SPACE FOR SUSTAINABLE DEVELOPMENT

POTENTIAL
Sustainable Development

Sustainable development meets the needs of the present without sacrificing the ability of the future generations to meet their own needs.
The **SDGoals** are ...

- A set of 17 goals for the world’s future, through 2030
- Backed up by a set of 169 detailed Targets
- Agreed to by nearly all the world’s nations, on 25 Sept 2015
Each goal is important in itself --- Poverty Food Health Education etc.
SD Goals

1. No poverty  
2. Zero Hunger  
3. Good Health  
4. Quality Education  
5. Gender Equality  
6. Clean Water and Sanitation  
7. Affordable Clean Energy  
8. Decent Work and Eco. Growth  
9. Industry, Innovation, Infrastructure  
10. Reduced Inequalities  
11. Sustainable Cities  
12. Respectable Production and Consumption  
13. Climate Action  
14. Life Below Water  
15. Life above land  
16. Peace justice and Inclusive Societies  
17. Partnerships for SD.
This Needs

- Reaching Out to People.
- Provide Information and Training
- Provide services like Health, Education
- Organise Campaigns, Monitoring and Field Support.
- Study of Resource availability and Consumption Pattern. E.g. Land and Water resources.
- Micro level planning with people.
- Education in Sustainable Practices.
- Peoples Involvement and Motivation.
- Can Space help in these areas ????
Space Strengths - communications

- Reach / Access to large number of Remote locations simultaneously.
- Multiplier effect.
- Distribute learning Materials
- Interact
- Conduct **Training Programs** of Teachers, Health workers, Women Workers, Local Officials.
- Trainings can be in Education, Health Nurses, Vaccination, Forestry, Child –Welfare, Governance Skill-development etc.. *(All areas of SD)*
Space strengths – commu. Contd...

- Trainings can be as frequent as required. Neither the participants nor the Resource persons have to travel long distances.
- Action Plans can be given and progress Monitored. These could be weekly fortnightly or even daily.
- Feed back can be obtained from the field and corrective measures taken.
- Through Two-Way systems Nurses and Doctors advice can be obtained.
Space strengths Commu. Contd..

- Space can help you to reach out to large number of workers/people in the field simultaneously with message and materials.
- It is a very effective tool for implementing Campaigns.
Space Strengths Earth Obs.

- Provides Synoptic of different resolutions data of area under consideration.
- It can provide longitudinal data over a period of time.
- It can provide repeated data over the same area very frequently.
- This data can be used to prepare **local development plans** like water harvesting structures, changing Crop pattern to more sustainable practices. Land use planning etc...
Earth Obs.. Contd...

- The data can be used for analysis of resource exploitation - Exploitation of forest, water and land resources.
- Data can be used for better weather forecasting, Disaster/cyclone forecasting and preparedness.
- Infrastructure planning – where to locate certain facilities etc...
- It is most useful for national level crop forecasting, Forestry planning, Infrastructure planning etc...
Space Applications for Development
The Indian Approach

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Space Program
Aim 1

Self Reliance in establishing Space Systems for the country.

- Develop in-house design, manufacture and Operational capabilities for Launch Vehicles, Satellites, Ground Systems including Hardware and Software.
- It therefore worked towards development of Launch vehicles like PSLV GSLV etc. Satellites like INSAT, IRS and several others.
ISRO Satellites
The Indian National Satellite (INSAT) system is one of the largest domestic communication satellite systems in Asia-Pacific region with nine operational communication satellites placed in Geo-stationary orbit. Established in 1983 with commissioning of INSAT-1B, it initiated a major revolution in India’s communications sector and sustained the same later.

Currently operational communication satellites are INSAT-3A, INSAT-3C, INSAT-3E, INSAT-4A, INSAT-4B, INSAT-4CR, GSAT-8, GSAT-10 and GSAT-12.
Earth Observation Satellites

Starting with IRS-1A in 1988, ISRO has launched many operational remote sensing satellites. Today, India has one of the largest constellations of remote sensing satellites in operation.

Currently, eleven operational satellites are in orbit – RESOURCESAT-1 and 2, CARTOSAT-1, 2, 2A, 2B, RISAT-1 and 2, OCEANSAT-2, Megha-Tropiques and SARAL.
Applications – for the betterment of society has been the driving force for the space program. It has been an article of faith since its inception.

There are some who question the relevance of space activity in a developing nation. To us there is no ambiguity of purpose.....We are convinced that if we have to play a meaningful role nationally and in the comity of nations, we must be second to none in the applications of advanced technologies to the real problems of man and society... Vikram Sarabhai.
 Satellite Applications

• The Indian Space programme has the primary objective of developing space technology and application programmes to meet the developmental needs of the country

• Satellite Communication
  • Tele-vision, Tele-education, Tele-medicine etc

• Satellite Navigation
  • GPS Aided Geo Augmented Navigation (GAGAN) system.
  • Indian Regional Navigation Satellite System (IRNS)

• Earth Observation
  • Natural Resources Management System (NNRMS)

• Disaster Management
  • Disaster Management Support (DMS) systems
Joint Experimentation

- **End to End Approach:**
  - Space agency does not limit its role to just providing the Space infrastructure.
  - It gets involved in each and every step of using space based systems from data/information collection, its dissemination, processing and end utilization.
  - The effectiveness of the application is jointly evaluated for on going updating and improvement and results presented to decision makers.
BROADCASTING - TYPICAL CONFIGURATION

SYSTEMS CONFIGURATION

ANTENNA

EARTH STATION

TV STUDIO

TRANSMISSION END

INSAT

MULTIPLE RECEIVING TERMINALS

DRS Rx

TV

RECEIVE ONLY TERMINALS

RECEIVING END

DRS Rx

TV

RECEIVE ONLY TERMINALS
Instructional Television

- SITE – Satellite Instructional Television Experiment (1975-76)
- Space Segment – Agreement with NASA
- Implementation Partners – Min.of I&B for broadcasting
  - Min of Education/NCERT for school programs
Instructional TV contd...

- ISRO took upon itself – Design of educational TV Studios
- Development of Ground hardware for Earth Stations, Receive terminals
- Installation of receive terminals in Villages and their maintenance
- CET of NCERT was responsible for school programs
- Doordarshan of I&B min was responsible for rural development programs for adults.
Instructional TV

- ISRO also took upon itself the production of Science programs for school children.
- ISRO also took up the responsibility of Development TV program Production and operations of a TV station.
- ISRO took on the job of evaluating the impact of the adult programs whereas the school programs were evaluated by the NCERT.
Instructional TV Contd..

- It is clear that the space agency played a role much beyond just provision of space infrastructure.
- It was involved in every step of implementation of the experiment with the user agencies.
- On completion of SITE- ISRO was approached by UGC for establishing a network for University level education. ISRO again was involved in setting up the complete network funded by the UGC.
Similarly when IGNOU approached ISRO all cooperation was extended to establish a network for Open and Distance learning.

To meet the demand of the Education sector ISRO went on to launch a dedicated satellite EDUSAT and provided all inputs and support in establishing broadcasting and interactive networks for Educational institutes of all levels.
Growth of satellite based educational TV

- **Experiment**
  - SITE Technology Tr.

- **Partner**
  - CET/NCERT
  - UGC
  - IGNOU
  - All Univ.

- **Operational**
  - EDUSAT
  - Off Line
  - Sakshat
  - NPTEL

- **Sector**
  - Primary
  - Graduate
  - ODL
  - All Sectors.
  - School
  - Engineering
Educational Broadcasting in India

**Primary**
- SIET in Regional Language
- Gyandarshan Channel

**Secondary**
- Curriculum based Broadcasts in Hindi/English
- Gyandarshan Channel

**Higher Education**
- UGC – EMRC/CEC/AVRC in Hindi/English
- Gyandarshan Channel

**Distance Education**
- IGNOU - Curriculum based Broadcasts in Hindi/English
- Private Channels Like Zee Education
- State Open Universities

**Non-Formal Education**
- General: DD – Health/Agriculture/Women/Children
Educational TV

- The all round expansion of satellite based networks for Education first happened due to the interest shown by the education department as space helped in reaching out to large numbers with uniform high quality teaching/learning material.

- ISRO responded by fully supporting in setting up ground networks, training and in finally setting up a dedicated satellite EDUSAT.
Development TV for Rural Audiences

- The partner agency for this was Doordarshan of Min. of I&B.
- As mentioned earlier ISRO was involved in defining the studio configurations, receive terminal installation and maintenance and Impact evaluation.
- ISRO also took upon itself the task of running a rural TV station at Pij from 1975 to 1989. This included program production, Transmission, feedback, Evaluation etc...
This long term intensive experiment resulted in developing new techniques for rural adult communications.

The techniques generated Field-based, Audience Oriented, Participative Upward Communications models. Quite in contrast to the conventional models.

This project received the 1985 IPDC-UNESCO prize for Development Communication.
Commenting on the work of Pij Seminar Dec. 1978 issue wrote:

“The experience at Pij..comes with a message to the Indian scene. ..The attempt to use TV in a vigilante role guarding the rights of the people .......has at last proved that it is possible for TV to fulfill its role in our conditions... this could have acted as a catalyst for future programming.....The experience must be disseminated more widely.”
Training Programs were conducted for Doordarshan staff as an exercise in Technology Transfer.

However the priorities of an operational large broadcasting organisation were different and the rich experience of the Pij experiment could not be institutionalised.

The National network had a large number of local stations where the Pij experience could have been institutionalised. This did not happen.
Telemedicine

- ISRO established networks to connect Rural/Remote Hospitals to Urban Super Specialty Hospitals.
- Existing telemedicine software of private providers was used.
- Initial experimentation with Narayan Hridyalaya and Karuna Trust. Found very useful.
- Networks expanded to several remote areas like Andaman Nicobar Islands, Leh, J&K, NE states etc. Mobile vans developed.
- Software was good for tertiary care. Not applicable to Primary care.
- ISRO did not get involved in relevant software development. Govt. department did not institutionalise. Private hospitals adapted.
SATCOM BASED
TELEMEDICINE CONNECTIVITY

Patient End

Specialist Doctor End

Tx/Rx

IP Interface
Mobile Tele-hospital
Telemedicine

- This was a very relevant application.
- ISRO did not get involved in getting software developed. Only used available software.
- The application was adopted by Private hospitals, rural/remote hospitals, NGOs.
- Telemedicine Society of India and other professional medical bodies used it for CMEs.
- Government health department did not institutionalise it.
Village Resource Center

- Village Resource Centers are established in villages jointly with the local NGOs.
- This serves as a single window delivery mechanism for space based services like Tele-education, Tele-medicine and advisories on agriculture, fisheries, livestock Management, Training in skill improvement, livelihood, weather information and e-governance services.
- About 400 such centers were established and serviced by the space agency.
Crop Forecasting

- The ISRO jointly with the IARI (India Agriculture Research Institute) undertook the Experiment called CAPE (Crop Acerage and Production Estimation) in Two districts.
- This was expanded to FASAL (Forecasting Agriculture output using Space, Agrometerology and Landbased observations)
- The procedures evolved were continuously revised and improved upon the accuracy and timeliness of the Crop Estimates.
Crop Forecasting contd..

- Over the years this led to establishment of National Crop Forecasting Center.
- So we clearly see the stages of experimentation CAPE, Techniques development and transfer under FASAL and finally Institutionalisation as a National Crop Forecast Center under the user ministry.
National Natural Resources Management System

- Presentation on need for National Natural Resources Management System made to the Planning commission.
- Fifty Nine experiments identified.
- Results presented to high level decision-makers.
- NNRMS Established under Planning Commission
- Eight Steering committees set up under user Chairmanship.
NNRMS contd

- 160 projects formulated.
- ISRO Established RSSCs and NESAC.
- States Established State Remote sensing centers.
- An overall system for providing space inputs for all user departments at the state/local level set up.
IMSD

- A few districts were selected by ISRO for study during the drought of 1987-88.
- Watershed characterisation was carried out in terms of Land cover, drainage, geomorphology, soil
- Action Plans were prepared for
  - construction of rain water harvesting structures
  - implementation of soil conservation measure
  - identification of areas suitable for afforestation, agro-forestry, agro-horticulture and fuel wood as well as fodder development
  - evolution of appropriate methods for sand-dune stabilisation
  - identification of appropriate locale-specific agricultural practices for maximising food grain output and protection of natural environment
IMSD Contd..

- The local administrative machinery was involved in this processes
- Watershed identification was done by the District Collector / Project Director, DRDA.
- The suggested action plans were validated in the field and suitably modified by local officials.
- Implementation of action plans was carried out by the district administration with the help of local population and NGO's through various centrally sponsored schemes.
- The results of these studies were presented to a National Level Committee which defined the Integrated Mission for Sustainable Development to cover 126 districts and ninety two Blocks for action plan development. This now covers almost one third of the districts of the country.
Potential Fishing Zones

- India has a long coast line of 7500kms.
- Large coastal population depends on Fishing for livelihood.
- ISRO worked with ESSO to develop techniques for locating fishing zones using Ocean color, SST profiles, surface wind vectors, GIS, and variables indicating food availability and suitability of environment.
PFZ contd...

- Advisories of PFZ are prepared in local languages and displayed on electronic boards on harbors and also disseminated through Radio, TV and Press.
- Evaluation indicates four fold increase in catch in eighty percent of cases. The search time is reduced by significantly. Results in great economic benefits to Fishermen.
Disaster Monitoring and support Systems

- Started with Cyclone tracking and warning systems. Resulting in great savings of life.
- Extensive studies were further carried out on cyclone genesis, its track and land fall point and intensity estimation.
- The ground systems for weather forecasting were densified by adding more AWS (Automatic Weather Stations) developed by ISRO.
- resulted in the installation of a meteorological data processing system installed at IMD and SAC Ahmedabad
DMSS Contd..

- ISRO developed a MOSDAC portal. (Meteorological and Oceanographic Satellite Data Archival Centre)
- This portal archives the meteorological & oceanographic data products from ISRO science missions and in-situ observation network.
- The portal provides a variety of products and services on a wide spectrum of applications needed by national/ international forecasting agencies, research organisations, educational institutions, individual researchers and students for advanced research.
Other Missions

Under the NNRMS fifty-nine experiments were initiated which grew to some one hundred sixty projects.
This included a very vast area of applications in National Drinking Water Mission, Wetland inventory, Geology and Mineral Exploration, Coastal Zone Management, Urban Mapping, etc. The list has only been growing.
Space infrastructure to support Development

- The Space Applications Center (SAC) at Ahmedabad
- Development and Educational Communications Unit (DECU) at Ahmedabad
- The National Remote Sensing Centre (NRSC)
- Decision Support Centre (for Disaster Management) at Hyderabad.
- The Four Regional Remote Sensing Service Centers (at Jodhpur, Kolkata, Nagpur, and Bangalore) and the North-East SAC at Shillong to support the regional requirements of the States
Observations

- In India the Space Research Organisation has had a well defined Applications Program and it initiates experiments in a wide variety of Applications of National importance.
- This initiative by the Space department *expedites* the process of adoption of Space inputs.
- The Space Department has created the infrastructure and organisation to be able to do this. (SAC. NRSC. RRSSC. NESAC etc..)
Observations contd

- The Applications program is jointly evolved with the user agency. ISRO works towards the development of necessary technologies and techniques to realise applications of Space inputs.
- This adds to the intensity and speed of the adaption. The application gets into project mode.
- Involvement of ISRO makes the process cost effective and timely.
- If contracted out to private contractors cost is likely to increase.
Observations contd...

- Joint implementation builds confidence in the user agency and it becomes self reliant in the long run.
- Joint evaluation of the experiments establishes the strengths and weaknesses of the Space inputs. Continuous up-gradation and improvement is undertaken.
- Joint working leads to easy acceptance by the user.
- Joint working increases the credibility with the funding agencies.
Issues in Space for Development

- Space by nature is **Global** –wide coverage, long reach.
- Development issues are by nature **Local**.
- Adaption of global to local requires understanding of local needs and sensitivities. It is best done with the involvement of the local authorities/agencies/NGOs etc.
- This bridging of the Global to Local gap requires great effort of Training, Technology transfer and Funding. It requires reaching out to final users.
Conclusion

- In India the Space agency has taken the lead in promoting Applications of Space inputs.
- It has been a primarily government funded effort, both by the Central and State governments.
- Active involvement and participation of local development agencies is essential for effective utilisation of space inputs.
- Working with local NGOs, Govt. funding, international funding, collaborations with developing countries, and peoples funding could be tried. Private agencies could be used for support.
THANK YOU

for your kind attention
Sustainable Development

- Sustainable Development meets the needs of the present without sacrificing the ability of the future generations to meet their own needs.
Each goal is important in itself... And they are all connected.
Case Studies

1. Communications – Instructional Television
   - Educational Television
   - Development Communications

2. Remote sensing -
   - Crop forecasting
   - National Natural Resources Management System
   - Potential fishing Zones
Communications applications
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