that our future of the planet hinges on the ability of us as humans and we become stewards for its survival because of engineering & use of technology. If we can deal with climate change, ecology and environment and sustainable development we would be creating better life for our future generations. That's a very big challenge. What role the space have in this challenge, which seems so much to terrestrial. That was the criticism which Isro had on its foundation, as to why India is investing in space research, space technology at a time when it had many problems at independence and little later. See the impact of Isro on our education, communication system, agriculture owes in no small measure to their success, today. So, between cutting edge technology and people welfare has been disproved by Isro existence over the years. Now Isro is opening up new kind of partnership that will allow young entrepreneurs to use the technologies in multiple ways. **Isro in its new 'avatar' has already decided to open this sector enormously, to take new responsibilities.** Now coming to what it can do, we can see major missions that govt. is undertaking, where space a very critical role. i) Water mission, where aim is to provide piped tap water to every village, that which requires use of sensor technology with back end of real time communication technology. Many terrestrial systems do this, but many are limited to space. Soil quality is another and agriculture too. Excessive use of fertilizers and pesticides and water in indiscriminate manner. These are very critical to be addressed. New technologies allow us to collect information & give feedback to farmers, look after land well and reach market as well. It is important, what Dr Kasturirangan mentioned about importance of research in astronomy and astrophysics, which will benefit enormously, where one can use and develop space science.

Inspiring example is that of NASA Grace two satellites made possible with university system. Very promising. They go around the earth, collect information about changes in sea level, melting of ice as a consequence of climate change. The inevitable question. **Where we will get resources for all of this new opportunities.** This is not a linear process, first give money and will do it. This is a '*boot-strap*' mechanism. **You have to be audacious and pitch for what you can do.** Should create an impact on the society,

industry or could be inspirational, money will come from anywhere, from govt. or from outside. I conclude by saying, this has to be a partnership between govt. and industry; **success of industry is success of govt.** and in the end success of all people. Thank you.

*Source* :Excepts of text from the recording of webinar held on youtube, dt 26thJune,2020 & Hindu news print dt 26-28th,June,2020

### **Student Forum**

Department of Geology, College of Science & Technology of Adikavi Nannaya University Rajahmundry, Andhra Pradesh, organized a live web session on the theme, "*Remote Sensing and GIS Applications for Earth Surface Processes and Resource Monitoring* " on 09thJune,2020 for faculty, researchers and students. Dr K Nooka Ratnam, Head Department of Geology, was the convener. Around 300 registered for the event. E-certificates were distributed to the registered participants. Prof M Jagannadha Rao, Hon'ble Vice Chancellor of the University delivered the welcome address. Prof YVN Krishnamurthy,

Senior Professor & Registrar, IIST /DOS, Govt. of India, Thiruvananthapuram, Kerala delivered talk on, "Geospatial Technologies and Opportunities for Entrepreneurs". Dr V Raghavaswamy, Former Deputy Director, NRSC/ISRO, Hyderabad, Telangana delivered talk on, " Remote Sensing Data and GIS techniques in Natural Resources Census in India". Prof B S Daya Sagar, Former Head, Systems Science & Information Unit, Indian Statistical Institute, Bengaluru delivered talk on, "Mathematical Morphology in Geospatial Data Science Overview"

The description of the program is given in the flyer, below

Compiled by V Raghavaswamy  
Co-Editor; Maps Today

**ADIKAVI NANNAYA UNIVERSITY**  
**Rajahmundry - 533296**  
*National Webinar*  
on

**"Remote Sensing and GIS Applications for Earth Surface Processes and Resource Monitoring"**

DEPARTMENT OF GEOLOGY  
UNIVERSITY COLLEGE OF SCIENCE AND TECHNOLOGY  
Webinar Date & Time 09.06.2020 (3pm to 5.30pm)

About the Webinar  
Remote sensing provides us with a continuous and constant source of information pertaining to any spatial phenomena, while Geographic Information Systems (GIS) as a technology and tool helps for handling the geospatial data. The two disciplines have allowed us to carry out large scale analyses of the Earth's surface and, at the same time, provide increasingly detailed knowledge on many planetary variables and improve our understanding of its functioning. These analyses are essential for decision-making for sustainable management of natural resources, designing networks of protected areas, and addressing the threats of global change.  
The webinar is being organized to benefit the faculty, researchers and student community gain more insights on the benevolent use of Remote Sensing data and GIS for applications ranging from resource management, disaster management, planning, governance and to frame policies for all-round development of the region.

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**Prof. M. Jagannadha Rao**  
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Patrons



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Principal, UCST, ANU



**Prof. B. Ganga Rao**  
Registrar  
Concluding Remarks

**SPEAKERS**



**Prof. Y.V.N. Krishna Murthy**  
Sr. Professor & Registrar  
IIST, Dept. of Space, Govt. of India, Vallamala, Thiruvananthapuram  
Formerly Distinguished Scientist ISRO, Scientific Secretary ISRO.  
Director NRSC, Director IIRS, Director CSSTEAP/UN affiliated Centre, Director Antrix Board,  
Director NARL, Director RRSC's, Head RRSC Central  
Topic: Geospatial technologies and opportunities for entrepreneurs (3:15pm to 3:50 pm)



**Dr. Vaddiparti Raghavaswamy**  
Dr. V. Raghavaswamy,  
Former Deputy Director (Remote Sensing Applications and Training),  
NRSC/ISRO,  
Hyderabad, Telangana.  
Topic: Remote sensing data and GIS techniques in natural resources census studies in India (3:55pm to 4:30 pm)



**Prof. B. S. Daya Sagar**  
Professor & Former Head  
Systems Science and Informatics Unit  
Indian Statistical Institute- Bangalore Centre, India  
Topic: Mathematical Morphology in Geospatial Data Science: An Overview (4:35pm to 5:10 pm)

**ORGANIZING COMMITTEE**

Prof. Y. Srinivasa Rao, Co-Convenor  
Dr. K. V. Swamy, Co-Convenor  
Dr. K. S. Peter, Member  
Dr. K. Sudha Rani, Member  
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Dr. S. Venkateswara Rao, Member



**Dr. K. Nooka Ratnam**  
Head of the department, Convener

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Important recommendation: It is advised to login from 2 pm onwards to avoid the last minute rush in being allowed by the host.

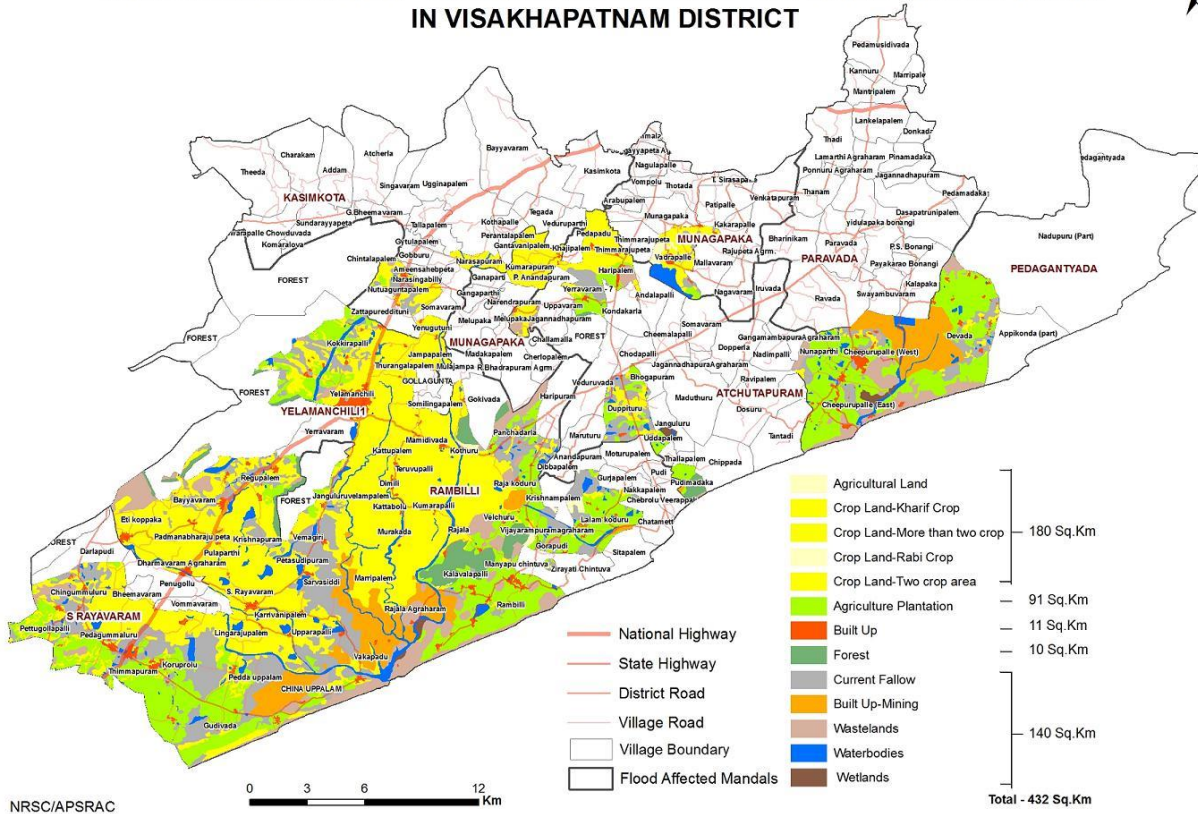
Cover One and 3 ( photos below )



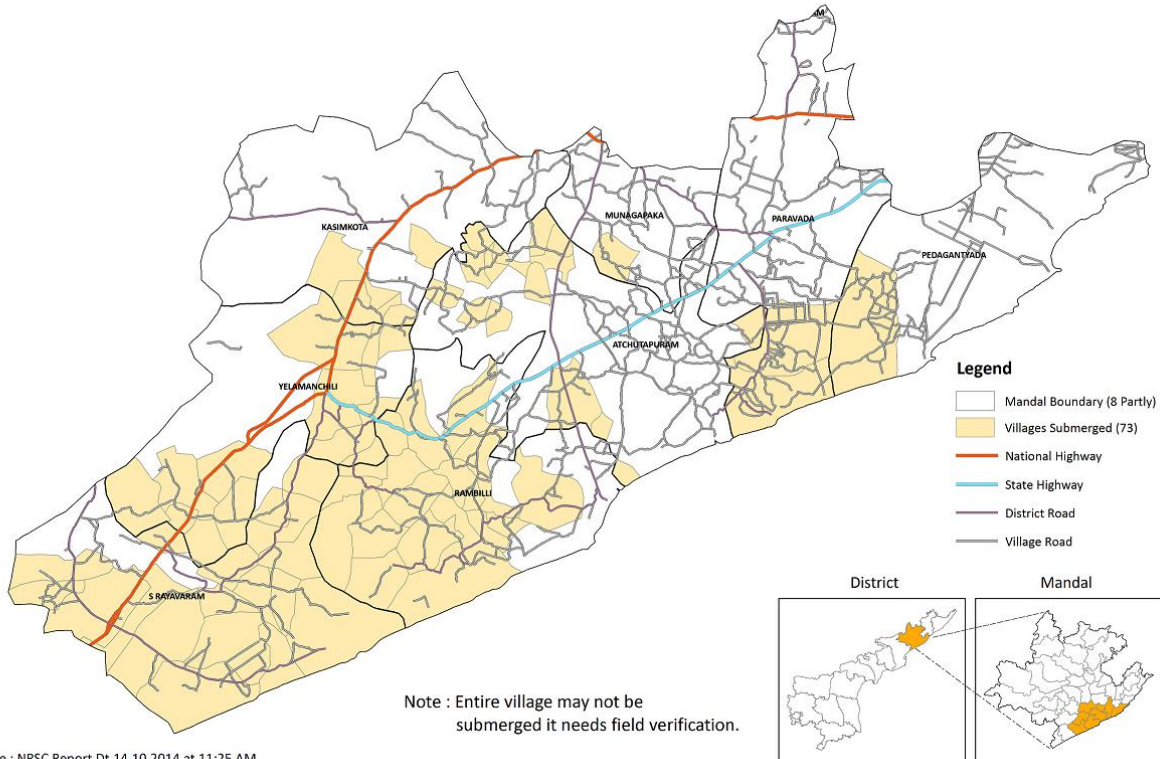


***ISRO chief K. Sivan. (IN-SPACE )***

# LANDUSE /LANDCOVER - VILLAGES SUBMERGED FOR MORE THAN 24 HOURS IN VISAKHAPATNAM DISTRICT

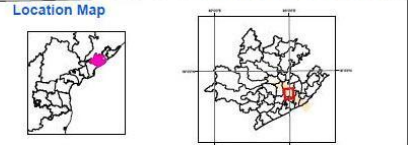
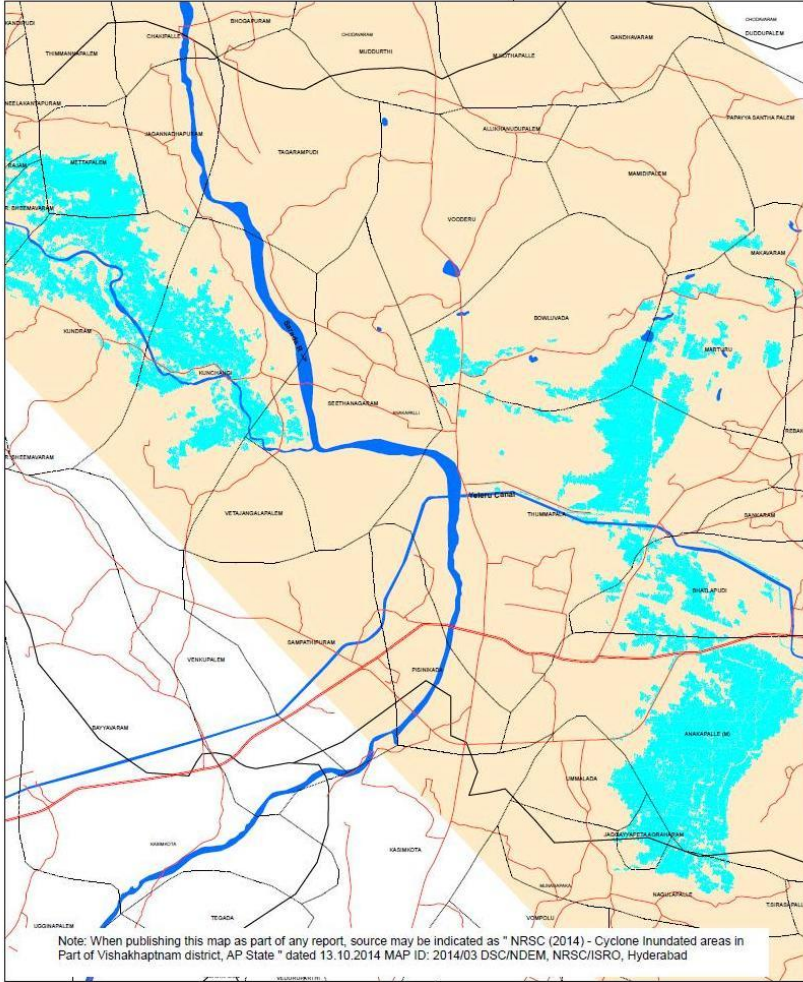


**NRSC REPORT - LIST OF 73 VILLAGES REPORTED SUBMERGED  
FOR MORE THAN 24 HOURS UPTO EVENING 13.10.2014**



**Cyclone Inundated Areas near Anakapalle, Vishakhapatnam District, AP**  
Based on analysis of RISAT-2 data of 13-October-2014 (0500hours IST)

For official use  
DISASTER EVENT ID: 14-CY-2014-AP  
MAP ID: 2014/03  
Date of Issue : 13.10.2014



**About the Event**  
Very severe cyclonic storm HUDHUD made landfall on Andhra Pradesh coast on Sunday (12 October 2014) triggering heavy downpour in the coastal regions of AP. (Source: News Media & IMD)

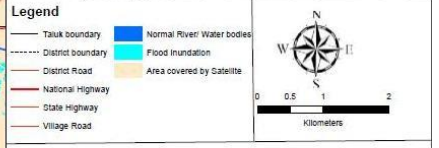
**Satellite Observations**  
This map highlights the cyclone inundation in Part of Anakapalle, Vishakhapatnam district as on October 13, 2014. About 22 villages were observed to be inundated. List of villages given below.

Taluk	Village	Taluk	Village
Anakapalle	Anakapalle East	Mangayyapeta	Devalakurupalem
	Bhatlapudi		D. Srinivasaram
	Chandavada		D. Srinivasaram
	Jaganmohanpuram		Palam
	Chandavada		Chandavada, Nandharani
	Kondam		Chandavada
	Makuram		Chandavada
	Makuram		Chandavada
	Makuram		Chandavada
	Makuram		Chandavada
	Makuram		Chandavada
Mangayyapeta	Chandavada	Mangayyapeta	Chandavada
	Chandavada		Chandavada
	Chandavada		Chandavada
	Chandavada		Chandavada
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	Chandavada		Chandavada
	Chandavada		Chandavada
	Chandavada		Chandavada

Note: These villages need not be revenue villages

**Satellite data used**  
Pre Cyclone: Satellite: RADARSAT-2  
Sensor: SAR  
Date: 12-Oct-2014 (0600 hours IST)  
Post Cyclone: Satellite: RISAT-2  
Sensor: SAR  
Date: 13-Oct-2014 (0500 hours IST)

**Other data used**  
NRC Landuse/Landcover Data  
Bhuvan Geoportal Legacy Data



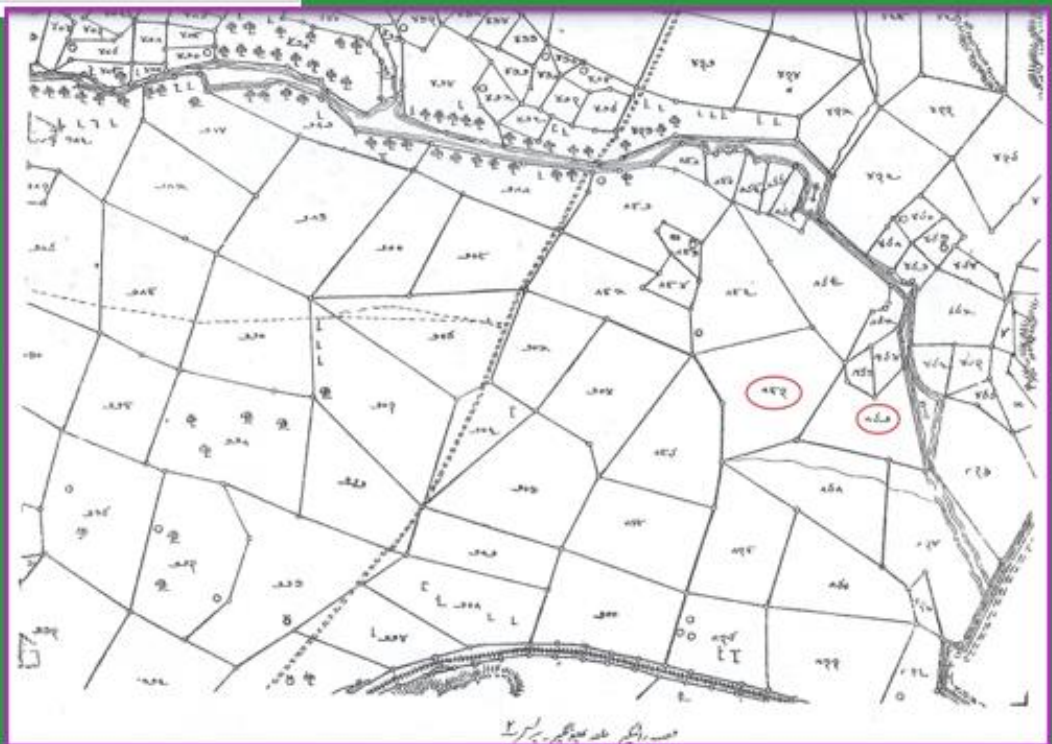
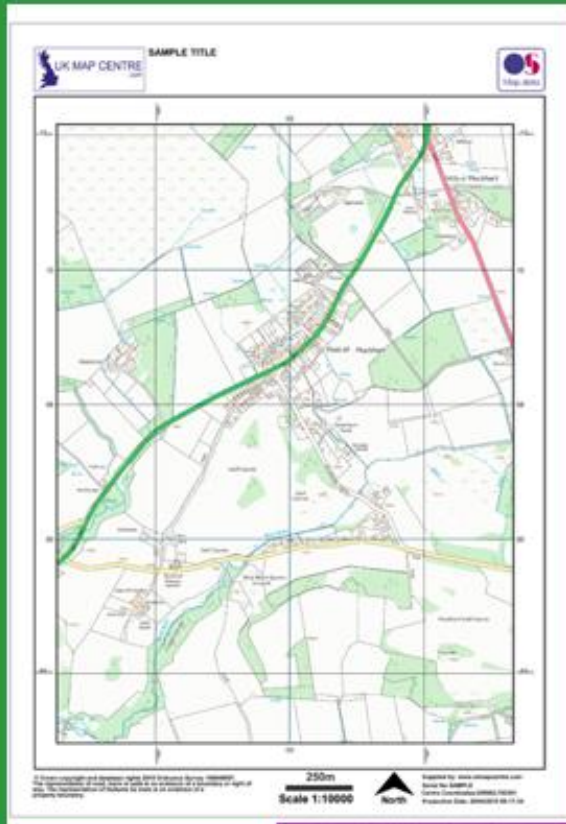
This product is prepared on rapid mapping mode for immediate use and sharing amongst official agencies. This provides preliminary results. Flood inundation may include rain water accumulation / flood water in low lying areas.

All geographic information has limitations due to the scale, resolution, date and interpretation of the original source materials.

No ground verification is done.  
DSC / NDEM  
National Remote Sensing Centre, ISRO  
Dept. of Space, Govt. of India  
Hyderabad- 500 037  
E-Mail: flood@nrsc.gov.in  
www.nrsc.gov.in

Note: When publishing this map as part of any report, source may be indicated as " NRSC (2014) - Cyclone Inundated areas in Part of Vishakhapatnam district, AP State " dated 13.10.2014 MAP ID: 2014/03 DSC/NDEM, NRSC/ISRO, Hyderabad







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