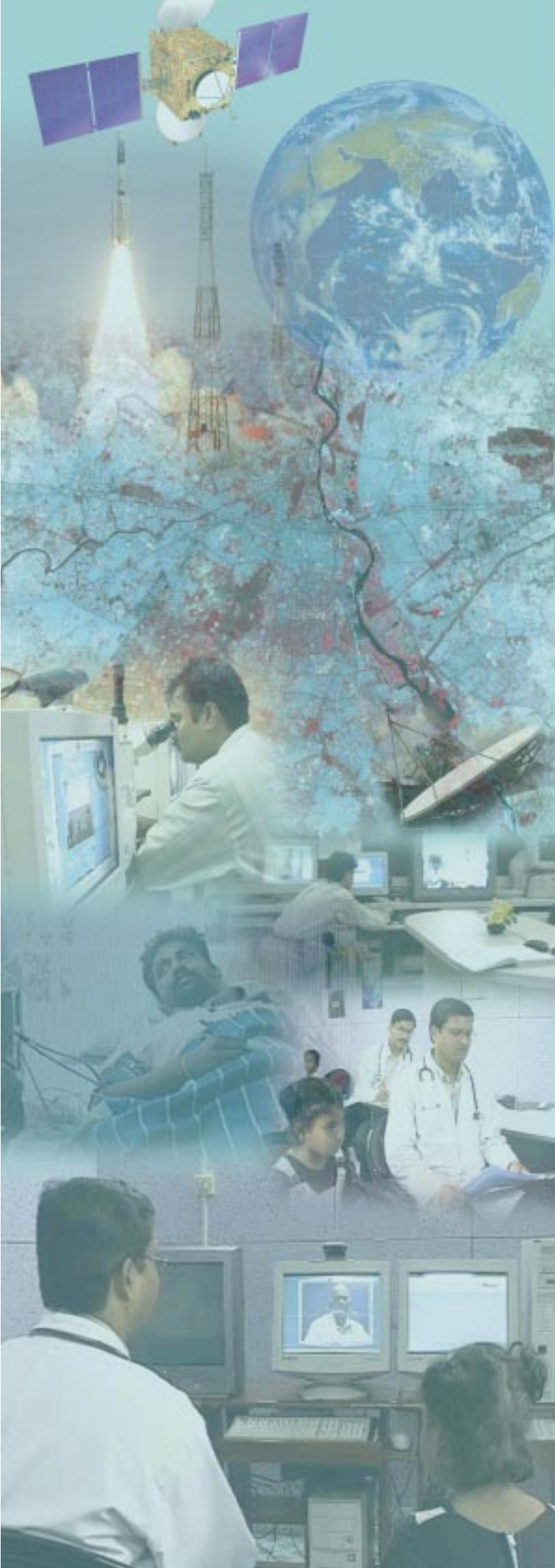# Telemedicine

Healing Touch Through Space

Enabling Specialty Healthcare to the Rural and Remote Population of India

इसरो ISRO

*W*ith an area of about 3.2 million square kilometres, India is the seventh largest country in the world. This vast South Asian country gifted with ancient historic background is endowed with varied landscapes like mountain regions, deserts, green plains, and the far-flung and hilly areas in the Jammu & Kashmir, Uttaranchal, North Eastern Region and the offshore islands of Andamans and Lakshadweep.
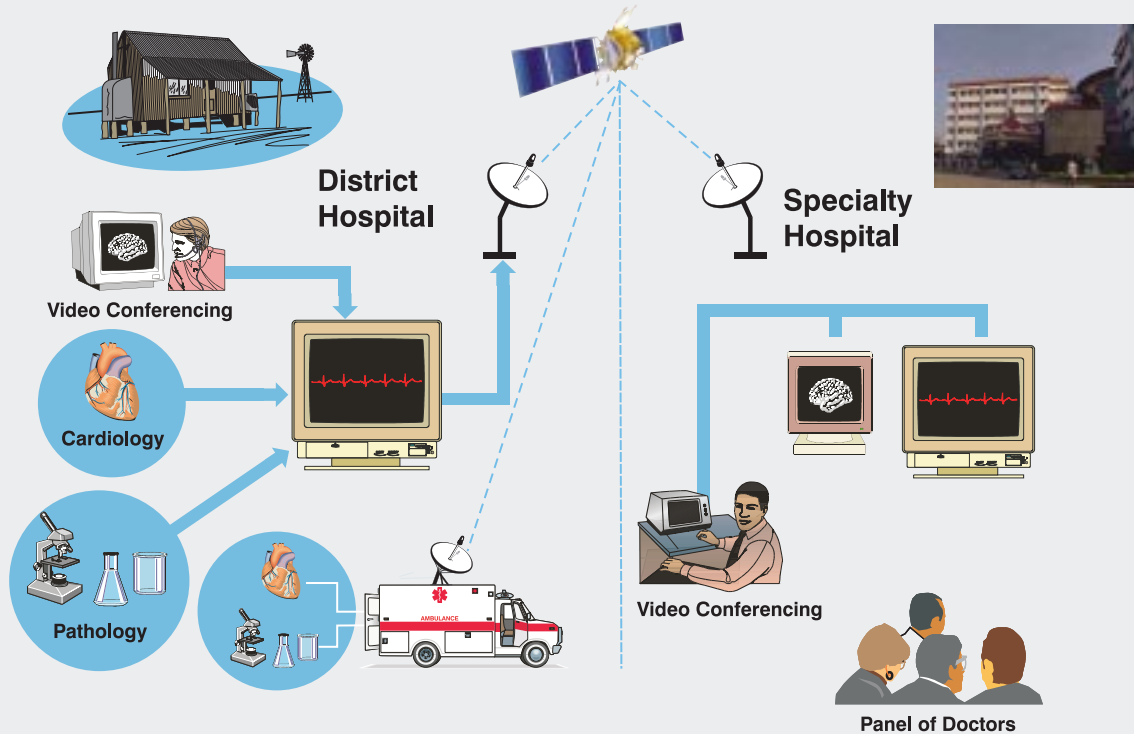
To provide the basic minimum healthcare for India's population which is predominantly rural and distributed across distant geographical locations has been one of the priorities of Health Administration all along. In today's world, despite several advances made in the Medical field, the benefits are still available to the privileged few residing mainly in the urban areas.

With the advent of Communication Technology, especially the Satellite Communications (SatCom) combined with Information Technology, we have means to extend the benefits from the advanced medical sciences even to the remote and inaccessible areas. It is known that 75% of the qualified doctors practice in urban centres, whereas the vast majority of India's population lives in the rural areas.

The Indian Space Programme is driven by the developmental needs of the country and has endeavoured to reach out to the grassroots. Today, the national space systems comprising of advanced communication and remote sensing satellites address a variety of national needs including communications and natural resources management.

Specifically in the noble context of benefiting the grassroot population, the Indian Space Research Organisation (ISRO) has successfully implemented a number of projects in the areas of Drinking Water Mission, Watershed Management, Wasteland Development, Tele-education and more importantly the Telemedicine/Tele-health, which is of great social relevance to the country for enabling Specialty Healthcare to the remote, rural and undereserved population.

TELEMEDICINE CONCEPT

District Hospital

Specialty Hospital

Video Conferencing

Cardiology

Pathology

AMBULANCE

Video Conferencing

Panel of Doctors

Reaching the un-reached
Extension of Education for Doctors in Rural/Remote areas...
General Doctors to learn from specialists and perform effectively...

The Beginning

Telemedicine facilitates the provision of medical aid from a distance. It is an effective solution for providing specialty healthcare in the form of improved access and reduced cost to the rural patients and the reduced professional isolation of the rural doctors. Telemedicine can enable ordinary doctors to perform extra-ordinary tasks.

Through its Telemedicine projects, ISRO has successfully linked hospitals and healthcare centers in remote rural areas with specialty hospitals in cities through INSAT satellites. Thus, connectivity between patients at remote end and the specialist doctors at urban centers has been effectively established.

With a large and skilled medical community receptive to new ideas, a modest beginning in Telemedicine was made by ISRO in the form of a Telemedicine Pilot Project in the year 2001, linking Apollo Hospital at Chennai with the Apollo Rural Hospital at Aragonda village in the Chittor district of Andhra Pradesh. Later in March 2002,

the Karnataka Telemedicine project linked the Narayana Hrudayalaya, a super specialty hospital for cardiac care at Bangalore with the district hospital, Chamarajanagar and the Vivekananda Memorial Trust Hospital at Saragur in south interior Karnataka.

The valuable experience gained during these Pilot Projects encouraged ISRO to further endeavour for enabling specialty healthcare delivery to the rural population.

In India, the healthcare is a state subject, administered and managed by the state governments. There are also a few trust/NGO run hospitals apart from the large number of private hospitals/clinics. Thus, the thrust of ISRO has been to introduce SatCom based Telemedicine Technology in various parts of the country through Pilot Projects.

This is to ensure that the hospitals will have sufficient training and experience to run the facility so that the states can subsequently introduce telemedicine in a regular operational mode.

What is Telemedicine?

"The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities"
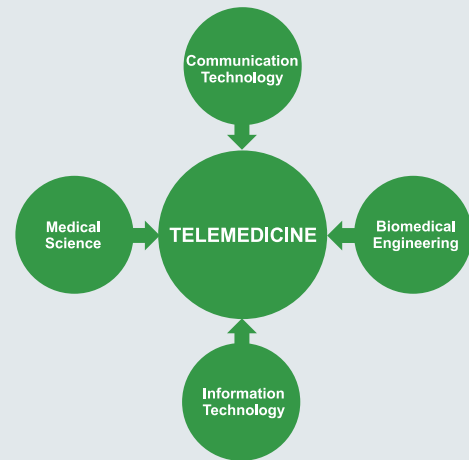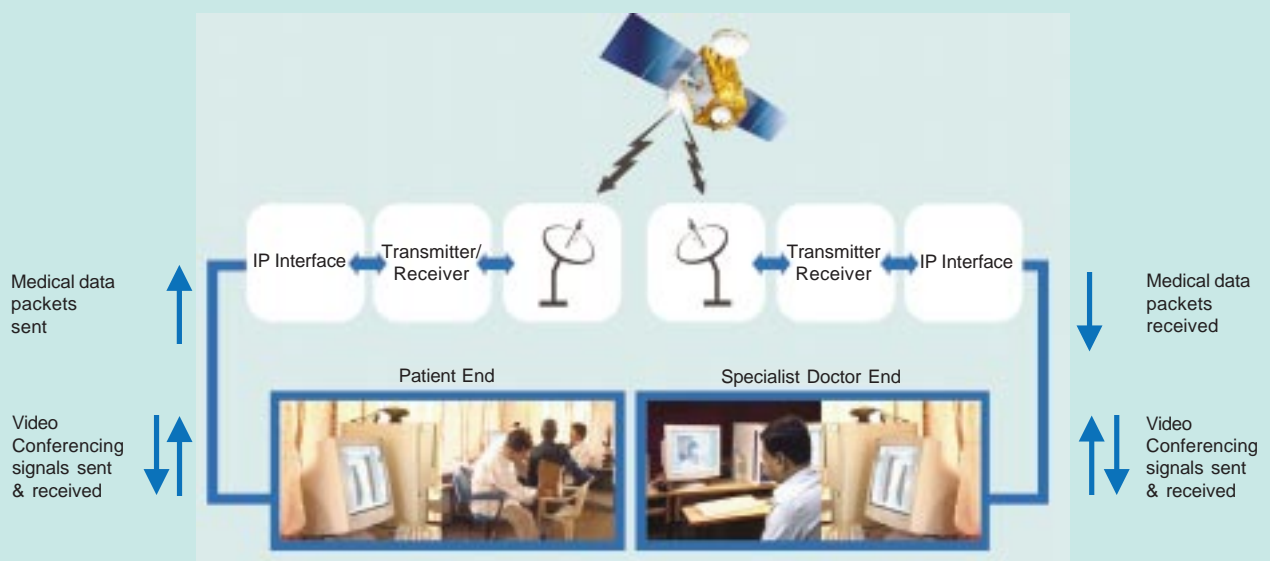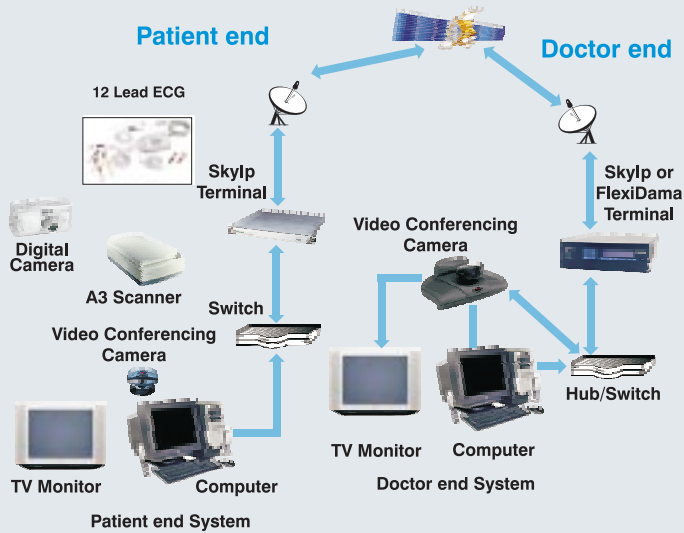

Technology of Telemedicine

Telemedicine is a confluence of Communication Technology, Information Technology, Biomedical Engineering and Medical Science. The Telemedicine system consists of customised hardware and software at both the Patient and Specialist doctor ends with some of the Diagnostic Equipments like ECG, X-ray and pathology Microscope/Camera provided at the patient end. They are connected through a Very Small Aperture Terminal (VSAT) system and controlled by the Network Hub Station of ISRO. Through a Telemedicine system consisting of simple computer with communication systems, the medical images and other information pertaining to the patients can be sent to the specialist doctors, either in advance or on a real time basis through the satellite link in the form of Digital Data Packets. These packets are received at the specialist centre, the images and other information is reconstructed so that the specialist doctor can study the data, perform diagnosis, interact with the patient and suggest the appropriate treatment during a Video Conference with the patient end. Telemedicine facility thus enables the specialist doctor and the patient separated by thousands of kilometers to see visually and talk to each other. This enables the specialist doctor to assess the physical and psychological state of the patient and suggest treatment. This remote tele-consultation and treatment is much more valuable in case of post operation (Post Surgery) follow up since the patient is not required to travel unnecessarily and hence saving money and time. In this way, the systematic application of Information and Communication Technologies to the practice of healthcare rapidly expands the outreach of the healthcare system.
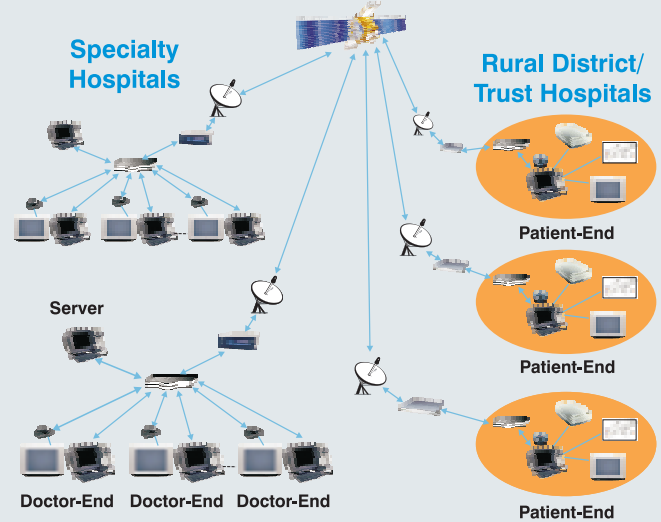
SATCOM BASED TELEMEDICINE CONNECTIVITY

POINT TO POINT SYSTEM

Patient end

Doctor end

12 Lead ECG

SkyIp Terminal

Video Conferencing Camera

SkyIp or FlexiDama Terminal

Digital Camera

A3 Scanner

Switch

Video Conferencing Camera

Hub/Switch

TV Monitor

Computer

TV Monitor

Computer

Doctor end System

Patient end System

MULTIPOINT-TO-MULTIPOINT SYSTEM

Specialty Hospitals

Rural District/ Trust Hospitals

Server

Patient-End

Patient-End

Doctor-End   Doctor-End   Doctor-End

Patient-End

Telemedicine Technology – Evolution

- Point to Point System - One patient end connect to One Specialist Doctor within the hospital
- Point to Multi Point System - One patient end at a time connect to any of the specialist Doctors' end within the hospital
- Multi Point to Multi Point System - Several patients' end simultaneously connect to different Doctors' end at different hospitals at different geographical locations

Major areas of Telemedicine Technology Adopted…

- Tele-consultation
- Tele-diagnosis
- Tele-treatment

} The patient with the local doctor consults the specialist, obtains the line of treatment

- Tele-education
- Tele-training

} For Continuing Medical Education, Training for doctors & paramedics from a higher level Hospital/Institution

- Tele-monitoring — Regular monitoring for intensive care & emergency care
- Tele-support — Support during disaster management

ISRO's Telemedicine Program – Thrust Areas Providing Technology and Connectivity

- Remote/Rural Hospitals and Specialty Hospitals
- Continuing Medical Education (CME)
- Mobile Telemedicine Units
- Disaster Management Support (DMS)

Telemedicine Initivatives

Beginning with ISRO's Telemedicine pilot project of 2001, the Telemedicine Network in India has treated more than 25,000 patients. Presently, ISRO's Telemedicine Network stretches to around 100 Hospitals all over the country with 78 Remote/Rural/District Hospitals/Health Centres connected to 22 Specialty Hospitals located in the major cities.

Many States have come forward to introduce Telemedicine on a regular operational basis and have planned to equip all the District Hospitals with Telemedicine facility both for ambulatory & Intensive care treatment. Karnataka, Chattisgarh, Kerala and Jarkand are some of the states which have initiated the establishment of Satellite Based Telemedicine Facility for all their district hospitals and a few trust hospitals. This will soon be followed by other States too.

As a result of ISRO's Telemedicine endeavour, remote areas like Kargil and Leh in the North, offshore islands of Andaman and Nicobar and Lakshwadeep, as well as some of the interior parts of Orissa, Karnataka, Kerala, Chattisgarh, J&K, North-eastern states of India and some tribal districts in certain other states have access to specialty healthcare from some of the major specialty hospitals in the country today.

Continuing Medical Education

Under ISRO's Telemedicine programme, Continuing Medical Education (CME) efforts provide doctors at rural healthcare centres a chance to upgrade their medical knowledge and skills through interactions with experts at the specialty hospitals through satellite based tele-link. Such interactions indirectly result in significantly enhancing the quality of healthcare available to rural patients. The Continuing Medical Education programme has been integrated with the tele-education programme by linking some of the Medical Institutions with the Specialty Hospitals and Research Centres.

Mobile Telemedicine

Mobile Telemedicine Unit consisting of Medical equipment along with Telemedicine hardware, software and VSAT system mounted in a Bus/Van can establish a Mobile Telemedicine centre at any place.

The major area of Mobile Telemedicine applications are in the field of Tele Opthalmology and Community Health. Under Mobile Tele Opthalmology, Rural Eye Camps

can be conducted and the Rural Population can undergo eye screening for Cataract, Glaucoma and Diabetic Retinopathy. Under Community Health Program, Mobile Telemedicine units are very useful not only for Disease Prevention but also for Health Promotion in terms of running awareness camps & teaching hygienic practices.

Village Resource Centres and Telemedicine

Recently, ISRO has also initiated pilot projects for integrating Telemedicine/Tele-health with the Resource Information database as well as Tele-Education facilities at the Village Resource Centres/Community Centres (VRC) to reach out to more rural areas of the country. The first of the pilot projects has been implemented in the state of Tamil Nadu wherein the nodal centre operated by an NGO agency at Chennai is connected to remote villages in three districts and more are to come in the future.

One of the major advantages of Telemedicine technology has been the saving of cost and effort to the rural patients as they are not required to travel long distances for obtaining consultation and treatment. A study conducted by an

independent agency on one thousand patients in the Chamarajanagar district hospital in Karnataka has revealed that there was a cost saving of 81% to the patient. That is, the patients who availed the telemedicine consultation and treatment spent only 19% of the money which they would have otherwise spent if they had to travel to the nearest cities for a similar treatment. In the case of remote off-shore islands, this is much more significant both to the patient and the Government administration. In such cases, not only the patients have the cost saving but can be provided with quick and timely medical aid.

Telemedicine for Special Situations

Telemedicine connectivity has been provided every year since 2002 at Pampa, at the foothills of Sabarimala shrine in Kerala where lakhs of pilgrims visit the shrine. Here the Telemedicine connectivity is provided between the Temple Board Hospital at Pampa and Amrutha Institute of Medical Sciences, Kochi and Trivandvam Medical College Hospital. Several pilgrims availed the facility and some lives were saved. Similar efforts will be made for other places also.
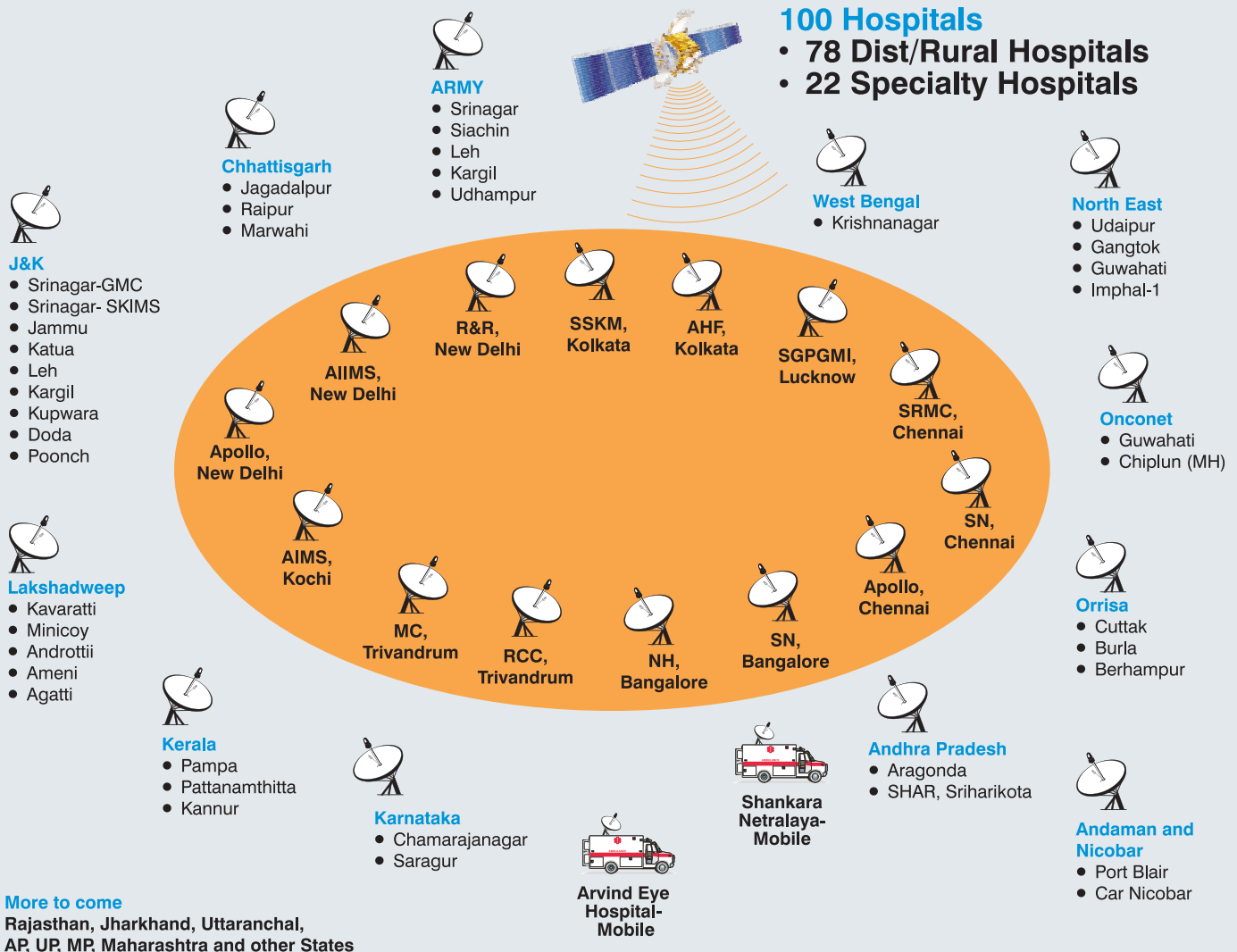
Telemedicine during Tsunami

The ISRO's Telemedicine facilities at three Hospitals – GB Pant Hospital, INHS Dhanvantari at Port Blair, Andaman Island and Bishop Richardson Hospital at Car Nicobar along with ISRO Gramasat Network at 8 Islands was effectively used during post Tsunami disaster relief work for the benefit of the remote population of Andaman and Nicobar Islands. More such Telemedicine centres are being planned at the primary health centres of various islands of Andaman and Nicobar.

ISRO'S TELEMEDICINE NETWORK

100 Hospitals
- **78 Dist/Rural Hospitals**
- **22 Specialty Hospitals**

ARMY
- Srinagar
- Siachin
- Leh
- Kargil
- Udhampur

Chhattisgarh
- Jagadalpur
- Raipur
- Marwahi

West Bengal
- Krishnanagar

North East
- Udaipur
- Gangtok
- Guwahati
- Imphal-1

J&K
- Srinagar-GMC
- Srinagar- SKIMS
- Jammu
- Katua
- Leh
- Kargil
- Kupwara
- Doda
- Poonch

R&R, New Delhi

SSKM, Kolkata

AHF, Kolkata

SGPGMI, Lucknow

AIIMS, New Delhi

SRMC, Chennai

Apollo, New Delhi

Onconet
- Guwahati
- Chiplun (MH)

AIMS, Kochi

SN, Chennai

Lakshadweep
- Kavaratti
- Minicoy
- Androttii
- Ameni
- Agatti

MC, Trivandrum

RCC, Trivandrum

NH, Bangalore

SN, Bangalore

Apollo, Chennai

Orrisa
- Cuttak
- Burla
- Berhampur

Kerala
- Pampa
- Pattanamthitta
- Kannur

Andhra Pradesh
- Aragonda
- SHAR, Sriharikota

Shankara Netralaya-Mobile

Karnataka
- Chamarajanagar
- Saragur

Andaman and Nicobar
- Port Blair
- Car Nicobar

Arvind Eye Hospital-Mobile

More to come
Rajasthan, Jharkhand, Uttaranchal, AP, UP, MP, Maharashtra and other States

The Future

ISRO's Telemedicine endeavour is expanding its outreach and has the potential to open up new frontiers for facilitating rural healthcare in India.

Encouraged by the steady growth of its Telemedicine programme, ISRO has also envisioned the development of "HEALTHSAT", an exclusive satellite for meeting the healthcare and medical education needs of the country at large. This satellite, when deployed along with wireless and terrestrial communication links, can bring a large change in augmenting the present healthcare delivery system in the country.

Due to the untiring efforts of various departments like the Department of Space and the Department of Information Technology, State Governments, NGOs and Private and Corporate Hospitals/Agencies, the majority of the rural population all over the country will stand to benefit from Telemedicine Technology that can usher in a revolution for transforming the face of Healthcare in India.

Thus, Telemedicine can enlarge the gap between life and death and can extend quality Healthcare to the needy and the under privileged rural, semi rural and urban population at large.

Towards "HEALTHSAT: A Concept"

Specialty Tele-Consultation access to large Population
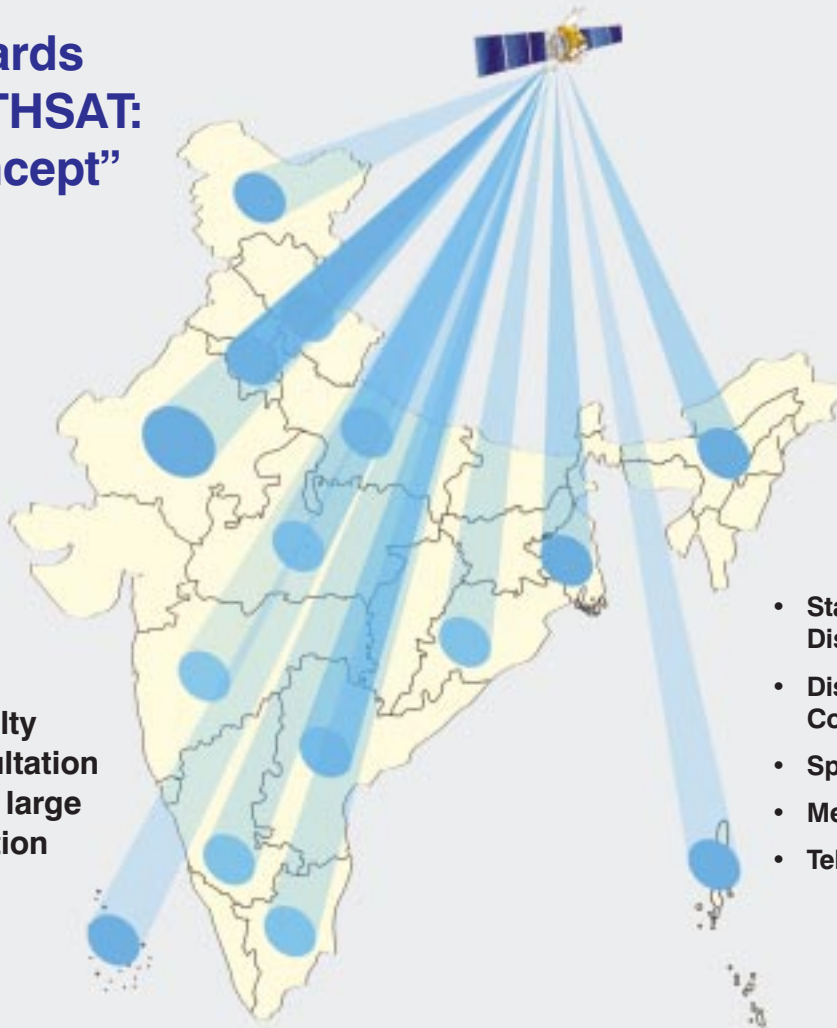
- **State Networks Connecting District Hospitals**
- **District Networks Connecting PHCs**
- **Specialty Hospitals Pool**
- **Medical Institutions Network**
- **Telemedicine Call Centres**

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