Research Paper

Volume : 4 | Issue : 12 | December 2015 • ISSN No 2277 - 8179

Space Resources and Science Education

Science

KEYWORDS : Science Education, Space resources, Space observatory, Developmental communication

Dr. R.S.Mani

Professor of Education, Department of Education, Faculty of Education and Psychology, The Maharaja Sayajirao University of Baroda, Vadodara-390 002,Gujarat, India

ABSTRACT

The interest in space resources and the space sciences have increased in the twenty first century to create more institutions for study of the space phenomenon and create educational institutions at various levels to prepare scientists of the future. In this article the author attempts to provide some sites and resources for navigation into the space for the understanding of science focusing on the space observatories and their development in India. India is a developing country coming under the middle human development index in the United Nations (Human development index 2005). The later Human development index developed in 2011 shows a marginal increment in the progress of India along with the other developing countries. However, the interest in space and education has been observed since ancient periods (for example, Arya Bhatta). The scientific progress in the space sciences has been steady, progressive, consistent and developmental in character with contemporary thought and action in modern scientific developments that has created a place for India in the developed countries list with regard to the space sciences. Space sciences need to be integrated with science education. The space sciences has remained for longer period as the research fields of few interested and growing scientists and technologists.

The interest in space resources and the space sciences have increased in the twentyfirst century to create more institutions for the study of the space phenomenon and create educational institutions at various levels to prepare scientists of the future. In this article an attempt is made to provide some sites and resources for navigation into the space for the understanding of science focusing on the space observatories and their development in India. India is a developing country coming under middle human development index in the United Nations listing (HDI). The HDI for India in 2011 and 2014 is showing a marginal increment in the social and economic progress. Space education has a ancient history in India but in the recent period it shows a steady, progressive, consistent and developmental character with contemporary thought and action in modern scientific development. Science education need to be integrated with the space sciences since space sciences has remained for longer periods in research fields of few interested and growing scientists and technologists in India.

The creation of ISRO, Bangalore has given impetus to space science for the concerted growth and continued planning of space exploration systematically in the relevant areas of knowledge.

The university education in space has gained grounds in the past one century for the growth in networked industries and targeted projects for national development. The school education is still in the awareness stage of the development. Certain areas have gained more ground and reflection due to the continued and sustained interests of the scientists in India.

Space Based Science and Technology Resources

Major developments in Space and Communication in India:
http://www.communication policy of india,2000

CASE: Indian Consortium of Research in Education (I-CORE), Department of Education, The Maharaja Sayajirao University of Baroda, Vadodara.Its functions are:

1. improving effectiveness of teaching-learning both in synchronous and asynchronous modes.
2. Promotion of collaboration and research in education in India and abroad and utilizing their findings.
3. Providing survey, statistical analysis and evaluation expertise and services.
4. Publication and dissemination through various modes (including tale information and broadcasting services through internet).

A C.D. on introduction to Universe-2012 Jayswal,A and Mani,R.S. Effectiveness of Audio-visual aids on achievement in Basic concept of Universe,I(v), Nov-Dec,2012,295-302,http://www.edupublication.com

http://www.enwikipedia.org/wiki/communication_in_india Enlisting and profiling space scientists and their innovations and its applications in India such as Space summit, Indian Science congress, Bangalore University, Bangalore and ISRO.

Goel,D.R.1984 Educational Television in India organization and utilization, Ph.D.,CASE,Vadodara: The Maharaja Sayajirao University of Baroda

Hiryur,S 1995 A study of the production and utilization of countrywide classroom programmes, Ph.D., CASE,Vadodara:

The Maharaja Sayajirao University of Baroda.

Introduction to Space Observatory: The Atacama Large Millimeter-sub millimeter Array (ALMA) in Chile is a joint venture of North American, European and Asian agencies. This is one of the largest space observatories. Gianni Marconi, an astronomer with ALMA says that 'it is possible to collect and refract the light emitted from a heavenly body, galaxy or star without any interference. As there is no humidity, ALMA's 66 antennas, ranging in diameter from 7 to 12 meters can glimpse at things in the darkest and remotest regions of the universe.

India has few solar observatories. This area has been of interest for many centuries in India for scientists, technologists and Kings such as Raja Sway Jai Singh of Jaipur.The instruments developed were accurate in observation but people lost the skills of observation in use of instruments.Twentyfirst century has observed a

change in the instrumentation, observation and analysis for satellites are used for these purposes. The studies are astronomy took strides in Benares Hindu University, Varanasi, and the Pune university,Pune, Maharashtra.These centres created knowledge through observation,analysis and theorization of the astronomical bodies, its movement and stellar phenomenon(Prof. Chandrashekar,USA-Chandra phenomenon,Black hole,Prof.Jayant Narlikar,etc). In this modern period, for astronomy to grow on and become stronger, a few good space observatories are needed of higher altitude and range. The telescopes with higher capacities to observe and record helps in clear interpretation in a scientific way.

A network that could link with international observations in observatories such as largest space observatory at Atakama, Ari-

zona University, Arizona.

Table No.1. Shows the space observatories in India. It may be observed that they were created long back and most of the them are solar observatories. Other types of observatories are focused in the recent period. The latest space observatory being Astrosat.

Table No.1. Showing Space observatories in India.

1. Gauribidanur Radio observatory,Gauribidanur, Karnataka state(Estb. 1976)
2. Giant Meterwave Radio Telescope (GMRT),Pune, Maharashtra(Estb.1995)
3. Kodaikanal Solar observatory,Palani,Tamilnadu,(Estb.1899).
4. Jantar Mantar,Jaipur, Rajasthan
5. Mount Abu Infra Red Observatory, Mount Abu,Rajasthan (Estb.1995).
6. Ooty Radio Telescope,Ooty,Tamilnadu (Estb.1970).
7. Panchmarhi Array of Cerenkov Telescope (PACT),Panchmarhi, Madhya Pradesh
8. Udaipur Solar Observatory, Udaipur, Rajasthan.

Some scientific institutions with sustained interest in various areas of science including Space education:

Indian Consortium of Research in Education (I-CORE), Vadodara: The M.S.University of Baroda.

Mani, R.S. 2014 Internet Access and Broadcasting in India, Education and Development, III (1), Jan-Dec 2014,ISSN No. 2320-3684, 296-311

Mapping of Scientific institutions of importance such as IISc, Bangalore, ISRO, Vikram Sarabhai space centre, DECU, SAC, ISRO, Ahmadabad and scientific institutions in United States of America such as NASA

National Remote Sensing Agency (NRSA) Estb.1974: It is distributed between Balanagar, Hyderabad (Data archival, processing, analysis, and dissemination, training facility) Hyderabad Airport (housing two aircrafts of NRSA) Shadnagar (Earth station-data reception facility) and

Dehradun (Indian Institute of Remote Sensing_NRSA's training facility). Functions: 1. Resource mapping using IRS satellite and high resolution cartography 2. Built a vibrant remote sensing programmed for civilian applications.3.It has an ISO 9001:2000 certification. Achievements:

1. The drinking water potential zone mapping has already covered 8 states of the country. With the help of ground water maps that were provided, over 67,000 wells were dug, registering a success rate of 90 percent.

NRSA covered Tsunami of Dec 26th 2004 and assessed the damage and also carried out risk analysis.

Drought (Drought bulletins for 14 states at district level and detailed assessment for Andhrapradesh and Karnataka).

Bio-diversity characterization,potential fishing zone mapping, integrated mission for sustainable development and IGBP.

Portals and Web based Resources: National Centre for Science Information (NCSI), IISc, Bangalore using Scigate.http://www.etd@IISc (Electronic Theses and Dissertations of IISc), http://www.e-JIS (Electronic Journal Information Service).

Prasar Bharati Act 1990

Agarkar,S.,Limaye,S and Pertzborn,R 2006 Proceedings of Space based resources to enhance science education in India, New Delhi: Indo-US Science and Technology Forum.

Indian Space Research Organization (ISRO) is the major space agency of the Government of India head quarter being Bengaluru.Its vision is to harness space technology for national development, while pursuing space science research and planetary exploration. Indian National Committee for Space Research (INCOSPAR) established in 1962 by Dr.Vikram Sarabhai and the vision of Prime Minister Pandit Jawaharlal Nehru. In the year 1969 ISRO was formed. ISRO built its first satellite, Aryabhata that was launched by Soviet Union on April 19th 1975. In the year 1980, Rohini became the first satellite to be placed in orbit by an Indian made launch vehicle, SLV-3.

India entered the space research and development late in comparison to other countries but it took fast strides to build the space infrastructure.

ISRO developed two other rockets: the polar satellite launch vehicle (PSLV) for launching satellites into polar orbits and the geosynchronous satellite launch vehicle (GSLV).

The Space Application Centre (SAC), Ahmedabad: It works under the umbrella of ISRO. It is one of the major centres that is engaged in the research, development and demonstration of applicationsof space technology in the field of telecommunication, remote sensing, meteorology and satellite navigation (Sat Nav). This includes research and development of onboard systems, ground systems and end user equipment hardware and software. Some of the achievements of the space application centre include development of communication and meteorological payloads for INSAT satellites, optical and microwave payloads for IRS satellites. SAC provides its infrastructure to conduct training courses to the students of the Centre for Space Science and Technology Education in Asia and The Pacific (CSSTEAP).

SAC has three campuses, two of which are located at Ahmadabad and one at Delhi. (www.isro.com)

ISRO, Bangalore with the Bangalore University organized the Indian Science Congress at Bangalore in the year 2003 A.D.The discussion in the Indian Science Congress was called as Space Summit for the discussion was on the present and future of space and space based resources in India. It is summarized in the following words.ISRO-Bangalore University, Indian Science Congress: Dr.M.G.Chandrasekhar of World space highlighted how audio broadcast via satellites-AFRISTAR and ASIASTAR are helping in providing vital information to the remotest corners in Africa and Asia. He highlighted that information related to social awareness on different aspects such as AIDS has become possible.

Indian classical music has become popular in other countries mainly because of the CD quality broadcast through World Space receivers, he added, Mr. Sergio Camacho, of the Office of the Outer Space Affairs, Vienna, highlighted the actions taken in implementing the recommendations of the

UNISPACE-III held in Vienna in July 1999. He said that out of the 33 recommendations, 11 are being

Implemented with several countries taking a lead and many other countries participating in their implementation. He said that India is leading the implementation of the recommendation on empowering countries in the use of space for natural resources monitoring.

Chairman of ISRO, Dr.K.Kasturirangan who had earlier welcomed the delegates to the Space Summit, presented his paper

Volume : 4 | Issue : 12 | December 2015 • ISSN No 2277 - 8179

"Space Applications for Sustainable Development-The vision for the Future". His lecture described the various stages of evolution of the Indian space programmed- the initiation phase of the 70's , experimental phase of 80's, operational phase of the 90's and expansion phase of the 2000's.He highlighted the user involvement in the Indian Space programme. Further, he provided the vision for Indian space programme for the future, especially, highlighting the advanced communication satellites for the INSAT-5, INSAT-6 and INSAT-7 series, providing larger bandwidth upto 50 GHz by 2025,

DTH and theme-specific satellites like EDUSAT and HEALTHSAT.

Similarly, in the area of remote sensing, he said that theme specific satellites like AGRISAT using microwave sensors, disaster management satellites (DM-SAT), etc are being proposed. He said that mapping, integration, information systems and knowledge extraction through the National Spatial Data Infrastructure are being evolved. In the launch vehicle technology, he said that launch vehicles for post GSLV-MKIII, beyond 2010 are also being studied using reusable launch vehicles, Air breathing technologies, etc. He also elaborated on the institutionalization mechanism for the Indian space programmed among ISRO,industries, academia and users of space.He also said that India would like to become a major player in the commercial space market in providing space services. In the afternoon, there was a demonstration of Space-Bridge demonstration on Telemedicine conducted by Dr. Devi Shetty and Andhra Pradesh net for developmental communication by the ISRO scientists.

The Space summit concluded with a Panel discussion on "Space Technology and Applications-Perspectives for the Future".This Space summit meet in the Indian Science Congress gave an opportunity to think on the proposals and plans for future development in space science. For the first time, the space sciences have given more importance to the developmental communication (theme based satellites in space) in Education, Health, Communication, and Agriculture.

The Developmental and Communication Unit, ISRO, Ahmadabad had a project to beam the signals to Uttarpradesh in the Elementary classrooms and study its impact. It was a successful project in terms of impact, coverage and use.

The experiments with Audio broadcast in Delhi and Madhya Pradesh was successful in bringing about changes in the achievement of the elementary students.Andhra Pradesh has implemented audio programme in the elementary level.It is a novel experience for the children.

The impact of these experiments needs to be studied together to get the total picture of development in the use of audio programmers.

In the year 1996, a satellite borne Indian X-ray Astronomy Experiment(IXAE) was launched and it was a success of the ISRO.It encouraged ISRO to develop full fledged astronomy satellite namely Astrosat(ASTROSAT) in the year 2004.It has a mission length of 5 years and a mass of 1,650Kg(3,640lb).Orbit height 650Km.Orbit period 1h38m. It is multi wave length satellite. It carries on board instruments such an Ultra Violet imaging telescope, Soft X-ray telescope, X-ray timing and low-resolution spectral studies, Hard X-ray imager.

India has made good stride in space observatory in the recent period by creating ASTROSAT a dedicated multi-wave length space observatory. It was launched on a PSLV-XL on 28th September 2015. In this satellite a number of astronomy research institutions in India and abroad are involved to build jointly instruments for the satellite. The Participants of ASTROSAT **are: ISRO, Bangalore, TIFR, Mumbai,**
Indian Institute of Astrophysics,Bangalore,Raman Research Institute,Bangalore, Inter-University Centre for Astronomy and Astrophysics,Pune,BARC,Mumbai, Bose National Centre for Basic Sciences, Kolkata, Canadian Space Agency, University of Leicester.

Astrosat helps in the studies of astrophysical objects ranging from nearby solar system objects to distant stars and objects at cosmological distances; timing studies of variables ranging from pulsations of hot white dwarfs to those of active galactic nuclei are possible with Astrosat with time scales ranging from milliseconds to days.

Mission of Astrosat: It is proposed as a general purpose observatory, with main scientific focus on: Simultaneous multi-wave length monitoring of intensity variations in a broad range of cosmic sources. Monitoring the X-ray sky for new transients, Sky surveys in the hard X-ray and UV bands, Broadband spectroscopic studies of X-ray binaries, AGN, SNRs, Clusters of Galaxies, and stellar coronae. Studies of periodic and non periodic variability of X-ray sources.

Astrosat performs multi-wavelength observations covering spectral bands from radio, optical, IR, UV, and X-ray wave lengths. Both individual studies of specific sources of interest and surveys are undertaken. While radio, optical and IR observations would be co-ordinated through ground-based telescopes, the higher energy regions, i.e.X-ray and visible wave length , would be covered by the dedicated satellite –borne instrumentation of Astrosat.

Payloads: The scientific payload has a mass of 1513kg and contains six instruments. They are:

- Ultraviolet Imaging Telescope(UVIT)
- The Soft X-ray Imaging Telescope(SXT)
- The LAXPC instrument covers X-ray timing and low resolution spectral studies over a broad energy band (3-80keV).
- The Cadmium Zinc Telluride Imager(CZTI)
- The Scanning Sky Monitor(SSM)
- The Charged Particle Monitor(CPM)

The ground command and control centre for Astrosat will be ISRO Telemetry, Tracking andCommandNetwork(ISTRAC),Bangalore ,India.The satellite is capable of gathering 420 gigabits of data every day that can be downloaded in 10 to 11 orbits visible at Tracking and Data receiving center of ISRO in Bangalore.

The successful explorations of India such as Chandrayan, Exploration in Mars have provided the necessary capacity to build, develop and use satellites and space vehicles for Indian purposes of capacity building. The data obtained from these explorations on Moon, Mars on the minerals, water, and other important features could be compared with the explorations in the Antarctic expeditions, Exploration of NASA, USA and Japan in investigating into the space for looking into black holes, understanding of the nature of sub atomic particles such as neutrinos, understanding the solar system for energy

Management, finding more means of renewable sources of energy(solar energy related). The reflected light on the moon could be studies for the utilization of the energy for developmental puposes. More empirical theories may be developed with regard to the rays emanating from several celestial sources that could throw light on the origin and development of the celestial bodies, their movement and the Milky Way.

REFERENCE

http://en.wikipedia.org/Astrosat | Retrieved on 11/19/2015 | http://www.en.wikipedia.org/wiki/list_of_observatories. | http://www.en.wikipedia.org/wiki/observatory | Jayswal,A and Mani,R.S. Effectiveness of audio-visual aids on achievement in basic concept of Universe,E-Reflection,I(V),Nov-Dec 2012,295-302,ISSN No.2278-120X | | | | | Mani ,R.S. Science education broadcasting in India, Classrooms of the Future-Interplay of Educational Psychology and Educational Technology,Guntur, Andhrapradesh:Department of Education,Acharya Nagarjuna University,ISBN No.978-93-85108-13-6 | Presidential Address by Dr. A.P.J. Abdul Kalam on Vision for the global space community prosperous happy and secure planet Earth,90th Indian Science Congress at Bangalore University and ISRO,Jan 4,2003. |