

**India's International Co-operation
Programmes
in
Science & Technology**

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The Setting

Programmes of international co-operation in science & technology: (a) provide a vehicle for mutually beneficial exchange of knowledge, experience and use of special or unique facilities, and (b) are a mechanism to develop suitable (including advanced) technologies, complicated or expensive equipment and new research tools and materials required for the S&T development of the participating countries. These programmes are a natural extension of national programmes, or alternatively, national activities can be developed based on the results of international collaboration.

International programmes assist and complement in-country capability-building by upgrading skills, and modernising facilities for scientific activities. If the S&T exchange for mutual benefit is properly organised, countries and their scientific communities gain from what business people call a "win-win" situation. However, many nations — particularly the scientifically and technologically developed ones — now regard S&T co-operation (or their denial) as instrumentalities of their foreign policy. Therefore, whatever the desires and hopes of participating-country *scientists*, ties in science and technology between two, or a group of, partners are, to variable degrees, influenced by the state of political relations between countries.

Science-based Indian Development

Item	Rank in World
Milk	1
Wheat (productivity per hectare)	1
Rice	2
Remote Sensing Satellites	1
Wind Power Capacity	4
Radio Astronomy	Largest facility
Super-Computers	One of three developer-producers

A

Categorisation of India's International S&T Programmes

- UN affiliated
- Multi-lateral (e.g. with FSU)
- Regional (e.g. with ASEAN)
- Bilateral:
 - Country-to-Country
 - Agency-to-Agency

Gol counterparts to selected UN or UN-affiliated agencies with significant S&T components

UN or its affiliated Agency	Gol Counterparts
FAO	Ministry of Agriculture
IAEA	Department of Atomic Energy
ICAO	Department of Civil Aviation
IMCO	Ministry of Surface Transport
International Sea-bed Authority	Department of Ocean Development
International Telecommunications Union (ITU)	Ministry of Telecommunications
IUCN	Ministry of Environment
UN Office of Outer Space Affairs	Department of Space
UNESCO	Ministry of Human Resources Development
World Health Organisation	Ministry of Health
World Meteorological Organisation	India Met. Department/ Department of Science & Technology

Atomic Energy

India's objectives for IAEA

- Restore original scientific-technical character of IAEA — a specialised UN agency.
- Stop its degeneration into a shadow political forum repeating 'non-proliferation' etc. debates in UNGA
- Promotional agency for nuclear power
- IAEA held in India in October, 1998 an "International Seminar on nuclear power in developing countries"
- India's expertise utilised by IAEA for International Group Training Programmes — e.g. radiation protection

Department of Atomic Energy Extracts from Annual Report 1998-99

India has been a designated member of the Board of Governors of the International Atomic Energy Agency (IAEA) since the inception of the IAEA. The Department continued to offer training facilities, fellowships, scientific visits etc. and provided services of its scientists for expert assignments both through the IAEA and to the countries with which India has agreements for cooperation in the field of peaceful uses of atomic energy.

About 360 scientists/engineers participated in international symposia, workshops and conferences held under the auspices of various UN and other international organisations as also the IAEA. 28 foreign scientists were trained in India under IAEA fellowships programme and bilateral agreements signed between Government of India and other countries. India also hosted 16 IAEA meetings, symposia and 6 other international meetings during 1997-98. A number of scientists visited BARC, IGCAR and CAT under the Indo-German bilateral agreement.

Chairman, Atomic Energy Commission (AEC) led the Indian delegation to the 42nd Regular Session of the IAEA General Conference held in Vienna, Austria during September 1998. Bilateral discussions were held with a number of other delegations participating in the Conference.

On June 21, 1998, the supplement to the Inter-Governmental Agreement (IGA) was signed between India and the Russian Federation. IGA was signed between India and former Soviet Union in 1988 for the construction of 2 x 1000 MWe nuclear reactors at Kudankulam, Tamil Nadu. On January 19, a Detailed Cooperation Plan for 1999 was signed between the AEC and the Vietnam Atomic Energy Commission (VAEC) under the framework of the 1986 bilateral agreement between the two countries, for cooperation in the peaceful uses of atomic energy. The plan envisages, inter alia, cooperation in the field of nuclear power, exchange of scientists and assistance by AEC to VAEC in the setting up of a training centre in Vietnam.

Having achieved a comprehensive capability in nuclear technology for many years now, India is in a position to offer on a commercial basis technology as well as equipment to other countries. Concerted efforts continued to publicise our expertise for the purpose of export of technology and equipment for peaceful applications of nuclear energy.

As in the previous year, many scientists from DAE units went abroad for post-doctoral research work.

**Selected UN-connected/
affiliated *international* S&T
Centres located in India**

- APCTT, New Delhi
- Centre for Space Science & Technology Education in Asia Pacific, Dehradun & Ahmedabad
- COSTED, Chennai
- Food Technology, Mysore
- ICGEB, New Delhi
- ICRISAT, Hyderabad
- STEPAN, New Delhi
- TERLS, Thiruvananthapuram

Selected National S&T facilities receiving project assistance from UN-agencies

- Advanced Training Institutes (ILO)
- Centre for Bio-Medical Engineering, IIT, Delhi (WHO)
- CSIO, Chandigarh (UNDP)
- CLRI, Chennai (UNDP)
- CWPRS, Khadakvasla, Pune (UNDP)
- Failure Analysis Facility for Electronic Components, Bangalore (UNDP)
- Indian Jute Research Association, Calcutta (UNDP)
- Lignite Fuel Research Institute, Neyvelli (UNIDO)
- Mineral Processing Laboratory, Nagpur (UNDP)
- NEERI, Nagpur (UNEP)
- Nehru Science Chair, JNCASR, Bangalore (UNESCO)
- SERC, Chennai (UNDP)
- Solar Energy Centre, Gurgaon (UNDP)
- Welding Research Institute, Trichy (UNDP)

Examples of Multi-lateral Co-operation in S&T Programmes

- Integrated Long-Term Programme of Co-operation in S&T with CIS countries.

- International Centre for Powder Metallurgy & New Materials, Hyderabad

(Belarus, Kazakhstan, Moldova, Russia, Ukraine)

- S&T Programming with ASEAN

Bilateral Co-operation

- Cross-linking between Indian S&T (mainly academic) institutions and similar institutions in other countries — since before Independence.
- In 'S', Indian National Science Academy (INSA) plays lead role. Through INSA — Federation of Asian Scientific Academies and Societies (FASAS): Afghanistan to Singapore.
- Since mid-70's, more than fifty country-to-country S&T Agreements between India (via DST) and other countries (Table 1).

- Agency-to-Agency S&T agreements e.g.: CSIR (Table 2).
- 'Space' has about eighteen on-going agreements.
- In Atomic Energy, Space and Defence Research, institutional arrangements exist for coordination with MEA. A Foreign Service officer seconded to Departments of Atomic Energy and Space oversees international relations of these departments.

International Co-operation in Biotechnology

(As of end-1998)

Bilateral Co-operation Programmes with

China

Sweden

France

Tunisia

Germany

UK

Israel

USA

Japan

ASEAN

Poland

G-15

Sri Lanka

SAARC

Switzerland

UNDP/FAO

International Co-operation in Space Research

The Indian space programme, since its inception, has pursued international cooperation very actively. The establishment of Thumba Equatorial Rocket Launching Station, conduct of SITE and STEP, launches of Aryabhata, Bhaskara-I and Bhaskara-II, IRS-1A, IRS-1B and APPLE, manned space mission, development of Vikas engine for PSLV second stage, etc, involved active cooperation with other space agencies/countries. India has flown payloads of other space agencies on its sounding rockets. The Modular Opto-electronic Scanner developed by the German space agency, DLR, was included as one of the payloads on board Indian Remote Sensing satellite, IRS-P3, and the payload is sending valuable ocean-related scientific data. Some details of international cooperation activities are covered in the following paragraphs.

Brunei

Following an agreement with the Government of Brunei, Darussalam, a telemetry, tracking and telecommand station for satellites and launch vehicles is being set up in Brunei.

Canada

Under Memorandum of Understanding with the Canadian Space Agency (CSA), cooperative programmes in different aspects of space science, technology and applications, including commercial tie ups, are being considered.

China

Cooperation is being pursued with China National Space Administration (CNSA) in the areas of space science, technology and applications.

European Space Agency (ESA)

Under an agreement with the European Space Agency, several areas of cooperation have been identified making use of each other's expertise and facilities. Microwave remote sensing data from the synthetic aperture radar on board ERS satellites is being acquired regularly in India. Cooperation in studies relating

to definition of navigation satellite systems for air traffic control is also being pursued.

India participated in the Euro-Asia Space Week organised by ESA during the year in Singapore.

France

An Agreement has been signed with the French Space Agency, CNES on cooperation in peaceful uses of outer space between the two agencies. A specific agreement has also been signed for cooperation in satellite network operations. Preliminary studies on a joint satellite mission known as Megha-Tropiques for obtaining research data on tropical convective systems is being jointly carried out. Cooperation in the field of remote sensing training, promotion of value added services in remote sensing, flight opportunities for CNES experiments on IRS satellites etc, are also being considered.

Germany

Under a Special Arrangement between the German Aerospace Research Establishment (DLR), several areas of cooperation of mutual interest are being pursued. Indian scientists and engineers are taking part in several joint development efforts in DLR centres under this arrangement. Areas of cooperation include processing of synthetic aperture radar data analysis of stereoscopic remote sensing data, artificial intelligence for satellite operations, orbit determination, structural analysis and a few areas of space science. Data from the Modular Opto-electronic Scanner (MOS) of DLR flown on board IRS-P3 satellite is being analysed by scientists from India and Germany as well as by scientists in other parts of the world.

Three sounding rocket flights were carried out from Sriharikota during the year, with German instruments on board, for the study of ionosphere. A workshop on applications of synthetic aperture radar was held at Bangalore as part of the cooperative programme in which several scientists from both countries participated.

Hungary

India has signed an agreement with Hungarian Space Office for cooperation in the exploration and utilisation of outer space for peaceful purposes. A delegation from Hungary visited some of the Space Centres during the year in pursuance of this agreement.

Indonesia

As per a Memorandum of Understanding with National Institute of Aeronautics and Space (LAPAN) of the Republic of Indonesia, establishment of telemetry, tracking and command (TTC) station for satellites and launch vehicles has been set up there.

Japan

A joint space panel for establishing and carrying out scientific and technological cooperation under the umbrella of an agreement between India and Japan is under consideration.

Mauritius

India has set up a TTC station at Mauritius to support IRS mission. The station also provides support for the initial tracking of PSLV using Precision Coherent Monopulse C-band (PCMC) Radar System set up there by India. A remote sensing centre and a satellite meteorology station have been set up in Mauritius with assistance from India.

Norway

Under an MOU with the Norwegian Space Centre, a test flight of an Indian sounding rocket has been carried out from Norway. Cooperation in the area of satellite tracking is also under consideration.

Peru

An MOU for cooperation in space has been signed with the National Space Agency of Peru (CONIDA). Several areas of space research are under consideration for taking up co-operative activities.

Russia

Agreements have been signed with Russia for cooperation in the peaceful uses of outer space. A Joint Working Group, under the agreement, has identified specific areas for scientific cooperation.

Sweden

Under the frame-work of a Memorandum of Understanding with Swedish Board of Space Activities (SBSA), a collaborative project with

Swedish Royal Institute of Technology on the management of water resources for irrigated areas, with geographical information system, has made significant progress during the year.

Syria

A Memorandum of Understanding has been signed with General Organisation for Remote Sensing in Syria for cooperation in remote sensing applications. A pilot project for remote sensing applications in a Syrian site is being carried out with technical and scientific assistance from India.

The Netherlands

Post-graduate diploma courses on human settlement analysis are being conducted routinely at Indian Institute of Remote Sensing (IIRS), Dehra Dun, as part of a collaboration programme with ITC of The Netherlands. Increased cooperation between ITC and IIRS is also being considered.

Ukraine

An Agreement has been signed between India and Ukraine for cooperation in peaceful uses of outer space. Several possibilities for cooperative programmes are being examined by both sides.

United Kingdom

Under a Memorandum of Understanding with British National Space Centre (BNSC) for cooperation in space, several companies from both countries have been brought together for discussions on joint ventures in several areas.

United States of America

An MOU has been signed between India's Department of Space and the Department of Science and Technology (DST) and the US National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA) for cooperation in the area of earth and atmospheric sciences. This involves carrying out joint research projects with exchange of visits and satellite data from both sides. Another MOU has been signed among ISRO, the German Aerospace Centre (DLR) and NASA for reception of data from DLR's Modular Opto-electronic Scanner instrument on ISRO's IRS-P3 satellite, at NASA's ground station for carrying out ocean related studies.

COSPAS-SARSAT System

India, as a member of the international COSPAS-SARSAT programme, has set up Local User Terminal (LUT) and Mission Control

Centre (MCC) at Bangalore and LUT at Lucknow as part of Low Earth Orbiting Satellite Search and Rescue (LEOSAR) network. Indian MCC/LUTs provide real time coverage to a large part of Indian Ocean area covering Bangladesh, Bhutan, Kenya, Maldives, Nepal, Seychelles, Somalia, Sri Lanka, Tanzania, Thailand and Zanzibar. India has also flown search and rescue transponders on board INSAT satellites to complement low earth orbit satellite system.

General

India is playing a very active role in the UN Committee on Peaceful Uses of Outer Space (UN-COPUOS) and the International Astronautical Federation (IAF). India holds the Chairmanship of the UN-COPUOS. DOS continues to participate in the technical activities of the inter-space agency, SFCG which is an informal forum for all space agencies to discuss frequency coordination related issues.

India, Chairman of the international Committee on Earth Observation Satellites (CEOS), hosted the Secretariat and steered the CEOS activities till November 1998. The 12th Plenary was hosted by India in November 1998 at Bangalore. An international symposium on Earth Observation for Sustainable Development was organised in India by the International Society for Photogrammetry and Remote Sensing in February 1998. India will be hosting the second ESCAP Ministerial Conference on Space Applications in New Delhi during December 1999.

India actively participates in international science campaigns like Geosphere-Biosphere Programme and Indian Ocean Experiments

(INDOEX). DOS has an active role in the Inter Agency Space Debris Coordination Committee (IADC), International Space University (ISU), Asian Association for Remote Sensing (AARS), Committee on Space Research (COSPAR), UN-ESCAP, etc. Several personnel from developing countries have been trained in India, specifically in the area of space-based remote sensing applications, under SHARES (Sharing of Experience in Space) scheme of DOS.

Centre for Space Science and Technology Education in Asia Pacific (CSSTE-AP)

The Centre for Space Science and Technology Education in Asia Pacific (CSSTE-AP), has been established by India at the initiative of the United Nations and is administered by an International Governing Board with representatives from Asia Pacific countries and United Nations. CSSTE-AP has been set up around the facilities of the Indian Institute of Remote Sensing (IIRS), Dehra Dun and the Space Applications Centre (SAC), Ahmedabad, of the Department of Space.

The Centre offers Post-Graduate education courses, leading to award of M Tech/MSc (Tech) degrees in Remote Sensing and Geographical Information Systems, Satellite Communications, Satellite Meteorology and Space Sciences to students of different countries in the region. Since its establishment in 1995, CSSTE-AP has already conducted two 9-month courses on Remote Sensing and GIS, one on Satellite Communications and one on satellite meteorology. The third course on Remote Sensing and GIS has started in October 1998 with 22 students from 11 countries participating in the course.

Table I

**Countries with which India has concluded S&T Agreements
(as of September, 1998)**

- | | |
|----------------|-------------------------|
| 1. Argentina | 28. Myanmar |
| 2. Armenia | 29. Oman |
| 3. Australia | 30. Peru |
| 4. Bangladesh | 31. Philippines |
| 5. Belarus | 32. Poland |
| 6. Brazil | 33. Portuguese Republic |
| 7. Bulgaria | 34. Republic of Korea |
| 8. China | 35. Romania |
| 9. Cuba | 36. Russian Federation |
| 10. DPR Korea | 37. Singapore |
| 11. Egypt | 38. Slovakia |
| 12. Estonia | 39. Slovenia |
| 13. France | 40. South Africa |
| 14. Germany | 41. Sri Lanka |
| 15. Hungary | 42. Syria |
| 16. Indonesia | 43. Tajikistan |
| 17. Iran | 44. Trinidad & Tobago |
| 18. Israel | 45. Tunisia |
| 19. Italy | 46. Turkey |
| 20. Japan | 47. Ukraine |
| 21. Kazakhstan | 48. United Kingdom |
| 22. Kyrgyzstan | 49. Uzbekistan |
| 23. Malaysia | 50. Venezuela |
| 24. Mauritius | 51. Vietnam |
| 25. Mexico | 52. Yemen |
| 26. Moldova | 53. Yugoslavia |
| 27. Mongolia | 54. Zambia |

Table II

**Countries with which the Council of Scientific & Industrial Research
(CSIR) has concluded agency-level bilateral agreements**

- | | |
|-------------------|------------------------|
| 1. Australia | 17. Nigeria |
| 2. Bangladesh | 18. Peru |
| 3. China | 19. Poland |
| 4. Czech Republic | 20. Romania |
| 5. Egypt | 21. Russian Federation |
| 6. France | 22. Saudi Arabia |
| 7. Germany | 23. Slovak Republic |
| 8. Guyana | 24. Sudan |
| 9. Italy | 25. Syria |
| 10. Japan | 26. Thailand |
| 11. Jordan | 27. The Netherlands |
| 12. Korea (ROK) | 28. Turkey |
| 13. Kuwait | 29. UAR |
| 14. Mongolia | 30. UK |
| 15. Nepal | 31. Vietnam |
| 16. New Zealand | |

Countries whose Missions in India have a post identified by them as carrying an 'S&T' remit

- Britain
- Canada
- China (Counsellor, S&T)
- France (Dy. Counsellor, S&T)
- Germany (Counsellor, S&T)
- Hungary (Counsellor, S&T)
- Israel (Head, Academic & Scientific Affairs)
- Italy (Scientific Counsellor)
- Japan
- Poland (Counsellor, Education, S&T)
- Russia (Chief, Business, S&T Section)
- USA (Counsellor, Environment, S&T)

Indian Missions abroad which have a post of Counsellor (S&T)

- Germany
- Japan
- Russia
- USA