

CHANGE LEADERS



Interview with
Dr. Shailesh Nayak, Director,
National Institute of Advanced Studies (NIAS), Bengaluru

September 2024

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“Change Leaders”, is a series of interviews by Explore The Space & The Global Trade Driver with leaders in business, academia, technology and government, across the world, whose actions and ideas have a positive and transformative impact in their field of work. Please give your valuable feedback to info@explorespace360.com

CHANGE LEADERS SERIES

An interview with Dr. Shailesh Nayak, Director, NIAS, Bengaluru



Dr. Shailesh Nayak

Dr. Shailesh Nayak is currently the Director, National Institute of Advanced Studies, Bengaluru, Chancellor, TERI School of Advanced Studies, New Delhi, and Editor-in-Chief, Journal of the Indian Society of Remote Sensing, Dehradun. He obtained his PhD degree in Geology from the M.S University of Baroda in 1980. He was Secretary, Ministry of Earth Sciences, during 2007-2015 and provided leadership for programs related to earth system sciences. His current research interest includes building strategy for blue economy, sustainable development and promoting research in the Indian Ocean and polar regions.

He had set up the state-of-the-art tsunami warning system for the Indian Ocean in 2007 and provided tsunami advisories to the Indian Ocean rim countries. He has pioneered the development of algorithms and methodologies for the application of remote sensing to the coastal and marine environment, and generated the baseline database of the

Indian coast, and developed services for fishery and ocean state forecast. This coastal database has formed basis for managing the Indian coast. He was instrumental in creating database of the glaciers of the Indian Himalaya.

He is an Academician of the International Academy of Astronautics (IAA) Fellow of the International Society of Photogrammetry & Remote Sensing (ISPRS) and Indian National Science Academies. He is the Regional Representative for Asia at the ISPRS Council. He was conferred the prestigious ISC Vikram Sarabhai Memorial Award 2012 and Bhaskara Award for 2009, for his outstanding contributions in remote sensing and GIS. He has published about 190 papers in peer-reviewed journals. The Govt of India awarded the Civilian Honour 'Padma Shri' in recognition of his outstanding contributions in the field of science and engineering. Dr. Shailesh Nayak, speaks to D. V Venkatagiri, CEO, Explore The Space & The Global Trade Driver, in this interview.

1) How does Space Technology and related fields fit into the programmes and policies of National Institute of Advanced Studies?

The National Institute of Advanced Technology (NIAS) was set up to address local, national and global issues through integration of findings of multi-disciplinary research in natural and social sciences with technology and arts. The space technology today has been influencing each sector, natural resources, environment, agriculture, rural and urban development, infrastructure, communication, entertainment, security, defence, and many more. Several studies have also indicated how space technology has helped to improve economic conditions and social life of people. NIAS has pioneered the use of remote sensing data in characterising cultural landscape of Nalanda, Bodh Gaya, Mammalapuram and many others. Satellite-based observations are integral part of all global and regional models for the forecast of weather, climate and hazards, focus areas at NIAS.

2) How important, in your opinion is International Collaboration in the Space Industry for India? What needs to be done to foster greater International Collaboration for the Indian Space Industry?

In my opinion, it is vital for us to collaborate with countries, especially to address issues related to planetary research and address issues related sustainable development goals, weather and climate and hazards, water and food security, conservation of terrestrial and marine ecosystems, education, inequality and poverty alleviation. India needs to collaborate with developed world to generate new knowledge and with developing world to provide satellite-based products and services.

INSPACe has been promoting the participation of the Indian industries at the various international events through organising exhibition and other promotional events. The industry associations, SatCom Industry

Association (SIA-India) and Indian Space Association (ISpA), provide platforms for both foreign and Indian industries for interaction as well as articulate requirements of the industry. An effective mechanism is evolving to transfer space technologies developed by ISRO to industries at the affordable cost as well to provide facilities for testing and validation of products and services. Many startups are developing new technologies as well. There is a need to develop plans for next 10-15 years about country's requirements of earth observations, communication and navigation satellites, both for civil and military use. I have already proposed to have national system of earth observation, identifying type and frequency of observations required for weather, ocean, agriculture and other sectors. I am sure based on global and country's requirements, industry will invest in building space ecosystem in the country. The Government needs to facilitate development of such ecosystem.

“The administration of science ministries needs to have a separate approach than other line ministries. The management of scientific programme should be carried out by scientists who have leadership qualities and experience in managing large teams, apart from technical expertise.”

3) You are a celebrated scientist and an administratoras a Scientist and administration, what are the changes that need to be brought in Science and Technology Administration.

The administration of science ministries needs to have a separate approach than other line ministries. The management of scientific programme should be carried out by scientists who have leadership qualities and experience managing large teams, apart from technical expertise. The general administration and finances should be handled by administrative

“Explore The Space” promotes STEM & Space Education and facilitates Industry Partnerships

Interview conducted by
D.V. Venkatagiri
CEO
Explore The Space &
The Global Trade Driver



services. The science ministries should have mission-mode approach.

An apex body comprising top decision makers in science ministries and government should take policy decisions. Most scientific projects may take more than 5-10 years to materialize, as well as there are chances of failure, so such mechanism is necessary.

In my opinion, scientific temperament relates to acceptance of failures as part of the path to success. We should have a mechanism to analyze failures to learn from them. In science ministries, other than space and atomic energy, failures are not analyzed critically. Most of time, such projects are dropped. This is not a scientific approach. I am aware that in ISRO, there very robust mechanism of reviews and failure analysis as a part of the project or a mission. The project/mission directors have a responsibility but also autonomy and have financial powers. Our attitude should be towards logical and rational thinking. The decision-making should be based on scientific facts and analysis. All the science ministries should adopt ISRO model for their functioning.

4) The growing number of Satellites and their applications are giving us enormous data... How is the Space Industry ecosystem responding to the need / necessity of packaging the data as a marketable product?

The industry has responded very well. There are many success stories. 'Map My India' App is one such example. There are many non-governmental organisations such as Foundation for Ecological Security has set up an 'India Observatory' to utilise satellite data for grass-root development and preserving and restoring ecosystem.

There are many small and medium industries that provide services like crop insurance, weather forecast, groundwater targeting, mineral exploration, etc. Many startups are involved in developing innovative solutions to varied applications.

5) We can say with reasonable pride that India is a leader in the launch Industry... How is India positioned in - A) Remote Sensing technology and B) In applying the Remote Sensing Data for Economic and Strategic use?

ISRO has variety of launch vehicles and has been providing services commercially at a very competitive cost. The Indian private industry are now developing launch vehicles. There are private players like Skyroot and Agnikul, who have been developing this technology. The technology for Small Satellite Launch Vehicle (SSLV), developed by ISRO, will be transferred to industry in near future. It may take some more time before these industries start offering services of international standards at a reasonable cost. They will have to compete with established players, but I am sure they would be able to match the requirements and succeed.

India has a very robust remote sensing technology and developed applications extremely well. The variety of satellite platforms and sensors such as INSAT – AVHRR, a Sounder, OCEANSAT – Ocean Colour Monitor, Scatterometer, SARAL – ALTICA, IRS/RESOURCESAT – LISS III & IV, AWiFS, CARTOSAT, RISAT have provided variety of data to improve short and medium-term weather forecasting and their applications in agriculture, disaster support, aviation, energy & power, transport, etc;

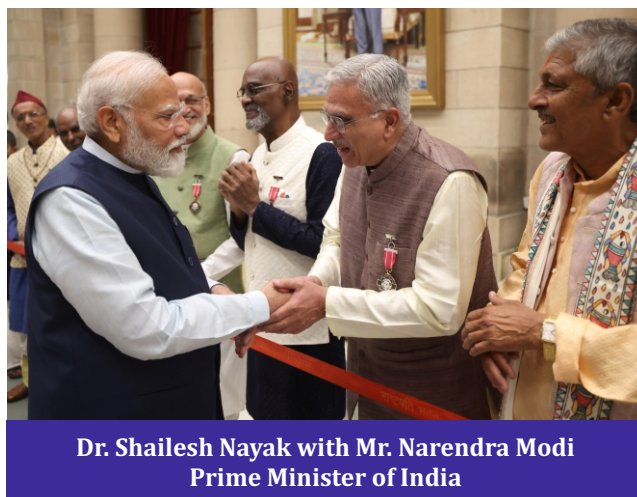
The many applications are being carried by the line ministries such Earth Science; Environment, Forest and Climate Change; Agriculture; Water Resources; Mines and Electronics and Information Technology. The Ministry of Earth Sciences is already supporting financially the launching of

satellites such as INSAT, OCEANSAT. The Ministry of Agriculture is likely to support the satellite designed specifically for agriculture use. India is leading in applications of remote sensing data.

The services developed based on the remote sensing data such as weather forecasting, hazard response, oceanographic services, groundwater targeting etc., have provided economic benefits. According to the National Council of the Applied Economic Research, New Delhi, services related to potential fishing zone advisory and

agrometeorological survey and many other services have provided economic benefits to the country. It has been estimated that annual potential benefit is Rs.13,331 crore from the Agrometeorological services. Location-based forecasts for power utilities providing additional benefits. The use of advisories on potential

fishery zone and ocean state forecasts, on an average, provide additional income of Rs. 17,820 per trip to fishers. The accurate forecasts of cyclones and other extreme events have helped to save lives of people. The lives lost during the Orissa cyclone was about 10,000. With improved forecast, the fatality is drastically reduced.



“The services developed based on the remote sensing data such as weather forecasting, hazard response, oceanographic services, groundwater targeting etc., have provided transformative economic and social benefits”

This is classic case of advantage of using remote sensing and numerical modelling to address issues related resources and hazards. There are several success stories of utility of remote sensing data in all sectors. The multi-

spectral and hyper spectral imagery, SAR data and interferometry and high-resolution data providing digital terrain models along with AI and ML techniques have provided information of strategic importance. The assessment of nuclear capability of Pakistan and situation on northern border, the importance of Gwadar port, Ukraine and Gaza wars, and many others have clearly demonstrated use of remote sensing data. In most space-faring nations, the use of space technology started with defence and military use, unlike India, who started with developing civilian applications first.

6) We are hearing quite a bit about agrometeorology and the farmers getting benefited out of that. Can we have more information on that please?

The agrometeorological advisory service is provided based on multi-model ensemble district/block level forecast on rainfall, maximum and minimum temperature, total cloud cover, surface relative humidity and wind for next five days. The accuracy of the forecast is 70-75 %. This advisory is provided twice a week to all districts of the country. State and national level composite advisories are also issued. According to the National Council for Applied Economic Research, the adaptation of all agricultural practices based on weather has a significant impact on the income of farmers and the estimated income gain per household is Rs 12,500. The important aspect is along with advisories, an effective mechanism of dissemination of these services to farmers has also been set up. Industries and foundations are also involved in dissemination and bringing awareness to farmers. There is a strong need to further strengthen this mechanism, so that each farmer of the country is benefited and their income enhances.

“The most important aspects of the geospatial policy are, one to set up a national framework for providing services to citizens, industry, government, non-government, academia; two, to ensure easy accessibility of geospatial data generated through public funds to all stakeholders and three, to promote geospatial industry to herald a digital economy in the country.”

7) What are the salient features of India's Geospatial policy?

The most important aspects of the geospatial policy are, one to set up a national framework for providing services to citizens, industry, government, non-government, academia; two, to ensure easy accessibility of geospatial data generated through public funds to all stakeholders and three, to promote geospatial industry to herald a digital economy in the country. It has clearly identified goals to be achieved by 2035, viz. high-



Dr. Shailesh Nayak, Director, NIAS, Bengaluru with Dr. S. Somanath, Chairman, ISRO and Dr. K. Sivan, former Chairma, ISRO.

resolution topographic data, digital elevation model, bathymetric data, sub-surface infrastructure and digital twins for cities and towns by different institutions. The role of geospatial data in achieving sustainable development goals (SDGs), 'Atmanirbhar Bharat' and in many government schemes has been emphasised. Another important aspect is role of government institutions such as the Survey of India, National Remote Sensing Centre, Forest Survey of India, Geological Survey of India, National Bureau of Soil Survey and Land use Planning, Census Commissioner, Bhaskaracharya National Institute of Space Applications and Geoinformatics, Line Ministries, and private sector have been identified and responsibilities defined.

The constitution of the apex body, Geospatial Data Promotion and Development Committee, has been tasked with to oversee the development geospatial ecosystem in the country and provide necessary guidelines and directions. In short, this visionary step will allow India to improve socio-economic conditions of communities, achieve SDGs and moved towards becoming a developed nation, soon.

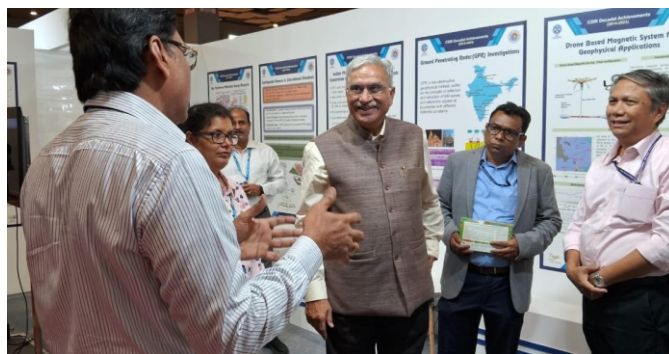
8) What kind of role can remote sensing technology and its applications play to speed up and sustain the growth of India?

The remote sensing technology has tremendously helped to provide data, information, knowledge and services on weather, natural resources, environment and infrastructure and facilitate in decision making. The first use of the satellite images from TIROS-8 was initiated by the India Meteorological Department (IMD) in 1965 to study monsoon and cyclones.

Today, the satellite data are integral part of weather forecasting and various services to about 30 sectors in the country. Large amount of satellite data is assimilated in weather, cyclone, thunderstorm forecasting and models. INSAT data provided every 15 minutes, is the backbone of IMD today. The other applications include implementation of Coastal Regulation Zone (CRZ) Notification where it is mandatory to use satellite data for delineation of reliable and accurate high-water line which is designated as construction setback line. India is one of the few countries where coastal management plans and vulnerability assessment are made for the entire country's coastline.

These maps are used by the State and Central governments to regulate developmental activities and conserve ecosystems. The web-enabled Water Resources Information system (India-WRIS) is providing hydrological information to all stakeholders in a standardised format. The location of potential groundwater zones, water harvesting structures, inventory of wetlands, water use for irrigation, etc. depends on analysis of variety of satellite data. The first-time glacial inventory of the Indian Himalaya was carried out using satellite data. The multi-date satellite data afforded changes in glaciers mass, indicating global warming and monitoring of glacial lakes to identify potential lake which can burst and cause downstream flooding as recently witnessed in Sikkim.

Forest Survey of India assesses the condition of forests using satellite data since 1987 and provides wealth of information on forest types, density and changes in area as well as carbon stock stored. The nation-wide data base on biodiversity provides



assessment of biological richness of Indian forests. The information on soil and land use, urban sprawl, topography, digital elevation model, archaeological applications, etc. are being routine provided. The contribution of remote sensing to the agriculture sector has been immense, which supports about 44 % of population and contributes about 17 % to GDP.

9) What is your advice to the youth (Engineering and Science graduate who aspire for a career / job in the Space Industry? What kind of qualities and skills should they cultivate to excel in the Space Industry.?

“Expertise in one’s own field, knowledge & interest in other fields, self motivation and dedication are required to succeed in the space industry”

My advice is, in whichever field you are, either engineering or science, you should strive for excellence. Space industry comprises launch vehicles, satellites, ground facilities and applications. All these areas are multidisciplinary and hence you will be able to find a role depending on your expertise. You have to be creative as new approaches are to be found for innovative solutions to provide timely, reliable and accurate information, at the local, regional, national and global scales in a standardised format. You should be able to work in a team for accomplishing specific tasks and should have leadership qualities to lead innovations. The third aspect is to develop ability to learn to work in a multidisciplinary environment as you will have to interact with people having expertise in other fields than your own. Lastly, you need passion, self-motivation and dedication to succeed in the space

Top 15 Remote Sensing Companies in World

(An Illustrative List)

1. Maxar Technologies - USA : Specializes in earth intelligence and space infrastructure, providing high-resolution satellite imagery, geospatial data, and analytics. It also supports various space missions with its satellite manufacturing and robotics services.

2. Planet Labs - USA : Known for its fleet of small Earth-imaging satellites that capture daily images of the entire planet. It provides geospatial data and analytics for applications in agriculture, forestry, and environmental monitoring.

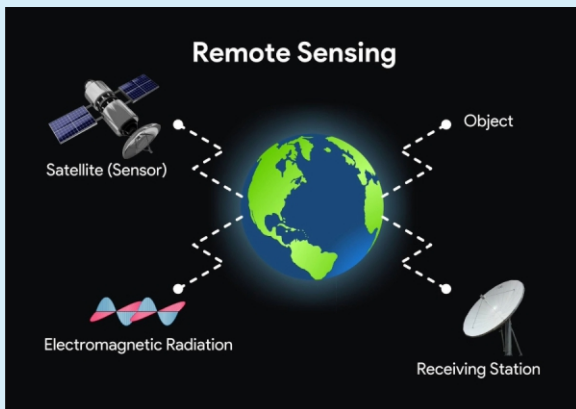
3. Airbus Defence and Space - France : Airbus offers a wide range of satellite-based remote sensing services, including high-resolution imagery, radar data, and geospatial intelligence. They serve various sectors such as defense, agriculture, and disaster management.

4. ESRI – USA : ESRI is a leading provider of Geographic Information System (GIS) software. While not a satellite operator, ESRI's ArcGIS platform is widely used for processing, analyzing, and visualizing remote sensing data.

5. ICEYE - Finland : Specializes in synthetic aperture radar (SAR) satellite imaging, providing high-resolution data for monitoring natural disasters, maritime tracking, and environmental changes.

6. Capella Space - USA : A constellation of SAR satellites that deliver high-resolution, all-weather, and day-night imaging services for defense, intelligence, and commercial applications.

7. GHGSat - Canada : Focuses on monitoring greenhouse gas emissions from space using its proprietary satellites, providing valuable data for environmental monitoring and regulatory compliance.



8. BlackSky Global - USA : Provides real-time geospatial intelligence and monitoring services by combining satellite imagery with AI and cloud computing. It serves sectors like defense, infrastructure, and humanitarian aid.

9. UrtheCast - Canada : Offers high-definition video and imagery from its Earth Observation (EO) platforms. The company provides geospatial data for agriculture, forestry, and infrastructure management.

10. SATPALDA - India : Offers geospatial services including satellite imagery, GIS services, and remote sensing data for urban planning, agriculture, and disaster management.

11. SpaceView - China : Provides high-resolution optical remote sensing data and imagery, focusing on urban planning, land use, and environmental monitoring.

12. European Space Imaging - Germany : Provides high-resolution satellite imagery and geospatial solutions for sectors like defense, security, environmental monitoring, and urban planning.

13. Head Aerospace - China : Provides remote sensing data and satellite-based services, including high-resolution optical and radar imagery, for various commercial and governmental applications.

14. Pixxel - India : Focuses on building a constellation of hyperspectral imaging satellites that provide detailed data for environmental monitoring, agriculture, and resource management.

15. Satellogic - Argentina : Operates a fleet of Earth observation satellites, offering high-resolution imagery and analytics for sectors like agriculture, forestry, and infrastructure.

Glimpses of Explore The Space



Prof. V. Sumittra Devi, CAO, ETS presents STEM & Space poster to Mr. Prakasha Rao P.J.V.K.S., Outstanding Scientist & Director - Space Infrastructure Programme Office, ISRO (Retd.) at the ETS - Albert Einstein STEM & Space Science Lab, Chennai on 20.10.2023



Mr. D. V. Venkatagiri, CEO, ETS welcoming Mr. S. Somanath, Chairman, ISRO at the ETS stall at Bengaluru Space Expo - September 2022



ETS was conferred the title "ISRO - Registered Space Tutor" by Mr. N. Sudheer Kumar, Director, CBPO, Dr. A.S. Kiran Kumar, Former Chairman & Mr. Shanthanu Bhatawdekar, Scientific Secretary ISRO at ISRO Headquarters, Bengaluru - August 2022



Explore The Space participating at Space Tech Expo, Long Beach, California, USA in May 2022



"Joy of Science", a fun-filled workshop, RKM Hr. Sec. School (South), Chennai - February 2019



Subhajit Maity, Accountable Manager, Thakur Institute of Aviation Technology, Mumbai with Jaydeep Mukherjee, PhD., NASA Scientist, Florida, USA - December 2023

"Explore The Space" is an educational NGO, registered in NITI Aayog, Government of India and works to promote awareness on Space Sciences and Technology among Schools and Colleges through seminars, quiz programmes, study tours and research. ETS connects Institutions and Industry through its programmes.

Established in 2010, The Global Trade Driver (TGTD), is a niche facilitator of Businesses connecting Indian Companies within the domestic market and International Markets, particularly USA through Business Delegations, B2B meetings, Strategic Consultancy, Advocacy and other programmes.

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