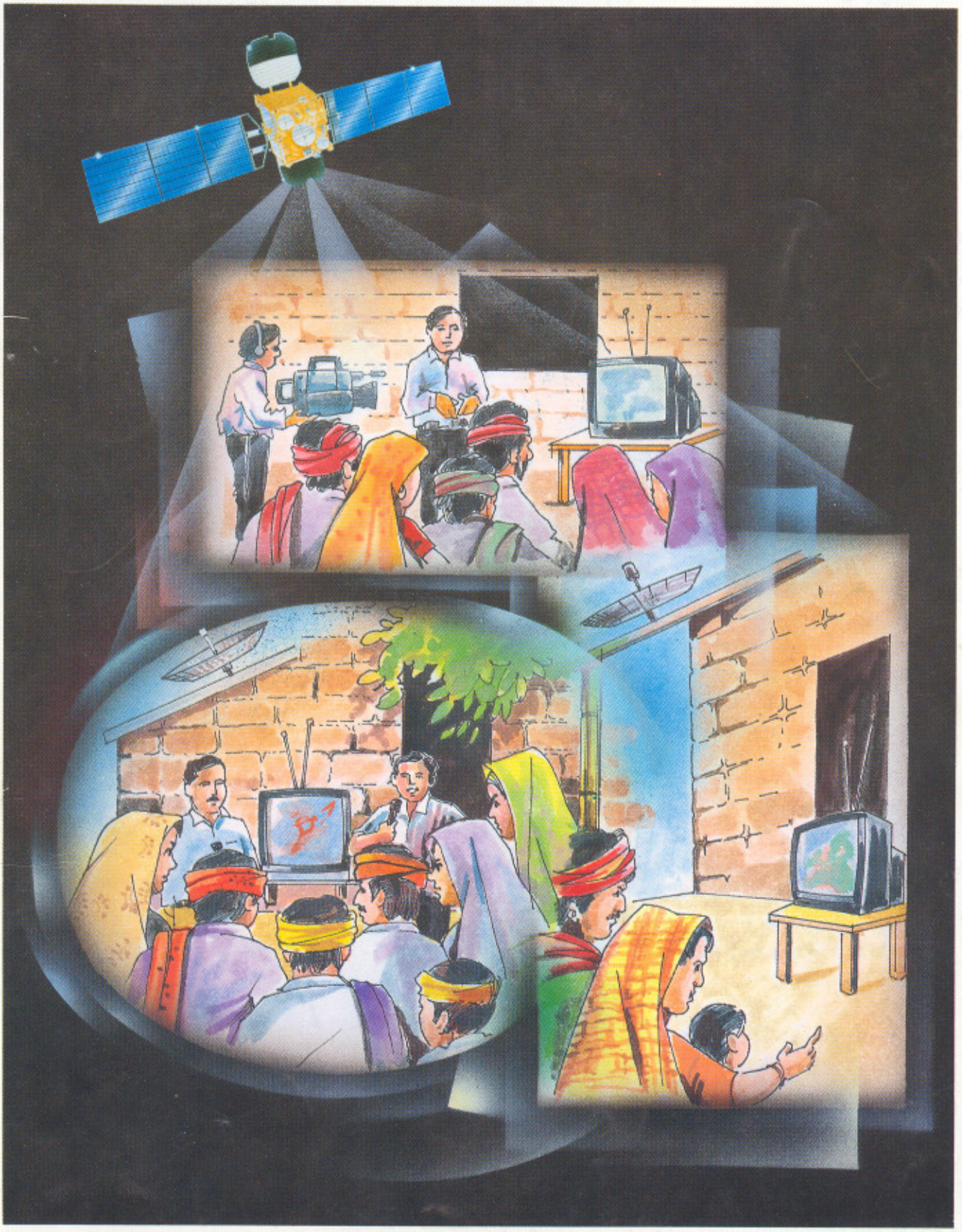
OCT. '96 - MAR. '97

SPACE india



INDIAN SPACE RESEARCH ORGANISATION

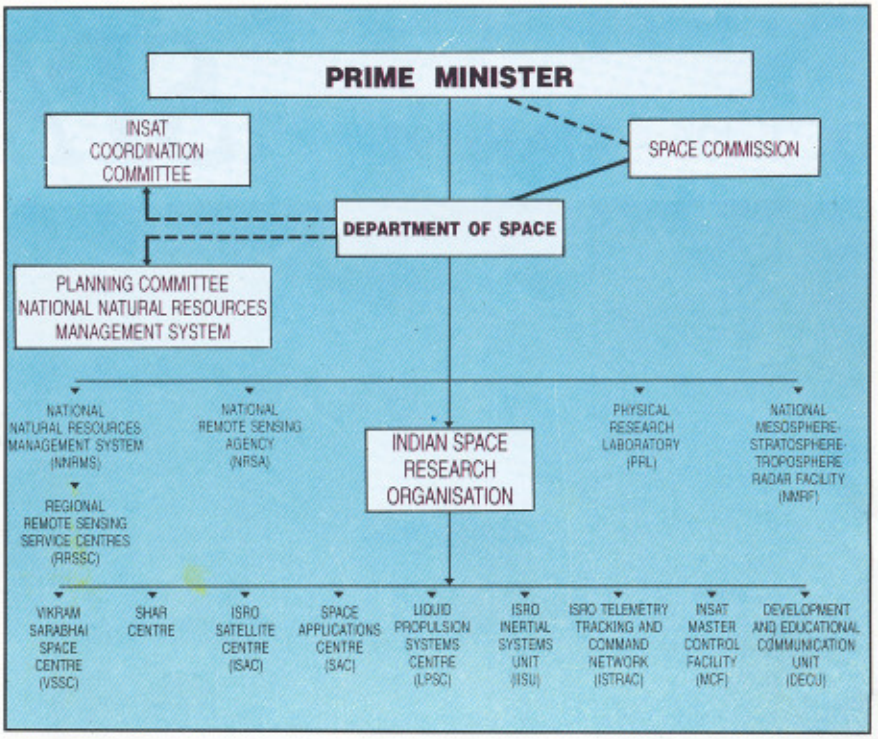
The Indian Space Programme

The setting up of the Thumba Equatorial Rocket Launching Station (TERLS) in 1963 marked the beginning of the Indian Space Programme. The Space Commission and the Department of Space (DOS) were established by the Government of India in 1972 to promote unified development and application of space science and technology for identified national objectives.

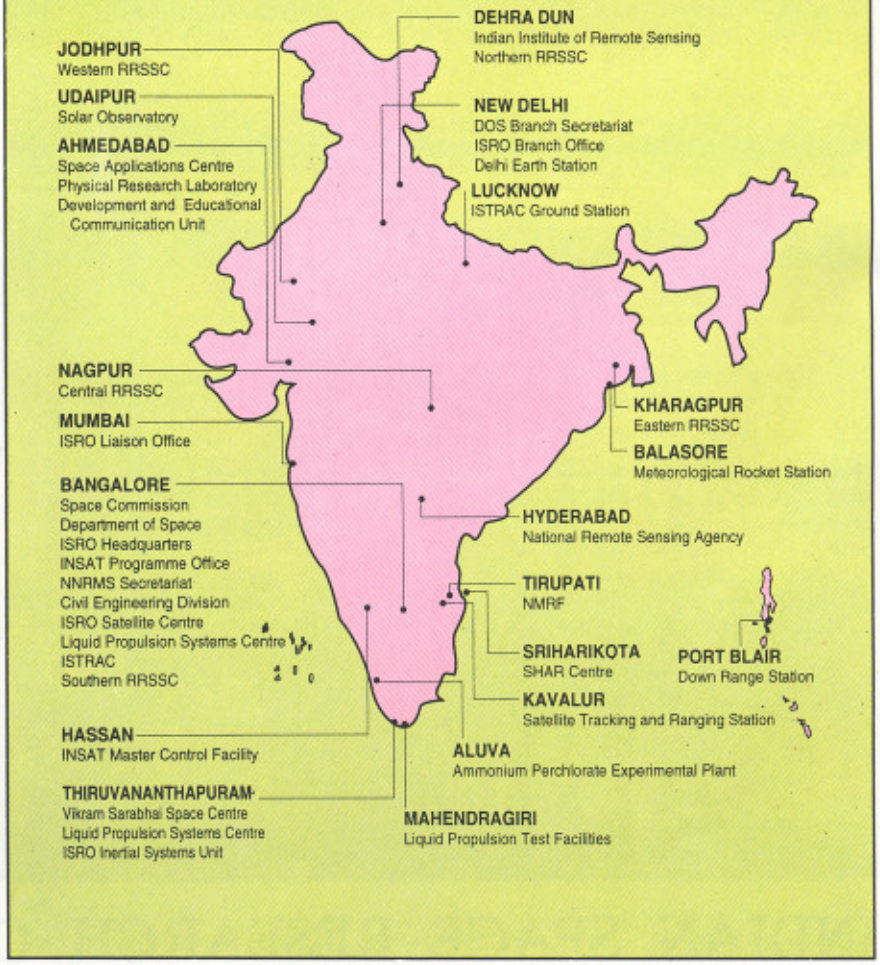
The Indian Space Programme is directed towards the goal of self-reliant use of space technology for national development, its main thrusts being: (a) satellite communications for various applications, (b) satellite remote sensing for resources survey and management, environmental monitoring and meteorological services and (c) development and operationalisation of indigenous satellite and launch vehicles for providing these space services.

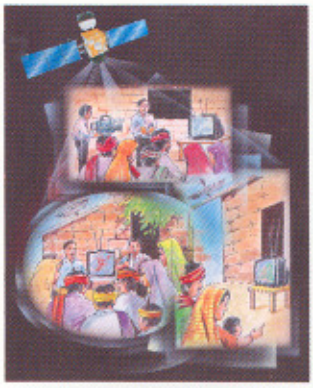
The Indian Space Research Organisation (ISRO) is the research and development wing of DOS and is responsible for the execution of the national space programme. ISRO also provides support to universities and other academic institutions in the country for research and development projects relevant to the country's space programme.

Both the DOS and ISRO Headquarters are located at Bangalore. The development activities are carried out at the Centres and Units spread over the country.



Space Centres and Units in India





FRONT COVER:
Artist's concept of Jhabua Developmental Communication Project

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Oct. '96–Mar. '97

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Space for Rural Development – Jhabua Demonstration Begins

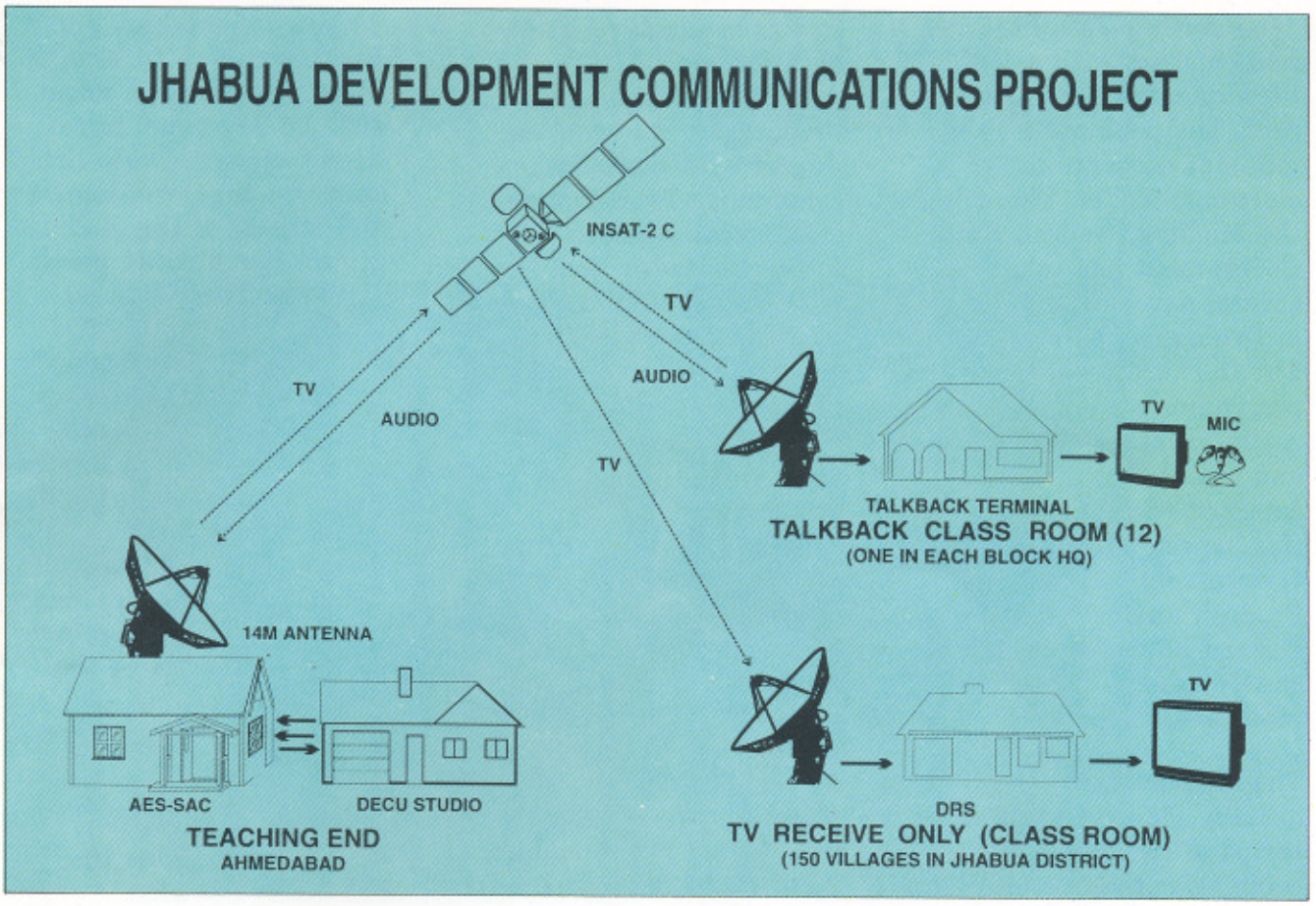
On November 1, 1996, 150 direct reception television sets located in as many villages of Jhabua District in western part of Madhya Pradesh came alive when transmission of programmes under developmental communications pilot project was started. Jhabua Developmental Communication Project (JDCP) has been taken up by Indian Space Research Organisation (ISRO) to specially tailor a satellite-based network configuration and transmit information and television programmes to meet the needs of rural areas. Specially produced development programmes are being beamed from Ahmedabad to 150 direct reception sets in Jhabua through INSAT-2C satellite. The programmes focus on areas like watershed management, agriculture, health education, Panchayati Raj and skill development. These programmes, which are largely produced in Jhabua with the participation of the local people, are intensive in content and address local issues. The aim is to build channels of communication in all directions to promote self-reliance, reduction in apathy and optimal use of local resources.

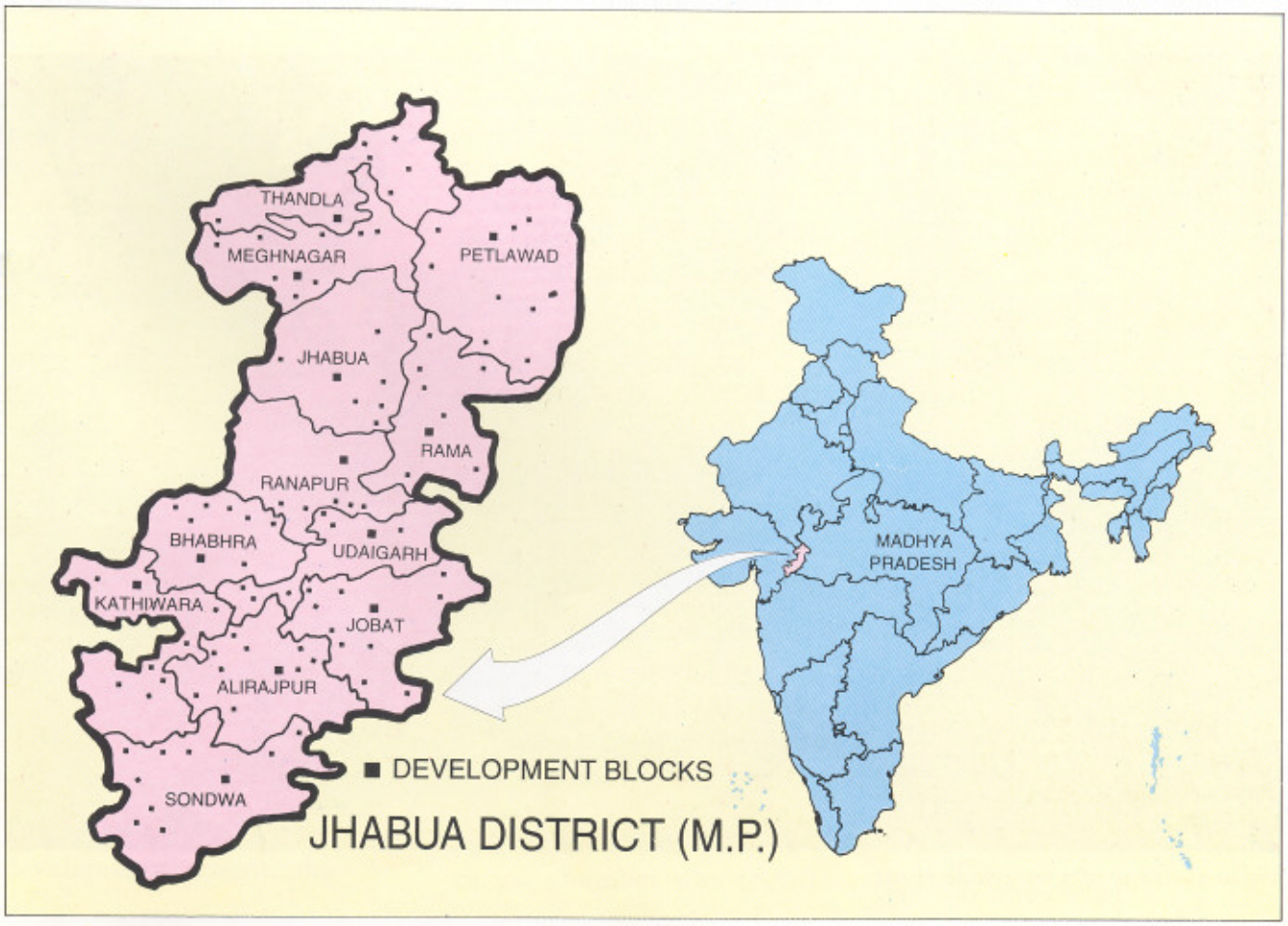
Installation of a Direct Reception TV Set at a Jhabua Village

On-site TV Programme Production

The Jhabua project also includes inter-active terminals at 12 Block Headquarters. These terminals are used for conducting intensive training of groups and officials such as primary school teachers, elected representatives, Panchayati Raj health workers and groups engaged in Development of Women and Children in Rural Areas. These interactive terminals provide frequent and continuous interaction between people and experts and district administrators.

Jhabua which has about 1,300 villages is pre-


JHABUA DEVELOPMENT COMMUNICATIONS PROJECT
INSAT-2 C
TV
AUDIO
TV
AUDIO
TV
TV
MIC
TALKBACK TERMINAL
TALKBACK CLASS ROOM (12)
(ONE IN EACH BLOCK HQ)
14M ANTENNA
AES-SAC
DECU STUDIO
TEACHING END
AHMEDABAD
TV
DRS
TV RECEIVE ONLY (CLASS ROOM)
(150 VILLAGES IN JHABUA DISTRICT)


THANDLA
MEGHNAGAR
PETLAWAD
JHABUA
RAMA
RANAPUR
BHABHRA
UDAIGARH
KATHIWARA
JOBAT
ALIRAJPUR
SONDWA
MADHYA
PRADESH
■ DEVELOPMENT BLOCKS
JHABUA DISTRICT (M.P.)

dominantly a tribal (85 per cent) district with a low literacy rate of 14.5 per cent. The population has minimal exposure to electronic media. Therefore, the Madhya Pradesh State Government has taken up several development programmes in the district. But the success of these programmes need a good communication mechanism and the Jhabua project is expected to demonstrate this aspect. Therefore, the Government of Madhya Pradesh and the Jhabua District administration are closely associated with the conduct of the project.

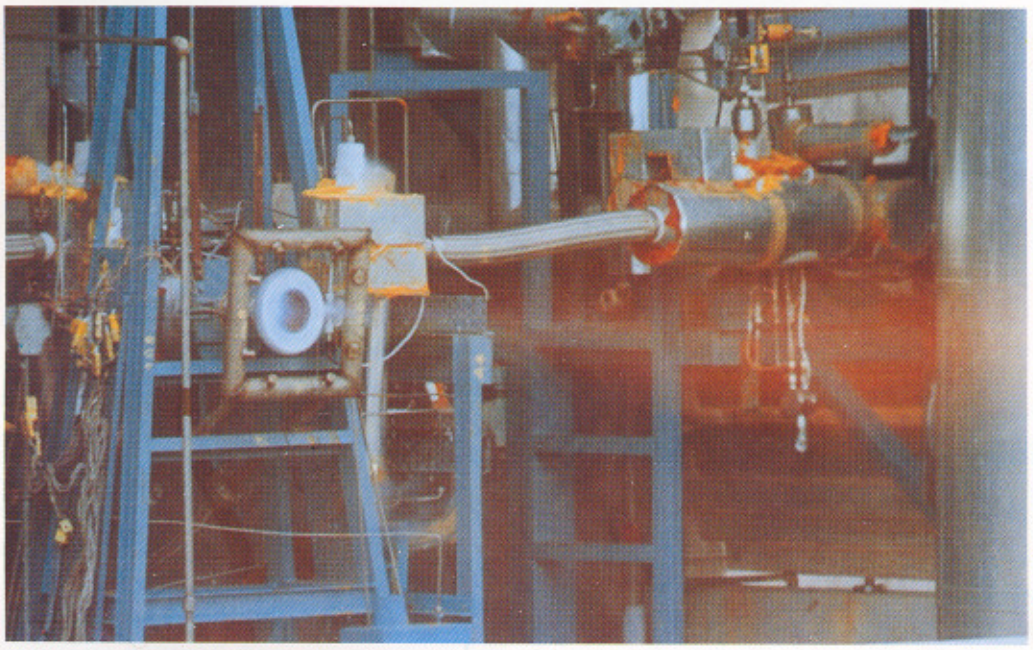
The Jhabua project is initially planned for a period of two years and is being executed by ISRO's Development and Educational Communications Unit and Space Applications Centre, both located in Ahmedabad. The preparatory work on the project such as installing community TV reception sets, social research, interaction with local administration and experts to understand specific needs of the people and production of appropriate video programmes had been going on for nearly 15 months. Efforts to enhance the value of the network by increasing the information content and technical improvements will continue during the course of the project.

The programmes conducted till February 1997 included training for women and children, watershed management for non-governemental organisations and others, training of teachers and Panchayat Raj. In each of these programmes, about 400-500 personnel have been trained. A base line study on the performance and impact of the Jhabua project has already been carried out covering 60 villages and over 3,600 respondents. The feedback indicates a keen interest among the participants. For example, when invited for interviews, about 400 actors, writers and musicians of Jhabua showed up and they had rich talents. They are now involved in many of the programmes being produced under the Jhabua project.

The Jhabua project is expected to lead to the establishment of nationwide developmental communication network system in the near future. □

Video shooting of a marriage event

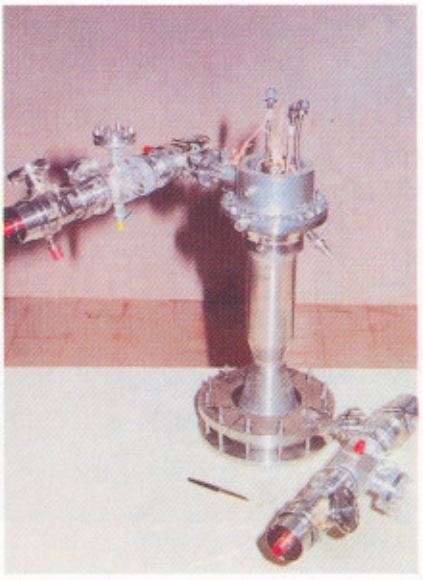
Development of Subscale (One -Tonne) Cryogenic Engine Completed



One-tonne cryogenic engine test at LPSC, Mahendragiri. The flame is almost invisible indicating complete combustion of hydrogen

With the successful performance evaluation test for 120 seconds on September 26, 1996, the development of a subscale, pressure fed cryogenic engine, with a rated thrust of one tonne in vacuum, has been completed. This is an important milestone in the cryogenic propulsion technology development in ISRO. The test, conducted at the Liquid Propulsion Test Facility at Mahendragiri in Tamilnadu, employed liquid oxygen and liquid hydrogen and was the last of the 14-test series of the subscale engine development programme.

The subscale engine development programme was taken up to understand the basic principles of cryogenic engine development in a phased manner. While the initial tests were conducted with gaseous hydrogen and gaseous oxygen, the last few were conducted with liquid hydrogen and liquid oxygen as will be employed in the cryogenic upper stage which is now under development at ISRO for the Geosynchronous Satellite Launch Vehicle, GSLV. Three different versions of the engine thrust chambers were designed – heat sink version, water cooled version and regenerative cooled version. The heat sink version with copper thrust chamber was tested for a short duration with liquid oxygen and gaseous hydrogen. The water cooled version, fabricated out of stainless steel with milled channel on the outer



Subscale cryo engine

Subscale cryogenic engine test stand at Mahendragiri.

surface for cooling, was tested for 200 sec with liquid oxygen and gaseous hydrogen. The regeneratively cooled version, designed for a chamber pressure of 36 ksc, was made of oxygen-free high conductivity copper with milled channels for cooling. The outer jacket was realised by electroforming nickel over the inner copper chamber and the engine, employing liquid oxygen and liquid hydrogen, successfully went through the test.

The hardware were designed and realised by ISRO and other institutions; electro-formed nickel outer jacket of the combustion chamber was realised through Central Electro Chemical Research Institute, Karaikudi. Indian Institute of Technology, Kharagpur, Indian Institute of Science, Bangalore, Anna University, Chennai and other academic institutes contributed in the design and analysis. ■

Message from Prime Minister

Prime Minister, Mr H D Deve Gowda, in a message to Dr K Kasturirangan, Chairman, ISRO, dated October 16, 1996, expressed his delight on the successful conclusion of the subscale cryogenic engine development programme. He said that the Department of Space and other institutions involved in the programme have done the nation proud and deserve to be complimented on this achievement. He conveyed his good wishes and assured continued support for the future programme.

Course on Satellite Communication Commences at CSSTE-AP

Students of Post-graduate course on Remote Sensing and Geographic Information System holding a discussion.

A Post-graduate course on Satellite Communications by the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTE-AP) which is affiliated to the United Nations, was inaugurated on January 20, 1997 at ISRO's Space Applications Centre, Ahmedabad. This is the second course of CSSTE-AP and is being attened by 14 scholars from 9 countries in the Asia Pacific region - three from Islamic Republic of Iran, two each from Democratic People's Republic of Korea, Nepal and Srilanka and one each from India, Indonesia, Kyrghyzstan, Republic of Korea and Uzbekistan. The course was inaugurated by Dr Adigun Ade Abiodun, Expert on Space Applications at the United Nations Office for Outer Space Affairs. It is oriented to provide in-depth knowledge on satellite communications technology and applications and covers technology of satellite communications, earth station management, broadcasting and specialised applications of satellite communication, network planning and management of communications systems, etc. The course also includes a three-month project work.

The passing-out function of the first Post-graduate course of CSSTE-AP on Remote Sensing and Geographic Information Systems was conducted on December 19, 1996 at the Centre's campus in Dehradun. This course, had been attended by 25 scholars from 14 countries of the Asia-Pacific region. The participants were presented the Diplomas by Dr K Kasturirangan, Chairman of the Governing Board of the CSSTE-AP and Secretary to the Department of Space, Government of India.

CSSTE-AP, established at the initiative of the United Nations, is administered by an international Governing Board with representatives from Asia Pacific countries and the United Nations. CSSTE-AP aims at providing education for conducting research and applications programmes in space science and technology by the countries of Asia-Pacific region. ■

SHAR Centre Celebrates Silver Jubilee

ISRO's SHAR Centre at Sriharikota in Nellore District of Andhra Pradesh celebrated its Silver Jubilee on October 10, 1996. The first rocket from this range, a 125 mm diameter Rohini sounding rocket, had been launched on October 9, 1971.

SHAR centre was identified as the most suitable launch range, after an aerial survey of the east coast of India, conducted in 1969. The important criteria for locating the launch range at Sriharikota was the availability of a vast uninhabitated area required for range safety. The spindle-shaped island of Sriharikota sandwiched between the Buckingham Canal on the West and the Bay of Bengal on the East, has about 170 square km area in the back waters of Pulicat Lake. It is located about 80 km north of Chennai.

Once Sriharikota was selected, development activities moved quite fast with the laying of a road to Sullurpeta on the main land. Essential amenities such as roads within the island, office buildings and technical facilities such as block house, rocket assembly hall, etc, were completed and the first Rohini-125 sounding rocket was successfully launched on October 9, 1971.

Dr K Kasturirangan, Chairman, ISRO presenting a memento to Prof S Dhawan, Member Space Commission and former Chairman, ISRO at the SHAR Silver Jubilee function. Dr S Vasantha, Director, SHAR Centre (left) and Shri K V Iraniraya, Additional Secretary, DOS (right) are also seen.

The subsequent years saw a launch complex coming up for India's first satellite launch vehicle, SLV-3, including launch pad, block house, telemetry and tracking facilities, communication, computers and data processing, CCTV, photography and range timing. A Solid Propellant Space Booster Plant (SPROB) for processing solid propellants and a Static Test and Evaluation Complex (STEX) for ground testing of solid propellant motors were set up. The telemetry, tracking and command support for the experimental satellites like Aryabhata, Bhaskara and APPLE were also provided from SHAR Centre.

SHAR Centre is now the most important launch range in the country from where all the launch vehicles of ISRO are launched. The PSLV launch complex has state-of-art facilities for vehicle assembly, checkout and launch operations. A 76

metre tall, 3,500 tonne, mobile service tower facilitates vertical integration of the vehicle and mating the satellite. The gigantic tower is moved 150 metre away before the lift-off of the vehicle.

The ground instrumentation include high-precision C-band radars for tracking the vehicle, telemetry stations for receiving and processing data on vehicle performance, telecommand system for range safety, CCTV, communication, range timing, etc. The Mission Control Centre which is the nerve centre of the launch activities is located 6 km from the launch complex and is connected to the launch complex using fibre optic cables. Elaborate real-time computer systems process the telemetered data from the launch vehicle providing position, velocity, altitude and trajectory information.

SHAR Centre has so far supported four launches of SLV-3, four launches of ASLV and three launches of PSLV, apart from several sounding rockets. The Centre is now being augmented for supporting the launch of India's Geosynchronous Satellite Launch Vehicle (GSLV).

Employing about 2,400 personnel, SHAR Centre, is a sprawling complex today. The personnel have been provided quarters and facilities like schools and hospitals have been established. The island has a varied and picturesque scenery with extensive jungles honeycombed with plantations of eucalyptus, casuarina and cashew and numerous groves of coconut, palmyrah and canebrakes. The varied ecological habitats, sand beach, sand dunes, salt-marsh, lagoons, stream courses, water lenses, low lying areas, etc., on the island harbour rich and valued floristic wealth. The tribals of the island the "Yanadis" have been rehabilitated and some of them form part of the work force of SHAR Centre.

As part of the Silver Jubilee Celebrations, SHAR Centre observed open-days during October 9-11, 1996 to enable general public to have a glimpse of the launch complex. A photo-exhibition had also been arranged. There were launches of RH-200 sounding rockets. On October 10, 1996, Chairman, ISRO addressed the SHAR personnel. Prof Dhawan, Member Space Commission and former Chairman, ISRO and some of the senior scientists including a few who have since retired, gave reminiscences of their association with the establishment of the Centre. SHAR Centre personnel who have completed 25 years of service in ISRO were also presented mementos. ■

UN-ESCAP Meeting on Space Cooperation in Asia-Pacific Held in Bangalore

The second dialogue meeting, organised by UN-ESCAP and hosted by the Department of Space, Government of India, was held during March 31 - April 2, 1997 at Antariksh Bhavan, Bangalore, the headquarters of ISRO. During the meeting, policies concerning harmonisation of various initiatives for promoting regional cooperation in space technology development and applications in the Asia-Pacific region were discussed. This meeting was a follow-up to the Ministerial Conference on Space Applications for Development in Asia and the Pacific held in Beijing, China, during September 1994; the Ministerial Conference had recommended that necessary steps be taken to harmonise various initiatives of the countries in space technology development and applications to optimise the efforts and maximise the benefits.

Inaugurating the Meeting, Dr K Kasturirangan, Secretary, Department of Space and Chairman, ISRO, highlighted the urgent need for optimal management of natural resources, especially in view of the rapid economic growth and increasing population in the region. He cited the example of India in effectively utilising space technology to solve several problems related to natural resources management, environment monitoring and disaster management. He said that the INSAT and Indian Remote Sensing satellites have been playing an important role in micro-level development planning in the country. He also detailed the efforts being made by India to assist cooperation in the Asia Pacific Region in the field of training and educational activities through arranging symposia/ workshops and conduct of joint experiments. Dr Kasturirangan underlined the need for a common minimum programme of space technology applications which

are of direct relevance to the region with an emphasis on human resources development and regional capacity building. In a message to the meeting, Mr Adriannus Mooy, Under Secretary-General, United Nations and Executive Secretary, ESCAP, highlighted the series of actions that have been taken in pursuance of the Beijing Declaration for harmonising the various initiatives to promote space applications for sustainable development in the region. Dr. D P Rao, Director, National Remote Sensing Agency, Hyderabad, Chaired the Meeting.

At the end of the deliberations, the concept of an applications oriented Asia-Pacific information network as a joint programme was unanimously supported. It was proposed that Japan take the lead in further developing this concept taking into account the inputs and suggestions given by Thailand, India and other interested countries as well as existing network activities such as UN/ESCAP ESINAP. It was also agreed that the project be implemented under RESAP as proposed by Japan. The need for a dialogue forum for hormonisation of various regional initiatives was reiterated at the meeting. Options for working mechanism were also generated and discussions will continue on selection of an optimal option.

The Bangalore meeting was attended by delegates from China, India, Indonesia, Japan, Pakistan, Republic of Korea and Thailand, besides UN-ESCAP. The third dialogue meeting, proposed to be held in November/December 1997, will be hosted by the Royal Thai Government. ■

Europe Starts Receiving IRS-1C Data

Data from the Indian remote sensing satellite, IRS-1C, has become available to the European countries with the German company, GAF/Euromap, beginning to market the satellite data received by its ground station in Neustrelitz near Berlin. Euromap have taken acquisition, archiving and distribution rights for Europe through Space Imaging-EOSAT (SI-EOSAT) of US.

With Euromap directly receiving, archiving and distributing IRS-1C data, new markets for the data are expected to open up among European industries who require near real-time data. The 5.6 metre resolution data of IRS-1C Panchromatic camera (PAN) will be useful for urban planning and mapping organisations. GAF which has expertise in processing satellite imagery and applying it towards practical solutions in business, mapping and environment, is now entering into commercial remote sensing other than value added work. IRS-1C, launched by India in December 1995, is the most sophisticated civilian remote sensing satellite in orbit today. It acquires imagery with resolutions of 5 metre in panchromatic band and 23 metre in multispectral bands as well as 188 metre resolution data with wide field coverage.

Part of Budapest City (Hungary) as viewed by IRS-1C

ISRO Signs MOU with Norwegian Space Centre and Canadian Space Agency

Dr K Kasturirangan, (left) Chairman, ISRO, exchanging the documents with Mr Paul Sorenson, President, Norwegian Space Centre.

Dr Kasturirangan, Chairman, ISRO and Mr W M Mac Evans, President, Canadian Space Agency signing the MOU.

Indian Space Research Organisation (ISRO) and Norwegian Space Centre signed a Memorandum of Understanding (MOU) on November 13, 1996 for cooperation in space. The MOU, signed by Dr K Kasturirangan, Chairman, ISRO and Mr Paul Sorenson, President, Norwegian Space Centre, at Antariksh Bhavan, the Headquarters of ISRO in Bangalore, provides for collaboration in areas like utilisation of remote sensing data, use of Svalbard Satellite Station in Norway (located at 80° North latitude which is ideally suited for supporting polar orbiting satellites) for ISRO's programme, jointly offering satellite ground station services to international customers, use of ISRO's sounding rockets by international scientific research community from Norway's Andoya Rocket Range, possibilities of using Indian launch services for missions of joint interest, cooperation in space technology and space science and exchange of experts.

The MOU between ISRO and Canadian Space Agency (CSA) was signed by Dr K Kasturirangan, Chairman, ISRO, and Mr W M Mac Evans, President, CSA, on October 15, 1996, at Antariksh Bhavan, Bangalore. The MOU covers

cooperation in study of satellite programmes for space research and applications, studies related to satellite communications and satellite remote sensing, organisation of training programmes, exchange of technical and scientific personnel and setting up of joint working groups to examine specific issues and, cooperation in the field of exploration and utilisation of outer space between and within the Government, the private sector and academia in both countries.

CSA has an ambitious space programme. It launched recently the Radarsat which is a highly advanced all-weather remote sensing satellite. Canada is also developing communications satellites for its domestic use and it is participating in the international space programmes like supplying robotics for the US Space Shuttle and the Space Station Alpha. With the advances made in India, both in the development of remote sensing and communication satellites and their application for national development, cooperation between ISRO and CSA is expected to yield mutual benefits. Representatives from the Canadian Space industries and their counterparts in India also held discussions to explore the opportunities for their participation in the space programmes of ISRO and CSA.

Important Visitors to ISRO

His Excellency, Dr Klaus Kinkel, Vice Chancellor and Foreign Minister of the Federal Republic of Germany (FRG), visited ISRO Satellite Centre, Bangalore, on January 25, 1997. He was accompanied by German Ambassador to India, H E Mr Frank Elbe, Members of Parliament and Members of German industry. It may be noted that ISRO has a long standing cooperation with Germany in the areas of space science, technology and applications; the Modular Opto-Electronic Scanner developed by the German Space Agency, DLR, and flown on board the Indian remote sensing satellite, IRS-P3, in March last year, is providing valuable data on ocean biology and atmospheric constituents. German scientific payloads are also proposed to be flown on Indian sounding rockets. The present visit of the German Foreign Minister is expected to further enhance the cooperation between the two countries.

Hon Dato Seri Dr Mahathir Bin Mohamad, Prime Minister of Malaysia, accompanied by his wife Hon Datin Seri Dr Siti Hasmah Haji Mohamad Ali and a high level delegation including senior ministers, officials and industry representatives, visited ISRO Satellite Centre (ISAC), Bangalore on December 22, 1996. The visiting dignitaries were shown around the Centre, including the INSAT-2D satellite in its final stages of preparation.

His Excellency Mr Thabo Mbeki, Deputy President, South Africa, accompanied by the High Commissioner, His Excellency Mr Matsila and two Deputy Ministers, Dr E Pahad and Mr A Pahad and other senior officials visited ISRO Satellite Centre (ISAC), Bangalore on December 5, 1996. Aspects related to possibilities of developing an Indo-South Africa cooperation in peaceful use of space were discussed during the visit.

Mr Ian Taylor, Parliamentary Under Secretary of State for Science and Technology at Department of Trade and Industry, UK, met Dr K Kasturirangan, Chairman, ISRO, on October 26, 1996 to discuss possibilities of greater cooperation in space between UK and India. Mr Taylor also visited ISRO Satellite Centre (ISAC) at Bangalore. As a prelude to Mr Taylor's visit, a delegation of British space industries visited ISRO on October 24 and 25, 1996. During these two days, an industry meet was organised by Antrix Corporation of the Department of Space (DOS) for exploring opportunities for collaboration among Indian and UK Space Industries.

Parliamentary Committee Reviews Space Programme

The Department-Related Parliamentary Standing Committee on Science and Technology, Environment and Forests, has expressed satisfaction on the progress made by the Department of Space and has said that the space programme should not be allowed to stagnate or suffer. The Committee which considered the performance of the Department in various fields during 1996-97 and its major thrust areas for the 9th Five Year, Plan and submitted its report on March 5, 1997. This report of the committee, the 42nd, is based on the 'Mid-Term Appraisal' of the programmes and functioning of the Department of Space.

The Committee has said that, with the state-of-the-art technology for remote sensing satellite data applications, drought monitoring and assessment, disaster management, wasteland management, water resources management, ocean/marine resource management, mineral prospecting, forests resources survey and management, etc, have become scientifically possible. Therefore, it is necessary that the multi-purpose activities of the Department of Space should reflect the aspirations of the people. The Committee has felt that the space programme should be more and more benefit oriented and the Department should earnestly help to percolate the benefits of space technology to different sections of the society.

The Committee has observed that remote sensing is catching up as a major source of activity for national development which was by and large, until recently, a Government activity. The Department of Agriculture, Environment

Constitution of the Committee

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Rajya Sabha

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3. Shri Brahmakumar Bhatt
4. Shri N Giri Prasad
5. Shri K R Jayadevappa
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7. Shri Pranab Mukherjee
8. Dr Y Radhakrishna Murty
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10. Dr Alladi P Rajkumar
11. Dr Mahesh Chandra Sharma
12. Shri G Swaminathan
13. Shri Prakanta Warisa

Lok Sabha

14. Shri Mahabir Lal Bishvakarma
15. Shri Ranjib Biswal
16. Shri A. B. A. Gani Khan Choudhury
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32. Smt. Vasundhara Raje
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34. Shri K B Raut
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36. Shri Harivansh Sahai
37. Dr Swami Sakshiji Maharaj
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39. Kumari Selja
40. Capt. Satish Sharma
41. Shri Soumya Ranjan Patnaik
42. Sushri Uma Bharati
43. Shri Srikanta Dutta Wadiyar
**44. Shri Surender Singh*

** Nominated w.e.f. February 4, 1997*

and Forests, Ocean Development, Science and Technology and other Departments have been using it for their individual requirements. There is a large magnitude of value addition to the remote sensing data, which can be used in marketable form in several disciplines, both by Government and Non-Government agencies. Therefore, more and more private entrepreneurs are to be associated in the process of remote sensing data utilisation programme.

In regard to GRAMSAT network, the Committee has felt that the system needs to be made economically viable because the area it covers is mainly inhabited by people having low per-capita income. The committee has also said that a schedule for implementing the GRAMSAT network to cover the villages in India for rural development on time-bound basis should be drawn up.

The Committee has recommended that, in order to avoid disasters in the coastal region, the INSAT disaster warning system should be augmented and designed to cover the whole of coastal region in order to avoid further human casualties, loss of livestock, etc.

"The Committee is strongly of the view that there is need to exploit remote sensing technological capabilities commercially, specially, in Asia-Pacific and West Asian Region where most of the world's undernourished and underdeveloped population live. The Government should explore the possibility of Asian countries using our space technology for the progress of their space programmes including launching of their own satellites" the report has said.

The Parliamentary Committee has also touched upon the need to develop indigenous technology for GSLV and preventing flight of talent from ISRO. ■

STOP PRESS

INSAT-2D, the fourth satellite in the ISRO-built INSAT-2 series, was airlifted from Bangalore to Kourou in French Guyana on April 10, 1997. The satellite will be launched by Ariane in early June, 1997.

Sriharikota island where ISRO's SHAR Centre is located attracts a variety of birds. A photographer captures a bird even as it waits for its catch.