

UNITED NATIONS  
OFFICE FOR OUTER SPACE AFFAIRS

**Capacity-building  
in space science and technology**

*Regional Centres for Space Science and Technology Education  
affiliated to the United Nations*



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UNITED NATIONS  
New York, 2008

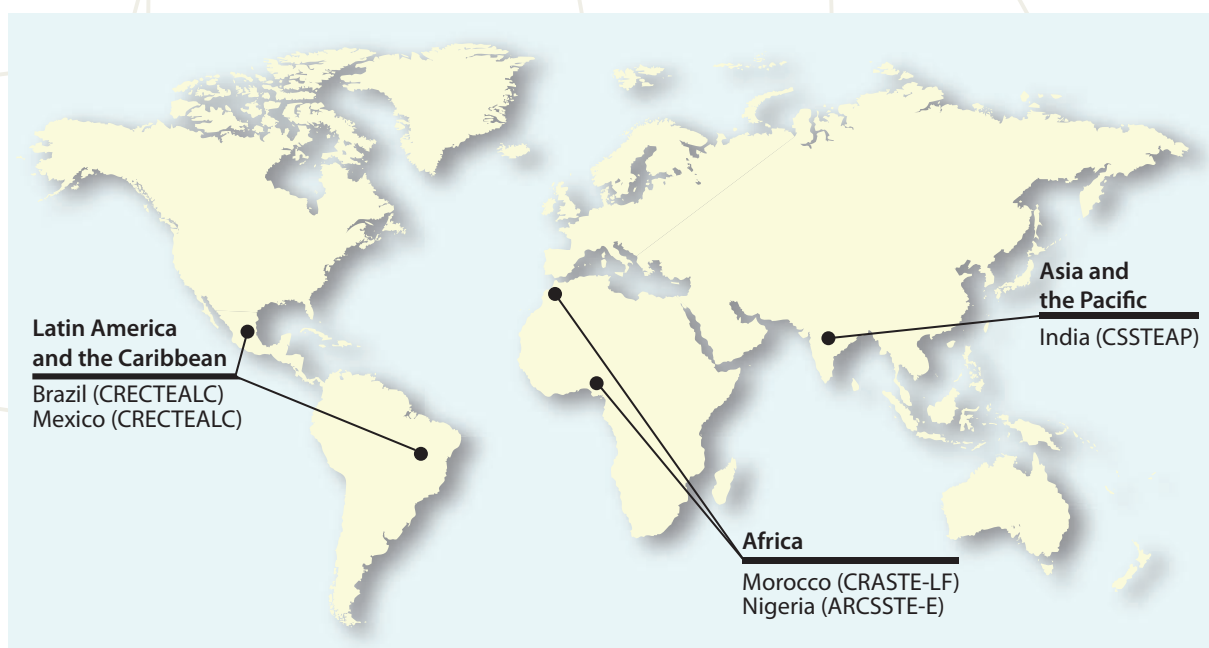
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## Preface

The exponential growth of scientific knowledge and continuing developments in technology are transforming society. Our lives and future depend profoundly on our understanding of planet Earth. Space technology enables us to observe possible threats to life on Earth and has tools at hand to help inhibit them. Knowledge about space, gained through scientific studies can have enormous economic and social benefits that contribute to meeting many societal needs, from human security to sustainable development.

Over the past two decades, space technology has become a significant part of our daily lives. Owing to the rewards and opportunities afforded by space technology and science and their use in promoting social and economic development, and looking at possibilities to enable developing nations to have access to space technology tools by strengthening their indigenous capacities in this field, the United Nations, through its Office for Outer Space Affairs, facilitated the establishment and operation of the Regional Centres for Space Science and Technology Education, affiliated to the United Nations.

This booklet highlights current programmes, achievements and future goals of the four Regional Centres for Space Science and Technology Education, affiliated to the United Nations. It is aimed at policymakers and the general public, interested in learning more about space science and technology education to inform them how to best use the existing resources of the Regional Centres aimed at developing, through in-depth education, an indigenous capability for research and applications of space technology. The booklet also highlights the role and importance of the Regional Centres in promoting cross-border educational activities in space science and technology.



## Background and mandate

The United Nations General Assembly (UN-GA), in its resolutions 45/72 of 11 December 1990, endorsed the recommendation of the Committee on the Peaceful Uses of Outer Space that “the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish Regional Centres for Space Science and Technology Education”, in developing nations.

Under the auspices of the United Nations, through its Office for Outer Space Affairs (UN-OOSA), four Regional Centres for Space Science and Technology Education were established in the regions that correspond to the United Nations Economic Commissions for Africa (Morocco, Nigeria), Asia and the Pacific (India), and Latin America and the Caribbean (Brazil and Mexico). The Centres are affiliated to the United Nations through UN-OOSA.

The Centres use existing educational facilities and build upon expertise already available throughout educational and other research institutions in their regions.

The overall policymaking body of each Centre is its Governing Board (GB), which consists of member countries of the region where the Centre is located, that have agreed to the goals and objectives of the Centre by endorsing a cooperation agreement through which the Centre was established. The standard model education curricula of the Centres were developed through the United Nations Programme on Space Applications, that is implemented by UN-OOSA, with the support of internationally prominent educators. The curricula include the following core disciplines, taught at the Centres: Remote Sensing and Geographic-Information Systems (RS and GIS), Satellite Communication (SATCOM), Satellite Meteorology and Global Climate (SATMET), and Space and Atmospheric Sciences.

Two further model curricula are currently being developed under the auspices of the United Nations in the area of global navigation satellite systems and space law. These disciplines would be included into the education programme of the Centres once the work is concluded.

The overall goal of the Centres is to develop, through in-depth education, an indigenous capability for research and applications in these core disciplines.



**REGIONAL CENTRES FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION  
AFFILIATED TO THE UNITED NATIONS**

# **Centre for Space Science and Technology Education in Asia and the Pacific**





Indian Institute for Remote Sensing, Dehradun



Dedicated earth station for satellite communication students

## Background

The Centre for Space Science and Technology Education in the Asia and the Pacific region (CSSTEAP) was established in India on 1 November 1995 under an agreement initially signed by 10 member countries of the region.

The Centre is hosted by the Government of India and is administered on behalf of the Government within the Department of Space (DOS). The headquarters of the Centre is located in the campus of the Indian Institute of Remote Sensing (IIRS), Dehradun, which is one of the main educational and training institutions of the Department of Space. DOS also made available appropriate facilities and expertise to the Centre at the IIRS in Dehradun for RS and GIS courses and at the Space Applications Centre (SAC) for satellite communications and satellite meteorology courses in Ahmedabad and the Physical Research Laboratory (PRL) for space and atmospheric courses in Ahmedabad.

CSSTEAP is administered by an international Governing Board consisting of representatives of 15 member countries (as of December 2007) in the Asia-Pacific region: Democratic People's Republic of Korea, India, Indonesia, Kazakhstan, Kyrgyzstan, Malaysia, Mongolia, Myanmar, Nauru, Nepal, Philippines, Republic of Korea, Sri Lanka, Thailand, Uzbekistan, and representatives of the United Nations (UN-OOSA) and the International Institute of Geo-information Science and Earth Observation (ITC) in Enschede, and the Netherlands as observers. The executive functions are exercised by the director of the Centre. The technical activities of the Centre are guided by the Advisory Committee, comprised of experts from India and abroad. Chaired by the representative of UN-OOSA, the Advisory Committee reviews all technical aspects, such as curricula, technical facilities, future directions of the Centre and reports to the Governing Board. The two bodies meet annually.

## Success stories

Since its inauguration in 1995, the Centre has conducted 26 postgraduate courses: 11 on Remote Sensing and Geographic Information Systems, 5 each on Satellite Communications, Satellite Meteorology and Global Climate, and Space and Atmospheric Science. Over the past 12 years, the Centre has also conducted 19 short-term courses and workshops. These programmes benefited 752 participants from 30 countries, including 26 participants from 16 countries outside the Asia-Pacific region. Among them, 83 scholars have been awarded the Master of Technology (M.Tech) degree by the Andhra University of India.

The Centre publishes lecture notes in a booklet and also in a CD-ROM format for its four postgraduate courses. Theme-specific lectures of the short-term courses are also published in a booklet as well as in a CD-ROM format. The Centre publishes its regular newsletter portraying its activities, progress of students, future announcements and also memoirs, marking the successful completion of each course. In November 2005 the Centre celebrated its ten year anniversary with a motto:

**“By giving to others knowledge increases”**

## Scientific cooperation

In promoting exchanges and sponsorships for students, the Centre signed Memorandums of Understanding with several international scientific institutions: the Aerospace Remote Sensing Development Group (GDTA), the International Centre for Integrated Mountain Development (ICIMOD), the International Institute for Geo-Information Science and Earth Observation (ITC), the Third World Academy of Sciences (TWAS), International Centre for Science and High Technology (UNIDO), Trieste, Italy and with the Netherlands. The Centre is also closely linked to several other institutes and universities, such as the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT), the Institute of Space and Astronautical Science





International hostel facilities  
at SAC, Ahmedabad



Physical Research Laboratory,  
Ahmedabad

## SPACE SCIENCE AND TECHNOLOGY EDUCATION IN ASIA AND THE PACIFIC

(ISAS), Japan; the National Aerospace Research Centre (ONERA), France; the National Oceanic and Atmospheric Administration (NOAA), USA; the University of Colorado, USA; the University of Reading, U.K; the University College of London, U.K; the University of Hannover, Germany; the University of Wisconsin, USA.

In 1998, CSSTEAP also signed a Memorandum of Understanding with the Andhra University, Visakhapatnam, India, under which the University can award the Master of Technology (M.Tech) degree to those students who have completed the nine-month post-graduate programme of the Centre together with one year research or application project implementation in the home country of the scholar.

In India, apart from DOS/ISRO Centres, CSSTEAP is cooperating with many universities and academic institutions for the provision of education and training.

### Outlook

Since its inception in 1995, CSSTEAP has established a viable system to impart education and training in space science and technology to countries in the Asia-Pacific region. However, the outreach is still limited. Each country requires a certain number of trained personnel in the area of space science and technology education to be able to effectively use science and technology to address domestic problems. The Centre will therefore direct its future efforts towards increasing the number of scholars who acquire specialized knowledge in space science and technology education. Various possibilities to increase the outreach of these educational programmes include interactive satellite-based distance education, web-based education, special programmes designed for teachers that can then convey their knowledge further to a larger number of students.

No educational programme can be sustained without research. Research programmes that are supported by

adequate scientific facilities and ambience can attract some of the brightest minds and enrich society. In general, research helps us gain a better understanding of many interrelated issues of the subject under study and can help teachers, undertaking the research, to improve their pedagogical practices. Plans are under way to organize research programmes on subjects relevant to national developmental programmes. Such research work can lead to the award of Ph.D degrees, in cooperation with prominent academic institutions.



### Message from the Director

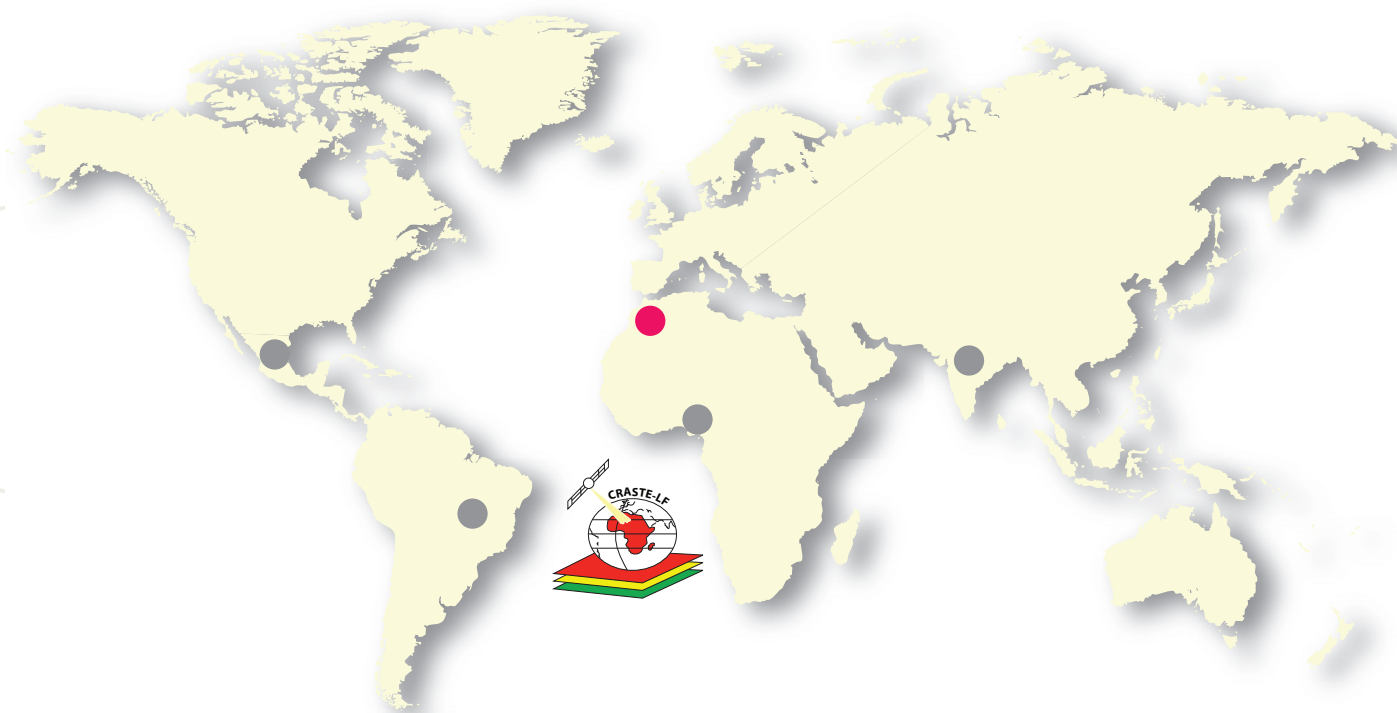
The Centre is on a mission of capacity-building in the Asia-Pacific region in space science and technology through education, training, and research. The Centre is committed to academic excellence to enable each scholar to reach his or her individual potential. This endeavour should result in the development and growth of technically and managerially competent human networks that will use those aspects of space science and technology, that can greatly impact economic and social development of countries, including the preservation of their environment.

With the joint efforts by all of the Regional Centres, it is sincerely hoped that in the near future every country in the region will not have to look abroad for expertise in space science and technology applications, but will find the expertise readily available at home.



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# **African Regional Centre for Space Science and Technology Education in French**





Participants of the postgraduate courses



International workshop on Climate Changes  
Algiers, Algeria, October 2007



## AFRICAN REGIONAL

### Background

The African Regional Centre for Space Science and Technology in French (CRASTE-LF), which is affiliated to the United Nations, was set up in Morocco in 1998. The Centre is based at the Mohammadia School of Engineers at the University Mohamed V in Rabat.

The main aim of the Centre is to increase knowledge in space science and technology by assisting nations in the region to develop and consolidate their indigenous capacities in this field. The Centre conducts a series of seminars, workshops and conferences as well as promoting its postgraduate and short-term courses in the core disciplines. The Centre pursues the following goals:

- Strengthening of national and regional capacities;
- Gathering and disseminating space-related information;
- Promoting cooperation between industrialized nations and developing nations, as well as among developing nations;
- Supporting activities that can further the region's scientific advancement;
- Implementing and developing continuous education for researchers, academics, and experts in space science and technology and their applications.

At present the Centre has the following 13 signatory member countries from the region: Algeria, Cameroon, Cape Verde, Central African Republic, Côte d'Ivoire, Democratic Republic of Congo, Gabon, Morocco, Mauritania, Niger, Senegal, Togo and Tunisia.

### Educational programme records

In order to execute its educational programmes, the Centre conducts a series of seminars, workshops and conferences together with short and long-term postgraduate courses in the core disciplines that target academics, researchers, engineers, administrators and policymakers. The education programmes serve to disseminate knowledge in the field of space science and technology to benefit countries in the region.

Each course has two phases. The first phase (Phase I), which lasts nine months, is designed to include formal training and preparation of a pilot project. Held at the Centre in Rabat, the course examines theoretical modules, including basic and specialized teaching through lessons and practical work; and prepares for a pilot project, which is then carried out by a scholar under the supervision of an advisor. The pilot scheme runs for 10 to 12 weeks during which key areas, such as planning, management and execution techniques are examined. The second phase (Phase II), which is 15 months in duration, focuses on the implementation of a pilot research project by the scholar in his/her country of origin. This phase draws on information and knowledge already acquired from training modules in Phase I.

The contents of the postgraduate courses are based on the model curricula developed by the United Nations through UN-OOSA, published in December 1996 and revised in September 2001. French is the official language of the programmes.

### Success stories

Since its inauguration in 1998, the Centre has conducted 10 postgraduate courses: 5 on Remote Sensing and Geographic Information Systems and 3 each on Satellite Communications and Satellite Meteorology and Global Climate. Over 150 professionals from both member and non-member countries have successfully completed these PG programmes. Among these professionals, 35 have concluded the Master's thesis in space science and technology. Their dissertations covered all the disciplines taught at the Centre.

In conjunction with postgraduate training, the Centre also organized workshops and symposiums, which have been attended by over 600 participants and experts. These scientific events addressed topics related to the use of space science and technology for sustainable development and regional capacity-building.

### Scientific cooperation

Within the Centre's programmes, regional and international cooperation plays an important role in the implementation of its training courses and scientific events.

## THE CENTRE FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION IN FRENCH

In this connection, CRASTE-LF pursues efforts to develop cooperation with counterpart Regional Centres, to share experiences and raise awareness, in particular among those institutions that could provide support for the work of Centre, and strengthen and improve cooperation with other national and international organizations in the developed countries.

- (a) Cooperation agreements have been concluded by the Centre with:

The Scientific Institute of Mohamed V University, Agdal, Rabat; the African Centre for Meteorological Applications for Development (ACMAD); the Islamic Educational, Scientific and Cultural Organization (ISESCO); the Moroccan Agency for International Cooperation (AMCI), which made it possible, in particular, to secure student funding to a limit of 12 scholarships per training session and, most importantly, to double the bursary level; the Higher Multinational School of Telecommunications (EMST), Dakar, Senegal; the University of Marne-la-Vallée, France; including the Cooperation and support agreement concluded between the Director of the Moroccan Agency for International Cooperation and the Director of CRASTE-LF.

- (b) Cooperation with regional institutions:

In Morocco: the Mohammadia School of Engineering (EMI), Mohamed V University, the Royal Centre for Remote Sensing (CRTS), the Royal Centre for Space Studies and Research (CRERS), the Hassan II Institute of Agronomy and Veterinary Science (IAV), the National Post and Telecommunications Institute (INPT), the Hassania School of Public Works (EHTP), the National Meteorological Directorate (DMN), the National School of Forestry Engineering (ENFI). In Senegal: the Higher Polytechnic School of the Cheikh Anta Diop University; the African Regional Centre for Technology (ARCT); and the Higher Multinational School of Telecommunications (EMST). In Algeria: the Algerian Space Agency (ASAL) and the National Space Technology Centre (CNTS).

In Tunisia: the Regional Remote-Sensing Centre for North African States (CRTEAN); and in Cameroon: the National Institute of Cartography (INC Yaoundé).

- (c) Cooperation with international organizations and agencies:

The UN-OOSA, Vienna; Centre national d'études spatiales (CNES), France; the European Space Agency (ESA); the Canadian Space Agency (CSA/ASC); the National Oceanic and Atmospheric Administration (NOAA), USA.

CRASTE-LF has also entered into cooperation and collaboration relationships with the other three Regional Centres for Space Science and Technology Education, affiliated to the United Nations (CSSTEAP, ARCSSTE-E and CRECTEALC).

### Outlook

The proposed programme of CRASTE-LF for 2008-2009, with the agreement of its Governing Board includes the following activities:

1. Postgraduate courses:
  - The sixth training course in Remote Sensing and Geographical Information Systems, October 2008;
  - The third training course in Space Meteorology and Global Climate, December 2008;
  - The seventh training course in Remote Sensing and Geographical Information Systems, October 2009.
2. Workshops:
  - International Workshop on "Space-based Disaster Management and Emergency Response in Africa", November 2008.
  - Short training on Global Navigation Satellite System (GNSS) in collaboration with the International Committee on Global Navigation Satellite Systems (ICG) and the UN-OOSA, June 2009;
  - Short training workshop on Radar Remote Sensing and its Applications, June 2009.



### 3. Other initiatives:

- To build up a database of experts in space technology and related specialized areas among member countries. The goal of this initiative is the identification, validation and the reinforcement of competences in the space application field in the African region;
- To set up a unit of documentation/library. A data bank of remote sensing images, weather and cartographic data will be made available in order to allow the trainees access to necessary information to develop research projects in their nations;
- To develop and implement the web portal of the Centre;
- To have a fully operational Advisory Committee, with its main task to evaluate each of the concluded postgraduate courses.

The Centre will work to get support for its educational initiatives with the following institutions: the African Bank of Development, the Islamic Bank of Development, the United Nations Economic Commission for Africa (ECA), the Food and Agriculture Organization of the United Nations (FAO), the Francophone University Agency, the World Weather Organization (WWO), the International Francophone Organization, and the Francophone University Agency.

The celebration of the tenth anniversary of the establishment of CRASTE-LF will take place in Rabat, in October 2008.

More information on the Centre can be found in the following website: [www.crastelf.org.ma](http://www.crastelf.org.ma)

## Message from the Director

This presentation of the work of CRASTE-LF, given its recent establishment, shows a significant volume of



activities involving both training courses and scientific events, despite an unfavourable financial situation and limited human resources to implement them.

It also reflects the growing interest aroused by the work of CRASTE-LF among major international institutions and scientific partners, which are convinced that a regional approach to training, and the formulation and execution of projects within the Centre's scope of responsibilities, offer opportunities for generating significant cost-effective benefits for each country as well as for the region as a whole.

These achievements are owed to the constant support of the Moroccan authorities, partner institutions and the body of experts who have assisted the Centre in this exciting venture. The activities of the Centre are further supported by UN-OOSA, in providing training and organizing scientific events, all with a view to building capacity in space science and technology on the African continent, which is of vital importance for the assimilation of new technologies on the continent, for the furtherance of its development and for the well-being of African peoples.

**REGIONAL CENTRES FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION  
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# **African Regional Centre for Space Science and Technology Education in English**



## Background

The African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E) was inaugurated in Lagos, Nigeria on 24 November 1998, under the auspices of UN-OOSA.

The Centre's main mandate is to increase indigenous capability in space science and technology applications through education and training at the postgraduate level in the four core disciplines: Remote Sensing and Geographic Information Systems (RS and GIS), Satellite Communications (SATCOM), Satellite Meteorology and Global Climate (SATMET), and Space and Atmospheric Sciences. The Centre is also engaged in activities to increase public awareness of the benefits of space technology for sustainable national development and to include space education in the national curricula in junior schools.

The Centre operates under the aegis of the National Space Research and Development Agency (NASRDA), an organization of the Federal Ministry of Science and Technology of Nigeria. Since its inception, the Government of Nigeria has been responsible for the funding of the Centre. UN-OOSA provides, on an annual basis, a grant to foreign participants in the form of travel support. The Obafemi Awolowo University (OAU), as the host institution, provides infrastructural facilities and human resources. At present, the Centre is located at the OAU campus, in the office accommodation, which is an extension to the premises of the Faculty of Science.

Main entrance to the Centre



## Success stories

In 2000, when the first nine-month postgraduate diploma (PGD) courses in RS and GIS and SATCOM began, the Centre was not as recognized and the enrolment of students was poor. Many qualified students could not be admitted to the programme due to lack of scholarships. By 2006, as a result of improved funding by the Government of Nigeria and through the support of NASRDA several qualified candidates from African countries were admitted to the programmes, portraying a truly regional representation. About 120 participants from the following 15 countries have benefited from the courses so far: Cameroon, Democratic Republic of Congo, Ethiopia, Gambia, Kenya, Liberia, Malawi, Nigeria, Sierra Leone, South Africa, Sudan, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe. The Centre contributes considerably towards capacity-building in applications of space science and technology for socio-economic growth and development in the region.

After completion of a PGD programme, graduates are encouraged to further their studies up to the Master's degree and Ph.D. levels, that can also secure better career opportunities. In conducting postgraduate programmes and research, the Centre is supported by experts from both local and foreign institutions, and the industry. Since its inception to date, the Centre has also successfully organized and hosted a number of international workshops and conferences.

PGD course participants attending stakeholders' workshop on GEO-FORMIN, Abuja (2006)





## Educational programme records

The PGD courses were reconsolidated to become fully-fledged regional academic programmes with participation of 15 African countries. The curriculum is common to the other United Nations-affiliated Regional Centres for Space Science and Technology Education. The total number of PGD projects in all disciplines completed so far is 83. The statistics of the programmes, taught at the Centre is presented in the tables below.

PARTICIPATION IN PGD COURSES (2000 - 2008)

	RS/GIS	SATCOM	SATMET	SPACE SCI
2000/2001	6			
2001/2002	4		4	
2002/2003		5		
2003/2004				
2004/2005	4	4	3	
2006	27	14		4
2007	18	8		
2008	21	11		
<b>Total numbers of participants</b>	<b>80</b>	<b>42</b>	<b>7</b>	<b>4</b>

DISTRIBUTION OF PGD RS/GIS COURSE PARTICIPANTS BY THE MEMBER STATES

Member State	Pre-2006	2006	2007	2008	Aggregate (2000-2008)
Liberia	2	1			3
Gambia		1			1
Ethiopia		3			3
Sudan		2	3	3	8
Malawi		1	2	2	5
Zambia		1			1
South Africa		1			2
Kenya		3			3
Uganda		1		3	4
Nigeria	3	9	5	9	26
Cameroon		4	7	3	14
Sierra Leone	1				1
DRC			1		1
United Republic of Tanzania			2		2
Zimbabwe			1		1
<b>Total No. of participants</b>	<b>6</b>	<b>27</b>	<b>21</b>	<b>20</b>	<b>74</b>

## Scientific cooperation

Since its inauguration, ARCSSTE-E is pursuing the establishment of bilateral research programmes with international participation. Scientists from several Swedish institutions, such as the International Programme in the Physical Sciences (IPPS), the University of Uppsala and Stockholm University have been participating in the development of the Centre's scientific programmes. The World Meteorology Organization (WMO) sponsored the trip of a scientist from Kenya to conduct practical courses in the SATMET postgraduate programme.

The following research projects have been carried out in the Centre:

- The Nigerian Mesoscale Experiment (NIMEX): This project is undertaken jointly with the University of Ibadan, the Federal University of Technology at Akure and Obafemi Awolowo University. The overseas collaborators come from the Department of Micrometeorology, University of Bayreuth, Germany. The project is also supported by the International Programme in the Physical Sciences (IPPS) of Uppsala University, Sweden through equipment purchase and training of scientists overseas;

- Monitoring of deforestation using satellite data: This project is a NASRDA sponsored research project, that is being executed by scientists at the Institute of Ecology and Environmental Studies, Obafemi Awolowo University. The Centre manages this project administratively on behalf of NASRDA.

## Outlook

The Centre envisages to achieve the following targets until 2010:

- Set up a world class institution for training in the area of space science and technology applications at the postgraduate level in Nigeria;
- Set up a data archive for the various operational satellites for purpose of research for sustainable development;
- Promote and build awareness of the benefits of space science and technology and their applications by organizing conferences, seminars and workshops in this field;
- Develop a space science curriculum for schools, within a three-year period (2007-2009);

A training session



Participants of the postgraduate programmes training in the field



## CENTRE FOR SPACE SCIENCE AND TECHNOLOGY EDUCATION IN ENGLISH

- Engage in the 25-year road map on space development by NASRDA, aimed at building the nation's capacity to send an astronaut into space by 2015;
- Produce teaching aids and resources for space education (mockups, teaching charts, etc.);
- Organize annual schools' quiz competition on space education.

Although the PGD programme has already recorded some tangible achievements since its inception in 2000, the vision for the future of this programme is to build upon available resources to strengthen capacity in space science and technology and their applications in Africa. The Centre is also exploring possibilities to join the Fulbright Senior Specialist programme to increase human capacity in delivery of its mandates. Elements of space law and policies are also introduced to broaden the perspectives of the course participants. Space Clubs are being established for school children.

### Message from the Director

The PGD programme began in 2000 without a full-fledged Governing Board in place and scarce international participation in the programmes. Availability of funds has always been a perennial issue in Africa. To circumvent these obstacles and to encourage foreign



participation in the PGD programme, the Centre, despite limited resources, provides support that covers tuition, accommodation, and monthly living expenses of participants in the PGD programme.

This approach is borne by the desire to make African member countries beneficiaries of the immense gains of space science and technology, to promote regional cooperation and socio-economic development as well as to support international activities and programmes.

Since 2006, the calendar for the programme has been changed to run from January to September, every year. On an annual basis, the PGD programme is advertised in July and the selection of candidates is made in October.

In 2008, the Centre is planning to celebrate the 10-year anniversary of its establishment as a United Nations-affiliated educational institution, making a substantial contribution towards regional capacity-building efforts in the field of space science and technology and their applications.



# **Regional Centre for Space Science and Technology Education in Latin America and the Caribbean**







CRECTEALC, Campus Brazil



CRECTEALC, Campus Mexico



Postgraduate courses laboratory, Mexico

## REGIONAL CENTRE FOR SPACE SCIENCE

### Background

The Regional Centre for Space Science and Technology Education in Latin America and the Caribbean (CRECTEALC) was established on 11 March 1997 through an Agreement signed by the Governments of Brazil and Mexico. At present, CRECTEALC is based in two campuses, located in Brazil and Mexico.

The aim of the Centre is to provide high-level education and training that develop skills and scientific knowledge for conception, development, and application of remote sensing and related technologies, satellite communications, satellite meteorology, and space and atmospheric sciences for subsequent use in national and regional programmes. Those programmes relate, among others, to the environment, protection of biological diversity, climate change studies, health and education, weather forecasting and early warning of extreme events, disaster management as well as to enhance participation in the development of space science at the international level. To attain this goal the Centre offers postgraduate programmes, workshops, short-term courses in the core disciplines: Remote Sensing and Geographic Information System, Satellite Communications, Satellite Meteorology and Global Climate, and Space and Atmospheric Sciences. The target beneficiaries are professors, researchers, practitioners working in public institutions and private enterprises as well as other professionals involved in the area of space science and technology in the countries of Latin America and the Caribbean region. The campus in Brazil benefits from the facilities made available to it by the National Institute for Space Research (INPE), a renowned research institution in space science and technology. Similar high quality facilities are found at the campus in Mexico which is supported by the National Institute of Astrophysics, Optics and Electronics (INAOE). The languages of education at the Centre are Spanish, Portuguese and English.

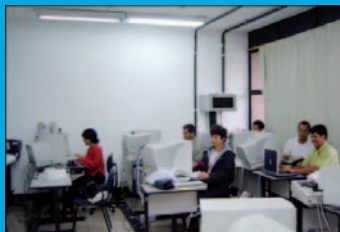
The policymaking body of the Centre is its Governing Board, comprised of representatives of the member countries of the Centre. The Centre has established an Advisory Committee to advise the Governing Board,

the Secretary General of the Centre and the Directors of the Campuses on establishing links with the academic, public and private sectors and to review education programmes and projects of the Centre. The Secretary-General and the Directors of the Campuses present work plans on a yearly basis for review and approval by the Governing Board.

### Success stories

Since its establishment, CRECTEALC has conducted eight 9- and 12-month postgraduate courses on Remote Sensing and Geographic Information Systems (GIS) at its Brazil and Mexico Campuses. The courses have been organized in partnership with INPE, INAOE, the National Council for Scientific and Technological Development (CNPq) of Brazil, the United Nations University and UN-OOSA. The courses have been designed for professionals from Latin America and Caribbean countries. By 2007, 210 professionals have graduated from these courses, and 90 per cent of them are still working in the areas of remote sensing and geographic information systems in their own countries. The Centre has also conducted one postgraduate course in satellite communications from which four professionals graduated and are now working at their home institutions. CRECTEALC has now prepared the first postgraduate courses on space and atmospheric science and the first postgraduate course on satellite meteorology and global climate to be offered in 2008. Through these achievements, the Centre will now offer the four core curricula proposed by UN-OOSA to cover all the space science and technology disciplines.

On the basis of a decision taken at its meeting in 2007 and followed up at its meeting in 2008, the Governing Board of the Centre has invited all countries of the Latin America and Caribbean region to join the Centre as full members through adherence to the Agreement that established the Centre. Additional members would join the Governing Board with equal rights and obligations. Through this initiative and follow-up actions, the Centre will be enriched by the coordinated use of the highly qualified resources of the region.



Geo process laboratory,  
Brazil



Students of the first  
postgraduate course  
of RS and GIS, 2006,  
Mexico

## SCIENTIFIC AND TECHNOLOGY EDUCATION IN LATIN AMERICA AND THE CARIBBEAN

### Educational programme records

Since 2003, the Centre has conducted five 9-month postgraduate courses in Remote Sensing and GIS at the Brazil Campus of CRECTEALC. These courses have benefited 190 participants from 12 countries in the region. The participants of these postgraduate courses have already concluded 44 pilots projects. The Centre has conducted three other postgraduate courses on remote sensing and GIS at the Mexico Campus. Graduates of these courses participated in INAOE projects (e.g. cadastre update for Tonantzintla, Puebla, development of a GIS for the city of Puebla) as further hands-on training before returning to their countries. In addition, the Centre conducted one course on Satellite Communications at its Mexico Campus and prepared postgraduate courses on Space and Atmospheric Science, and Satellite Meteorology and Global Climate to be offered at the Mexico and Brazil Campuses respectively in 2008. The Centre has also organized five workshops on remote sensing and GIS at the Brazil Campus and a short-term course on geo-technologies for the prevention and mitigation of natural disasters. This short-term course, a partnership between the Brazil Campus and the Centro de Levantamientos Integrados de Recursos Naturales por Sensores Remotos (CLIRSEN) of Ecuador, was held in Quito.

The Government of Brazil provides support for the educational activities of the Brazil Campus of CRECTEALC. All students from Latin American countries receive fellowships from the National Council for Scientific and Technological Development (CNPq), a Brazilian science foundation. UN-OOSA and the United Nations University also provided financial support to the participants of postgraduate courses at the Brazil Campus. The diplomas of the postgraduate courses are recognized by both the United Nations University as well as the National Institute for Space Research (INPE). The postgraduate programmes at the Mexico Campus have been carried out through fellowships and other support provided by INAOE and the Ministry of Foreign Affairs of Mexico.

### Scientific cooperation

CRECTEALC, has signed cooperation agreements and memoranda of understanding with UN-OOSA, the Organization of American States (OAS), Inter-American Institute for Global Change Research (IAI); Latin American Institute of Educational Communications (ILCE), Sociedad de Especialistas Latinoamericanos en Percepción Remota y Sistemas de Información Geográfica (SELPER); Comisión Nacional de Actividades Espaciales (CONAE), and CLIRSEN. In addition, the Brazil Campus has a cooperation agreement with the United Nations University.

At the national level, the Brazil Campus cooperates with academic institutions such as Universidade do Vale do Rio dos Sinos (UNISINOS), the National Institute for Space Research (INPE) and the National Council for Scientific and Technological Development (CNPq). The Mexico Campus cooperates with the National Institute of Astrophysics, Optics and Electronics (INAOE), which is the academic institution where the Campus is located. The Ministries of External Relations of Brazil and Mexico also provide strong support to the Centre.

### Outlook

In 2008 and future years, the main activities of CRECTEALC aim to:

- Support the initiative of the Governing Board to increase the number of member countries of the Centre;
- Promote an exchange of professors between the Campuses in Brazil and Mexico and the joint organization of activities;
- Establish and strengthen cooperation relationships with regional and national institutions in Latin America and the Caribbean;
- Establish and strengthen cooperation relationships with the other Regional Centres affiliated to the United Nations;
- Establish cooperation relationships with the private sector;

- Establish and strengthen cooperation relationships with other relevant national and international institutions, public, private and non-governmental, from outside of the region;
- Introduce curricula on Global Navigation Satellite Systems and in Space Law;
- Seek the official recognition by competent national and international authorities of the postgraduate diplomas awarded by the Centre.

## Message from the Secretary-General of CRECTEALC

Within the period of existence of CRECTEALC, space activity has increased considerably in the Latin America and Caribbean region. Several countries have established, or are in the process of establishing, space

agencies or similar bodies to coordinate national space activities. Government institutions are increasingly using space technology to carry out national and local plans for sustainable development, including protection of the environment and disaster reduction. Through international cooperation the academic community is participating in basic research in many areas of space science and exploration. Although at an incipient level, the private sector is finding commercial applications of space technology. The Centre is committed to academic excellence and is in a position to prepare highly qualified personnel for these entities. To achieve this, CRECTEALC will act as a catalyser to bring together existing, and create new, expertise in education and research activities within the region and beyond. The strategy of the Centre will be to involve all actors and to promote national, regional and international cooperation that provides benefits to all who participate in it.





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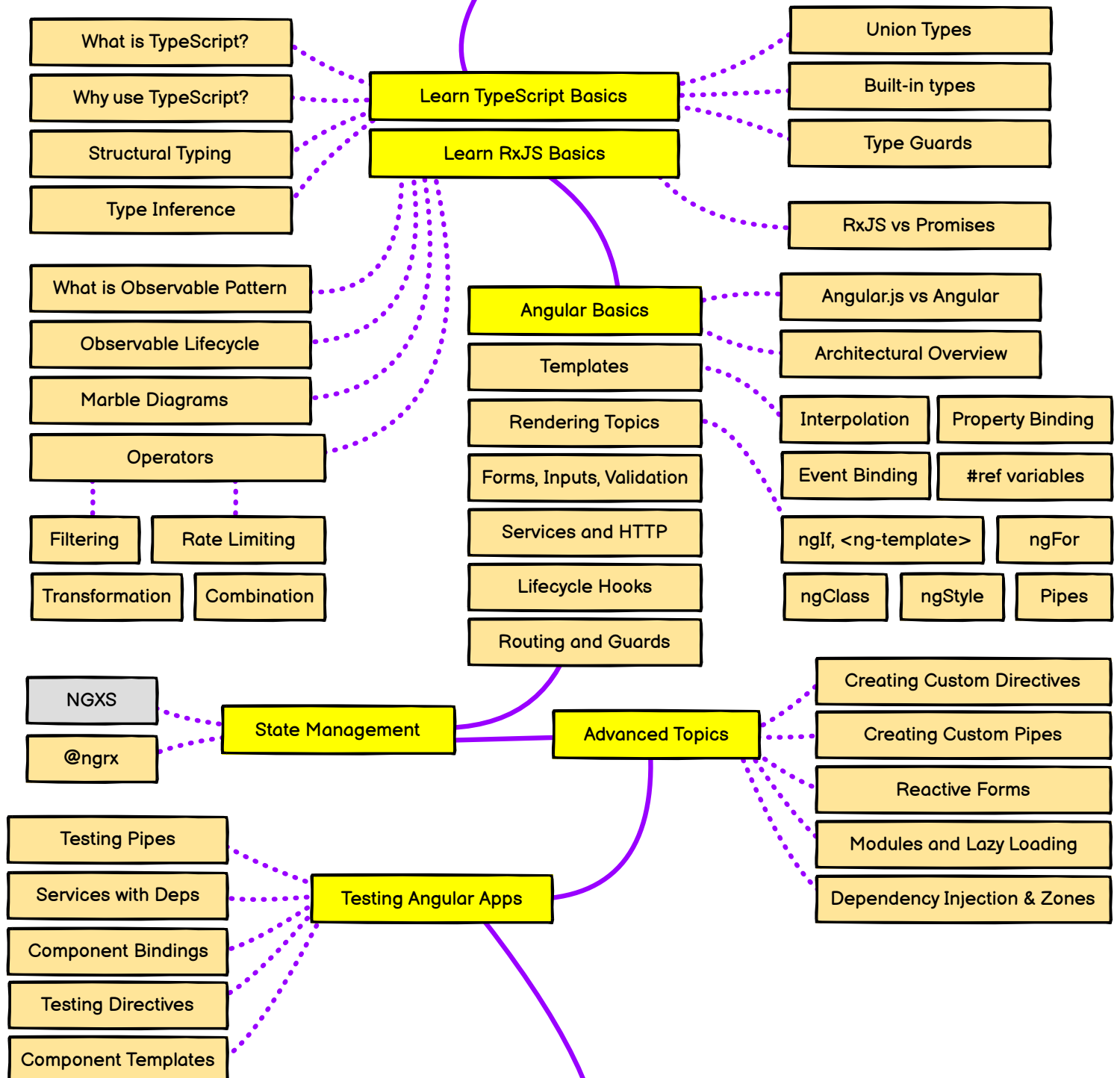
## Frontend Roadmap till Framework Selection

[roadmap.sh/frontend](http://roadmap.sh/frontend)

Find the detailed version of this roadmap along with resources and other roadmaps

<http://roadmap.sh>

## Angular



## Frontend Roadmap after Framework Selection

[roadmap.sh/frontend](http://roadmap.sh/frontend)