Argentina

Centro de Investigaciones Opticas (ClOp)

Address: Casilla de Correo, 124, 1900 La Plata, Argentina. **Phone:** (+54 21) 842957, 840280; **Fax:** (+54 21) 71-2771; **E-mail:** postmaster@ciop.edu.ar.
Director/Head: Mario O. Gallardo.
Number of Research Scientists: 20; **Number of Staff:** 25.
Scientific Fields of Interest: Materials; Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Image processing (digital and analog); optical metrology; laser spectroscopy; optical spectroscopy; photophysics; technological applications of optics and lasers; optical properties of materials; fibre optics; postgraduate courses and continuing education.
Major Scientific Results or Products: More than 350 papers in professional journals, metrological services related to optics and lasers; calibration services in fields of mechanical metrology and fibre optics communications; research and development of instruments and systems for real-time optical metrology.
Main Research Facilities Available: Spectrographs; lasers; optical tables and benches; supporting optical and laser equipment; library; PC computers; workshop classroom; 750 square metres of laboratory space.
Future Development Plans: To turn Centre into international metrological base and Latin American school in optics for under- and postgraduate activities, technical advising and multidisciplinary education.
Cooperation Arrangements with Developing Countries: Colombia, Brazil, Chile and Mexico.
Other International Cooperation Arrangements: Laboratories in Spain, Sweden, Germany and Italy.

Comisin Nacional de Energa Atmica (CNEA), Buenos Aires

Address: Avenida Libertador 8250, Buenos Aires 1429, Argentina. **Phone:** (+54 1) 707711/19, 7012431/33; **Telex:** 21388; **Fax:** (+54 1) 5449252.
Director/Head: Eduardo F. Santos.
Number of Research Scientists: 100; **Number of Staff:** 125.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Environment; Physics/Astronomy.
Main Lines of Research and Training Activities: Extractive Metallurgy; nuclear fuels; processing of spent nuclear fuels; hot cells operation.
Major Scientific Results or Products: Technology in fields of nuclear materials and fuels.
Main Research Facilities Available: Extractive Metallurgy pilot plant; nuclear fuels pilot plant; shielded cells for postirradiation tests.

Comisin Nacional de Energa Atmica (CNEA) Centro Atmico Bariloche (CAB)

Address: 8400 S.C. de Bariloche, Pcia. Rio Negro, Argentina. **Phone:** (+54 944) 45100; **Telex:** 80723 CABAR; **Fax:** (+54 944) 45299; **E-mail:** info@cab.cnea.edu.ar.
Director/Head: Francisco Carlos Lovey.
Number of Research Scientists: 160; **Number of Staff:** 152.
Scientific Fields of Interest: Energy; Materials; Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Training in physics and nuclear engineering; solid state physics; surface physics; atomic physics; neutron physics; elementary particles; statistical mechanics; material sciences (ceramics, nuclear materials, metallurgy); computational mechanics; hydrogen storage; nuclear safety; applications of neutron irradiation; gamma spectroscopy; thermohydraulics, heat transfer; condition monitoring.
Major Scientific Results or Products: Contributions to refereed international journals; technology development and applications; prototypes.

Main Research Facilities Available: Nuclear reactor for research and training (type MTR, 0.5 Mwt); thermohydraulic laboratory; computers: workstations and silicon graphics power challenge iris, L-series with 4 processors; linear and electrostatic accelerators; liquid He facilities; EPR equipment; electromicroscopes, STM microscope; X-rays.
Future Development Plans: Interaction of particles with surfaces; materials and solid state sciences; superlattices, quantum wires and dots, optical properties of solids, superconductivity; advanced ceramics; ceramics pilot plant; physical chemistry of HT_c superconductors; chlorination of minerals; sintered solar cells; titanium and zirconium-based alloys, hydrogen energy; waste management; development of boron neutron capture therapy facility.
Cooperation Arrangements with Developing Countries: Brazil, Chile, Venezuela, Mexico, Paraguay.
Other International Cooperation Arrangements: USA, European Community (Spain, England, France, Germany, Switzerland, Sweden, Italy) and Japan.

Instituto de Desarrollo Tecnolgico para la Industria Qumica (INTEC-CONICET)

Address: Guemes 3450, 3000 Santa Fe, Argentina. **Phone:** (+54 42) 532965 or 559175; **Fax:** (+54 42) 532965 or 550944; **E-mail:** director@intec.arcride.edu.
Director/Head: Alberto Enrique Cassano.
Number of Research Scientists: 59; **Number of Staff:** 64.
Scientific Fields of Interest: Energy; Chemistry; Engineering/Technology; Environment; Mathematics; Physics/Astronomy.
Main Lines of Research and Training Activities: Chemical Engineering: chemical reactions and reactors; polymers; processes control, design and optimization; thermodynamics; food engineering; fluid mechanics; pollution; wood; pulp and paper. Physics. Mathematics. Computational mechanics.
Major Scientific Results or Products: Doctoral degrees; scientific publications; technical reports; industrial technological services.
Main Research Facilities Available: Laboratories for chemical engineering research, biophysical research, computational mechanics, analytical chemistry.
Future Development Plans: Expand programmes in current research areas; organize undergraduate curriculum on environmental science and engineering.
Cooperation Arrangements with Developing Countries: Brazil.
Other International Cooperation Arrangements: CNR, Italy; KFK, Germany; European Union; NSF, USA; CNRS, France; Polytechnic University of Cataluña, Spain; FNRS, Belgium; Slovak Academy of Sciences; Zulia University, Venezuela; Autonomous University of Madrid, Spain.

Planta Piloto de Ingeniera Qumica (PLAPIQUI-CONICET)

Address: 12 de Octubre 1842, Casilla de Correo 717, 8000 Bahía Blanca, Argentina. **Phone:** (+54 91) 882541; **Fax:** (+54 91) 883764; **E-mail:** alcrapis@criba.edu.ar.
Director/Head: Guillermo H. Crapiste.
Number of Research Scientists: 30 Researchers and Professors; **Number of Staff:** 60 Professionals, technicians and general staff.
Scientific Fields of Interest: Materials; Engineering/Technology.
Main Lines of Research and Training Activities: Catalysis, Chemical Reactors, Polymers, Process Engineering, Transport Phenomena, Applied Thermodynamics, Process Control, Food Engineering.
Major Scientific Results or Products: About 90 Master and Doctoral degree theses approved since creation of postgraduate programme in chemical engineering in 1979; more than 120 international publications and 260 presentations at national and international meetings in past five years; more than 300 technological projects for chemical, petrochemical and food industry.
Main Research Facilities Available: Polymer and catalyst laboratories for characterization, testing and evaluation of polymeric materials and catalysts; laboratories for analytical chemistry, phase equilibrium, reactor engineering and food science; pilot plant; library with information and documentation service; computing centre and auxiliary services.
Future Development Plans: To increase undergraduate and postgraduate educational activities in chemical engineering; research and technological development in petrochemistry, chemistry, food engineering and material science; technical assistance to industry.

International Cooperation Arrangements: Joint projects with universities and academic institutions in Europe and USA.

Brazil

Centro de Hidrulica e Hidrologia Professor Parigot de Souza (CEHPAR)

Address: Centro Politécnico, Jardim das Américas, Caixa Postal 1309, CEP 80001-970, Curitiba, PR, Brazil. **Phone:** (+55 41) 267 1754; 266 2941; 267 7843 **Fax:** (+55 41) 266 2935; **E-mail:** cehpar@cch.copel.br.
Director/Head: Heinz Dieter Fill.
Number of Research Scientists: 22; **Number of Staff:** 25.
Scientific Fields of Interest: Energy; Engineering/Technology; Environment; Teaching.
Main Lines of Research and Training Activities: Water resources engineering; hydrologic regionalization; flood studies; reservoir impact analysis on river flow regime; mathematical and physical modelling in fluid mechanics, hydraulics, hydrology, environment and hydraulic structures; aeration in high velocity water flows; dynamic action of water on rock filled structures; energy dissipation in hydraulic structures; drainage and environmental aspects in management of urban areas; environmental aspects in design and management of power plants; micrometeorology and atmospheric turbulence.
Major Scientific Results or Products: Hydraulic model studies of hydraulic structures, especially hydroelectric power plants (93 projects, including hydroelectric power plants); total installed capacity of power plants studied (37,500 MW); hydrologic studies, including energy balance, flood flows, hydrologic regionalization, reservoir operation; feasibility studies for hydroelectric projects (90 projects); graduate course in hydraulic engineering; technical and scientific publications (38 published by CEHPAR and 290 published elsewhere).
Main Research Facilities Available: Facilities for experimental studies (fluid mechanics, hydraulics and hydraulic structures): total research area, 12,000 square metres; covered area: 7,000 square metres; flow capacity: 1,600 1/s; reservoir accumulation capacity: 2,000 m^3. Computational resources: 42 microcomputers, most connected to mainframe; 17 printers; 1 scanner; 1 plotter. Library with 3,750 volumes and subscriptions, including 48 specialized technical journals.
Future Development Plans: Consolidation of Institution as centre of research, knowledge diffusion and human resources education in field of water resources and environmental engineering through applied and basic research in topics of major interest to country; maintenance of link with private/state institutions involved in applied engineering to remain in touch with real social needs; extending contacts with similar institutions in country and abroad for updating and diffusion of knowledge at general level (through technical and scientific publications) and at specific level (through graduate course in hydraulic engineering).

Centro de Pesquisas de Energia Eltrica (CEPEL)

Address: Caixa Postal 2754, Rio de Janeiro, RJ 20001-970, Brazil. **Phone:** (+55 21) 5982112; **Telex:** (21) 21035 CEPE BR; **Fax:** (+55 21) 2601340.
Director/Head: Xisto Vieira Filho.
Number of Research Scientists: 172; **Number of Staff:** 197.
Scientific Fields of Interest: Energy.
Main Lines of Research and Training Activities: Electric planning and operation; energy planning and operations; electric power facilities life extension and retrofitting; energy use; electric system supervision, control and protection; transmission and distribution equipment and facilities; distribution automation; alternative generation systems.
Major Scientific Results or Products: 120 computer programmes for electric and energetic planning; hardware in electronics for digital measurements for supervision, control and protection.
Main Research Facilities Available: Laboratories for high voltage (dielectric testing of equipment); high power (currents of up to 300 kA); network simulation (for transients of AC/DC networks); materials

(testing of insulating and conducting materials); electronics (testing of relays and electromagnetic compatibility testing); power utilization (energy efficiency testing of various equipment); testing equipment for use in explosive atmospheres; equipment and instrument calibration.
Cooperation Arrangements with Developing Countries: ITE, Mexico; ISA, Colombia; OLADE, Ecuador; University of La Plata, Argentina.
Other International Cooperation Arrangements: Central Research Institute of Electrical Power Industry (CRIEPI), Japan; EPRI, USA; KEMA, The Netherlands; CESI, Italy; IREQ, Canada; ASINEL, Spain; INESC, Portugal; ABB, Sweden; NREL, USA; BPA, USA.

Centro de Pesquisas e Desenvolvimento (CPqD) Telecomunicaes Brasileiras S/A (TELEBRS)

Address: Rodovia Campinas a Mogi-Mirim, km 118,5, Caixa Postal 1579, 13088-061 Campinas, SP, Brazil. **Phone:** (+55 19) 789-6204; **Fax:** (+55 19) 239-2346; **E-mail:** violato@cpqd.br.
Director/Head: Claudio A. Violato.
Number of Research Scientists: 855; **Number of Staff:** 252.
Scientific Fields of Interest: Engineering/Technology; Telecommunications R&D.
Main Lines of Research and Training Activities: Telecommunications services technologies; TMN and operations systems; Networking; Switching; Conformance testing; Support technologies (EMI/EMC, electrical protection, microelectronics, outside plant systems and materials, energy for telecommunications plants and facilities, etc.).
Major Scientific Results or Products: 75 products transferred to 72 industries; several operations support systems developed and transferred to operating companies; over 250 patents filed/granted; over 350 consultation projects per year for Brazilian Telcos.
Main Research Facilities Available: Vax stations; Unix workstations; laboratories (hardware, software, multimedia, signal processing.); library with 22,000 publications.
Future Development Plans: Maintain CPqD in telecommunications technologies at international level.
Cooperation Arrangements with Developing Countries: CATT/MPT (China); CINTEL (Colombia); University of Belgrade (Yugoslavia); SPTIC/TATID (China); CONATEL (Venezuela).
Other International Cooperation Arrangements: UNDP/ITU, Bell-Sygma (Canada); BELLCORE (USA); CET (Portugal); LAAS (France); Mentor Graphics (USA); NTT (Japan); NYNEX S&T (USA); Qualcomm (USA); SHL System House (USA); Telefónica de España (Spain); University of Rome Tor Vergata (Italy); University of Toronto (Canada) and Us West In. (USA).

Centro de Pesquisas e Desenvolvimento Leopoldo A. Miguez de Mello (CENPES)

Address: Cidade Universitária, Quadra 7, Petrobras/CENPES, Ilha do Fundáo, 21949/900 Rio de Janeiro, RJ, Brazil. **Phone:** (+55 21) 598 6000; **Fax:** (+55 21) 280 1101; **E-mail:** solange@cenpes.petrobras.gov.br.
Director/Head: Antonio Sergio Fragomeni.
Number of Research Scientists: 622 (233 BSc 112 PhD, 277 MSc); **Number of Staff:** 95 BSc and 833 Technicians.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Earth Sciences; Environment.
Main Lines of Research and Training Activities: Deep water exploitation systems, refining technologies, advanced oil and gas recovery, horizontal wells, offshore technology, diesel technology, gasoline technology, lubricant technology, environment technology, new exploration frontiers. 45 employees on MSc programmes and 52 on PhD programmes. Approx. 10% of he time-schedule is devoted to training.
Major Scientific Results or Products: In past 8 years, granted 187 patents in Brazil and 234 worldwide.
Main Research Facilities Available: Total Area: 122.000 square metres; installations: 45.000 square metres; laboratories: 137; pilot plants: 28; IBM 9021 main frame; 2 Net servers Vax; Scientific Vax; 4 PC Net Servers; 62 Unix Stations; 1,474 PCs; 91 Macintoshes; 676 Local Printers; library with 75,500 documents (books, technical reports, subscriptions, videos, CD-ROMs) and facilities for on-line research.

Cooperation Arrangements with Developing Countries: Arrangements with CODICID (Latin America Petroleum R&D Centers) that includes Brazil, Venezuela, Mexico and Colombia; presently conducting 7 projects on artificial lifting and project on catalysts.
Other International Cooperation Arrangements: 73 joint industry projects with partners around world that includes 31 institutes and research centres, 5 oil companies, 29 universities, 7 engineering companies and a classification society.

Federal University of So Carlos (UFSCar) Department of Materials Engineering (DEMa)

Address: Rod. Washington Luis, km 235, CEP 13565-905 São Carlos, SP, Brazil. **Phone:** (+55 162) 748250; **Telex:** 162369 SCUF BR; **Fax:** (+55 162) 727404; **E-mail:** dwbp@power.ufscar.br.
Director/Head: José A.R. Gregolin.
Number of Research Scientists: 48; **Number of Staff:** 15.
Scientific Fields of Interest: Materials.
Main Lines of Research and Training Activities: *Ceramics:* Thermomechanical properties, processing, electron ceramics, glasses and glass-ceramics, refractories; *Metals:* Powder metallurgy, gases in metals, fabrication and welding, heat treatment, thermomechanical processing, mechanical properties; *Polymers:* Alloys, blends and composites, electrical properties, rheology and processing, morphology, degradation. *Basic Science:* Microstructural analysis, energy conservation and recycling of materials.
Major Scientific Results or Products: *Ceramics:* Nucleation mechanisms of oxide glasses: development of advanced zirconia-cordierite-aluminia; ceramic matrix composites of aluminia-zirconia; silicon carbide refractories and bio-glass ceramics. *Metals:* Studies on gases in refractory metals and alloys, development of HSLA steels, magnetic alloys and hot torsion test equipment. *Polymers:* Studies on UV and thermal and environmental degradation, miscibility and rheology of polymers; development of piezoelectric, liquid-crystalline, intrinsic conductive polymers and polymeric-matrix composites.
Main Research Facilities Available: 3 scanning electron microscopes; transmission electronic microscope; 2 X-ray facilities; high temperature GPC; FTIR; 2 universal testing machines; surface analyser facility, including XPS, ESCA, AES, SAM and ISS); plasma spectrometer; NMR; 2 DSC.
Future Development Plans: Establishment of Centre of Research and Development of Materials (CCDM) with budget of US$ 5,000,000 and Nucleus for Technological Information (NIT) with budget of US$ 760,000.
Cooperation Arrangements with Developing Countries: Brazilian representative in materials technology project of Cyted programme in network of 4 developing countries.
Other International Cooperation Arrangements: Cooperation programmes with University of Aveiro, Portugal and with University of Barcelona, Spain. Brazilian representative in Crystallization Committee (TC7) of International Commission on Glass; Universities of: Oxford, Leeds, Manchester (UK); Lehigh, California, Rice and Arizona, Colorado School of Mines and Lincoln Foundation (USA); Hamburg-Barburg Tech. University and Max-Planck Institute (Germany); Inst. de Ric. Naples (Italy).

Instituto de Pesquisas Energeticas e Nucleares (IPEN)

Address: Trav. R. no. 400, Cidade Universitaria, São Paulo, SP, Brazil. **Phone:** (+55 11) 816 9000; **Telex:** 23592; **Fax:** (+55 11) 2123546; **E-mail:** claudio@sup.ipen.br.
Director/Head: Claudio Rodrigues.
Number of Research Scientists: 282; **Number of Staff:** 1006.
Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Earth Sciences; Environment; Veterinary Sciences; Medical Sciences; Physics/Astronomy.
Main Lines of Research and Training Activities: Nuclear physics, radiochemistry; chemical engineering; nuclear metallurgy; nuclear materials; nuclear reactor maintenance and operation; genetic engineering; biomaterials radioimmunoassay reagents; high technology materials; ceramics, metallic materials, polymers, solid state lasers; radioprotection; environmental monitoring and radiowaste management.

Major Scientific Results or Products: Radioisotopes and radiopharmaceuticals for diagnostic and therapy (more than 1 million patients); operation of pilot plant for industrial effluents treatment using electron beam; successful accomplishment of the gene responsible for the beta subunity of hypophysis; 37 articles published in international journals.
Main Research Facilities Available: Workstations (3); computers and servers (520); building area (more 100 square metres; analytical and other electronic instruments (5,000); 22,500 books, 237 journals, 444,000 microfiches.
Future Development Plans: Reinforcing indigenous radioisotope production programme, by initiating molybdenum via gel production and 18 Fluor radioisotope production; implementation of particled materials centre and materials characterization centre; installation of 100,000 Ci irradiator for food and radiosterilization; increase research activities in the following biotechnology fields: monoclonals, hormones, toxins, biomaterials.
Cooperation Arrangements with Developing Countries: Brazil, Argentina, IAEA and Brazilian-Argentine for Accounting and Control (ABACC) agreement of cooperation in nuclear material safeguards; Binational Technical Cooperation in Nuclear Applications Brazil-Cuba and Brazil-Chile.
Other International Cooperation Arrangements: Following cooperation programmes are supported by IAEA: electron bean purification of flue gas; electron bean purification of waste water; radiotherapy sources and brachytherapy for cancer treatment; production and quality control of therapeutic radionuclides.

Instituto de Pesquisas Tecnolgicas do Estado de So Paulo S/A (IPT)

Address: Av. Prof. Almeida Prado, 532, Cidade Universitária, Butanta, 05508-901, São Paulo, SP, Brazil. **Phone:** (+55 11) 268-2211; **Fax:** (+55 11) 819-5730; **E-mail:** milton@dce03.ipt.br.
Director/Head: Milton de Abreu Campanario.
Number of Research Scientists: 560; **Number of Staff:** 940.
Scientific Fields of Interest: Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Earth Sciences; Environment; Marine Sciences; Mathematics; Technological Information.
Main Lines of Research and Training Activities: Applied and technological research in the engineering fields of: civil engineering, chemistry and chemical engineering, biotechnology, metallurgy, forest products, geology, transport technology, naval engineering, mechanics and electricity, economy and systems engineering and training activities as specific training in laboratories services, tests and analysis as well as short term courses in the areas of technological activities above.
Major Scientific Results or Products: Tests and chemical analysis results; certified reference materials; scientific research projects in biotechnology; chemical processes evaluation and new products development. Laboratory and pilot plant process development for metals and alloys production and composites; technology for rare-earth magnets production; electrical steel production technology; atmospheric corrosion studies and prevention; development of investment casting in ceramic moulds for directional solidification; development of melting and refining of metals and alloys; tests and measurement of mechanical properties of metallic materials; assessment of structural integrity and residual life of industrial equipment; failure analysis; microstructure-mechanical characterization and properties analysis; studies of ships and offshore platforms models/towing tank; full scale measurements of ships and platforms performance; tests on packaging, pallets and containers, testing equipment development; test and equipment development for railway and trucks transport; research and development on forest products and processes: further utilization of woods from planted forests; technological characterization of native and introduced species and wood-based properties, including pulp and paper; investigation monitoring and stability of geological risk; research of sites for waste deposit; geotechnical mapping; geochemistry testing; rock hydraulics testing and hydrogeomechanics analysis, hydrogeology; rock mechanics testing and monitoring; and environmental impact assessment; economical and feasibility studies, technological studies, systems development, logistics studies, technical and economical surveys; civil engineering: laboratory testing, *in situ* testing, physical modelling; numerical testing, field instrumentation related to maintenance of civil engineering works, materials, Brazilian tropical soils, soil-structure interaction, dynamic behaviour of structures, environmental protection, landslides and slope stabilization, tunnels and highways; housing: planning; materials, components and systems testing; products, materials and technical systems approval.

Main Research Facilities Available: Laboratories and equipment in fields listed above; pilot plants; 76,000 books, 44,000 serial publications, 1,000,000 technical standards and 150,000 industrial products catalogues; scientific and technological databases.
Future Development Plans: New materials development; new processes; environmental protection; development of information technologies; courses for master degree.
Cooperation Arrangements with Developing Countries: Training programmes in ceramic technology and planning and housing technology, short-term courses jointly sponsored with Japan International Cooperation Agency (1987-1996).
Other International Cooperation Arrangements: Housing planning and materials, components and certification, European Union and Mercosul countries.

Instituto Nacional de Pesquisas da Amaznia (INPA)

Address: Caixa Postal 478, 69083-000 Manaus, AM, Brazil. **Phone:** (+55 92) 6433098/3097; **Fax:** (+55 92) 6433095/3096.
Director/Head: Ozório José de Menezes Fonseca.
Number of Research Scientists: 235; **Number of Staff:** 571.
Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Chemistry; Engineering/Technology; Earth Sciences; Environment; Medical Sciences.
Main Lines of Research and Training Activities: Compared biology in the Amazon Region; neotropical biology and ecology; management, technology and utilization of natural resources; rural production systems; the human being in the Amazonian environment; climatology and hydric resources.
Major Scientific Results or Products: Researchers published 827 papers between (1987-1992); vertebrate and invertebrate collection; research on forest area responsible for 50% of rainfall in Amazon Basin and 80 to 90% of mineral nutrients related to above ground biomass.
Main Research Facilities Available: Spectrophotometer; auto analyser; auto diluter; balance; dendrometer; computer; microscope; scanner and electronic microscope; atomic absorption; eight field stations covering 40,000 hectares; library with 290,000 publications (8,000 scientific journals titles, only 4,000 are updated.
Future Development Plans: Implement INPA's Strategic Plan.
Cooperation Arrangements with Developing Countries: Through UNAMAZ (Association of Amazonian Universities).
Other International Cooperation Arrangements: UK Overseas Development Administration, Smithsonian Institution, Max-Planck Institute, ORSTOM, CIDA, ITTO (G7). Planned: Japan International Cooperation Agency.

Instituto Tecnolgico de Aeronutica (ITA)

Address: Praça Eduardo Gomes, 50, Vila das Acácias, 12228-900 São José dos Campos, SP, Brazil.
Phone: (+55 12) 341-2211; **Telex:** ZW024-N 1233393 CTAE BR (RNT); **Fax:** (+55 12) 341-7069.
Director/Head: Euclides Carvalho Fernandes.
Number of Research Scientists: 137; **Number of Staff:** 210.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Mathematics; Physics/Astronomy.
Main Lines of Research and Training Activities: Courses in aeronautical, electronic, mechanical, civil and computing engineering; MSc and PhD courses in the above areas plus physics; Research activities related to the above areas.
Major Scientific Results or Products: Graduated 76 engineers, 37 MSc, 5 PhDs; published 188 technical articles in national/international periodicals; sponsored 65 research contracts and grants.
Main Research Facilities Available: Laboratories in physics, chemistry, aeronautics, electronics, mechanics, civil engineering, and CAD/CAM; computing facilities: 2 IBM 4341 computers, IBM RISC-6000 stations, SUNPAC workstations, personal computers, graphic stations; technical library with more than 90,000 volumes, including 2,000 journal titles.
Future Development Plans: Consolidation of laboratory facilities; implementation of modern technologies in teaching and learning activities.

International Cooperation Arrangements: Cooperation with Organization of American States (student grants); cooperation with UNDP (student grants).

Universidade Estadual de Campinas (UNICAMP) Faculdade de Engenharia Agrcola

Address: Caixa Postal 6011, Campinas 13100, SP, Brazil. **Phone:** (+55 19) 788-2000; **Fax:** (+55 19) 788-2090; **E-mail:** biagi@agr.unimcamp.br.
Director/Head: João Domingos Biagi.
Number of Research Scientists: 44; **Number of Staff:**
Scientific Fields of Interest: Engineering/Technology.
Main Lines of Research and Training Activities: Post Harvest; farm machinery design; rural construction of controlled environment; natural resources (soil and water); rural planning and a decision support.
Major Scientific Results or Products: Electronic control of tractor diesel engine operation; rotary tiller energy requirements; tractor implement optimization; plant-machinery interaction; whole stalk sugar cane harvester; mathematical models for decision support; environmental impacts in microbasins.
Main Research Facilities Available: Labs soil, agricultural products drying; computer; physical properties of agricultural products; water quality (environment protection) farm machinery design, controlled environment for plants of animals, electronics.
Future Development Plans: Expansion of laboratory; upgrading of equipment; increase number of graduate students; complete PhD training for all faculty members (99% have PhD).
Cooperation Arrangements with Developing Countries: Cooperation with Cuba on biomass energy and post-harvest.
Other International Cooperation Arrangements: Cooperation with: Canada (post-harvest), Ministry of Agriculture and Food; England (biomass, agriculture, engineering), Silsoe Institute.

Universidade Estadual de Campinas (UNICAMP) Faculdade de Engenharia Eltrica e de Computao (FEEC)

Address: Caixa Postal 6101, 13081-970 Campinas, SP, Brazil. **Phone:** (+55 19) 7882137; **Telex:** (019) 1150; **Fax:** (+55 19) 239-1395; **E-mail:** wagner@dca.feec.unicamp.br.
Director/Head: Wagner Caradori do Amaral.
Number of Research Scientists: 100; **Number of Staff:** 77.
Scientific Fields of Interest: Engineering/Technology.
Main Lines of Research and Training Activities: Electronics and microelectronics; Communication; Automation; Computer engineering; Power systems; Microwave; Photonics; Systems engineering; Control theory; Systems control; Semiconductor; Biomedical engineering.
Major Scientific Results or Products: About 300 papers published per year in periodicals and conferences, 500 MSc/PhD degrees awarded in past five years.
Main Research Facilities Available: Research laboratories in electrical and computer engineering; 130 SUN and 20 IBM workstations interconnected through ethernet network; more than 450 PC microcomputers; more than $10 million in software packages for electrical and electronics design.
Future Development Plans: Update undergraduate curricula to emphasize foundations of engineering and increase in number of projects and practice classes; increase interaction with productive segments of country.
International Cooperation Arrangements: Argentina, Cuba, Chile. France and USA.

China

Chinese Academy of Sciences (CAS) Changchun Institute of Optics and Fine Mechanics

Address: 112 Stalin Street, Changchun 130 022, China. **Phone:** (+86 431) 5684692; **Fax:** (+86 431) 5682346.
Director/Head: Wang Jiaqi.
Number of Research Scientists: 393; **Number of Staff:** 2,922.
Scientific Fields of Interest: Materials; Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: *Optoelectronic engineering:* optoelectronic tracking, measurement and control; optoelectronic engineering in space and underwater; CAD/CAM/CAT in optics, mechanics and electronics. *Applied optics*: modern technical optics/optical design/optical coating/optical testing; short-wavelength optics; Colour optics and imaging spectrum technology; optical material and optical function material; optical ultraprecision manufacturing. *Photoelectrical technology*: lasers and laser technology; optical information and optical computing technology; photoelectrical detecting technology. *Fine engineering*: precision measurement instruments; elemental technology in fine mechanics; fine mechanical equipment; micromechanical engineering.
Major Scientific Results or Products: Obtained 900 scientific results, including 400 important achievements; developed series of high-tech products for markets at home and around world.
Main Research Facilities Available: Main computers: VAX 4100 VAX 4090 station and CODE V Optical design engineering software, 5 sets of HP 9000/715/100 UG Nastran and Cadence Software. Twenty-four departments and pilot factory, including State Key Laboratory of Applied Optics, China National Centre for Quality Supervision and Testing of Optomechanical Product; Simulative Remote Sensing Laboratory, Micromachine Laboratory. Library includes 250,000 books and 2645 journals.
Future Development Plans: Level of research level will continue to rise and fields will continue be extended in such areas as space optics, underwater optics and information optics.
Cooperation Arrangements with Developing Countries: With such developing countries as Hong Kong, Taiwan province, Thailand, Syria, South and North Korea.
Other International Cooperation Arrangements: USA, England, Japan, former USSR, Canada, Australia, Italy, Israel, Romania, Germany, Poland, Hungary, Switzerland.

Chinese Academy of Sciences (CAS) Institute of Acoustics(IOA)

Address: 17, Zhongguancun St., P.O. Box 2712, Beijing 100080, China. **Phone:** (+86 1) 2564602, 2553765; **Telex:** 222525 IOAAS CN; **Fax:** (+86 1) 2553898.
Director/Head: Hou Zigiang.
Number of Research Scientists: 217; **Number of Staff:** 507.
Scientific Fields of Interest: Materials; Engineering/ Technology; Environment; Marine; Physics.
Main Lines of Research and Training Activities: Underwater acoustics and marine acoustic equipment; environmental acoustics; ultrasonic electronics; acoustic transducers and materials; nonlinear acoustics; acoustic standards and metrology; high speed signal processing; distributed array processors; speech recognition, understanding and translation; ultrasonic NDT of ceramic materials; artificial intelligent robots; studies of physical modelling and computer simulation of sound fields; inverse problems in sound fields; design of LSI circuits used in signal processing.
Major Scientific Results or Products: Studies of shallow water sound fields; studies of jet noise; transient behaviour of the piezoelectric transducers; development of vocoder; ultrasonic deep hole processing system; development of semi-perforated wideband piezoelectric transducer; GPY sub-bottom profiler; real-time speech recognition system; underwater stereo system.
Main Research Facilities Available: Model facilities of underwater sound, environmental acoustic and ultrasonic fields; anechoic rooms; underwater sound measuring pool; acoustic tube; nonlinear acoustic experimental system; facilities of SAW device manufacturing, piezoelectric ceramics and transducer manufacturing, and crystal growth; geoacoustic experimental stations and atmospheric acoustic receiving stations; workstations and computers (SUN Server 1000, INTEGRIX SPARC 10, VAX 8350, etc.) and about 100 mini- and microcomputers; library collection of about 80,000 books and journals.

Future Development Plans: Attention to international trends and new frontiers in basic research of acoustics and development of high technology; efforts to put scientific results into practice.
Cooperation Arrangements with Developing Countries: Improve mutual understanding and develop academic exchanges.
Other International Cooperation Arrangements: Continue conducting joint ocean investigations with Russian scientists; collaboration on tone language hearing aids with scientists at University College, London; participate in programme of Acoustic Thermometry of Ocean Climate (ATOC).

Chinese Academy of Sciences (CAS) Institute of Automation (IA)

Address: 1 Nanyitiao, Zhongguancun, Haidian, P.O. Box 2728, Beijing, China. **Phone:** (+86 10) 62551397; **Fax:** (+86 10) 62545229; **E-mail:** masd@prlsun2.ia.ac.cn.
Director/Head: Ma Songde.
Number of Research Scientists: 350; **Number of Staff:** 100.
Scientific Fields of Interest: Engineering/Technology.
Main Lines of Research and Training Activities: Pattern recognition theory and application; computer vision; speech recognition; complex system modelling; discrete event dynamic systems; robotics; giant intelligent systems; expert systems; IC defect detection; neural networks; process control; automation; etc.
Major Scientific Results or Products: Chinese handwritten character recognition theory; IC chip defect detection system; theory and algorithms for computer vision; Chinese speech recognition algorithms and application systems; modelling and analysis for control system reliability. Products include HanWang series handwritten/printed character recognition software; GS series digital read-out; image grabber; video special effect device; etc.
Main Research Facilities Available: Active vision platform; RIB2000 industry robot; computers; library.
Future Development Plans: Strengthen long- and medium-term research through participation in national science programmes; broaden high-tech R&D activities to make more contributions to national economy; become more involved in international product development and joint projects.
Cooperation Arrangements with Developing Countries: Cooperative research with Hong Kong Chinese University, mobile robot and active vision; joint project with South Korea: Korean character recognition.
Other International Cooperation Arrangements: Sino-French joint laboratory for information, automation and applied mathematics; major donors include INRIA (France) and CAS from PRC; joint project for Japanese character (Japan).

Chinese Academy of Sciences (CAS) Institute of Electronics

Address: P.O. Box 2702, Beijing 100080, China. **Phone:** (+86 1) 2554608; **Telex:** 222582 IEAS CN; **Fax:** (+86 1) 2567363.
Director/Head: Zhu Minhui.
Number of Research Scientists: 400; **Number of Staff:** 900.
Scientific Fields of Interest: Biochemistry/Biophysics; Materials; Engineering/Technology.
Main Lines of Research and Training Activities: Electromagnetic theory and application; radar and signal process; HDTV and telecommunication; transducer technique and application; microwave/millimeterwave devices and techniques; laser instruments; modern information engineering.
Major Scientific Results or Products: Average more than 10 important achievements each year; honoured with several national awards from Chinese Academy of Sciences.
Main Research Facilities Available: 10 well-equipped laboratories with special experimental systems for research and technical development; measurement fabrication facilities; library, manufacture workshops and set up.
Future Development Plans: Basic research on advanced global topics, high technology products development with applications to national economy.
Cooperation Arrangements with Developing Countries: Short-term visitors exchange.
Other International Cooperation Arrangements: Academic cooperation based on agreements under CAS.

Chinese Academy of Sciences (CAS) Institute of Mechanics

Address: 15 Zhongguancun Road, Beijing 100 080, China. **Phone:** (+86 1) 62554185; **Fax:** (+86 1) 62561284.
Director/Head: Ming Lun Xue.
Scientific Fields of Interest: Energy; Materials; Engineering/ Technology; Environment.
Main Lines of Research and Training Activities: Nonlinear mechanics; mechanics of energy science and technology; material science and technology; environmental science and technology; aeronautical and space science and technology.
Major Scientific Results or Products: More than 200 papers published annually in scientific journals.
Main Research Facilities Available: Shock tunnels; DC and HF plasma sources; explosion chamber; laser-material processing facilities; computer and PC facilities.
International Cooperation Arrangements: Cooperation with Reading University (UK) on material properties under high strain rate and cooperation with Kumaoto University (Japan) on explosion processing.

Chinese Academy of Sciences (CAS) Institute of Metal Research

Address: 72 Wenhua Road, Shenyang 110015, China. **Phone:** (+86 24) 383531; **Telex:** 80095 IMR CN; **Fax:** (+86 24) 391320.
Director/Head: Li Yiyi.
Number of Research Scientists: 600; **Number of Staff:** 600.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Alloying steels; superalloys; composite materials; magnetic materials; ceramics; Ti-alloys; metal physics; atomic imaging in solids; non-equilibrium materials; International Centre for Materials Physics.
Major Scientific Results or Products: Materials physics reports; advanced materials reports; pilot products.
Main Research Facilities Available: High-resolution electron microscopes; scanning electron microscopes; field ion microscope; surface analyser; electron probe; flow forming machine; Schenck testing machines.
Future Development Plans: Become main centre of materials physics in Third World; main centre of advanced materials in Third World; main centre of materials engineering in China.
Cooperation Arrangements with Developing Countries: Hold workshop on materials physics in Third World each year.
Other International Cooperation Arrangements: Institutions in USA, UK, Germany, Japan, Russia, France, Italy, Sweden, Canada.

Chinese Academy of Sciences (CAS) Institute of Semiconductors (IS)

Address: P.O. Box 912, Beijing 100083, China. **Phone:** (+86 1) 2554993; **Fax:** (+86 1) 2562389.
Director/Head: C.M. Wang.
Number of Research Scientists: 650; **Number of Staff:** 350.
Scientific Fields of Interest: Materials; Engineering/ Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Superlattice physics; applied physics; semiconductor materials and materials physics; new circuits and devices; ultrathin film materials; sensors and surface devices; semiconductor microwave devices; semiconductor optoelectronic devices; physical and chemical analysis; optoelectronic technologies.
Major Scientific Results or Products: Generally, more than 10 important achievements each year; honoured with several awards from Chinese Academy of Sciences.
Main Research Facilities Available: MBE equipment (both home-made and imported); MOCVD equipment; spectroscopy equipment/PL (pressure); spectroscopy equipment; SIMS and multi-target sputtering system and multi-sources-beam.
Future Development Plans: Research fields cover semiconductor materials, devices (optoelectronic devices, transducers, microwave devices, power devices and integration) and semiconductor physics

aiming to explore new phenomena, effects, theories and development of new materials, devices, circuits, technologies and applications; emphasis on III-V compound materials, optoelectronic devices.
Cooperation Arrangements with Developing Countries: Only some to date.
Other International Cooperation Arrangements: Cooperation with Florida University on optoelectronic materials and devices and cooperation with Russian research institutes.

Chinese Academy of Sciences (CAS) Shanghai Institute of Ceramics

Address: 1295 Ding-xi Road, Shanghai 200 050, China. **Phone:** (+86 21) 2512990; **Telex:** 33309 ASSIC CN; **Fax:** (+86 21) 2513903.
Director/Head: Jingkun Guo.
Number of Research Scientists: 450; **Number of Staff:** 554.
Scientific Fields of Interest: Materials; Chemistry; Engineering/ Technology.
Main Lines of Research and Training Activities: Structural ceramics, functional ceramics, ceramic coatings, amorphous materials, single crystals.
Major Scientific Results or Products: Achievements in past 40 years include wide use in many industrial fields of high temperature structural ceramics and composite materials, as well as use of functional ceramics, ceramic coatings.
Main Research Facilities Available: Equipment facilities used in preparation and processing of inorganic materials; PCs; computers linked to Chinese Academy of Sciences, Shanghai Branch; library with more than 1,000 square metres of space and 70,000 books.
Future Development Plans: More attention to be paid to R&D Centre of Advanced Inorganic Materials, Chinese Academy of Sciences.
Cooperation Arrangements with Developing Countries: Wide cooperation with developing countries that will continue in the future.
Other International Cooperation Arrangements: Many international cooperation arrangements have been signed—for example agreement between CER-IRTEC and SICCAS.

Chinese Academy of Sciences (CAS) Shanghai Institute of Metallurgy

Address: 865 Changning Road, Shanghai 200 050, China. **Phone:** (+86 21) 2511070; **Fax:** (+86 21) 2513510.
Director/Head: Zou Shichang.
Number of Research Scientists: 700; **Number of Staff:** 1,000.
Scientific Fields of Interest: Materials.
Main Lines of Research and Training Activities: *Microelectronics:* 2-3 mm CMOS processing design and technology for 0.8-1.2 mm ICs and devices; application specified integrated circuits; optoelectronic ICs and related devices; computer-aided design and mask fabrication. *Functional materials and devices:* Compound semiconductor materials and devices; sensor materials and devices; magnetic materials and devices; magneto-optic materials and discs; special metallic materials; superconducting materials; ion beam technology. *Corrosion and protection of metals:* Corrosion-resistant alloys for special environments; high temperature corrosion; corrosion electrochemistry and electrochemical protection; stress corrosion; anti-corrosive coatings; protection engineering.
Major Scientific Results or Products: 3 mm CMOS technology optimization; high speed bipolar logic circuits and memory; high capacity CMOS SRAM; 16-bit CPU; 16K-bit EPROM; sources and detectors for optical fibre telecommunication; single crystals (InP, GaAs, GGG, LiNbO3, LiTa03); GaAs high speed devices and solar cells; thin film platinum temperature sensors; polysilicon pressure transducers and SOS pressure transducers; steam sterilizable pH electrode; apparatus for multi-contacts antiform sensor; magneto-optic disks; Nd-Fe-BAl-Ni-Co permanent magnetic materials; high Tc YBCO superconducting film; superconducting multifilament Nb3Sn composite; new corrosion-resistant alloys.
Main Research Facilities Available: SIM has microelectronic branch in Hi-Tech Park, Shanghai, a branch of pilot production of functional materials and devices, consisting of 21 departments, of which three are state key or open laboratories and one a centre of computer aided design and mask fabrication. *Equipment:* Computer aided design system, fully automatic metal organic chemical vapour deposition system, molecular beam epitaxy system, laser trimming system, reactive ion beam etching facility, Ion beam enhanced deposition system, backscattering and channelling analysis system,

sputtering system with loadlock chamber, ultra high vacuum electron beam deposition system, vibrating sample magnetometer, laser assisted deposition system for think films, automatic Hall measuring system, high precision X-ray double crystal diffractometer, inductively coupled plasma atomic emission spectroscope, 400Kev high resolution electron microscope.
Future Development Plans: Future development of SIM focuses on: IC design and mask fabrication, IC technology and manufacture, novel functional materials and devices, major anti-corrosion project.
Cooperation Arrangements with Developing Countries: Collaboration and exchange in basic research between research groups in SIM and Instituto de Pesquisas Espaciais, Brazil. Joined research project between Ion Beam Laboratory, SIM and Surface Engineering Laboratory, Korea Institute of Machinery and Metals and Vacuum Industrial Technology Research Institute, Sung Kyun Kwan University, Korea. Memorandum of Understanding for bi-directional research collaboration between Institute of Microelectronics of Singapore National University and State Key Lab of Transducer Technology of SIM and Transducer Research Laboratory of Fudan University, Shanghai, China.
Other International Cooperation Arrangements: Joint research laboratory between Daimler-Benz AG, Germany and SIM for advanced electronic packaging in SIM. Collaborative programmes between SIM and**:** the Royal Melbourne Institute of Technology and Australian National University; University of Surrey, UK; Université Claude-Bernard Lyon-1, France; Institute of Semiconductor Physics, Russia; University of Sheffield, UK; Institute of Inorganic Chemistry, Russia; Institute of Thermophysics, Russia; Max-Planck Institut für Kernphysik and Universität Heidelberg, Germany and Electrotechnical Laboratory, Japan.

Chinese Academy of Sciences (CAS) Shanghai Institute of Optics and Fine Mechanics

Address: P.O. Box 8211, Shanghai 201 800, China. **Phone:** (+86 21) 59528896; **Fax:** (+86 21) 59528812.
Director/Head: Zhi-Zhan Xu.
Number of Research Scientists: 400; **Number of Staff:** 1,000.
Scientific Fields of Interest: Materials; Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Laser physics (nonlinear optics, laser plasma physics, laser spectroscopy, quantum optics); laser devices (solid state, gas, semiconductor, excimer, free-electron lasers); electro-optical techniques (optical disc, optical information processing); laser materials (glasses, crystals); technical optics (optical instrument, optical design, optical thin films, light sources).
Major Scientific Results or Products: Developed China's first laser, ruby laser in 1961; all kinds of lasers developed successfully; 1-5 KW CO_2 lasers are available for commercial application; China's largest laser facility with output power of 10^{12}W operated in 1985; significant results obtained in X-ray laser and plasma physics; ranked as China's leading laser research centre.
Main Research Facilities Available: 14 laboratories with special experimental systems for research and development; measurement fabrication facilities; library; manufacture workshops.
Future Development Plans: Basic research on advanced scientific topics; high tech product development for applications to national economy.
Cooperation Arrangements with Developing Countries: Short-term visitors accepted each year.
Other International Cooperation Arrangements: Academic cooperation based on agreements under Chinese Academy of Sciences.

Cte dIvoire

Centre Ivoirien de Recherches Technologiques (CIRT)

Address: 08 B.P. 881, Abidjan 08, Côte d'Ivoire. **Phone:** (+225) 44 3978; **Fax:** (+225) 44 5345.
Director/Head: Diomande Mamadou.
Number of Research Scientists: 17; **Number of Staff:** 40.

Scientific Fields of Interest: Energy; Engineering/Technology.
Main Lines of Research and Training Activities: Nutrition; food technology; food microbiology; biotechnology; renewable energy.
Major Scientific Results or Products: Stabilization of ginger *(Zingiber officinale roscoe)* beverage; elaboration of infantile food with tropical products; coffee and cocoa alcoholic beverages.
Future Development Plans: Installation of cells for crops conservation under controlled atmosphere.

Egypt

Central Metallurgical Research and Development Institute (CMRDI)

Address: P.O. Box 87, Helwan, Cairo, Egypt. **Phone:** (+20 2) 501-0640; **Telex:** 93 116 CMRDI UN; **Fax:** (+20 2) 501-0639.
Director/Head: Aziza A. Yousef.
Number of Research Scientists: 62; **Number of Staff:** 281.
Scientific Fields of Interest: Materials; Chemistry; Engineering/Technology; Earth Sciences.
Main Lines of Research and Training Activities: Ore evaluation; Mineral beneficiation; Agglomeration; Hydrometallurgy; Pyrometallurgy; Electrometallurgy; Iron making; Steel making; Industrial wastes; Melting and casting; Nonferrous alloys; Heat treatment; Corrosion; Metal working; Surface protection; Welding technology; Welding metallurgy; Welding consumables.
Major Scientific Results or Products: Technology transfer to local mining, metallurgical and chemical companies; Local and regional training in metallurgical field; improving QA/QC of welding, inspection of equipment and non-destructive testing; scientific research patents and papers in national and international periodicals.
Main Research Facilities Available: Fully equipped laboratories for material and metallurgical research; pilot plant units for ore beneficiation, hydrometallurgy, foundry mill and welding; library; computers.
Future Development Plans: Establish new divisions (new materials, informatics); increase work with industrial institutions on contractual basis; more regional training programmes.
Cooperation Arrangements with Developing Countries: Training in welding metallurgy and non-destructive testing for African engineers from more than 8 African countries; training in iron and steel casting for Jordanian engineers.
Other International Cooperation Arrangements: US-AID; Japanese International Cooperation Agency (JICA); IDRC, Canada.

Egyptian Petroleum Research Institute (EPRI)

Address: Zohhor Area, Nasr City, Cairo, Egypt. **Phone:** (+20 2) 607917, 607847; **Telex:** 21300 EPRI UN; **Fax:** (+20 2) 607433.
Director/Head: M.F. Ezzat.
Number of Research Scientists: 220; **Number of Staff:** 630.
Scientific Fields of Interest: Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Geological/Earth Sciences; Environment; Mathematics; Physics/Astronomy.
Main Lines of Research and Training Activities: Exploration; production; analysis and evaluation; petroleum refining; products application; petrochemicals; process design and development.
Major Scientific Results or Products: Application of research projects results: upgrading of asphalt and asphaltic mixture; prevention of sludge formation in crude oil tanks; production of chemicals used by petroleum industry.
Main Research Facilities Available: P.V.T. core analyses; mud and cement; X-ray analyses; electron microscopes; gas chromatograph; infrared; ultraviolet.
Future Development Plans: Pilot catalyst preparation facilities; special core analyses; pilot thin film distillation; polymer preparation and evaluation facilities.

Cooperation Arrangements with Developing Countries: Training for Arab and African personnel workshops in collaboration with UN Industrial Development Organization (UNIDO) and/or UN Development Programme (UNDP).

General Organization for Housing, Building and Planning Research (GOHBPR)

Address: 56 El-Tahrir Street, Dokki, Cairo, Egypt.
Director/Head: Mohamed Ramez.
Number of Research Scientists: 134; **Number of Staff:** 197.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering; Earth Sciences; Environment; Physics.
Main Lines of Research and Training Activities: Research: Preparation of standards in fields of structure, building materials, soil mechanics, raw materials and processing, and building physics. Analysis and development of new building materials and components. Economic analysis for building systems. Theoretical and experimental evaluation of physical performance of buildings. Degrees are awarded by Egyptian Universities. Assistance to Building Sector: Inspection of damaged buildings: Diagnosing causes and mechanisms of deterioration and/or failures, and recommending methods of repair and strengthening. Soil investigation for foundation engineering purposes. Investigation of building materials to optimize utilization in the building industry. Investigation of thermal and acoustical performance of buildings, theoretically and experimentally. Consultation problems of design and construction with special reference to strength evaluation of existing buildings with non-destructive methods. Active participation in preparation of national standards and specification. Evaluation and investigation of new location for raw materials. Feasibility studies for building materials and construction industry.
Major Scientific Results or Products: Over 1000 publications in the different research areas published in research journals, periodicals and presented at international conferences. About 40 PhD and 50 MSc theses, and more than 1000 technical consultations in the area of housing, building and planning over the last three decades. Numerous technical research reports.
Main Research Facilities Available: Well equipped testing laboratories (reinforced concrete, soil mechanics, strength of materials, raw materials, building physics).
Future Development Plans: Establishment of some branches of the centre in other governatorates (e.g. Alexandria, Port Said, Suez) in Egypt.
International Cooperation Arrangements: Cooperation in training with IHS in Rotterdam, Netherlands; Brick industry, Canada; Wood technology, Sweden.

Ghana

Council for Scientific and Industrial Research (CSIR) Building and Road Research Institute (BRRI)

Address: University P.O. Box 40, Kumasi, Ghana. **Phone:** (+233 51) 4221/2; **Telex:** 2555 (GH), UST.
Director/Head: M.D. Gidigasu.
Number of Research Scientists: 38; **Number of Staff:** 47.
Scientific Fields of Interest: Materials; Engineering/Technology; Geological/Earth Sciences.
Main Lines of Research and Training Activities: Housing and shelter construction: development and better uses of local building materials, development of laterite soil building materials for housing. Construction techniques and management, studies on lime production for use in paints and soil stabilizers; civil engineering and architectural consultancy services; structural analysis and uses of materials and manufactured components, such as timber in construction; housing statistics for national policy formulation and implementation management. Transport and road research: traffic and transportation engineering; highway geotechnical and pavement engineering; engineering geology and foundation engineering; socioeconomic impact of urban road improvement programme; safety improvement on urban and rural roads in Ghana.

Major Scientific Results or Products: Development of pozzolana cement that could reduce current cement imports by 40%; West African secondary species of timber classified and rated for use in construction and resistance to subterranean termites attack; kilns for production of lime from local limestone deposits developed, tested and made operational as pilot plant; small-scale burnt brick production factories established in various parts of country by private entrepreneurs through BRRI's technical assistance; cost saving, low-income house delivery strategies developed and tested; strategy transferred to small scale contractors through training courses; innovative timber bridge developed, built and now under observation in field; monitoring work in progress.
Main Research Facilities Available: Equipment for materials development, geotechnical engineering, soil composition, soil strength testing, rock testing, library, computers.
Future Development Plans: Increase efficiency and cost effectiveness of relevant research activities, improve effectiveness of materials science and technology, information generation and dissemination to make knowledge, information and facilities accessible to other institutions of industrial sector of the economy; engage in commercialization of research findings.
Cooperation Arrangements with Developing Countries: Cooperating with Commonwealth countries, mainly in Africa, through bilateral arrangements supported by Commonwealth Science Council (CSC), especially in development of new and advanced materials. Collaboration with International Development Research Centre (IDRC) in development of new materials from lateritic feedstock materials. Research projects with other developing countries through UN Industrial Development Organization (UNIDO); collaboration with African Regional Centre for Technology and African Regional Centre for Engineering Development and Manufacture.
Other International Cooperation Arrangements: Collaborative arrangements with following international and UN organizations: International Development Research Centre (IDRC), Canada; International Council for Building Research Studies and Documentation (CIB); World Association for Industrial and Technological Research Organization (WAITRO); Commonwealth Science Council (CSC), UK; Transport and Road Research Laboratory (TRRL), UK; UN Industrial Development Organization (UNIDO); Human Settlement and Materials section of Economic Commission for Africa (ECA), Ethiopia and UN Centre for Human Settlements (Habitat), Nairobi.

University of Science and Technology Institute of Mining and Mineral Engineering (IMME)

Address: Kumasi, Ghana; **Telex:** 5354 UST.
Director/Head: K. Sraku-Lartey.
Number of Research Scientists: 13; **Number of Staff:** 30.
Scientific Fields of Interest: Materials; Engineering/Technology; Geological/Earth Sciences; Environment, Environmental Engineering.
Main Lines of Research and Training Activities: Geological engineering; mineral processing/extractive metallurgy; materials science/environmental engineering.
Major Scientific Results or Products: New methods of mineral processing/extraction; processing routes for new ores/materials; graduates (skills development).
Main Research Facilities Available: Communication equipment; atomic absorption spectrometer; 6 PCs; library.
Future Development Plans: Acquisition of basic research tools to advance work on minerals, materials and related environmental issues.
Cooperation Arrangements with Developing Countries: School of Mines, University of Zimbabwe (present); School of Mines, University of Zambia (planned).
Other International Cooperation Arrangements: Pennsylvania State University (research collaboration); Technical University Clausthal, Germany (research collaboration); German technical cooperation (donor).

India

Bhabha Atomic Research Centre (BARC)

Address: Trombay, Mumbai, 400 085, India. **Phone:** (+91 22) 5564716; 5563060; **Telex:** 011-61017, 61022; **Fax:** (+91 22) 5560750; 5560534.
Director/Head: Anil Kakodkar.
Number of Research Scientists: 3,933; **Number of Staff:** 13,960.
Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/ Technology; Environment; Medical Sciences; Physics/Astronomy.
Main Lines of Research and Training Activities: Research and development in nuclear fuel cycle to generate know-how for nuclear power programme for India and other peaceful applications of nuclear energy; production of radioisotopes and development of applications in medicine, industry and agriculture; basic and applied research in such frontier areas of science and technology as accelerators, lasers, electronics, computers, robotics, superconductors, nuclear materials, genetic engineering; training programmes, one week to one year in length, in radiological physics, radiation medicine, radiation safety).
Major Scientific Results or Products: Developed indigenous know-how in nuclear fuel cycle, including processing of nuclear raw materials, nuclear fuel assembly facilities, heavy water technologies, nuclear reactor design, construction and operation, spent nuclear fuel reprocessing and nuclear waste management and their safe disposal; designed and built seven research reactors for reactor research, isotope production and materials study; produce more than 100 types of radioisotopes (more than 1.3 million radioisotope consignments despatched in past 35 years for applications in medicine, industry and agriculture in India and abroad); crop improvement by mutation breeding, radiation technology for preservation and sterilisation; developed technologies and know-how in nuclear and allied areas as well as various high-tech areas of science and engineering.
Main Research Facilities Available: Research reactors with special irradiation facility for basic and applied research and isotope production, Van-de-Graff and pelletron accelerator; shielded and remote control facilities for radioisotope handling; R&D laboratories in physics, chemistry, metallurgy, nuclear engineering, electronics, computers, robotics, biological sciences.
Future Development Plans: Development of advanced heavy water reactor systems with inherent safety features; research and development support for other reactor programmes in India; strengthen research and development programmes in various fields of science and engineering.
Cooperation Arrangements with Developing Countries: Under RCA programmes of IAEA, Centre participates in training and research programmes in Asian and Pacific region by providing experts, fellowships, training and equipment. Training of scientists from developing countries in areas related to expertise.
Other International Cooperation Arrangements: Bilateral cooperative agreements in science and technology with various countries.

Centre for Advanced Technology (CAT)

Address: Indore 452 013, India. **Phone:** (+91 731) 64626; **Telex:** (0735) 275; **Fax:** (91-731) 481525; **E-mail:** ddb@cat.ernet.in.
Director/Head: D.D. Bhawalkar.
Scientific Fields of Interest: Engineering/Technology; Physics/Astronomy.
Main Lines of Research and Training Activities: Identified by Indian government as main laboratory for conducting R&D in fields of lasers and particle accelerators; built India's first synchrotron radiation source; developed expertise and facilities in ultra high vacuum, cryogenics, magnet technology, RF and microwave technology; developed technology for lasers with medical, industrial and research applications; oversee research programmes in nonlinear optics, pico and femto sec studies, produced laser plasmas and studied interaction of laser light with tissue; created programme to develop laser-based instruments; participate in teaching programme at Devi Ahilya University, Indore; accept about 70 Indian students each year India for project work.
Major Scientific Results or Products: 20 MeV microtron; 700 MeV synchrotron; 450 MeV storage ring; accelerator components such as UHV, sputter ion pumps, turbo molecular pumps and UHV

components, large electromagnets; lasers, including: 5 kW industrial CO_2 laser, 40 W medical CO_2 laser, tunable dye laser, N_2 laser; various types of Nd: YG lasers; Multi gigawatt Nd Glass laser chain and many diagnostics for studying laser produced plasmas; picosec and femtosec lasers, laser Raman spectrometer, SQUID magnetometer.
Main Research Facilities Available: Laboratory facility to develop lasers, ultra high vacuum systems, electronic instruments and research in picosec femtosec phenomena, nonlinear optics, superconductivity; computing and library facilities.
Future Development Plans: Research, develop and construct 2 GeV synchrotron radiation sources; proton linac; industrial and medical accelerators; laser crystal growth; femtosec lasers; new industrial and medical lasers.
Cooperation Arrangements with Developing Countries: Department of Atomic Energy, Government of India, parent body of CAT, has cooperation programmes with many developing countries.

Council of Scientific and Industrial Research (CSIR) Central Glass and Ceramic Research Institute (CGCRI)

Address: 196, Raja S C Mullick Road, Calcutta 700 032, India. **Phone:** (+91 33) 5829; 4733469; 473-3496; **Telex:** 021.7787 GANGA IN; **Fax:** (+91 33) 4730957; **E-mail:** net%"cgcri%sirnetc@sirnetd.ernet.in".
Director/Head: C. Ganguly.
Number of Research Scientists: 165; **Number of Staff:** 540.
Scientific Fields of Interest: Materials; Chemistry; Environment; Physics/Astronomy.
Main Lines of Research and Training Activities: *Optical materials:* Optical Communication Fibre, Special Optical Fibres for radiation resistance. Laser Glass, New Generation of Optical Glass. *Engineering and Structural Ceramics:* Bioceramic materials for prosthetic implants and bone grafting materials, High aluminia, Transformation toughened aluminia and zirconia ceramics for engineering uses. *Non-oxide ceramics:* Silicon nitride/carbide, boron nitride, Aluminium oxy-nitride and other related ceramics for high temperature applications. *Ceramic coatings:* Coatings for protection of metal surface against high temperature wear and corrosion for engineering applications. *Electronic Ceramics:* Materials for multilayer capacitor, thermistor, relaxor, sensor, etc. Processing and fabrication of superconducting ceramics to tapes and wires, printed electronic circuit. *Refractories:* Refractories and castables based on beach sand, dolomite/magnesia, aluminia, zirconia, sillimanite etc. for steel, cement and other industries. *Soil Gel Techniques:* Glass and Ceramic materials by sol-gel processing, viz., high purity fused silica, AR coating on glass, ceramic oxide powders, microsphere powder of zirconia, aluminia, etc. for plasma coatings, ultrathin glass sheets. *Building Materials:* Low cost building materials utilising cheap and waste materials like fly ash, cinder etc. *Energy and Pollution Control:* Low thermal Mass down draft kiln for higher thermal efficiency. Design of improved furnaces for glass and ceramic industries for reduction of smoke emission. *Training Activities:* PhD programmes, Postdoctoral training, Entrepreneurship development programme, specialised short term training programme for professional scientists and technicians in the field of glass, ceramics and refractories.
Major Scientific Results or Products: 30 varieties of optical glass; radio-photoluminescent dosimeter glass; laser glass for range finders and plasma applications; optical communication fibre; glass and ceramic by sol-gel processing; silicon nitride; silicon carbide; boron nitride; ALON ceramic materials and components; bio-ceramic hip-joint prosthetics; bone grafting materials (HAP); transformation toughened ceramic cutting tool bits; partially stabilised zirconia ceramics; ceramic coatings for aero-jet engine components; mag-chrome/chrome-mag synthetic refactory aggregates; high aluminia cement, mag-dolo sinters; low moisture castables; low cost building bricks and roofing planks, PTC thermistor; barium and strontium titanate powders for multilayer capacitors.
Main Research Facilities Available: *Equipment:* ESCA, X-ray, SEM, TEM, Instron Universal Testing Machine, XRF, FTIR, IR, UV-V15 spectrophotomers, hot press, bending strength, creep testing machine. DTA, TGA, dilatometer, surface area, particle size equipment, zetameter, AAS, Acousto-ultrasonic tester, image shearing microscope, ultrasonic equipment US1R-12, Hot MOR; fibre draw tower, gas control module for OCF, glass working lathe, lapping machine, furnaces (up to 1700 C). *Computers:* 80486 based Eisa system with CAD/CAM facility and capacity of 16 terminals. *Extension Centre:* 1. Khurja, U.P. 2. Naroda, Gujarat. *Library:* books and journals in field of glass, ceramics and related material science; documentation services, data bank and information network linkages.
Future Development Plans: Main area of work would be speciality glass, including communication fibre, laser glass, new generation of optical glass; bio-ceramics, transformation toughened

aluminia/zirconia ceramics and protective ceramic coatings non metals; development of raw materials (titanates, niobates, zirconates) for electronic and other advanced ceramics; high performance refractories and castables for steel and other industries; silicon carbide/nitride components for specific end uses; solid Oxide fuel cell technology, doped zirconia fibres, ceramic membranes for microfiltration and other applications, sol-gel technology for preparation of glasses, ceramics and ultrafine precursor materials for advanced ceramics.
Cooperation Arrangements with Developing Countries: S&T collaboration with Bangladesh, Malaysia, Thailand, Mongolia, China, Vietnam, Syria and Sri Lanka in fields of advanced ceramics, electronic materials, sol-gel technology, special glass, technology ceramics, refractories, material characterisation, exchange/training of personnel and technology transfer.
Other International Cooperation Arrangements: Sponsorship tie-up proposed with Pitts Burgh Plate Glass, USA, on sol-gel technology. Project sponsored by Billiton Refractories, Netherlands. Deputation of scientists to USA, UK, Germany, France under NSF, Raman Research Colombo Plan/British Council, DAAD, CNRS.

Council of Scientific and Industrial Research (CSIR) Central Leather Research Institute (CLRI)

Address: Adyar, Chennai 600 020, India. **Phone:** (+91 44) 4912150; 4910897; **Telex:** 041-21014 CLRI IN; **Fax:** (+91 44) 4911589; **E-mail:** root@niclai.ernet.in; clri@sirnmetm.ernet.in.
Director/Head: T. Ramasami.
Number of Research Scientists: 246; **Number of Staff:** 241.
Scientific Fields of Interest: Biology; Biochemistry/Biophysics; Materials; Chemistry; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: Basic, applied and industrial research. Leather processing, footwear design and fabrication, garment design and fabrication, chemical science, chemical engineering, risk and hazard analysis, bioscience, microbiology, by-products, biochemistry polymer science, biophysics, environmental engineering, human resource development, economics research.
Major Scientific Results or Products: Technologies developed: myrobalan/wattle tanning extracts; lacquer and lacquer emulsion; urethane varnish from castor oil; syntan NC, NCR, PUR; lacquer CA; acrylic resin emulsion binder RS; sulphated oil fatliquor; sulphited oil fatliquor; cenlesoils 1, 2, 12, 30, 40, 70 and 360; cencatisol “O”; chrome aluminium syntan (Aldrotan); aluminium Syntan (Alutan); acrylic soft binder; casprol T; absorbable surgical suture/catgut from mammalian intestines; acrylic syntan synthetic tanning agent; cenlecol ‘F’ beer clarifying agent; polytan; claribleach.
Main Research Facilities Available: 300 MHz FT NMR; FT IR, SEM TEM, HPLC, GC DSC TGA DTA and variety of CHN aminoacid analysers and spectrophotometers; gait analysis laboratory; thermochemical laboratory.
Future Development Plans: 14 projects and 15 thrust area projects in leather processing.
Cooperation Arrangements with Developing Countries: Bilateral arrangements with Asian and African countries.
Other International Cooperation Arrangements: UNDP; UNIDO; FAO, TNO, CWS, SSARC, IDRC, University of Amsterdam, World Bank.

Council of Scientific and Industrial Research (CSIR) Indian Institute of Chemical Technology (IICT)

Address: Uppal Road, Hyderabad 500 007, Andhra Pradesh, India. **Phone:** (+91 40) 673289, 673874; **Telex:** 0425-7061 IICT IN; **Fax:** (+91 40) 673757, 673387.
Director/Head: K.V. Raghavan.
Number of Research Scientists: 300 **Number of Staff:** 1,078.
Scientific Fields of Interest: Agriculture; Biochemistry/Biophysics; Materials; Chemistry; Engineering /Technology.
Main Lines of Research and Training Activities: Synthesis, product/process development and design engineering for technologies for agrochemicals, industrial chemicals, drug intermediates (including CFC substitutes and CO based chemicals), oils and fats, surface coatings and polymers, coal/gas based chemicals; training offered in specialized disciplines, including computer aided services.

Major Scientific Results or Products: Complete technology package developed for agrochemicals (40 licences); life saving drugs (18 processes), castor oil based products, catalysts, several adhesives including surgical and structural.
Main Research Facilities Available: Equipped with analytical instrumentation, multipurpose pilot plants, computer hardware and software facilities for process analyses, simulation and optimization; additional sophistication in progress under World Bank soft loan.
Future Development Plans: R&D on synthesis of biologically active molecules from natural products leading to use as agrochemicals, drugs, dye and dye intermediates.
Cooperation Arrangements with Developing Countries: Under negotiation.
Other International Cooperation Arrangements: Existing collaborations with DuPont Agro (Div), USA, DuPont Merck, USA, Cyto Med, USA, Cargill USA, Searle R&D, USA, European Community, CNRS, France in field of agrochemicals, drugs, chemical intermediates.

Council of Scientific and Industrial Research (CSIR) Indian Institute of Petroleum (IIP)

Address: Dehradun 248 005, India. **Phone:** (+91 135) 24508;**Telex:** 0585-217; **Fax:** (+91 135) 23152; 621986; 627675; 28392.
Director/Head: T.S.R. Prasada Rao
Number of Research Scientists: 178; **Number of Staff:** 502.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology.
Main Lines of Research and Training Activities: Development of processes for petroleum refining; Assistance to refineries in absorption, adoption, selection of technologies and optimization of unit operations; Evaluation of products for market development; Technical services including crude evaluation; R&D work on utilization of crude petroleum, its products, natural gas and petrochemicals; Impart training to personnel of oil and petrochemical industry; Assistance to the Bureau of Indian Standards (BIS) in formulating standards for petroleum products; Conduct technoeconomic feasibility studies and market demand surveys of petroleum products;
Major Scientific Results or Products: *Processes:* Benzene and toluene through solvent extraction of naphtha; Solvent de-aromatization of naphtha; Food grade hexane through solvent extraction; Superior kerosene/ATF through solvent extraction; Solvent de-waxing and de-oiling; Visbreaking technology; Delayed coking technology; Catalytic reforming; Pt-Re bimetallic reforming catalyst; Hydrodesulphurization of naphtha, kerosene and gas oil; Pyrolysis gasoline hydrogenation; Re-refining of used crankcase lube oil; Additives for petroleum industry; Speciality chemicals. *Products:* Low air pressure film burner; Kerosene wick stove; LPG stove; Hurricane lantern; Smoke meter; Hot rolling oil; Diesenol retrofit kit.
Main Research Facilities Available: *Pilot plants:* de-waxing/de-oiling; Visbreaking and delayed coking; Microprocessor controlled automatic hydrocracker; Microprocessor controlled catalytic reforming unit; Batch propane de-asphalting unit; Glass lined stirred tank reactor. *Laboratory Facilities:* Equipment for separation processes; catalysis and catalytic conversions; analysis and analytical spectroscopy; chemical sciences; biotechnology; petroleum products application; industrial and domestic combustion.
Future Development Plans: Adsorptive and membrane separation process; Catalytic conversions for hydrocracking, reforming and fluidized cracking; Engine emissions and use of alternative fuels in engines; Renewable sources of hydrocarbons; Development of lubricants for CFC substitutes and waxes; Natural gas to petrochemicals.
Cooperation Arrangements with Developing Countries: Regular bilateral exchange programmes with several developing countries like Egypt, Libya, Syria, Bangladesh, Nigeria, Indonesia, Vietnam, Tanzania, etc.
Other International Cooperation Arrangements: Earlier IIP had 3 major programmes with the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO); currently, it has a special agreement with IFP (France) in the area of petroleum refining.

Council of Scientific and Industrial Research (CSIR) National Aerospace Laboratories (NAL)

Address: P.B. No. 1779, Bangalore 560 017, India. **Phone:** (+91 80) 557 0584; **Telex:** 0845 2279 NAL IN; **Fax:** (+91 80) 560 862; **E-mail:** viman@sirnetb.iisc.ernet.in.
Director/Head: K.N. Raju.
Number of Research Scientists: 484; **Number of Staff:** 869.
Scientific Fields of Interest: Energy; Structure and Materials; Chemistry; Engineering/Technology; Mathematics; Aerospace Electronics/Aerodynamics/Flight Mechanics and controls.
Main Lines of Research and Training Activities: *Aerodynamics and Computational Fluid Dynamics*: Low/High speed wind tunnel studies, advanced wind tunnel test techniques, data bases, flow visualization facilities/techniques, development of parallel computers and flow management; design/fabrication of advanced wind tunnel models, including composite construction. *Materials and Structures Technology*: Development of composite materials, analysis, design and fabrication, structural ceramics and surface technology, structural analysis, FEM software, aeroelastic analysis. *Propulsion*: Turbo machinery, blading technology, combustion and rotor dynamics. *Flight Dynamics*: Light Canard Research Aircraft, Flight Experiments. *Civil Aviation:* Design, development and production of 2 seater aircraft and 14 seater light transport aircraft, atmospheric factors and airworthiness studies. Mathematical Modelling and energy studies.
Major Scientific Results or Products: 1.2M trisonic wind tunnel established in 1967 has logged more than 17000 blowdowns; designed, engineered and built acoustic test facility for testing satellites and launch vehicle segments for qualifications tests; composite light canard research aircraft built and successfully test flown; design development and fabrication of flosolver, parallel processing computer; full scale fatigue testing of Ajeet and Gnat aircraft; development of automatic visual range assessor, technology transferred to industry; design and development of digital flight data recorder read out system for transcription of Boeing 747 and Airbus A300 data and installed at Air India; over 200 failure analysis and accident investigations related to aircraft and other industrial plants; design, development and installation of plant for heavy nickel plating of metal seals at MTAR, Hyderabad; set Advanced Composite Technology Laboratory for design, fabrication and testing of advanced composite aircraft structural components; development of a general purpose finite element software package called FEPACS to be used as effective and reliable analysis tool for static, dynamic buckling and thermal analysis of composite/metal structures; transfer of several technologies such as aramid fibres, aerospace grade epoxy resins, black chromium plating bath to industries.
Main Research Facilities Available: 1.2M Trisonic wind tunnel test facility complete with special test rigs, instrumentation and model design and fabrication; 0.6M transonic wind tunnel test facility; 0.3M subsonic wind tunnel test facility; boundary layer tunnel; dynamic simulation wind tunnel; computer controlled full-scale fatigue test facility; polar filament winding machine; turbine research rig; transonic/supersonic cascade tunnel; closed circuit centrifugal compressor test rig; axial flow compressor research facility; computer aided vibration test and analysis; aeroelastic and acoustic test facility; motion simulator; failure analysis and accident investigation facilities; facilities for development of advanced composite technologies; material testing/evaluation characterization.
Future Development Plans: Civil aviation aspects like special software, communications DFDR, AVRA, life estimation and problems of aging; design and prototype of small commuter aircrafts (2-20 seater).
Cooperation Arrangements with Developing Countries: CSIR/NAL-SSRC, Syria special agreement for conducting lectures; missions in aeronautical sciences; NAL-CAE protocol for cooperation in aeronautics with China.
Other International Cooperation Arrangements: Indo-Russian integrated long-term programme of cooperation in science and technology (theoretical and applied mechanics); CSIR/NAL-German aerospace research organization cooperative programme in aeronautical sciences.

Council of Scientific and Industrial Research (CSIR) National Chemical Laboratory (NCL)

Address: Dr. Homi Bhabha Road, Pune 411 008, India. **Phone:** (+91 212) 336151 337860; **Telex:** 0145-7266, 7586, 7653; **Fax:** (+91 212) 330233; 334261.
Director/Head: P. Ratnasamy.

Number of Research Scientists: 340; **Number of Staff:** 705.
Scientific Fields of Interest: Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: Basic and applied R&D in field of chemistry, chemical engineering and technology; develop new process, products and application; transfer skills and technologies to industries; protect intellectual property.
Major Scientific Results or Products: World-class high technologies in area of catalysis, polymers organic chemical technology, special materials, biotechnology.
Main Research Facilities Available: NMR, XRD, Mass Spectrometer, ESCA, IR, UV, GC mass, transmission electron microscope, Raman spectro, integrated catalysis pilot plant, Catatest unit, Internet, e-main, Nichem centre.
Future Development Plans: Strengthen basic and industrial research; IPR management and international partnership coupling R&D goals with market needs.
Other International Cooperation Arrangements: Bilateral Exchange programmes with most of the countries under S&T, DST; Rockefeller Foundation, McKnight Foundations, EC, IECPAR, DAAD, etc.

Council of Scientific and Industrial Research (CSIR) National Environmental Engineering Research Institute (NEERI), Nagpur

Address: Nehru Marg, Nagpur 440 020, Maharashtra, India. **Phone:** (+91 712) 226071; **Telex:** 0715-7233 NERI IN; **Fax:** (+91 712) 222725; **E-mail:** root@csneeri.ren.nic.in.
Director/Head: P. Khanna.
Number of Research Scientists: 170; **Number of Staff:** 365.
Scientific Fields of Interest: Environment.
Main Lines of Research and Training Activities: The Institute's thrust areas for R&D and training are: Environmental biotechnology; Environmental impact and risk assessment; Environmental monitoring; Environmental systems design, modelling and optimization; Environmental policy issues; Toxic waste management.
Major Scientific Results or Products: Improved process for desulphurization of coal; improved process for recovery of elemental sulphur from gases containing hydrogen sulphide; immobilization technology for *in situ* biodegradation of crude oil; preparation of biosurfactant useful in emulsifier for recovery of oil; improved on-solvent based process for extraction and recovery of poly-β-hydroxybutyrate from microbial biomass; improved device for reduction of smoke emitting form diesel engine exhaust; development of non-noble metal based two way catalytic converter to achieve higher conversion efficiency for CO and HC removal in auto exhaust.
Main Research Facilities Available: *Equipment:* HPLC; GLC; AAS; spectrophotometer. *Computers:* workstations (HP730); several Pentiums; 486; AD facility; LAN; VSAT. *Library* with books on basic sciences and engineering related to environmental science and engineering, journals, reports and reviews.
Future Development Plans: Major activities include development and field installation of biotechnological process for environmental protection, restoration, reuse and recovery; regional carrying capacity studies for sustainable development; environmental impact and risk assessment for industrial projects and increased cooperation among Southeast Asia through training and collaborative research programmes.
Cooperation Arrangements with Developing Countries: Training programmes at several SARC countries, including Nepal, Bangladesh, Sri Lanka.
Other International Cooperation Arrangements: R&D ventures with UN Environment Programme (UNEP), World Health Organization (WHO), and Chem Control, Denmark; WHO Collaborating Centre on Environmental Health and Regional Centre of India for Commonwealth Science Council Project on Management and Disposal of Hazardous Wastes; pursuing MOU with Mitsui Environmental Engineering Thrust (MEET) for joint R&D studies with Japanese institutions on measures related to environmental protection; pursuing contracts with Multiservice Engenharia Ltda, Brazil, Chem Control A/s, Denmark, Indo-US collaborative project on industrial complexing of phosphatic fertilizer and cement industries, and Indo-Swiss project on environmental biotechnology.

Council of Scientific and Industrial Research (CSIR) National Metallurgical Laboratory (NML)

Address: Jamshedpur 831 007, Bihar, India. **Phone:** (+91 657) 310131, 427251,426091-7; **Telex:** 0626-210, 274 NMLJ IN; **Fax:** (+91 657) 426527.
Director/Head: P. Ramachandra Rao.
Number of Research Scientists: 269; **Number of Staff:** 771.
Scientific Fields of Interest: Materials; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: One of chain laboratories under aegis of Council of Scientific and Industrial Research (CSIR); equipped for R&D activities on such diverse disciplines of metallurgy as beneficiation of lean ores, extraction of metals, processing, evaluation, corrosion protection; technical consultant to industrial companies; training and short-term courses for personnel of ferro-alloy industries; conventional instrumental chemical analyses of minerals, metals; graduate training in metallurgy; vocational training in metallurgical and computer application.
Major Scientific Results or Products: Developed about 100 technologies for small, medium and large industries with more than 50% commercially utilized, including magnesium metal, sponge iron, $V_2 0_5$/ferro vanadium, beneficiation of low grade iron ore, copper ore, fluorspar; aluminium conductor, electrolytic manganese dioxide, welding flux, graphite crucibles; about 100 research papers published each year; about 10 patents filed per annum.
Main Research Facilities Available: Pilot plants for mineral beneficiation, electrolytic manganese dioxide/metal, ferro-alloys, sponge iron and refractory materials. 0.8 ton direct arc furnace, induction furnace, creep testing (218 points), SEM, TEM, UFD, AE, XRF, XRD; mini computer/workstation with ANSYS/NISA. Field stations at Chennai (formerly Madras), Howrah, Batala, Ahmedabad, Digha and Calcutta; library equipped with 50,000 documents, on-line connection to global information Vendar, CD-ROM workstation and equipment for information storage and retrieval.
Future Development Plans: Promote user linkages to 75% of R&D efforts, recovery of valuable metals from polymetallic sea nodules; component integrity evaluation programme; development of low ash (less than 10%) coal; iron aluminides for high temperature application; sintered magnetite anodes for cathodic protection.
Cooperation Arrangements with Developing Countries: Exchange programmes under nation's bilateral agreement in S&T as part of South/South and South/North operation.
Other International Cooperation Arrangements: World Bank loan for "Component Integrity Evaluation Programme" (Rs. 42 million). Collaboration with British Universities: Brunel and Sheffield.

Indira Gandhi Centre for Atomic Research (IGCAR)

Address: Department of Atomic Energy, Kalpakkam 603 102, Tamil Nadu, India. **Phone:** (+91 4114) 40240; 40267; **Fax:** (+91 4114) 40360; 40396; 40336; **E-mail:** dir@igcar.ernet.in.
Director/Head: Placid Rodriguez.
Number of Research Scientists: 911; **Number of Staff:** 1413.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Physics/Astronomy; Reactor safety research.
Main Lines of Research and Training Activities: The R&D activities of the Centre are mainly oriented towards the development of fast breeder reactor technology. The main areas of activity are: *Reactor engineering:* Sodium technology; Design of high temperature component; Structural mechanics; Thermal hydraulics; Reactor physics; Transient analysis; Quality assurance. *Materials:* Mechanical properties; Welding science and technology; Structure-property correlations; Corrosion science and engineering; NDT science and technology. *Chemistry:* Sodium chemistry; Sensors; High temperature mass spectrometry; Thermochemistry and modelling; Actinide solution chemistry. *Physics:* Positron annihilation; Superconductivity and cryogenics; High pressure physics; Optics; Theoretical physics. Health, safety and waste management. Electronics, instrumentation and computer science. Fuel reprocessing.
Major Scientific Results or Products: Competence to design, construct and operate fast reactors with sodium as coolant.
Main Research Facilities Available: *Computational Support:* Novsk data ND-560; Super 32170 (2 Nos.); Anupam; silicon graphics; power challenge. *Library:* 60,000 books, 640 journals; 225,000 reports; 15,000 standards; microfilm, microfiches; DTP, DIALOGUE, CD-ROMs. *Research Facilities:* Material testing laboratory; analytical chemical laboratory; electronics laboratory; particle irradiation facility; 2 Mv

tandem accelerator; 400 Kv heavy ion implanter; 150 Kv gaseous ion implanter; 10ev to 10Kv ion gun; KAMINI, a 30 KW; U233 φυελλεδ research reactor having 3x1010 n/sqcm/sec flux for carrying out neutron radiography of spent fuel and other non radioactive objects, activation analysis of materials with short half lives and radiation physics research.
Future Development Plans: R&D work in following areas for construction of prototype fast breeder reactor (PFBR) of 500 MWe: fuel development; safety studies; engineering development; seam generator test facility; quality control and inspection of NPP components; fuel reprocessing; technology development for manufacture of reactor components; development of materials; structural mechanics; development of manufacturing process; basic research in materials; improved instrumentation system.
Cooperation Arrangements with Developing Countries: Specialist services made available under regional cooperation agreements, governed by IAEA.
Other International Cooperation Arrangements: Visits exchanged under bilateral agreements with USA, USSR and Germany.

Nuclear Science Centre

Address: Aruna Asaf Ali Marg, Post Box 10502, New Delhi 110067, India. **Phone:** (+91 11) 689 3045; **Fax:** (+91 11) 689 3666; **E-mail:** gkm@nsc.ernet.in.
Director/Head: G.K. Mehta.
Number of Research Scientists: 41; **Number of Staff:** 69.
Scientific Fields of Interest: Biology; Materials; Chemistry; Engineering/Technology; Earth Sciences; Physics/Astronomy.
Main Lines of Research and Training Activities: Nuclear reaction and nuclear spectroscopy; atomic physics; materials science; surface science; radiation chemistry; radio-biology/biosciences; training of MSc students in thin film technology, cryogenics, ultra vacuum, magnet engineering, RF electronics etc.
Major Scientific Results or Products: Recoil mass spectrometer, gamma detector array; RF amplifier, RF sputtering set up; nuclear electronics modules; preamplifiers; charged particle detectors.
Main Research Facilities Available: Heavy ion reaction analyser (HIRA); gamma detector array (GDA); general purpose scattering chamber; materials science beam line with UHV chamber; 15 UD Pelletron; Tata-Elexi mainframe computer, workshop library.
Future Development Plans: Superconducting linear accelerator (LINAC) and on-line experimental facilities.
International Cooperation Arrangements: Argonne National Laboratory, for development of superconducting resonators.

Tata Energy Research Institute (TERI)

Address: Habitat Place, Darbari Seth Block, Lodi Road, New Delhi 100 003, India. **Phone:** (+91-11) 462 2246, 460 1550; **Fax:** (+91 11) 462-1770, 463-2609; **E-mail:** mailbox@teri.ernet.in.
Director/Head: R.K. Pachauri.
Number of Research Scientists: 290; **Number of Staff:** 167.
Scientific Fields of Interest: Agriculture; Energy; Materials; Chemistry; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: *Policy Analysis:* Energy-environment Interface, global environment research, modelling and policy analysis, statistical analysis, conventional energy sources, information technology. *Energy Technology:* Chemical and hydrogen energy, industrial energy, renewable energy technology applications, biomass energy technology applications, environmentally sound technology applications. *Renewable Resources Management:* Forestry, biodiversity, rural energy. *Biotechnology:* Microbial biotechnology, plant molecular biology, plant tissue culture. *Information Services:* Library, documentation and information centre, publications unit, outreach cell. *Training Programmes:* for senior officials in government, energy utilities and the corporate sector.
Major Scientific Results or Products: TEESE (TERI energy, economy, environment, simulation and evaluation) model, least cost energy optimization model for India; gasifier; solar pond; joint participatory forest management programme; tissue culture pilot plant.
Main Research Facilities Available: *Equipment:* Fully equipped laboratories for tissue culture, genetic engineering and microbiology, surface analysis, air quality analysis and fuel cell. *Computers:* 250 PC

systems on LAN; laser printers for remote LAN printing; 10 notebook systems, Internet access with SMTP mail and Web service; netware, windows NT and Unix services; peripherals for colour printing, colour plotting, digitizing, multimedia, slide making, scanning, optical backup and data acquisition. *Field stations:* Tissue culture pilot plant, Gual Pahari, India. *Library:* more than 13,000 technical books, reports, proceedings, 600 current journals and 5,800 back volumes in field of energy, environment, biotechnology and forestry. *Other:* Regional Centres at Bangalore, Buwahati, Goa; Affiliate Institute in North America; Representation in Germany and Moscow.
Future Development Plans: Regional energy-environment issues, impact of population on environment, waste management, environment and health, environmental planning of industrial complexes, promotion of clean and efficient technologies, NGO networking for training and dissemination in rural energy issues, joint forest management, biodiversity conservation, biotechnology applications in rural development and industry.
Cooperation Arrangements with Developing Countries: Asian Development Bank, Philippines; UN-ESCAP, Thailand; Food and Agriculture Organization, Thailand; International Centre for Integrated Mountain Development, Nepal; Biomass Users Network, Costa Rica; Swiss Development Corporation, New Delhi, British High Commission, New Delhi, India.
Other International Cooperation Arrangements: European Commission, Belgium; I.T. Power Ltd. U.K; The Ford Foundation, USA; UNDP, USA; UNU, Japan; The World Bank; World Wide Life Fund, USA; MacArthur Foundation, USA; UNIDO, Austria; ECN, Netherlands Energy Research Foundation, Netherlands; Université Catholique De Louvain, Belgium; Shell International Gas Limited, UK; INFRAS, AG, Switzerland; Transalta Enterprises Corporation, Canada; East-West Center, USA; Ecoenergy International Corporation, USA; GTZ Central Board, Germany; Cambridge Energy Research Associates, USA; UNEP, USA; New Energy and Industrial Tech. Dev. Orgn., Japan; Commonwealth Science Council, London, UK; Unocal Corporation, USA; National Renewable Energy Laboratory, USA; Oiltanking Ltd., India; ANZDEC Ltd., New Zealand; Fuji Research Institute Corporation, Japan; Environmental Research Management, UK; United Nations Population Fund, USA; McKenna & Co. London, UK; EXXON Company, USA; Cairn Energy Plc., UK.

University of Bombay Department of Chemical Technology

Address: Matunga, Mumbai 400 019, India. **Phone:** (+91 22) 414-5616; **Fax:** (+91 22) 414-5614; **E-mail:** mmsharma@vact.ernet.in.
Director/Head: M.M. Sharma.
Scientific Fields of Interest: Engineering/Technology.
Main Lines of Research and Training Activities: The Department conducts courses in chemical engineering, seven branches of chemical technology and pharmacy and is recognized as a leading school in the country, in these branches, measured by any standards. It has two Centres of Advanced Studies, in Textiles, Fibres and Dyes, and Chemical Engineering, approved by the University Grants Commission (UGC) and two Departments of Special Assistance in Foods and Fermentation Technology and Pharmaceutical Sciences and Technology. In chemical engineering the main line of research activities is centred around multiphase reactions and reactors. In pharmaceutical sciences it is on structure activity relationship. In the case of textiles, new methods of processing, cotton and synthetic textiles, are pursued and in the case of dyestuff technology, novel dyestuff structures are generated. In the case of food technology, biochemical and nutrition aspects of different raw materials particularly of Indian origin are pursued. In the case of oil technology this institute pioneered the development and use of minor oils and seeds.
Major Scientific Results or Products: Faculty members serve as consultants; industries have developed based on our work, including India's dyestuff industry.
Main Research Facilities Available: Sophisticated instruments, such as NMR, FTIR, laser Doppler-anemometer, computers, DSC, UV-spectrophotometers, XRD, atomic spectrophotometer, ion chromatograph, gas chromatographs and liquid chromatograph, quantitative TLC; library (receives approximately 10% of total budget); in chemical technology and chemical engineering library recognized as leading library in India.
Future Development Plans: Produce more multidisciplinary postgraduate courses; introduced MSc (Tech) bioprocess-technology with special reference to downstream processing, supported by Department of Biotechnology, Government of India.

Variable Energy Cyclotron Centre Department of Atomic Energy

Address: 1/AF Bidhan Nagar, Calcutta 700 064, India. **Phone:** (+91 33) 371230 (4 lines), 37-0032 (direct); **Telex:** 21-4526 VECC IN; **Fax:** (+91 33) 346871.
Director/Head: Bikash Sinha.
Number of Research Scientists: 49; **Number of Staff:** 474.
Scientific Fields of Interest: Materials; Chemistry; Engineering/Technology; Medical Sciences; Physics/Astronomy.
Main Lines of Research and Training Activities: Charged particle reactions and scattering, alpha induced fragmentation of target nuclei, mechanism of charged particle induced fission, in-beam gamma ray spectroscopy, giant dipole gamma decay following alpha induced reactions, short-lived radioactivity studies using helium jet transport system, materials science studies through radiation damage and activation analysis and production of radioisotopes for medical use; studies related to heavy ion physics at intermediate and relativistic energies.
Major Scientific Results or Products: Development of theories of "Photons and dileptons as signals of phase transition to quark gluon plasma;" evidence of classical dynamics in non-classical Hamiltonian from level statistics in nuclear systems with spin-orbit interaction and from Dirac equation; studies of intermediate mass segment emission; dynamical evolution of reaction mechanism at Fermi energies, incomplete fusion reactions; experimental studies of intermediate mass fragment emission in alpha induced reactions; production of Ga^{67} for diagnostic purposes.
Main Research Facilities Available: Remote controlled scattering chamber for charged particle experiments; beam line for in-beam gamma spectroscopy studies; and irradiation facilities for production of radioactivity and material science experiments; radiochemistry laboratory, sophisticated on-line data acquisition system and two large mainframe computer system for data analysis.
Future Development Plans: Development of high resolution beam utilizing existing cyclotron undertaken to enlarge scope of research for nuclear scientists; project/programme approved for development of K-500 superconducting cyclotron; work started on finalizing design parameters of superconducting cyclotron.
International Cooperation Arrangements: CERN-India collaboration on development of photon multiplicity detector for sulphur beam and future programme for development of larger detector system for lead beam; collaboration with MSU and Texas A&M University for fabrication of superconducting cyclotron based on machines operating at those places.

Indonesia

National Atomic Energy Agency (BATAN) Nuclear Techniques Research Centre

Address: Tamansari 71, Bandung 40132, Indonesia. **Phone:** (+62 22) 2504898; **Telex:** 28271; **Fax:** (+62 22) 2504081.
Director/Head: Harjoto Djojosubroto.
Number of Research Scientists: 79; **Number of Staff:** 340.
Scientific Fields of Interest: Biochemistry/Biophysics; Materials; Chemistry; Engineering/Technology; Physics.
Main Lines of Research and Training Activities: Radiochemistry: synthesis of labelled compounds, especially radiopharmaceuticals and radiometric analysis (neutron activation analysis and radioimmunoassay); condensed matter physics, nuclear physics and metallurgy; reactor physics and technology.
Major Scientific Results or Products: Radioisotopes and labelled compounds; design and installation of neutron diffractometer for structure and magnetic studies; nuclear fuel pins of natural uranium; scientific papers in nuclear metallurgy and physics, neutron activation analysis, and synthesis and characterizations of labelled compounds; safe operation of TRIGA Mark II reactor 3-5 days/week continuously (24 hours/day, at power level of 700 kW, 1MW) for research and radioisotope production since 1971.

Main Research Facilities Available: TRIGA Mark II reactor equipped with digital console and instrumentation; facilities for radioisotope production and radiopharmaceutical kit preparation, and hot cell; spectrometers (atomic absorption, infra red, UV and visible), scanning electron microscope, neutron and X-ray diffractometers, chromatographs (gas and liquid), thermohydraulic loop NILO I, computers.
Future Development Plans: Fabrication of ^{60}Co pencil for gamma irradiator; applications of computation chemistry in synthesis of labelled compounds.
International Cooperation Arrangements: Joint research in utilization of research reactor for neutron activation analysis in Asia Pacific region; major donor are Japan and IAEA.

Madagascar

Centre National de Recherches Industrielles et Technologiques (CNRIT)

Address: B.P. 3330, Antananarivo, Madagascar. **Phone:** (+261 2) 20975.
Director/Head: Etienne Rakotomaria.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/Technology; Earth Sciences; Environment; Computer Science.
Main Lines of Research and Training Activities: Building materials; Inorganic chemistry; Energetics (solar energy, biogas).
Major Scientific Results or Products: Lime, pozzolana-lime; activated carbon; refractory bricks; mineral pigments and chemicals from local raw materials.
Main Research Facilities Available: 3 computers.
Future Development Plans: Research and development.
International Cooperation Arrangements: PNUD, ONUDI, FAO, FAC, COI.

Institut National des Sciences et Techniques Nucleaires (INSTN)

Address: BP 4279, Antananarivo, Madagascar. **Phone:** (+261 2) 355 84; **Fax:** (+261 2) 35583.
Director/Head: Raoelina Andriambololona.
Scientific Fields of Interest: Agriculture; Energy; Engineering/Technology; Earth Sciences; Environment; Veterinary Sciences; Mathematics; Physics/Astronomy.
Main Lines of Research and Training Activities: The Institute organized the following main training activities: October 1991: Interregional training course on "Interfacing in nuclear experiments"; June 1993: National training Course on "Nuclear Instrumentation"; October-November 1995: Regional course on "Notification registration, licencing and control of ionizing radiation sources"; October 1996: "National training course on radiation protection for radiographer".
Major Scientific Results or Products: Set-up of laboratory for radioactive foodstuff monitoring; industrial and urban pollution measurement in capital of Madagascar by X-Ray Fluorescence technique; set up of Secondary Standard Dosimetry Laboratory (SSDL); heavy elements detection, abnormal alpha radioactivity in Malagasy ores; study of building material radioactivity.
Main Research Facilities Available: Liquid scintillation counter; germanium detectors systems (2); NaI (Tl) detectors systems (3); alpha spectroscopy system with surface barrier detectors; Si (Li) detectors systems using total reflection method (2); TLD radiation monitoring; Secondary Standard Dosimetry Laboratory with Co-60, Cs-137 sources and X-ray generator 160KV.
Future Development Plans: Extend quality control in radioprotection; keep monitoring environmental pollution.
International Cooperation Arrangements: Technical cooperation with IAEA; cooperation with Paris VI and Paris VII Universities; cooperation with ITC/FZK Karlsruhe, Germany; University of Aix-Marseille, France; agreement with Lomonosov University of Moscow (planned).

Malaysia

Malaysian Institute of Microelectronic Systems (MIMOS)

Address: MIMOS Berhad, Technology Park Malaysia, 57000 Kuala Lumpur, Malaysia. **Phone:** (+60 3) 966 5000; **Telex:** MA 28145; **Fax:** (+60 3) 966 2755; **E-mail:** tmas@mimos.my.
Director/Head: Tengku Mohd Azzman Shariffadeen.
Number of Research Scientists: 185 researchers (1994); **Number of Staff:** 15 professionals; 28 technicians; 77 others.
Scientific Fields of Interest: Engineering/Technology; Information Technology (IT).
Main Lines of Research and Training Activities: R&D in microelectronics and information technology, especially in the areas of computer systems, telecommunications, VLSI design, semiconductors technology, machine intelligence, product development.
Major Scientific Results or Products: *Computer System:* computer networking, Malay language spell checker; *Telecommunications:* ISDN PC card and rural telecommunication; *VLSI Design:* ASIC and PCB; *Product Development:* time management systems; *Machine Intelligence:* supervisory control.
Main Research Facilities Available: *Facilities:* CAD tools; network (JARING); software development centre and tools; PCB manufacturing laboratory. *Services:* consultancy; training; technical and information services; contract R&D; technical licensing.
Future Development Plans: National programmes in microelectronics and information technology: development of national capability in integrated circuit fabrication technology; semiconductor microsystems, packaging and testing; Advanced semiconductor devices and technologies; indigenous development of rural telecommunication; development and utilization of broadband networking; data gathering and market intelligence for IT sectors; increasing number of IT personnel in key areas; development and upgrading of the capability of SMIs in electronics and IT in product and process technology.
Cooperation Arrangements with Developing Countries: Database project with Organization of Islamic Countries.
Other International Cooperation Arrangements: Ericsson, Sweden; Fraunhofer Gesellschaft, Germany; Interaniversitair Micro-Electronica, Germany; Hewlett Packard, USA; Marconi-Italiana-USA; SUN/SPARC, USA.

Standards and Industrial Research Institute of Malaysia (SIRIM)

Address: Persiaran Datò Menteri, Seksyen 2, P.O. Box 7035, 40911 Shah Alam, Selangor, Malaysia.
Phone: (+60 3) 5592601, 5591630; **Telex:** SIRIM MA 38672; **Fax:** (+60 3) 5508095; **E-mail:** postmaster@sirim.my.
Director/Head: Ahmad Tajuddin Ali.
Number of Research Scientists: 420; **Number of Staff:** 1,120.
Scientific Fields of Interest: Biology; Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/ Technology; Geological/Earth Sciences; Environment.
Main Lines of Research and Training Activities: *Materials Technology:* research services in areas of ceramics, plastics and metal technology. *Advanced Manufacturing Technology:* assembly technology, manufacturing system, mechatronics, software development and circuit and electronic systems; process technology projects related to chemical technology, industrial biotechnology, environmental technology, and energy conservation and auditing; *Product and Machine Development:* expertise in product development, packaging, machine, production tooling, foundry and prototyping services. *Measurements Technology:* research for precision measurement in fields of length, mass, flow, temperature, force, pressure and most electrical parameters. *Packaging Technology:* improving quality, safety, environmental compatibility of packaging materials contributing toward product competitiveness.
Major Scientific Results or Products: New advanced fireproof materials; inclivator system; high quality casting products; electroless nickel plating technology; electroplating wastewater management and treatment; friction welding system; spray-mixed powder detergent; manufacture of marine navigational buoy using glass reinforced polyester; vinegar production plant and technology; anaerobic waste treatment technology; briquetting of rice husk as solid fuel; high corrosion resistance material for propeller; automatic labelling machine; co-extrusion process for manufacture of two layer PE films for

industrial and agricultural use; metal recovery from electroplating sludge; mini-automated machining cell; SIRIM time management system; white amorphous silica.
Main Research Facilities Available: *Laboratories*: assembly technology; automation; computer integrated manufacturing (CIM); chemical technology; fermentation pilot plant; environmental technology; energy technology; plastics testing and characterization; ceramics technology; metals characterization and evaluation; corrosion protection; metallurgy; food and microbiology; water and effluent; textile and paper; metals and building materials; surface coating; materials sciences; industrial appliances and accessory I & II; domestic appliances and accessory I & II; electronic appliances and accessory; lighting and accessory; vehicle and component testing; physical and dynamic testing. *Workshops*: research and development; prototype development; prototyping services; graphics and prototyping.
Future Development Plans: Future development includes setting up advanced materials research centre; electromagnetic compatibility laboratory, national CAD/CAM centre, national artificial intelligence centre.
Cooperation Arrangements with Developing Countries: Cooperation programmes with developing countries such as Vietnam, ASEAN countries, Sri Lanka and Tunisia.
Other International Cooperation Arrangements: Cooperation programmes with international organizations in field of standards, quality, technical information, inspection, joint research projects, experts services.

Mexico

Centro de Investigacin y de Estudios Avanzados del IPN, Unidad Saltillo

Address: Apartado Postal 663, 25000 Saltillo, Coahuila, Mexico. **Phone:** (+52 84) 882169; **Fax:** (+52 84) 881139; **E-mail:** jmendez@saltillo.cinvestav.mx.
Director/Head: Juan Méndez Nonell.
Number of Research Scientists: 19; **Number of Staff:** 11.
Scientific Fields of Interest: Materials.
Main Lines of Research and Training Activities: 1. Extractive Metallury: Concentrating Processes; pyrometallurgy and hydrometallurgy. 2. Metals Processing: Liquid metal treatment; solidification processes; microstructural engineering. 3. Ceramics: Bioceramics; structural ceramics; composites.
Major Scientific Results or Products: 55 graduated students; 80 papers in international journals; 40 papers in Mexican journals; 150 papers in congress and symposia; 5 US patents.
Main Research Facilities Available: Chemical Laboratory; thermal analysis laboratory; microscopy laboratory; mechanical testing laboratory; diffractometry laboratory; foundry laboratory; extractive processes laboratory; ceramic processes laboratory; computing laboratory.
Future Development Plans: One academic department in metallurgical engineering. Plan to open second academic department in ceramics materials within next three years.
International Cooperation Arrangements: University of Mining and Metallurgy of Cracow, Poland; University of Laval, Canada; Glass and Ceramic Institute, Spain; Polytechnic Institute of Lorraine, France.

Nigeria

Federal Institute of Industrial Research, Oshodi (FIIRO)

Address: Private Mail Bag 21023, Ikeja, Lagos State, Nigeria. **Phone:** (+234-1) 522905; **Telex:** 26006 FIIRO NG; **Fax:** (+234 1) 525880.
Director/Head: S.A. Odunfa.

Number of Research Scientists: 60; **Number of Staff:** 436.
Scientific Fields of Interest: Biology; Biochemistry/Biophysics; Materials; Chemistry; Engineering/Technology; Biotech; Ind. info; Tech marketing and extension.
Main Lines of Research and Training Activities: Food colours from indigenous plant sources; Lesser known oils for cosmetics and essential oils for perfumery; Malted sorghum grains for the brewery and beverage industries; Development of high protein full nutrient weaning foods from local raw materials; Engineering design and fabrication of equipment to meet scientific research and development needs; Development of ceramics and foundry material from local sources; Transfer of technology through training workshops.
Major Scientific Results or Products: Soy-ogi (weaning food); cassava processing equipment; foundry crucible developed; cosmetics based on benniseed oil; beer from 100% malted sorghum grain; cosmetics based on palm kernel oil: preservation and bottling of palm wine beverage drink.
Main Research Facilities Available: Spectrophotometer, flame photometer, infrared photometer, GLC. Computers, library.
Future Development Plans: Build biotechnology pilot plant; upgrade operations of engineering design section with computer aided design.
Cooperation Arrangements with Developing Countries: Transfer of technology for cassava processing under contract with UNIDO to Togo, Cameroon, Ghana, Zaire and Sierra Leone (all in Africa).
Other International Cooperation Arrangements: Research equipment donated by FAO, EEC and UNIDO in food processing, ceramic materials, textile testing and documentation.

National Center for Energy Research and Development (NCERD)

Address: University of Nigeria, Nsukka, Nigeria. **Phone:** (+234 42) 771853; **Telex:** 51496 ULIONS NG; **Fax:** (+234 42) 771855; **E-mail:** misunn@aol.com.
Director/Head: A.O. Odukwe.
Number of Research Scientists: 13; **Number of Staff:** 15.
Scientific Fields of Interest: Energy; Materials; Environment.
Main Lines of Research and Training Activities: Solar thermal; Solar photovoltaic; Biomass and biotechnology; Solar radiation and environmental data; Wind energy; Energy management-economics-policy; Energy systems modelling and analysis; Undergraduate research projects; Graduate research projects; Workshops, conferences and seminars on renewable energy technologies; Field and pilot demonstration projects.
Major Scientific Results or Products: Solid absorption on solar refrigerator; design model (computer based) for refrigerator; solar rice dryer (commercial scale); solar chicken brooder; solar manure dryer; coal briquette stoves; improved fuelwood stove; characterization of FeS thin film deposits on glass by spray pyrolysis.
Main Research Facilities Available: Library: PCs; multipurpose laboratory; mechanical and electrical workshops; conference and seminar rooms; pilot solar rice dryer plant.
Future Development Plans: Development of international cooperation and collaboration; acquisition of additional equipment for laboratories; acquisition of books and journals; employment of additional research staff; extension of activities to other NRSE areas not presently active; construction of new laboratory building.
Cooperation Arrangements with Developing Countries: Centre runs international conference on NRSE every two years and solar drying workshop annually, to which scientists from the African region are invited; offers research positions to scientists from developing countries; cooperates with China under Technical Cooperation among Developing Countries programme.
Other International Cooperation Arrangements: Center is Federated Institute of ICTP; has done collaborative research with Cranfield Institute of Tech., UK.

Pakistan

National Institute of Electronics (NIE)

Address: Plot No. 17, Sector H-9, P.O. Box 1406, Islamabad, Pakistan. **Phone:** (+92 51) 448436-39;
Telex: 5538 NIEPK; **Fax:** (+92 51) 448451.
Director/Head: Muhammad A.I. Rana.
Number of Research Scientists: 83; **Number of Staff:** 234.
Scientific Fields of Interest: Electronic Engineering/Information Technology.
Main Lines of Research and Training Activities: Design, develop and guide fabrication of electronic components, particularly integrated circuits, and PCB's keeping abreast of latest technologies; design, develop and guide production of electronic measuring instruments, industrial control equipment, computing devices, medical electronic equipment and opto-electronic devices; design, develop and guide production of radio and television sets, including colour television power supplies, inverters, and other consumer electronic devices; develop expertise in digital electronic techniques to enable application to communication/networks control systems, data processing and data transmission equipment of the future; undertake design and development projects on contract with user organizations in public, private sector, technical universities/colleges and coordinate work in various development centres in case of composite projects; conduct seminars on electronic topics of national interest and exchange specialized know-how with other research organizations, and centres of competence; undertake small quantity production of specialized components, integrated circuits and equipment; assist industry to acquire and absorb electronic technology to enable increased use of local components and circuits; design and assist in indigenization and standardization of components, equipment and techniques at national level.
Main Research Facilities Available: Multiple subdiscipline electronic laboratories including, microelectronics, medical electronics, computer architecture. Computers PC, XT, AT logic development systems, oscilloscopes, logic simulation systems, logic analysers, wave form analysers, spectrum analysers, clean room, complete mechanical workshop, PCB fabrication facilities, technical library and display centre.
Future Development Plans: Trying to further commercialize activities to become revenue generating; has already generated significant revenue as result of commercial activities; will enhance and continue its coordination with local industry and other public sector organizations to provide R&D services for high-tech products to be locally produced at low cost; will offer postgraduate courses and conduct research in fields of electronics engineering, computer science and other relevant areas when resources are available; objective is to augment R&D and technical educational work being done by the universities; a large number of courses and technical lectures have already been conducted; widen its scope and facilities to extend repair and maintenance facilities for private and public sector organizations in selected areas; repair cell already exists and has earned a substantial amount; existing manpower will be trained and exposed to high technology ensuring country keeps pace with developments in technological world.
Cooperation Arrangements with Developing Countries: Number of delegations from Saudi Arabia, China, USA, India and Singapore have visited Institute; NIE is full member of Asia Electronics Union (Japan); bilateral protocols for visits of scientists exists with China, Korea and ECO countries; potential for cooperation and collaboration including transfer of technology.

National Physical and Standards Laboratory (NPSL)

Address: Plot 16, Sector H-9, P.O. Shaigan, Islamabad, Pakistan. **Phone:** (+92 51) 282500, 854475;
Telex: 58541 PCSIR PK; **Fax:** (+92 51) 272325.
Director/Head: Syed Sarfraz Hussain Zaidi.
Number of Research Scientists: 51; **Number of Staff:** 147.
Scientific Fields of Interest: Materials; Chemistry; Engineering/Technology; Environment; Physics/Astronomy; Metrology.
Main Lines of Research and Training Activities: Metrology; Materials (standard reference); Applied physics and chemistry; Calibration, standardization; Training imparted in standard transfer techniques.
Major Scientific Results or Products: Secondary level masses and CRM's; radio receiving clock, digital clocks; voltage transfer standards; secondary level resistance standards.

Main Research Facilities Available: ICP, AA, IR, NMR GLOW emission; tensile testers, harness testers, oscilloscopes, frequency counters and generators; standards of time and frequency, volt, ampere, temperature length and mass; library and computers (PCs).
Future Development Plans: Requirements submitted to Government through regular channels and have been agreed to in principle. Sources of F.E. funding (US$ 9 million) are being negotiated at government level for approved phase II of NPSL.
Cooperation Arrangements with Developing Countries: Links with APMP in fields of metrology resulted in cooperation with S. Korea, China, India.
Other International Cooperation Arrangements: MOU's exist between NIST (USA), under process of renewal; with P.R. China and S. Korea, will be signed in near future.

Senegal

African Regional Centre for Technology (ARCT)

Address: B 2435, Boulevard Djily Mbaye, Dakar, Senegal. **Phone:** (+221) 237712.
Director/Head: Ousmane Kane.
Number of Research Scientists: 3; **Number of Staff:** 16.
Scientific Fields of Interest: Agriculture; Energy; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: Computer-software design and production; General computer training programmes; Technology policy; Industrial research and management; Company re-engineering and management analysis; Technology transfer, incubation and application in industry.
Major Scientific Results or Products: Pilot demonstration units (technology); food processing technologies; energy processing technologies.
Main Research Facilities Available: 60 computers for R&D, training, networking and data processing; 4 pilot demonstration units for technology incubation; computerized special library; workshops in member states for research analysis.
Future Development Plans: Brazil, India and all countries in Africa, joint programmes in food processing, planned, includes South Africa, and some Southeast Asian countries.
Cooperation Arrangements with Developing Countries: ECA, UNDP, UNIDO, FAO, UNCTAD, UNESCO, GET, BDEA, IDB, ADB, IDRC, Carnegie Corporation of New York, World Bank.
Other International Cooperation Arrangements: Have 31 national focal points in 31 African member states; collaborate with several specialized institutions in Europe, USA and Canada.

Institut de Technologie Nuclaire Applique (ITNA)

Address: Université Cheikh Anta Diop de Dakar, B.P. 5730, Dakar Fann, Senegal. **Phone:** (+221) 252891; **Fax:** (+221) 252895.
Director/Head: Christian-Sina Diatta.
Number of Research Scientists: 7; **Number of Staff:** 5.
Scientific Fields of Interest: Agriculture; Biology; Biochemistry/Biophysics; Materials; Chemistry; Earth Sciences; Environment; Veterinary Sciences; Medical Sciences; Plasma Physics, Meteorology.
Main Lines of Research and Training Activities: Nuclear physics and technology; Plasma physics; Physical chemistry; Medical physics; Applied physics to meteorology, biology, agronomy and agriculture. Other main activities are applied nuclear technology: XRF, electronics, radiation protection, nuclear chemistry, food irradiation, maintenance and scientific instrumentation. ITNA is running a PhD training programme in the 5 fields described above. These programmes are jointly under the responsibility of ITNA and the Laboratoire de Physique Fondamentale et d'Etudes Energétiques of the Faculty of Science, University of Dakar, Senegal.
Major Scientific Results or Products: Study of cowpea irradiation and Senegalese potential in food irradiation; maintenance and scientific instrumentation network programme in Africa; food irradiation project for Senegal; creation and running of the PhD training programme in 5 fields.

Main Research Facilities Available: XRF (experimental set up with computer), electronic hardware, kits, tools and oscilloscopes, MCA (2), liquid nitrogen plant, ovens (2), water filters (2), experimental chemistry plants (4), computers (4), printed circuits laboratory with equipment, video camera and television, slides projector, transparencies projector (2), workshop, photocopier, fax, modem, library.
Future Development Plans: Use of the high PhD programme possibilities and needs in the industry-research-university relations; creation of research antenna in various regional countries through PhD students; development of regional maintenance and scientific instrumentation policy for coherent science and technology development; development of active North-South cooperation from this policy.
Cooperation Arrangements with Developing Countries: Exchange visits with African centres of excellence planned; good contacts exist with Scientific Instrumentation Centre of Rabat, Morocco.
Other International Cooperation Arrangements: Exchange visits exist with IAEA; membership in Network on Equatorial Electroproject programme; cooperation planned with the Universities of Padua (Italy), Orleans (France).

Sri Lanka

University of Colombo Institute of Computer Technology (ICT)

Address: P.O. Box 1490, Colombo, Sri Lanka. **Phone:** (+94 1) 581245/8; **Fax:** (+94 1) 587239; **E-mail:** vks@ict.ac.lk.
Director/Head: V.K. Samaranayake.
Number of Research Scientists: 16; **Number of Staff:** 11.
Scientific Fields of Interest: Engineering/ Technology; Information Technology.
Main Lines of Research and Training Activities: *Research Activities:* Sinhala application software; graphics for telecasting; Sinhala and Tamil BIOS natural language processing RDBMS and image processing. *Training Activities:* Training information technology professionals and practitioners; special training programmes in RDBMS; software development; networking; desktop publishing; SSADM; unix and programming.
Major Scientific Results or Products: Wadan Tharuwa, Word processing package (Sinhala, Tamil, English); Athwela, Desktop publishing package (Sinhala, Tamil, English); SBIOS, Sinhala basic input and output system for IBM PC; TBIOS, same for Tamil.
Main Research Facilities Available: 1 NEC system 430 model 30; 10 intelligent terminals (IBM PC/AT compatible APCIV power mater 2); 1 NEC MS/4100 (multi service graphics processing unit); 1 IBM AS/400 model 30; 2 NEC system 50/Super8; 14 NEC APCIV PowerMate2; 2 NEC APC IV PowerMate 386/20; 6 NEC APC III; 2 NEC PowerMate SX/20 vi; 10 NEC PowerMate SX/16i; 1 NEC PowerMate 433; 10 NEC PowerMate 325; 1 NEC notebook computer, UltraLite VERSA; 33 printers; 1 scanner HP Scanjet II C, colour/grey Scale.
Future Development Plans: To set up modern software resource centre equipped with state-of-art computing equipment to support developers of software for export and local markets and training programmes for country and region.
Cooperation Arrangements with Developing Countries: Regional training programmes in IT with collaboration of development agencies, such as CICC and the Japan International Cooperation Agency (JICA); accredited by Oracle Corporation and Novel Institute to run their courses in Sri Lanka.
Other International Cooperation Arrangements: Institute established with technical assistance of Japan; negotiations underway to obtain additional assistance under this programme through Japan International Cooperation Agency (JICA) for their Third Country Training Programme.

Syria

Atomic Energy Commission of Syria (AECS)

Address: P.O. Box 6091, Damascus, Syria. **Phone:** (+963 11) 668114/5; **Telex:** 411420 ATENCO SY; **Fax:** (+963 11) 6620317.
Director/Head: Ibrahim Othman.
Number of Research Scientists: 45; **Number of Staff:** 200.
Scientific Fields of Interest: Agriculture; Chemistry; Earth Sciences; Environment; Medical Sciences; Physics/Astronomy.
Main Lines of Research and Training Activities: Application of nuclear techniques in the following fields: Improvement of animal production and animal health; Radiation induced mutation for crop improvement; Study of pesticide residues in food and the environment; Use of irradiation facility for sterilization; Isotope hydrology for the improvement of water management; Radiation protection; Environmental protection.
Major Scientific Results or Products: Scientific papers published in international journals; conference proceedings; technical reports.
Main Research Facilities Available: X-ray diffraction and fluorescence, liquid scintillation counter, chromatography, spectrometry, low-dose irradiator, agricultural research field-station, industrial gamma irradiator (CO-60-100 KCI); library.
Future Development Plans: With assistance of IAEA and People's Republic of China, miniature neutron source reactor, for research purposes, is under construction.
Cooperation Arrangements with Developing Countries: India, Iran and Jordan.
Other International Cooperation Arrangements: IAEA, ICTP, TWAS, TWNSO, UNDP, UNESCO.

Higher Institute for Applied Sciences and Technology (HIAST)

Address: P.O. Box 7028, Damascus, Syria. **Phone:** (+963 11) 774639; **Telex:** SCITEC 412130 SY; **Fax:** (+963 11) 223771.
Director/Head: Mohamed Mrayati.
Number of Research Scientists: 106; **Number of Staff:** 63.
Scientific Fields of Interest: Biochemistry/Biophysics; Energy; Materials; Chemistry; Engineering/Technology; Environment; Mathematics; Physics/Astronomy; Management.
Main Lines of Research and Training Activities: *Research and Development:* Information systems; dedicated electronic systems; signal processing; automatic control; sensors, physics and systems; artificial intelligence; pollution; optical devices; solar energy; management sciences; computer networks. *Training*: Bachelor level (5 years): computer engineering; electronic systems engineering; physics engineering. Specialized Diploma (1 year): management computer system; communications; electronic systems; mechanics; chemical sciences.
Major Scientific Results or Products: Several software systems; educational equipment for laboratories; applied systems for environment.
Main Research Facilities Available: Computing centre; signal processing laboratory; optical design laboratory; personal computer network; pollution test and automatic control design laboratory; materials characterization laboratory; documentation centre.
Future Development Plans: Biological activities; technologies transfer centre.
International Cooperation Arrangements: European Economic Community (EEC) France/England/Italy; Japan; C.E.I. Russia; the UN Industrial Development Organization (UNIDO); International Development Research Centre (IDRC); UN Educational, Scientific and Cultural Organization (UNESCO)-Arab League Educational, Cultural and Scientific Organization (ALECSO); The Japan International Cooperation Agency (JICA); European Economic Community (EEC).

Tanzania

Tanzania Industrial Research and Development Organisation (TIRDO)

Address: P.O. Box 23235, Dar es Salaam, Tanzania. **Phone:** (+255 51) 68822; **Telex:** 41409; **Fax:** (+255 51) 68984.
Director/Head: Paul Kaspar Haule.
Number of Research Scientists: 45; **Number of Staff:** 90.
Scientific Fields of Interest: Energy; Materials; Chemistry; Engineering/ Technology; Geological/Earth Sciences; Environment; Mathematics; Food Science and Technology, Textile and Fibre, Non Destructive Testing.
Main Lines of Research and Training Activities: Raw materials processing into industrial inputs; natural products utilization; cleaner production technology in industry; non-destructive testing (NDT); welding; new and renewable energy; food preservation.
Major Scientific Results or Products: Natural dyestuff production; caustic soda production by causticization; sodium alginate from seaweeds; tannin based wood adhesives; gypsum processing for production of pop; Turkey red oil from castor oil; abrasive hand wash paste; alum from Pugu kaolin; wind ventilated solar dryers; satellite dish antennae.
Main Research Facilities Available: Energy and NDT laboratories; materials testing laboratory; analytical instruments; dry and wet chemical laboratories; microbiological laboratory; library (with limited H/C collections); 7 IBM PCs; 1CD-ROM reader; large variety of statistical databases and word-processing software.
Future Development Plans: Grow into International Centre for Industrial Technology and Marine Sciences as centre of excellence of TWNSO for R&D in areas of energy, raw materials processing, welding, cleaner production technologies and related fields.
Cooperation Arrangements with Developing Countries: Technical cooperation with CMDRI of Egypt and Council of Scientific and Industrial Research (CSIR) of India; affiliated informally with Tanzania Commission for Science and Technology (COSTECH), affiliated formally with World Association of Industrial and Technological Research Organizations (WAITRO) and Metal Engineering Development Association (MEIDA) of Tanzania; member of Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA), and Confederation of Tanzania Industries (CTI).
Other International Cooperation Arrangements: UN Industrial Development Agency (UNIDO) and IAEA in Vienna; International Development Research Center (IDRC) of Canada; Norwegian Agency for International Development (NORAD).

University of Dar es Salaam Department of Chemical and Process Engineering (CPE)

Address: P.O. Box 35131, Dar es Salaam, Tanzania. **Phone:** (+255 51) 410038; **Telex:** 41561 or 41327; **Fax:** (+255 51) 410038.
Director/Head: M.R. Halfani.
Number of Research Scientists: 7 PhDs; 12 others; **Number of Staff:** 11.
Scientific Fields of Interest: Energy; Materials; Engineering/Technology; Environment; Food Engineering, Bioprocessing.
Main Lines of Research and Training Activities: *Research:* Industrial effluent treatment in a three-phase fluidised bed reactor; Novel method of an extraction of edible oils from oil seeds; Conversion of tall oil into fuel using locally available zeolites; Production of precipitated calcium carbonate from local raw materials; Utilization of agricultural and industrial waste for industrial alcohol (ethanol) production by fermentation; Drying in a spouted bed; Recovery of ethanol from fermentation broth by distillation with a third component. *Training Activities:* MSc and diploma (yet to be formalised) in food engineering, bioprocessing chemical engineering, pulp and paper, minerals processing.
Major Scientific Results or Products: Results submitted to industry for implementation; some results published in professional journals; all results available in form of research reports; some technologies available in laboratory and/or pilot scale units; projects being continued to optimize processes.

Main Research Facilities Available: Chemical laboratory equipped with analytical instruments like HPLC, atomic absorption spectrophotometer (AAS), gas chromatograph; 7 PC computers and new network being installed; library stores about 3,500 volumes (the largest in the region).
Future Development Plans: In addition to undergraduate teaching in chemical engineering on BSc level, an MSc will be offered in chemical engineering with specialisation in food engineering, bioprocessing, pulp and paper technology, mineral processing and environmental engineering; research will be carried out in areas of environmental engineering, food engineering, mineral processing and bioprocessing.
Cooperation Arrangements with Developing Countries: Link agreement with Moi University, Kenya being formulated; international conference on role of chemical engineering in development organized by in 1990; about 80 participants from developing countries attended.
Other International Cooperation Arrangements: Link agreements with Norwegian Institute of Technology, Trondheim and with Utrecht University (under preparation) Netherlands; contacts with universities in South Africa and SADDC countries.

Thailand

Asian Institute of Technology (AIT)

Address: P.O. Box 4, Klong Luang, Pathum Thani 12120, Bangkok, Thailand. **Phone:** (+66 2) 516-0110/44; **Telex:** 84276 TH; **Fax:** (+66 2) 516-2126; 516-1418; **E-mail:** omis@ait.ac.th.
Director/Head: Roger G.H. Downer.
Number of Research Scientists: 340; **Number of Staff:** 775.
Scientific Fields of Interest: Energy; Chemistry; Engineering/Technology; Earth Sciences; Environment; Marine Sciences; Social Science; International Business; Management of Technology; Telecommunications; Computer Science; Information Technology.
Main Lines of Research and Training Activities: *Training:* degree programmes (diploma, masters and doctoral) offered by four schools: 1. Civil Engineering: Geotechnical engineering; Transportation engineering; Structural engineering and construction; Infrastructure planning and management; water engineering and management. 2. Management: International business; Management of technology. 3. Advanced Technologies: Telecommunications; Computer science and information management; Industrial systems engineering. 4. Environment, Resources and Development: Agricultural and aquatic systems; Agricultural and food engineering; Bioprocess technology; Energy; Environmental engineering; Human settlements development; Pulp and paper technology; Space technology applications and research; Urban environmental management. *Research:* Sponsors and grants research conducted by the four schools and student research.
Major Scientific Results or Products: Trained engineers and scientists in large number of disciplines; publications (journal papers, conference papers/proceedings, research reports, books/chapters in books, others); sponsored and grant research; continuing education programmes for industry and academic institutions.
Main Research Facilities Available: *Laboratories:* Bioprocess technology; computer integrated manufacturing; computer science; energy technology and energy park; environmental engineering; regional computer centre; manufacturing control and automation; remote sensing; telecommunications; civil engineering (catering to work in hydraulics, structural engineering, soil engineering, engineering geology, geophysics, rock mechanics, airphoto interpretation, traffic engineering and highway materials). *Field Station:* Habitech; regional experimental centre; aquaculture farms.
Future Development Plans: *Academic programmes:* Genetic engineering; public administration; microelectronics; integrated coastal zone management; sustainable development; executive MBA; construction engineering and management; water supply and drainage and sewerage engineering; mechatronics; pulp and paper technology. *New centres:* Environmental modelling; policy research; information technology; sustainable; human settlements.
Cooperation Arrangements with Developing Countries: *Present:* Cambodia, India, Indonesia, Laos PDR, Philippines, PRC, Thailand and Vietnam. *Planned:* Brunei, Malaysia, Mongolia and newly independent states.

Other International Cooperation Arrangements: *Present:* Austria, Australia, Canada. European Community, Finland, Japan, New Zealand, Norway, Republic of China, Republic of Korea, Sweden, Switzerland and USA. *Planned:* Italy.

Tunisia

cole Nationale dIngnieurs de Tunis (ENIT)

Address: B.P. 37 Belvedere, 1060 Tunis, Tunisia. **Phone:** (+216 1) 872 880; **Telex:** 15 0051; **Fax:** (+216 1) 872 729.
Director/Head: Khlifa Maalel.
Number of Research Scientists: 140; **Number of Staff:** 40.
Scientific Fields of Interest: Energy; Engineering/Technology; Environment.
Main Lines of Research and Training Activities: Civil engineering: structural and building engineering, soil mechanics, hydraulics, water resources management; industrial engineering; applied mathematics; transportation and energy; electrical engineering: telecommunications and control engineering.
Main Research Facilities Available: Fifty computers; 30 laboratories in civil, electrical and mechanical engineering.
Future Development Plans: Development of Department of Mechanics and Department of Computer Science.
International Cooperation Arrangements: Agreements with universities in France, Belgium, Canada, Italy and Russia (approx. 20). Cooperation planned: USA and Great Britain.

Regional Institute for Informatics and Telecommunications (IRSIT)

Address: B.P. 212, 1082 Cite Mahrajene, Tunis, Tunisia. **Phone:** (+216 1) 289205; **Telex:** 14570 IRSIT TN; **Fax:** (+216 1) 787827; **E-mail:** irsit@tunisia.eu.net.
Director/Head: Noureddine Ellouze.
Number of Research Scientists: 40; **Number of Staff:** 18.
Scientific Fields of Interest: Engineering/Technology.
Major Scientific Results or Products: Bilingual videotex system; ALIFCOM: Arabic Latin PC based videotex emulator; VTX-A: bilingual videotex server on VAX; PC based electronic bilingual dictionary with more than 50000 English entries and 150000 equivalent Arabic entries; spell checker for Arabic text; Arabic optical character recognition system; full node on Internet and BITNET networks; leading network technology provider in Tunisia and North Africa; leading GIS technology providers; acceptance of international standard for bilingual videotex by CCITT standardization body.
Main Research Facilities Available: VAX VMS 6310; 40 PCs (15386 and 20 486); 15 Macintoshes; 10 Sun stations; 2 Bull DPX 2000; Telecommunication hardware; library with 1500 books, 120 periodicals and 600 proceedings.
Future Development Plans: Telematics: introduction of multimedia and development of videotex series. Arabization: machine communication in Tunisia and Arab world; computer sided translation; modelling and development of GIS system; space.
Cooperation Arrangements with Developing Countries: Morocco, Ecole Mohammed V des Ingénieurs; Algeria, CERIST, INI; Egypt, RITSEC; Saudi Arabia, King Fahd University, King Saud University.
Other International Cooperation Arrangements: USAID; UNDP; GTZ (Germany); OSS, INRIA, CNET, CNES, CNRS, IGN (France); USGS, NSF (USA).

Venezuela

Centro de Investigacin y Apoyo Tecnolgico Filial de Petrleos de Venezuela (INTEVEP)

Address: Urb. Santa Rosa, Edif. Sede Central, Fase “E”, piso 3°, Modulo Ejecutivo, Apartado Postal 149, Los Teques, Edo. Miranda, Venezuela. **Phone:** (+58 2) 908-6303; **Fax:** (+58 2) 908-7634, 908-6932.
Director/Head: Francisco Pradas.
Number of Research Scientists: 1,504; **Number of Staff:** 265.
Scientific Fields of Interest: Oil; Chemistry; Geological/Earth Sciences; Engineering/ Technology; Materials; Environment; Energy.
Main Lines of Research and Training Activities: Generation of L/M crudes; product quality; upgrading of heavy crudes/residues; production of heavy and extra-heavy crudes and bitumen; petrochemicals; industrialization of gas; ecology; corrosion; catalysis; description of disorderly media; development of analytical methods.
Major Scientific Results or Products: Upgrading and transportation of heavy crudes and residual and production of better quality products; principal achievements cover areas of processing, equipment, catalyst laboratory; dynamic field tester for corrosion; test well.
Main Research Facilities Available: Pilot plants for refinery processes; Analytical/chemistry laboratories; Information centre (CIT); Earth science laboratory; Catalyst laboratory; dynamic field tester for corrosion.
Future Development Plans: Seismic technology, reservoir description and engineering, deep drilling, artificial lift non-gas, emulsion technology, exploitation of heavy crudes; by-product disposal, treatment, transformation, catalytic conversion (bottom of barrel), new process catalyst, asphalt/lubes manufacturing.
Cooperation Arrangements with Developing Countries: Brazil; Mexico; Colombia.
Other International Cooperation Arrangements: British Petroleum; VEBA Oil; Shell; I.F.P; NYNAS; DOE; AMOCO.

Instituto Venezolano de Investigaciones Cientficas (IVIC) Department of Nuclear Technology

Address: Apartado 21827, A-1020 Caracas, Venezuela. **Phone:** (+58 2) 5011095; **Fax:** (+58 2) 5011095; **E-mail:** evaz@ivic.ivic.ve.
Director/Head: Jesus Eduardo Vaz García.
Number of Research Scientists: 3; **Number of Staff:** 26.
Scientific Fields of Interest: Engineering/ Technology.
Main Lines of Research and Training Activities: Applications of nuclear and ionizing radiation; health physics; nuclear engineering; radiation dosimetry; food Irradiation.
Major Scientific Results or Products: Publications; services to government and industry.
Main Research Facilities Available: All equipment related to research activities, nuclear reactor (3 MW), Co-60 radiation source (20 k curies).
Future Development Plans: Upgrade of nuclear reactor (3 MW); strengthening of laboratories with new researchers.
Cooperation Arrangements with Developing Countries: Colombia, Cuba and Chile.
Other International Cooperation Arrangements: IAEA

Zambia

National Council for Scientific Research (NCSB)
Nuclear Analytical Laboratory (NAL), Radioisotopes Research Unit (RIRU)

Address: P.O. Box CH 158, Chelston, Lusaka, Zambia. **Phone:** (+260 1) 281081; **Telex:** 40005 ZA.
Director/Head: M.B. Zaman.
Number of Research Scientists: 6; **Number of Staff:** 10.
Scientific Fields of Interest: Chemistry; Environment; Physics/Astronomy.
Main Lines of Research and Training Activities: Application of nuclear analytical techniques in minerals, environmental samples, industrial raw materials and finished products; Application of gamma radiation for food preservation, medical sterilisation and other radiation processing; Environmental radioactivity measurements and radioactive waste management.
Major Scientific Results or Products: Results of R&D work have been published. No major products have yet resulted.
Main Research Facilities Available: 14 MeV neutron generator, 45000 Ci (present strength), Cobalt-60 gamma radiation source, 13000 Ci Cesium-137 laboratory irradiator, tube and source excited energy dispersive X-ray fluorescence spectrometer, flame atomic absorption spectrometer, Mössbauer spectrometer, scintillation and semiconductor based gamma spectrometer coupled with DEC P-350, IBM PS/2 and compatible microcomputers. IR, UV-visible spectrophotometers and INSTRON universal testing machine.
Future Development Plans: Blossom into full-fledged institute for nuclear and radiation sciences with nuclear reactor and electron accelerator; with present austere economic climate, this can only take place in distant future.
Cooperation Arrangements with Developing Countries: Plan for regional cooperation among XRF laboratories in Africa put into motion by the IAEA.
Other International Cooperation Arrangements: IAEA may assist in some future projects.

Zimbabwe

Forestry Research Centre

Address: 1 Orange Grove, P.O. Box HG 595, Highlands, Harare, Zimbabwe. **Phone:** (+263 4) 496878; **Fax:** (+263 4) 497070.
Director/Head: E.M. Shumba.
Number of Research Scientists: 14; **Number of Staff:** 165.
Scientific Fields of Interest: Environment; Mathematics; Forestry.
Main Lines of Research and Training Activities: Forestry silviculture, breeding, protection, biometrics, social forestry.
Major Scientific Results or Products: Realized 30% increase of timber yield of *P. patula,* 50% improvement on stem form, reduction of rotation age to 25 years from 30.
Main Research Facilities Available: Over 20 computer PCs; seed technology laboratory; library; 3 field stations; pathology laboratory.
Future Development Plans: Strengthening research capacity in indigenous/natural forest, obtaining private sector funding for plantation forestry research.
Cooperation Arrangements with Developing Countries: SADC Tree Seed Network.
Other International Cooperation Arrangements: CAMCORE, SAREC, ACIAR, IDRC/FORD, CIDA and ODA.

Institute of Mining Research (IMR)

Address: P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe. **Phone:** (+263 4) 336418; **Telex:** 26580 UNIVZ ZW; **Fax:** (+263 4) 336418.
Director/Head: Muwindwa Lipalile.
Number of Research Scientists: 14; **Number of Staff:** 22.
Scientific Fields of Interest: Materials; Engineering/Technology; Earth Sciences; Environment.
Main Lines of Research and Training Activities: Analytical chemistry (X-ray fluorescence, coal analysis instrumental: classical); Metallurgy (Hydrometallurgy: Pyrometallurgy); Mineral Processing; Mineral economics (Feasibility studies, ore reserve estimation, environmental studies); Mineralogy (electron microprobe, electron microscope, optical microscope: X-ray diffraction analyses); Economic geology (geochemical exploration and environmental geochemistry).
Major Scientific Results or Products: Underground rock support in small chromite mines lowering carbon content in ferrochrome production, mineral resource database for Zimbabwe, gold extraction by cyanide using bottle rolling techniques.
Main Research Facilities Available: Atomic absorption spectrophotometer, X-ray fluorescence analyser, microscopes, inductively coupled plasma analyser, microcomputers, XRD analyser.
Future Development Plans: Research on small scale mining and its environmental affects, underground water pollution from mining and transportation modes; chromite and ferrochrome research (metallurgy and mineralogy).
Cooperation Arrangements with Developing Countries: National Institute of small mines (India), Minerals Commission (Ghana) SADC Mining Unit (Zambia).
Other International Cooperation Arrangements: SAREC (Sweden), IDRC (Canada), funded research on underground rock stability in small mines (chromite mines).