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2001-2002

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Ministry of Science & Technology
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TEXT

I(A). AN OVERVIEW

1.1 The formation of the Ministry of Science and Technology was announced through a Presidential Notification dated January 4, 1985 (74/2/1/8. Cab.) contained in the 164th Amendment of the Government of India (Allocation of Business) Rules, 1961; the Department of Scientific and Industrial Research (DSIR) forms a part of this Ministry.

During 2001-2002 the Minister In-charge is Dr. Murli Manohar Joshi, Union Minister for Ministry of Human Resource Development and Ministry of Science and Technology. Shri B.S. Rawat is the Minister of State for the Ministry of Science and Technology.

1.2 The Department of Scientific and Industrial Research (DSIR) comprises of the activities of the Council of Scientific and Industrial Research (CSIR), Departmental Schemes viz. Research and Development by Industry (RDI), Programme Aimed at Technological Self Reliance (PATSER), Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) and National Information System for Science and Technology (NISSAT) and two public enterprises viz. National Research Development Corporation (NRDC) and Central Electronics Limited (CEL).

1.3 Council of Scientific and Industrial Research

The CSIR is the national R&D organisation providing scientific and industrial research for India's economic growth and human welfare. It has a country-wide network of forty laboratories and eighty field centres covering fundamental and applied R&D in all areas of science and technology barring atomic research, developing and nurturing S&T human resource for the country through extramural support and promoting scientific talent through awards, fellowships etc.

The major achievement during the year was in regard to intellectual property rights – for the first time in the history of CSIR, foreign patent filing outstripped the Indian patent filing. The foreign patent filing was 452 (199 in 1999-2000) and Indian patent filing was 410 (up from 377) besides 25 copyrights for software and 16 trademarks were obtained indicating the emergence of CSIR in the domains of other forms of Industrial property as well. The output of papers and the average impact factor seem to have reached a saturation level, thus the average impact factor per paper increased to a mere 1.552 from 1.538. The external cash inflow was also highly constrained due to the very slow growth rate in the industrial sector. There was a marginal decline in ECF from Rs. 252 crore to Rs. 245 crore but despite the difficult times the industrial production based on CSIR knowhow grew by around 9% which was double the rate of growth of the industrial sector per se.

New Millennium Indian Technology Leadership Initiative (NMITLI) was launched for from the year 2000-2001 with a budgetary allocation of Rs. 50 crore, which was revised to Rs. 25 crore later. NMITLI envisages to support innovation centered scientific and technological developments as a vehicle to attain for the country a global leadership position in selected niche areas, in a true Team India manner.

CSIR Plan 2000-2001 based on Zero Base Budgeting (ZBB)

With a view to optimise on the deployment of scarce resources, Government directed to incorporate ZBB as an integratal part of the budgeting process, from the financial year 2000-01. A CSIR Task Force under the Chairmanship of Dr. Harsh K. Gupta, Director, NGRI with the Financial Adviser, CSIR as the Convenor and other members from the CSIR system was constituted. The Task Force reviewed the ongoing & new Plan schemes of CSIR and recommended that, since the scheme `National Laboratories' was the major component of the CSIR Plan, detailed exercise of formulation of the programmes/projects/activities in the national laboratories be done by applying ZBB.

New avenue for business development: Opportunia.com consortium

CSIR together with National Research Development Corporation (NRDC), global

consultants Ernst & Young (E&Y) India and the leading US stock exchange Nasdaq, have come together through Opportunia Enterprises in a major strategic alliance. The alliance seeks to promote technology based business in India, in the fast growth sectors of biotechnology, pharmaceuticals etc. by assisting entrepreneurs to tap the potential of CSIR's excellent infrastructure, technology and technical skills. Opportunia is a one-stop platform where entrepreneurs and emerging fast growth companies get end-to-end support and solutions for all points in the business life cycle – conceptualizing, seeding, growth, diversification, doing IPO's and mergers and acquisitions.

Knowledge alliance for genomics R&D

Nicholas Piramal India Ltd. (NPIL) and CBT forged a historic knowledge alliance, in November 2000, titled GenoMed. The alliance seeks to harvest the knowledge generated by human genome research alongwith the vast and diverse genetic wealth of India in combination with knowledge of Indian traditional & current schools of medicine towards the development of genomic medicines.

Some of the scientific and technological achievements of CSIR covering a wide spectrum are as follows:

In the field of Aerospace Science & Technology: Light Combat Aircraft (LCA) completed its first block of 12 test flights ; the 14 seater multirole SARAS aircraft was getting ready; productionisation of the HANSA-3 was taken up; An ejector ramjet combustor development programme was carried out under VSSC sponsorship. A full scale fatigue test of the MiG-21 bis aircraft was carried out by NAL using NISA-II software. Molybdenum disilicide (MoSi2) composites were synthesized by the hot pressing technique and characterized by X-ray and SEM. A jet noise generator to generate high frequency noise between 2.5 kHz and 10 kHz in 1/3 octave bands was designed, fabricated, tested and delivered to Wyle Laboratories, USA. **In the field of Biological Science and Technology**: CBT carried out 'association analysis' of CAG repeats at the KCNN3 locus in the Indian population with bipolar disorder and schizophrenia. A study on genome diversity of Indian population has been undertaken by IICB in association with Saha Institute of Nuclear Physics and Indian Statistical Institute and mitochondrial DNA (mtDNA) profiles of 23 ethnic popultations of India drawn from diverse cultural, linguistic and geographical backgrounds have been analyzed. CBT has developed a method for isolating Lutenizing hormone (LH) from Bovine Pituitary glands. Rabies genomic RNA of the street virus stain was extracted from purified virus. NBRI undertook detailed computational analysis of plant gene database to identify conserved features in upstream regions of highly expressed plant genes. IMT is carrying out structural and functional studies on proteins derived from Mycobacterium tuberculosis, with the long term objective of utilizing them for drug design studies. IHBT has successfully isolated for the first time, an autoclavable superoxide dismutase (SOD) catalyzing dismutation of superoxide radical from +80°C to sub-zero temperature from a plant of high altitude. CIMAP has developed agro-technology for cultivation of pyrethrum in other agroclimates of the country. Transgenic plants of tobacco with the specially designed synthetic cry gene have been developed at NBRI. IICB has developed a herbal composition for treating asthma. CSMCRI has developed a Polysulfone-polyamide (PS-PA) thin film composite membrane based plant extract concentrator. Metal induced conformational changes in mitrogenic Achatinin H binding to carbohydrate ligands have been analysed at CLRI. A laboratory-scale process for the preparation of clot-specific streptokinase has been standardized at IMT. RRL, Jm. has developed an improvised and economical process for the production of Colchicine and colchicoside. CSMCRI has developed a liquid seaweed fertilizer (L.S.F.), which is a bio-fertilizer prepared from brown seaweed Sargassum.

In the field of Chemical Science & Technology: IICT has developed an ecofriendly process for 2,4 Dichlorofluorobenzene (2,4 DCFB). A technology for pyrazinamide, an anti TB drug is under development jointly by IICT & SPIC R&D Centre. CECRI has dveloped an electrochemical process for the production of perfluoro octanoic acid by the electrochemical perfluoronation of octanoyl chloride. CFRI has developed a process for purification of crude phenanthrene and converting the refined product to 9:10 phenanthrenequinone through liquid phase oxidation. Homobrassinolide was developed by NCL. CLRI has undertaken the study of synthesis of block copolymers of Poly Ethylene Glycol

(PEG). CSMCRI has developed an improved process for removal of Ca^{++} ion impurity in brine. A furfuryl alcohol plant has been commissioned in Andhra Pradesh on the basis of technology developed by IICT. A gas cracker plant is being set up at GAIL's Petrochemical Complex at Pata jointly by IICT, GAIL & IIT, Kanpur. CLRI has proposed a new unified molecular theory for tanning. **In the field of Earth Science & Technology**: A simple practical method has been developed at C-MMACS to characterize the strength and stiffness of jointed rock masses. NGRI has developed a rapid multi-channel data collection system to elucidate the dynamics of fault nucleation using AE hypocenters under conditions of constant stress (creep) loading. Seismic structure of the Indian shield has been investigated by NGRI. A 2-dimensional hydrodynamical model has been developed by NIO to simulate the tides and currents in the Gulf of Kachchh. **In the field of Engineering Science & Technology**: CSIO has developed a state-of-the-art intelligent seismic data recorder and analyser. CSIO has developed a low power consuming, portable, stand alone 28 channel data acquisition system for snow temperature profiling. CSIO has developed a glow discharge lamp atomic emission spectrometer. IHBT in collaboration with CMERI has developed a tea-leaf plucking machine. CMERI has designed a 35 HP tractor upgradable to 60 HP with features suited to Indian farm terrain and local implements. CBRI has developed a fibre reinforced composite sheet for use as an alternative material for wood and plywood shuttering. CBRI has developed CBRICK machine and block making machine for the casting of bricks and blocks using marble waste. A seismic design software for reinforced concrete framed buildings has been developed at SERC. CECRI has developed a coating system for high strength steel. A teaching package on structural steel design was developed by developed by SERC, Madras in collaboration with IIT, Chennai and Anna University, Chennai. SERC has developed a passive control method for structures subjected to seismic loads. CRRI has developed a traffic simulation model for Indian roads. A natural disaster network was established at CRRI. **In the field of Food Science & Technology**: CFTRI studied acoustic enhancement of transmembrane flux. CFTRI has developed an enhanced phase demixing by microwave field. Wheat flour fortification unit was developed by CFTRI. CFTRI has developed speciality biscuits. Raw mango cutting equipment for pickle industry has been developed by CFTRI. IHBT has developed a method for preparing an analogue of natural whisky lactone and coconut aldehyde. **In the field of Information Science & Technology:** A blasting software has been developed by CMRI alongwith Tata Infotech Ltd. A software for condition monitoring of bearings has been developed at CMRI. INSDOC updated the CD-ROM databases. INSDOC-KIT abstracts containing 1000 records were processed. **In the field of Material Science & Technology**: Biomimetic synthesis of nano sized inorganic materials developed in NML. Carbon nanotubes synthesis was done at NPL. Seismograph calibration facility was developed at CMRI. NEERI has developed a process for production of fly ash based zeolites (FAZs). **In the field of Societal Science & Technology**: Iron making process used by tribals of India was documented by NML. NML has designed and developed a model of technology package for rural blacksmiths. CLRI commissioned Carcass Recovery System. CLRI conducted study on marrying tradition & technology in leather products:Shanthiniketan Bag. CLRI has developed specialized footwear for foot care. Energy efficient multi purpose biomass drier was developed at RRL, Bhubaneswar. Electronic device for disinfecting drinking water on-line has been developed by ITRC. Low cost water filter was developed by RRL, Bhubaneswar. NBRI has developed a garden for the blind. Cultivation of Himgold was conducted by IHBT. CIMAP developed a process for essential oil formulation coated urea in water-logged fields. CFRI demonstrated use of fly ash in agriculture.

1.4 The major programmes of Department Of Scientific and Industrial Research (other than CSIR) have been grouped as under:

I. Research and Development by Industry (RDI) consisting of:

a) In-house R&D in industry.

b) R&D by Scientific and Industrial Research Organisations (SIROs).

c) Fiscal Incentives for Scientific Research.

II. Programme Aimed at Technological Self-Reliance (PATSER) consisting of:

a) Development of new or improved technologies.

b) Development of special/custom built capital Goods.

c) Absorption and Adaptation of imported technology.

d) Studies and interactions concerning Technology Evaluation and pre-industry feasibility of major sectors/products.

e) Technopreneur Promotion Programme.

III. Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) consisting of:

a) National Register of Foreign Collaborations (NRFC).

b) Transfer and Trading in Technology (TATT).

c) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).

IV. Linkages with International Organizations

V. National Information System for Science and Technology (NISSAT).

VI. Public Enterprises viz.

a) National Research Development Corporation (NRDC).

b) Central Electronics Limited (CEL).

Some of the achievements under these programmes are as follows:

1.5 Research and Development by Industry (RDI)

DSIR is the nodal department for granting recognition to in-house Research and Development centres; there were 1140 units having valid recognition as on 31 December 2001. 80 in-house R&D centres incurred an annual expenditure of over Rs.5 crores and 213 in-house R&D units incurred an annual expenditure in the range of Rs. 1 crore to Rs. 5 crores. During the year, 73 in-house R&D centres were accorded fresh recognition and 352 centres were accorded renewal of recognition. During the year 2001, 15th National Conference on in-house R&D in industry was organised; DSIR National Awards were presented to 10 industrial units. A publication on "Outstanding in-house R&D Achievements (2001)" and 4 issues of "In-house R&D in Industry Update" were brought out.

Scientific research foundations in the areas of medical, agriculture, natural and applied sciences and social sciences seek DSIR approval as Scientific and Industrial Research Organisations (SIROs) under the DSIR scheme of granting recognition to SIROs. The approved SIROs are eligible for availing customs duty exemption and excise duty exemption on imports and indigenous purchase respectively, of essential scientific and technical instruments, apparatus, equipment (including computers), accessories, spare parts thereof and consumables, required for research and development activities. During the year, 22 new SIROs have been accorded DSIR recognition.

5 certificates for accelerated depreciation allowance on plant and machinery set up, based on indigenous technology involving an investment of Rs. 5743 lakhs, 11 certificates for import of capital equipment and consumables/materials for R&D projects supported by DSIR, 864 essentiality certificates for claiming customs duty exemption on imports amounting to Rs. 45 crores and 139 essentiality certificates for claiming excise duty exemptions on indigenous purchase amounting to Rs. 199.13 lakhs were issued by DSIR.

DSIR is the nodal department for registration of Public funded research institutions/universities/ IITs / IISc., Bangalore/RECs, for availing Customs Duty Exemption and Central Excise Duty Exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the year, 31 such institutions were registered with DSIR. 635 institutions were granted renewal of registration.

Secretary, DSIR, who is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961, approved in-house R&D centres of 12 companies. Agreements of cooperation for research and development were signed with these companies on behalf of the Secretary, DSIR.

1.6 Programme Aimed at Technological Self Reliance (PATSER)

Under the "Programme Aimed at Technological Self Reliance" PATSER) the Department has so far supported over 120 R&D projects of Industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives. 45 PATSER projects have so far been completed and a number of projects have been commercialized. Some of the products/ processes developed under PATSER projects since inception of the scheme include, IGBT based controller for fork lift, multilingual pager, EHV self supporting & guyed type transmission line towers, high speed machining center, process for manufacture of furfuryl alcohol by hydrogenation of furfural, nickel extraction technology proving plant for recovery of nickel, energy efficient drying system, in-plant material handling system internal grinding machine with 4 turrets, digested organic supplement from agricultural waste, Earth moving machinery such as 70T dumper, 200 HP front-end loader, 10T excavator, 460 HP Wheel dozer, Xenon and Crypton lamps for Laser pumping, 6-Hi cold rolling mill, Ginger oil based on green Ginger in Manipur, upgradation of technology for Solar Photovoltaic Cells, Interactive voice response system (multilingual), Detonating Cards for shaped charges and Indigenous catalyst for recovery of Sulphur from sour gas in ONGC, Hazira, Nuclear based moisture & density gauge, Special Aluminas & Hydrates based on Sodium Aluminate Liquor, Deep hole site mixing slurry explosives, etc.

Under PATSER, about 75 projects are in progress and these have considerable commercial potential for products/ processes such as Novel Heat Treatment furnaces, unified electronic controller for dump trucks, tetra bromo biphenol-A, cold dry beneficial system, load cells, microbalance of 1 mg accuracy, L(+) Tartaric Acid from Tamarind, a mechanized process for utilization of distillery effluents for production of bio-composts, Heat resistant slurry explosives, 500 KW Gas Turbine for co-generation in process plants, PC based CNC system for Machine tools, a new process for Pyrazinamide based on methyl pyrazine and cyano pyrazine.

PATSER projects have strengthened the linkages with more than 25 national research laboratories/ institutions such as NAL, Bangalore; RRL, Trivandrum; IICT, Hyderabad; CMRI, Dhanbad; IIP, Dehradun; C-DAC, Pune; NML, Jamshedpur; Institute of Plasma Research, Ahmedabad; ER&DC, Trivandrum; Dalmia Centre for Biotechnology, Coimbatore; CMTI, Bangalore; which have been collaborating with industry in the specific Research, Design, Development and Engineering (RDDE) projects of high techno-socio-commercial impact. DSIR has also been interacting with other ministries for identification of technology development projects and, in this direction, task forces with Railways for networking and technology development in the areas of signaling/ communications and electrical equipment/ power electronics have been formed. More such interactions with other economic ministries are being planned. Under PATSER projects, over 20 Patents have been filed/ under filing/ being scaled up.

Besides the projects, support under PATSER has been given to technology related studies and interactions/ workshops. In this direction, one study and 10 Workshops/ Seminars related to new technologies / technology development were supported under PATSER. These have involved numerous industries, national labs/ institutions. The Scheme has been successful in synergising the R&D efforts of industry and national research organizations. It is expected that several completed projects would lead to significant commercial production in the years to come.

As a new initiative during 1998-99, the Ministry of Science & Technology has launched a novel programme known as "Technopreneur Promotion Programme (TePP) jointly operated by DSIR and DST to tap the vast innovative potential of the citizens of India. TePP is a crucible to promote individual innovators to become technology based entrepreneurs. The activities under TePP include providing financial support to individual innovators having original ideas and convert them into working models, prototypes, etc. It also helps in providing linkages with technology finance schemes so that the innovative idea would come to fruition in the market place, finally with a benefit to industry and society. So far, 33 projects have been supported under TePP activity and 7 products / prototypes have been developed by

inventors including farmers. A number of novel products with commercial potential are under development. The Department also participated in **"Innovative India"** Exhibitions concerning TePP and PATSER in Science Congress in Pune , Delhi and Lucknow. These exhibitions attracted a large attendance of population and were very well received.

1.7 Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)

The Department continued its activities relating to the scheme on National Register of Foreign Collaborations & Technology Management (NRFC & TM). A compilation of primary data on Foreign Collaborations (FCs) for the year 2000 was brought out. Computerization of data collected on foreign collaborations for 2001 has been completed. During the year, studies on Assessment of Minor Forest Produce Based Industries in the State of Madhya Pradesh, Status and Strategy for Development of Essential and Medicinal Plant Species in the North Eastern Region, Technology Status and Prospects of Bio-degradable Plastics in India and the status of Technology Management Education in India have been completed. Studies on Technology Status of Vegetable Dyes Industries in the Country, Technology status of Guar Gum based industries and Status of Technology Management Education in Select Countries are in progress. With a view to Strengthen the Networking and enhancing technology management capabilities particularly in small and medium enterprises a number of activities have been taken up. A MOU has been signed with Karnataka Council for Technological Upgradation. The various programmes envisaged in the collaborative activities with IIT, Bombay and PSG Institute of Management, Coimbatore are being continued. Programmes covering various aspects of Technology Management, Intellectual Property and Knowledge Management are being organised. These programmes include training of trainers as well. Few of these are especially designed to meet the requirements of small and medium enterprises.

Under the scheme on Transfer and Trading in Technology, major activities carried out include: bringing out a Publication on "Technologies Exported & Exportable Technologies for the year 1999-2000"; release of 4 quarterly issues of a Newsletter on "Technology Exports"; organisation of a "Technology Trade Pavilion" at India International Trade Fair (IITF) '2001, Pragati Maidan, New Delhi; organisation of a Seminar on International Trade Opportunities in Technology; support to the activities of Technology Export Development Organisation (TEDO); support for participation of R&D laboratories in INDIATECH: 2001 at Caracas, Venezuela; bringing out monthly Newsletters on "IPR for Export Oriented Industrial Sectors"; organisation of sectoral workshops on IPR awareness for export oriented industries; support to a Centre for International Trade in Technology at IIFT; conducting a research study on impact of FDI on export competitiveness of our technology based industries; and conducting studies on technology export potential in jute and construction sector. All these efforts seem to have catalyzed the technology intensive and high value added exports. The percentage of such exports, in the overall exports, has steadily increased over the years. A large segment of exporting community has been trained and sensitized towards high value added exports.

The scheme relating to Promotion and Support to Consultancy Services essentially aims to strengthen our consultancy capabilities for domestic and export markets. During the period under review, the services of Consultancy Clinic for Lime Kiln Industry at Katni primarily to help small and medium industries were continued. There were some problems at Consultancy Clinic for Textile Industry at Bhilwara which were being looked into and efforts were being made to reactivate the same. Besides, a Study on Role of Consultants in R&D and Innovation was completed through NISTADS and final draft report was prepared and also a study on consultancy needs for improving performance / upgradation of textile industry in UP by UPICO was under progress. Institutional and programme support to Consultancy Development Centre (CDC) was provided. Also, support was provided to Consultancy Engineers Association of India (CEAI) and other consultancy promotion organisations.

CDC was promoted in January 1986 as a non-profit society, primarily with a view to implement some of the programmes of DSIR. CDC is implementing a programme "Consultancy Development, Promotion & Assistance (CDPA)" maintains a computerised database of consultants,

organises training particularly on ISO-9000 and ISO-14000 and Human Resources development Programmes for promoting consultancy, conducts consultancy related programmes sponsored by other agencies. DSIR is providing recurring and non-recurring support to CDC. 5th National Consultancy Congress on "Implications of GATS in the Service Sector" was organised on 15-16th January, 2002. To enhance technological and managerial capabilities of consultants as well as export capabilities, interactions with international organisations such as World Bank, APCTT, ITC and ESCAP were organised by CDC. The 5th batch of the trainees of the post graduate degree (MS) programme in Consultancy Management in association with BITS, Pilani, continued. Several Interactions Meets and Training Programmes in various areas including ISO-9000 & ISO-14000 systems were organised by CDC.

Second Executive Committee Meeting of TCDPAP was held in Three Gorges, China during October 2001. CDC continued as secretariat for a further period of 4 years w.e.f. September 1, 2000.

CDC has earned revenues of Rs. 93.24 lakhs during the year 2000-01 as against Rs. 88.43 lakhs during the year 1999-2000.

1.8 Linkages with International Organizations

During the year, the Department continued to participate in the activities of various international organisations such as UNCTAD, WIPO, UNIDO, ESCAP and APCTT at various levels and fora on issues related to Technology Development and Technology Transfer in co-ordination with other concerned Ministries.

DSIR participated in the Seventeenth Technical Advisory Committee meeting of Asian Pacific Centre for Transfer of Technology (APCTT) and the Sixteenth session of the Governing Board of APCTT held in Shanghai, China.

1.9 National Information System for Science & Technology (NISSAT)

The National Information System for Science & Technology (NISSAT) commenced its operations in 1977 with the objectives of organizing information support facilities for a customer base largely dominated by people engaged in research and academics. In tune with the changing global scenario and in pursuance of the national efforts in liberalization and globalization of the economy, NISSAT reoriented its programme activities continually in order to be useful to a wider base of clientele in diverse subjects. Besides establishing the internal linkages between the information industry, its promoters and users, NISSAT has been making efforts to establish a bridge between information resource developers and users in India and other countries.

NISSAT's emphasis during the period of report was on application of the Internet Technology for information Access and Dissemination. It has established VIGYAN Server on Indian Science & Technology and initiated action for the development of Sector Specific websites containing information on Tea manufacturing and Marketing, Indian Intellectual Property Law, Indian Ocean, Indian Food Technology & Mysore Library information, Indian Publications on CDROMs, Virtual Information Centres for R&D in Industry, Electronic Theses and Dissertations (VIDHYANIDHI)

NISSAT encourages and supports a variety of manpower development programmes which cover topics such as CDS/ISIS, WINISIS, Internet and Web Designing, TQM in Library Services, Patent Information for R&D and Industry, ISO 9000 Quality Management System, etc. Twenty courses have been organized during the current year.

IT applications in library and information centres in the form of computerization of information on holdings and services, online and CD based information services etc have introduced revolutionary changes in the availability of science and technology information to scientists, industry and other library users. Till date, textual data management package of CDS/ISIS has been implemented in 1830 information centres, Statistical analysis package of IDAMS in 65 institutions and integrated library management package SANJAY in 64 institutions to facilitate fast and reliable information.

1.10 Public Enterprises

Two public enterprises namely, National Research Development Corporation (NRDC) and Central Electronics Limited (CEL) attached to the DSIR were engaged in important activities of development and commercialisation of indigenously developed technologies.

Due to economic recession, NRDC was able to sign only 16 licence agreements during the year as compared to 39 agreements signed in the previous year. Some of the major technologies licensed by the Corporation during the year include Anti Corrosive Treatment for Steel Reinforced Rods, Platinized Titanium Anodes, Pollution Control System for Vertical Shaft Lime Kiln, Glycol Based Antifreeze Coolant (DAFC), Test Kit for Microbiological Quality of Drinking Water, Electrolytic Manganese Dioxide, Aero Microbial Filters for Hospitals, A Technique for Wood Plasterisation for making Bent Wood Components, Azotobacter Biofertilizer Technology For Mulberry.

Central Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in electronics, with its emphasis on indigenous technology inducted both from its in-house developments and from the National Laboratories, for its production programme in diverse high-technology areas of national importance. The activities of CEL are sharply focused in three thrust areas:

i) Solar photovoltaic cells, modules and systems for a variety of applications.

ii) Selected Electronic Systems-Equipment for Railway Signalling and Safety, Cathodic Protection Equipment for Oil Pipelines, Rural Automatic Exchanges (RAX), Switching Systems and Very Small Aperture Terminals (VSATs).

iii) Selected Electronic components-professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components.

CEL has been the pioneer in the country in the areas of solar photovoltaics, ferrites and piezo ceramics. Today, it enjoys the international status of being among the top producers of single crystalline silicon solar cells in the world.

2. During the year 2001-2002, there was an all-round progress and growth in the activities under different programmes of DSIR

I(B). FINANCIAL SUMMARY

The financial summary giving the Actuals 2000-2001, BE 2001-2002, RE 2001-2002 AND BE 2002-03 of Various Plan and Non-Plan schemes (Headwise/broad category wise) is as under:-

(Rs. in crores)

S.No.	Head of Development Projects	Actual Expenditure 2000-01			Budget Estimates 2001-02			Revised Estimates 2001-02			Budget Estimates 2002-03		
	Programmes/Schemes	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
1	Assistance to Council of Scientific & Industrial *Research*	301.910	574.880	876.790	332.000	600.220	932.220	320.800	584.120	904.920	412.000	597.650	1009.650
2	Technology Promotion Development and Utilisation Scheme	10.768	0.081	10.849	17.550	0.100	17.650	15.890	0.100	15.990	22.650	0.200	22.850
3	Research and Development (APCTT & NISSAT)	2.065	0.000	2.065	2.750	0.000	2.750	2.530	0.000	2.530	0.100	0.000	0.100
4	Investment in Public Enterprises												
4.1	Central Electronics Limited	0.000	0.000	0.000	2.500	0.000	2.500	0.000	0.000	0.000	2.500	0.000	2.500
4.2	National Research Development Corporation	0.000	0.000	0.000	0.250	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000
5	Loans to Public Enterprises												
5.1	Central Electronics Limited	0.000	0.000	0.000	2.500	0.000	2.500	0.000	0.000	0.000	2.500	0.000	2.500
5.2	National Research Development Corporation	0.000	0.000	0.000	0.250	0.000	0.250	0.000	0.000	0.000	0.000	0.000	0.000
6	Secretariat Economic Services	0.093	2.519	2.612	0.200	3.150	3.350	0.200	3.040	3.240	0.250	3.080	3.330
7	Management, Administration and Infrastructure	0.000	0.000	0.000	2.000	0.000	2.000	1.000	0.000	1.000	0.000	0.000	0.000
	Grand Total	**314.836**	**577.480**	**892.316**	**360.000**	**603.470**	**963.470**	**340.420**	**587.260**	**927.680**	**440.000**	**600.930**	**1040.930**

II. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

1. INTRODUCTION

Council of Scientific & Industrial Research (CSIR) is a national R&D organisation providing scientific and industrial research of value for India's sustained growth, strategic needs and nurturing of national human resource in S&T. It has country-wide network of 40 Laboratories and 80 Field Centres (See list of establishments) undertaking fundamental and applied R&D in diverse areas of Science & Technology.

CSIR continued its efforts to provide scientific and industrial R&D of value to the nation. The 2001-2002 Report highlights the more significant contributions made by the Council for the advancement of science & technology, to the growth of economy and in addressing societal concerns and issues. The Report gives details of the performance of CSIR as a whole. The S&T achievements and activities are categorized sectorally and the Chapter on Central Management captures the policy directions emanating from the overarching decision making bodies of CSIR i.e. Society, GB, AB etc. and the activities managed by the HQs.

1.1 Performance During the Year

The major achievement during the year was in regard to intellectual property rights – for the first time in the history of CSIR, foreign patent filing outstripped the Indian patent filing. The foreign patent filing was 452 (199 in 1999-2000) and Indian patent filing was 410 (up from 377) besides 25 copyrights for software and 16 trademarks were obtained indicating the emergence of CSIR in the domains of other forms of Industrial property as well. The output of papers and the average impact factor seem to have reached a saturation level, thus the average impact factor per paper increased to a mere 1.552 from 1.538. The external cash inflow was also highly constrained due to the very slow growth rate in the industrial sector, there was a marginal decline in ECF from Rs. 252 crore to Rs. 245 crore but despite the difficult times the industrial production based on CSIR knowhow grew by around 9% which was double the rate of growth of industrial sector per se.

1.2 Operationalising of New Millennium Indian Technology Leadership Initiative (NMITLI)

NMITLI was launched for from the year 2000-2001 with a budgetary allocation of Rs. 50 crore, which was revised to Rs. 25 crore later. NMITLI envisages to support innovation centered scientific and technological developments as a vehicle to attain for the country a global leadership position in selected niche areas, in a true Team India manner. A special meeting of the CSIR Advisory Board (AB) was held to discuss and give a direction to the NMITLI scheme. Thus wide-ranging national inputs from diverse constituencies were sought.

Over 1000 personal letters were addressed by DG, CSIR to leaders in academia, S&T, industry etc. seeking suggestions for these niche areas. Workshops were organised on the occasion of National Technology Day by all CSIR laboratories to foment national churning of ideas. Also special advertisement was issued in leading national dailies and around 8500 posters, seeking suggestions on potential niche areas, were sent to diverse educational and R&D establishments.

The process of national consultations thus involved fountainheads of wisdom from diverse walks of life to the young school students.

An overwhelming response of 1000 bare ideas was received. Thereafter a very stringent and rigorous system of screening, expert evaluation and assessment, championing and brainstorming was set up involving eminent experts from Industry, Academia and Research Institutions. Over 4000 high quality man days were devoted to sift through the bare ideas and to bring them to 28 niche opportunity areas. In order to obtain an inverse risk-investment profile i.e. low investment – high-risk areas, two sets of technologies - firstly those where the initial R&D work had been successfully done and secondly those attempting to chart out a

new technology path for the first time in the world were considered.

Thereafter another 2000 specialists man-days were devoted in converting nine of these areas to strategic technology projects. These detailed projects were then considered by a High Powered Committee - sub-committee of the CSIR Advisory Board - under the chairmanship of Prof. R. Narasimha and subsequently by the CSIR Governing Body.

The nine projects cover a wide spectrum of technology ranging from mesoscale weather modeling and forecasting, to defunctionalisation of carbohydrates as building blocks for chemical industry of the future, to nano-particle based drug delivery systems to selected diseases & drugs. The nine projects involve fifty five research institutions and twenty three industrial partners. Eight of the nine projects were taken up during the year and the nation reposes great hope and attaches great importance to the scheme and the farsighted projects.

1.3 CSIR Plan 2000-2001 based on Zero Base Budgeting (ZBB)

With a view to optimise on the deployment of scarce resources, Government directed to incorporate ZBB as an integratal part of the budgeting process, from the financial year 2000-01. A CSIR Task Force under the Chairmanship of Dr. Harsh K. Gupta, Director, NGRI with the Financial Adviser, CSIR as the Convenor and other members from the CSIR system was constituted. The Task Force reviewed the ongoing & new Plan schemes of CSIR and recommended that, since the scheme `National Laboratories' was the major component of the CSIR Plan, detailed exercise of formulation of the programmes/projects/activities in the national laboratories be done by applying ZBB.

Considering the diverse nature of programmes/projects/activities being carried out at various national laboratories, broad guidelines for undertaking ZBB were devised the specific methodology was left to the laboratories. The Guidelines were based on the designation of Decision Units (DUs) (not Divisions) in the laboratory which in turn comprised of several Decision Packages. However, to educate the concerned personnel in the national laboratories on the methodology, nuances and intricacies of ZBB, regional Awareness Programmes were organized, at five locations.

High Level Committees (HLCs) were constituted in the national laboratories to implement the ZBB. The Annual Plan 2000-2001 of the national laboratories were thus prepared in consonance with a very detailed and involved ZBB exercise. These Plans of the national laboratories were reviewed then by CSIR Task Force and the CSIR Annual Plan was also accordingly based on ZBB. The CSIR Plan was presented to the Core Group on ZBB for the Scientific Departments under the Chairmanship of Dr. APJ Abdul Kalam, Principal Scientific Adviser to the Government of India. CSIR's Plan based on ZBB was appreciated.

1.4 New avenue for business development: Opportunia.com consortium

CSIR together with National Research Development Corporation (NRDC), global consultants Ernst & Young (E&Y) India and the leading US stock exchange Nasdaq, have come together through Opportunia Enterprises in a major strategic alliance. The alliance seeks to promote technology based business in India, in the fast growth sectors of biotechnology pharmaceuticals etc. by assisting entrepreneurs to tap the potential of CSIR's excellent infrastructure, technology and technical skills. Opportunia is a one-stop platform where entrepreneurs and emerging fast growth companies get end-to-end support and solutions for all points in the business life cycle – conceptualizing, seeding, growth, diversification, doing IPO's and mergers and acquisitions.

The strategic partners in the consortium bring with them a vast complementary experience and knowledge interalia of the brick and mortar sectors giving the entrepreneur an integrated business service for technology, IPR, legal, financial, management and marketing. The alliance has set-up the portal, 'www.opportunia.com', employing cutting edge technology tools to offer services such as information sharing, team discussions, customized mentoring as well as value added content in business, management technology, legal and other areas like idea validation, regulatory opinion etc. The consortium has already received enthusiastic response.

1.5 Knowledge alliance for genomics R&D

Nicholas Piramal India Ltd. (NPIL) and CBT forged a historic knowledge alliance, in November 2000, titled GenoMed. The alliance seeks to harvest the knowledge generated by human genome research alongwith the vast and diverse genetic wealth of India in combination with knowledge of Indian traditional & current schools of medicine towards the development of genomic medicines.

GenoMed is business driven R&D with super focussed knowledge activities. The genome R&D is to be taken up mainly at CBT and the pharmaceutical and clinical ones at NPIL. The Genomic R&D is to concentrate on in-silico drug target identification and screen development, functional polymorphism, and microarray drug target screening. NPIL is to establish two special laboratories for the purpose, one at CBT and the other at NPIL. GenoMed has been initiated and the work on establishing the two laboratories is underway.

2. SCIENTIFIC & TECHNOLOGICAL CONTRIBUTIONS

2.1 AEROSPACE SCIENCE & TECHNOLOGY

2.1.1 NAL's contributions to LCA

India's Light Combat Aircraft (LCA) had it maiden flight on 4 January 2001. The aircraft has since completed its first block of 12 test flights. NAL and NAL-led teams have played a major supporting role in the development of LCA. Most of the composite structures of LCA such as the fin, rudder, center fuselage, landing gear etc. have been developed at NAL. CFC wings for the LCA were also designed and developed by a national team led by NAL. Practically every LCA wind tunnel model has been fabricated at NAL (including the ¼ scale high speed air intake model built in 1990 against all odds, and numerous 1/7 scale composites models). These models have then been extensively tested at NAL's trisonic wind tunnel (many hundreds of wind tunnel tests have been undertaken spanning a whole decade). The LCA control law was completely designed and developed by a national team led by NAL. The success of the first block of test flights confirms that the safe, robust "inner loop" of the control law is performing well. NAL teams have also undertaken projects for the aero elastic testing of LCA models and carried out numerous CFD calculations to study LCA's configuration and the associated flow properties.

2.1.2 SARAS getting ready to fly

Work on the 14 seaters multirole SARAS aircraft was in full swing to manufacture, assemble and equip major modules of the first prototype. Major SARAS related activities were underway at NAL, HAL, TAAL and 30 other work centers in and around Bangalore. Major structural assemblies of the aircraft were completed; in particular three numbers of horizontal tail, two numbers each of vertical tail and rear fuselage, one each of center and front fuselages and three emergency doors were completed. The rear, center and front fuselage modules of the first prototype were mounted on the fuselage-coupling jig at NAL. In addition, a large number of carbon fibre composites viz. elevator, aileron and rudder were assembled. Structural tests on the horizontal tail and elevator have been conducted with the participation of DGCA representatives. The trial equipping of the rear fuselage consisting mainly of the line replaceable unit (LRU)'s of the environmental control system, fire sensing systems and flight control system was also completed. Ground tests on the environmental and cabin pressure control systems and fuel systems were also completed. The first phase of the avionics system integration and testing on a ground test rig has been completed. The wing assembly has commenced at HAL (Nasik).

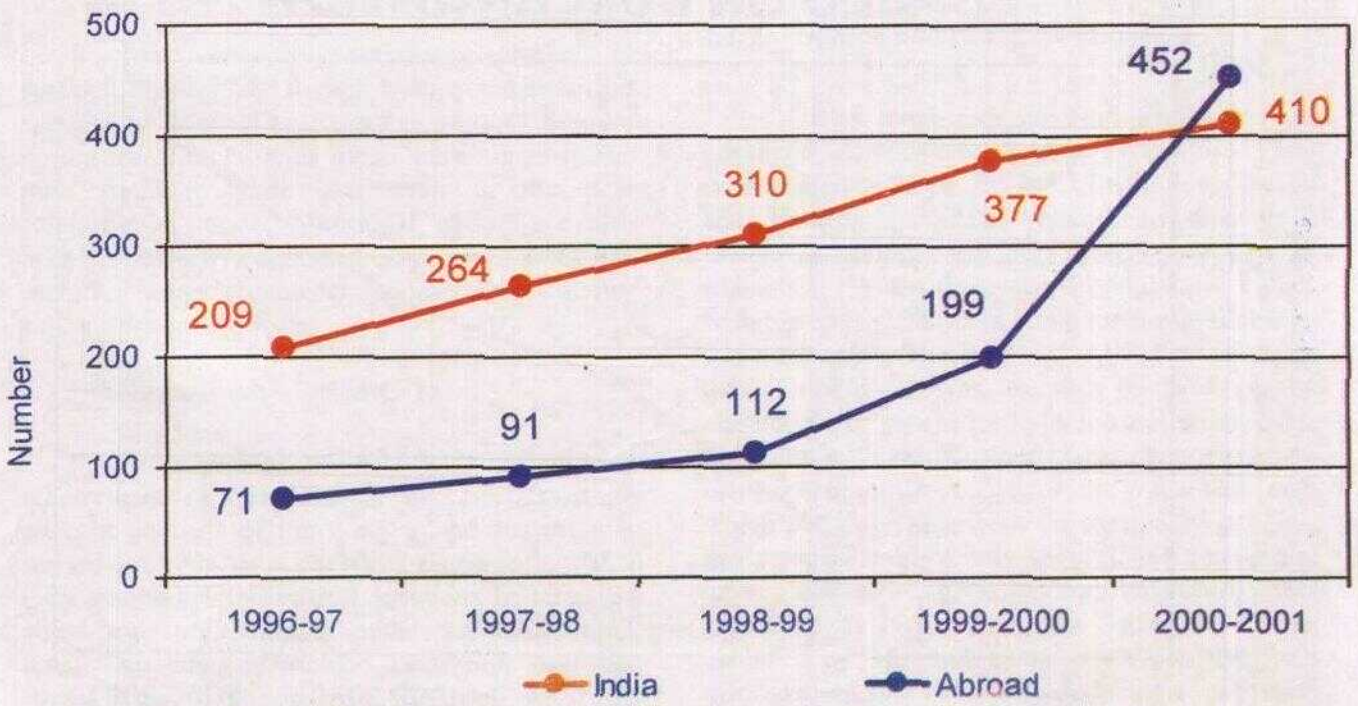
A systematic experimental study of deep stall characteristics of SARAS was carried out on a 1/6 scale model in the low speed wind tunnel at Indian Institute of Science. Ten ventral fins and three horizontal tails were tested as a part of this study. Based on the analysis of the wind tunnel results, suitable ventral fin geometry was chosen to overcome deep stall.

2.1.3 Hansa productionisation

The Ministry of Civil Aviation (MCA) supported the initial procurement of three Hansa aircrafts. Productionisation of the three HANSA-3 based on standard aircraft manufacture, to prescribed production procedures and to stringent quality assurance with elements covering approved inspection procedures, snag dispositions and

EXTERNAL CASH INFLOW

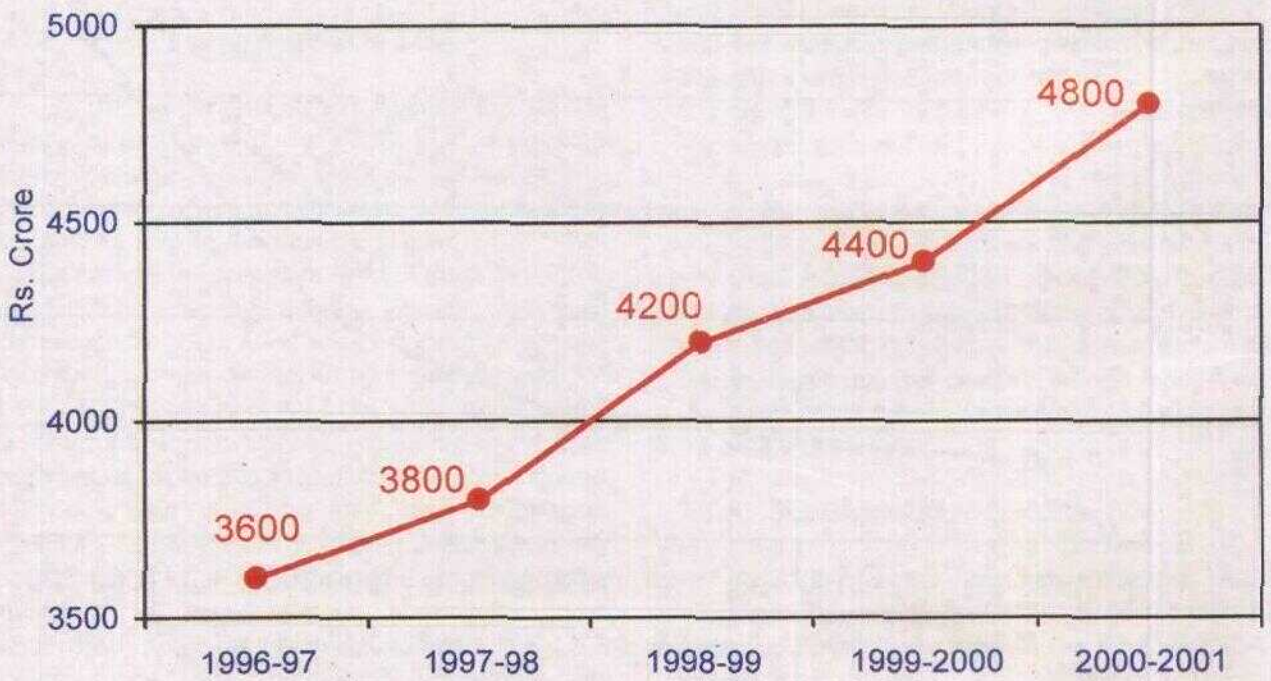
PATENTS FILING



II.1 External Cash Inflow & Patents filed by CSIR

PAPERS CONTRIBUTED
AVERAGE IMPACT FACTOR /PAPER

ANNUAL INDUSTRIAL PRODUCTION
BASED ON CSIR KNOWHOW



inventory control documentation through controls were taken up. The HANSA VT-HNT was built and production test flights were completed successfully. This aircraft has been handed over to DGCA and which in turn has offered the aircraft to Andhra Pradesh Aviation Academy.

2.1.4 Ejector ramjet combustor employing a cavity cascade flame stabiliser

An ejector ramjet combustor development program was carried out under VSSC sponsorship. Rocket based combined cycle (RBCC) propulsion is considered a promising candidate for application to reusable space launch vehicle. The secondary combustor needs to be aerodynamically clean and also allow effective flame stabilization and combustion.

A novel method of achieving flame stabilization in an ejector ramjet has been proposed by NAL. It employs a cavity cascade as a flame stabilizer on with some of the cavities also serving as integral fuel injector/flame holders. A cavity cascade flame holder has been successfully tested in the main $1/3^{rd}$ scale ejector ramjet combustor facility. The cavity cascade was found to stabilize flames when the ramjet was operated both in the ejector ramjet mode as well in the pure ramjet mode.

This method has been shown to successfully stabilise flames, both in subsonic and supersonic flows. Consequently, it could be used during the ejector rocket mode, pure ramjet mode, pure scramjet mode and even in the dual ram/scramjet mode. Additional trials have also been successfully conducted on a full scale 45 deg sectorial ramjet combustor incorporating a cavity cascade flame stabiliser.

2.1.5 Stress analysis of MiG-21

As a part of the full scale fatigue test requirement of the MiG-21 bis aircraft, finite element analysis of the wing of the aircraft was carried out by NAL using NISA-II software, with a view to predict the critical locations in terms of stress and strain induced under the design limit load. The analysis yielded maximum principal stress value which matches very well with that obtained from the stress album, in terms of both stress magnitude and location on the wing bottom skin. Also, it was found that the maximum strain value in the wing bottom skin along the lateral direction was within the permissible strain value for the material.

2.1.6 Aerostats

Aerostats used for surveillance, advertisements, weather predictions etc. comprise a fabric balloon floating in air, maintaining equilibrium under aerodynamic load, buoyancy internal pressure and self-weight. It is held at the desired altitude by a connecting tether attached to a mooring system. They are generally made up of polyurethane-coated nylon fabric which is capable of resisting the load through membrane action. Since it is operated at high altitudes for long periods, the aerostat structure can undergo varied stress conditions, which have to be accounted in the design.

NAL has generated flat pattern templates for the fabrication of the doubly curved flexible aerostats of different sizes (250 m^3 and 1000m^3). The development of the geometric modeling and the flat pattern templates was carried out using the special development features of CATIA software. The aerostats have been built using these templates.

2.1.7 Speech and hearing evaluation

In an interesting "spin-off application" of advanced composites, NAL's FRP Pilot Plant collaborated with the All India Institute of Speech and Hearing (AIISH), Mysore, to develop a composite mobile van for speech and hearing evaluation. While there are hospitals and clinics with low noise chambers, these are not available in the rural areas. The best that AIISH could do in these conditions was to use relatively silent classrooms or panchayat halls in rural areas. NAL designed a "mobile" speech and hearing clinic using a composite body for the van. This van, which has three chambers for examining patients, has a sound level of only about 25 dB inside (the noise "outside" can be as high as 90 dB) was fabricated at NAL. This low sound level was achieved by determining the optimal density and thickness of the composite foam core and skin. With better internal acoustic treatment, the sound level could even be reduced to 10-15 dB.

2.1.8 Molybdenum disilicide ($MoSi_2$) composites

Molybdenum disilicide ($MoSi_2$) and its composites have attractive properties and are considered for high temperature structural applications. $MoSi_2$ composites were synthesized by the hot pressing technique and characterized by X-ray and SEM. The introduction of second phase particles resulted in an increase in the hardness of the matrix and a decrease in the coefficient of friction and the specific wear rate. It was also found that introduction of $MoSi_2$ into the SiC matrix was beneficial in reducing the wear rate of SiC and the SiC based pins have low wear compare to pins based on $MoSi_2$ due to higher hardness.

2.1.9 Jet noise generator

A jet noise generator to generate high frequency noise between 2.5 kHz and 10 kHz in 1/3 octave bands was designed, fabricated, tested and delivered to Wyle Laboratories, USA on 28 Feb. 2001. The noise levels are controlled by the velocity of the gas jet and the frequency spectra by changing the dimensions parameters. This unit will be used to augment the acoustic test facility at NSPO, Taiwan, Republic of China.

2.1.10 Fatigue meter

NAL developed and type certified electro-mechanical fatique meter were flight tested on the Jaguar at HAL. Five flights were conducted for studying the system and for obtaining the provisional type certificate. A comparative study of the performance and accuracy of NAL's FM and Nagreti Zambra fatigue meter from one Jaguar aircraft was taken up at the LRDE centrifuge. Both the fatigue meters worked in a similar manner within the required accuracy. Also three smart fatigue meters developed as part on an ARDB project are getting ready for type certification. FM's with more accurate fatigue prediction are being designed to fix the time of occurrence of a peak or valley in the load spectrum.

2.1.11 Prototype ecam cutting machine

An electro –chemically assisted arc machining (ECAAM) process was demonstrated at NAL by retrofitting a band saw. Using this laboratory machine, design parameters like the feed rate, speed of moving cathode, are of electrolyte flow and the parameters for the power supply were generated. A prototype ECAAM was designed to use INTELK's 'FAGOR' CNC drive system. Detailed and assembly drawings were made of (a) assembly layouts, (b) overall machine tool assembly, (c) band drive, (d) band guiding mechanism, and (e) CNC linear table/drive etc. Based on these drawings, an industry is fabricating the machine.

2.1.12 National trisonic aerodynamic facilities

A total of 707 blowdowns in the 1.2 m wind tunnel and 168 blowdowns in the 0.6m wind tunnel were carried out during the year. Some of these were on fighter aircraft models for force measurements and effect of add-on devices such as vortex plates, lateral stability at high angles of attack and effects of a pressure-based angle of attack sensor on the performance of air intakes; a jet trainer model to obtain its basic aerodynamic characteristics; a launch vehicle model with a provision to alter the alignment of boosters and fins to determine the rolling moment induced by such asymmetries; a missile model with different flare geometries for force measurements.

A system using pressure sensitive paints for pressure distribution measurements on aerospace models was also successfully commissioned for the first time in the country in the 1.2m trisonic wind tunnel. Comparison of tests on a model coated with the Russian binary paint and the indigenously developed paint indicated excellent validation.

2.1.13 Information centre for aerospace science and technology (ICAST)

The center caters to the information requirements of the Indian aerospace community in particular and the engineering and technical personnel in general. ICAST also maintains the " AeroInfo", a WWW virtual library for aerospace science and technology, the first of its kind in the country and serves as a one-window information search facility for the entire aerospace community in the world in general and in India in particular. ICAST's collections of books, journals and Technical reports from NASA, DLR, ONERA, NLR, ARL and UTIAS is unmatched.

2.1.14 HRD programmes at NAL

During 2000-2001, 47 diploma holders, 112 graduates, 5 post-graduates and 7 ITI holders

were trained under these programmes. Besides 119 of BE/MCA/M.Sc. students from Bangalore University and 436 students from other Universities did their project work at NAL. Two batches of 8 students from BITS, Pilani for B.Tech also carried out their full time project work in different Divisions of NAL. Under the CPYLS 41 top students of State/CBSE/ICSE examinations along with their parents/teachers participated in the special two-day programme arranged at NAL.

2.2 BIOLOGICAL SCIENCES & TECHNOLOGY

2.2.1 Association analysis of CAG repeats at the KCNN3 locus

The phenomenon of 'anticipation' is seen in some diseases caused by trinucleotide repeat expansions. CBT carried out 'association analysis' of CAG repeats at the KCNN3 locus in the Indian population with bipolar disorder and schizophrenia. CBT's analysis found no statistically significant evidence for the presence of an excess of longer alleles in the patient population, as compared to ethnically matched controls. However, an analysis of the difference of allele sizes revealed a significantly greater number of patients with schizophrenia having differences of allele sizes 0.5 when compared to normal controls. This finding is of functional significance as the KCNN3 protein is believed to act as a tetramer, and a large difference in allele sizes would result in an asymmetric molecule with a different number of glutamine residues in each monomer. A method for detection of human spinocerebellar atascia 2 gene variants has also been developed and a patent for it has been filed.

2.2.2 Genomic structure analysis of Indian population

A study on genome diversity of Indian population has been undertaken by IICB in association with Saha Institute of Nuclear Physics and Indian Statistical Institute and mitochondrial DNA (mtDNA) profiles of 23 ethnic populations of India drawn from diverse cultural, linguistic and geographical backgrounds have been analyzed. It has been observed that there was extensive sharing of a small number of mtDNA haplotypes, reconstructed on the basis of restriction fragment length polymorphisms, among the populations. This indicated that Indian populations were founded by a small number of females, possibly arriving on one of the early waves of out-of-Africa migration of modern humans; ethnic differentiation occurred subsequently through demographic expansions and geographic dispersal. By examining the sharing of haplotypes between Indian and southeast Asian populations, the IICB study has provided evidence that southeast Asia was peopled by two waves of migration, one originated in India and the other in southern China.

2.2.3 Genotyping for angiotensin converting gene

CBT has developed a method for isolating Lutenizing hormone (LH) from Bovine Pituitary glands. Based on the principle of pseudoaffinity, the novel process replaces the use of a bio-molecule by an ordinary copper metal which has high protein binding capacity as a ligand. The process is cost effective and commercially viable.

2.2.4 Cloning and sequencing of rabies virus glycoprotein G-gene

Rabies genomic RNA of the street virus strain was extracted from purified virus. The integrity of RNA was checked by denaturing agarose gel electrophoresis. From the known nucleotide sequence of rabies virus genome forward and reverse primers specific for rabies virus glycoprotein G-gene were synthesized at CIMAP and were purified using oligonucleotide purification cartridges. The oligos used were 5'CTC TAG AGG AAA GAT GGT TCC TCA GGC TCT CCT G3' and 5'CGG ATC CAG TCC TCA CAG TCT GGT CTC 3'. They have specific restriction sites which were further used for cloning in appropriate vector. cDNA copy of RNA was synthesized by using reverse transcriptase enzyme and subjected to PCR amplification (RT-PCR). Intact 1.6kb fragment obtained was eluted from low melting agarose gel and used for directional cloning in Bluescript II SK+vector. The cloned fragment was sequenced in the automated DNA sequences (ABI Prism 377) and was confirmed to be the glycoprotein G-gene of the rabies virus. This gene showed 95% homology with the Marshall virus strain of rabies.

2.2.5 Proteomic analysis of mycobacterial cell membrane

The bacterial plasma membrane is rich in protein content and considered as the site for several important enzymes, receptors and

transporters. Immunogenecity of membrane proteins, specially the 'integral' ones, has been attributed to their hydrophobicity and lipid modification. These features make them attractive candidates for development as novel drug targets or subunit vaccines. The sequenced genome of *Mycobacterium tuberculosis* has predicted >700 'putative' membrane proteins though their location, expression patterns, and function remain mostly unexplored. CDRI has characterized the mycobacterial membrane proteins. In both BCG and *M. tuberculosis* H 37Rv the IMP pool was found to contain, besides many unidentified proteins, 3 of the known 'immunodominant' ones – the 38 and 19 kDa lipoproteins and 33/36kDa 'proline-rich' protein. The proteomic analysis of IMP of *M.tuberculosis H37Rv* has led to identification of some real integral membrane protein of the bacillus for the first time.

2.2.6 Regulation of gene expression in plants

NBRI undertook detailed computational analysis of plant gene database to identify conserved features in upstream regions of highly expressed plant genes. Appropriate software has been developed for such analysis and novel features in the architecture of plant genes were identified. A gene expression cassette, representing the conserved features was designed and synthesized chemically. The experimental reconstruction led to the development of very efficient plant gene expression vector. A number of patents have been filed on these developments.

2.2.7 Mycobacterial chaperone proteins

Efforts are on at IMT to carry out structural and functional studies on proteins derived from *Mycobacterium tuberculosis*, with the long term objective of utilizing them for drug design studies. For the structural work, the hsp60 and hsp10 proteins have been worked out. These proteins are the homologues of well-characterized GroEL, GroES chaperonins from *E.coli*. Crystallizations of the protein in complex with divalent cations yielded several new crystal forms. Extensive sequence analysis has been carried out on protein folds similar to the GroES fold. The crucial isoniazid resistance related enzyme-alkyl hydroperoxidase has now been characterized in biochemical details. The enzyme interestingly was decameric in nature unlike its homologues from gram negative bacteria.

2.2.8 Rapid estimation of polymer supported functional groups

A rapid method for the estimation of polymer supported functionalities under microwave irradiation has been developed by CBT. This uses a novel universal reagent, S-(4,4'-dimethoxytrityl)-3-mercaptopropionic acid (DMPA) for the estimation of polymer supported hydroxyalkyl, aminoalkyl and mercaptoalkyl functionalities in the presence of triphenylphosphine-bromotrichloromethane (TPP-BTCM) as an oxidation-reduction coupling reagent. The loadings obtained on the supports following the proposed method were found to be comparable with those obtained with the standard, 4,4'-dimethoxytrityl chloride (DMTr-Cl) method. The usefulness of the method was demonstrated by monitoring the functionalization of polymer supports, suitable for solid phase peptide and oligonucleotide synthesis.

2.2.9 Bioprospecting SOD from high altitude plants

IHBT has successfully isolated for the first time, an autoclavable superoxide dismutase (SOD) calalyzing dismutation of speroxide radical from +80° C to sub-zero temperature from a plant of high altitude. The enzyme is autoclavable with no loss of activity rendering a germ free preparation and enabling smooth functioning in a temperature range of subzero to >50°C in presence of sodium chloride and detergents like SDS. It thus can be used for humans, animals and plants wherein the damage is mediated through the production of superoxide free radicals. In a living system generation of toxic oxygen or superoxide radical is inevitable. Under the situations of stresses and diseases, the generation of superoxide radical exceeds the scavenging capability thereby causing severe damage to the system. Therefore SOD is required to remove this toxic species of oxygen. Several medical operations require SOD. Plants require SOD to improve stress tolerance and better yields. Food industry requires to avoid spoilage in terms of alteration of taste, texture and increasing shelf life of the food products. In cosmetics SOD is required to be mixed with solutions, lotions, creams, oils, gels, and balms for extending the shelf life and maintaining the quality of the product.

2.2.10 Cultivation technology for pyrethrum in north Indian plains

Chrysanthemum cinerariaefolium, commonly known as pyrethrum, is an economically important perennial crop grown to extract pyrethrins from its flowers. Pyrethrins have insecticidal properties and are localised mainly in the achenes (flower buds). The cultivation of pyrethrum is limited to the hilly areas of Kashmir and Tamil Nadu. CIMAP has developed agro-technology for cultivation of pyrethrum in other agroclimates of the country. The crop has been acclimatised for flowering under the subtropical climate of Central Uttar Pradesh. The profusely flowering selection Avadh suitable for plains has about 1.0% pyrethrins in its flowers which is at par with that obtained in the south Indian hills. Thus with the use of CIMAP agro-technologies, pyrethrum could now be successfully produced in the north Indian plains, which is so far being produced in the temperate region of the country.

2.2.11 Transgenic tobacco

Transgenic plants of tobacco with the specially designed synthetic cry gene have been developed at NBRI. Evaluation of the novel cry protein design established its superiority over the earlier reported δ-endotoxins. Molecular analysis of the selected plants established accumulation of the protein at more than 0.5% of total leaf protein, substantiating functionally excellent designing of the gene. The strategically designed gene will be used for developing transgenic lines of medicinal plants, groundnut and castor under a collaborative programme. A gene of 1930 bp was also designed to encode 609 amino acid long Cry1Aa3 active toxin. The gene was modified for optimal expression in dicot plants using PC/Gene software.

2.2.12 Gladiolus hybrids

IHBT has developed six superior gladiolus hybrids through conventional breeding as per the international standards of plant growth and flowering parameters. These hybrids have been selected and classified as per the specification systems of North American Gladiolus Council, U.S.A., and The Royal Horticultural Society, U.K and the colour description done as per the RHS colour chart.

2.2.13 Mini distillation unit

A mini essential oil distillation apparatus useful to distill essential oils and hydrosols such as rose, ajowain, geranium, lavender etc. from fresh and dried plant material like leaves, flowers, roots and rhizomes has been developed at IHBT. The distillation can be carried out by steam and as an option steam distillation can also be performed at atmospheric pressure. This unit can be heated on brick-clay furnace with small agro-waste, LPG cooking gas, electrically heated stove or kerosene/diesel burner etc., and requires minimum attention during handling. The unit is ideal for small and marginal farmers, aromotherapists and for demonstration purposes. Since the apparatus is made of stainless steel and glass, the essential oil distilled is of better quality than the oil distilled by glass Clevenger type apparatus used in the laboratory.

2.2.14 Distillation plants for aromatic oils

CIMAP has developed two specialised aromatic oil distillation plants for:

- Rose oil which is one of the most valuable perfumery compounds, used for the production of high quality premium perfumes. A low cost distillation plant based on a novel cohobation system for the extraction of the rose oil has been designed and developed which has higher distillation efficiency than the conventional units.

- Geranium oil which is one of the most valuable essential oils required by the Indian perfumery industry. Geranium herb, when distilled by the conventional steam distillation system, yields low oil recovery of 0.1% as compared to 0.22% oil present in the herb. An improved, efficient low cost plant for geranium distillation which gives higher oil yield has been designed and developed. The improved plant design incorporates a packed stripping column, provision for generation of more steam through enhanced heating area and design improvements in furnace.

2.2.15 Modulation of winter dormancy in tea

An exclusive isozyme of superoxide dismutase (SOD), responsible for imparting low

temperature tolerance in tea has been identified and purified at IHBT. Antibody was raised in rabbit against this enzyme with a view to clone the genes using antibody as a probe. cDNA was synthesized using MMLV reverse transiriptase in the presence of a bifunctional primer. After synthesizing the second strand, appropriate adaptor was ligated to generate a directional clone to be ligated into the vector. Cloned cDNA were packed in lamba phage. The isolated gene can modulate winter dormancy in plants like *Taxus*, kiwi, figs, strawberries, almonds, walnuts etc. for better utilization of land, manpower and machine.

2.2.16 Herbal composition for asthma problems

IICB has developed a herbal composition for treating asthma. The composition to be taken orally in liquid or tablet form helps in improving quality of life of an asthmatic patient. It relieves from all chronic and old bronchial problems, blocks the key enzymatic step for the synthesis of leukotriene (asthma inducer) and shows no hepatotoxicity unlike currently used drugs. The composition has been licensed for commercial production.

2.2.17 Production of artemisinin derivatives

Dihydroartemisinin (DHA) and arteether are important derivatives obtained from artemisinin having useful antimalarial properties. Synthesis of DHA and arteether from artemisinin is a delicate process involving close control over the process conditions. The bench scale process for conversion of artemisinin to DHA has been successfully scaled up at CIMAP from 100 g/batch to 1500 g/batch on pilot plant. The pilot plant has been specially designed to achieve and maintain the required reaction conditions of temperature, agitation, pH and vacuum at optimum levels to obtain high product purity.

2.2.18 Herbal/ plant extract concentrator

The existing practice of concentrating herbal/ plant extract is through rota-evaporation, which is very time consuming and often affects structure of biomolecules due to higher temperature of operation thus inhibiting proper concentration of plant extracts. CSMCRI has developed a Polysulfone-Polyamide (PS-PA) thin film composite membrane based plant extract concentrator, which overcomes this limitation as it operates at ambient temperature, and the process of dewatering is much faster. The membrane removes only water from the extracts. An added advantage is that unlike a rotavapor this equipment avoids formation of froth thereby eliminating the need to remove the same and enhancing efficiency. The equipment would thus be very handy for studies involving large number of aqueous plant extracts.

2.2.19 Beverages and brewing products from tea and natural flora

The making and brewing of wines from fruits and vegetables is an ancient art and as old as human civilization. However, the wine industries around the world are based on commercially grown fruits mostly grapes and apples and rarely on wild edible fruits which endow greater food attributes in terms of chemical constituents and other health values. IHBT has developed technology for preparing fine table dry and sweet wines of white and red variety from natural products like, tea and fruits both wild and cultivated. The nutritive herbal health product thus formed is self-preservative and with aging maturation, its valuation goes up.

2.2.20 Tea manufacturing in non-traditional areas in Himachal Pradesh

IHBT has imparted training on tea-manufacturing to the small growers in the non-traditional tea area of Himachal Pradesh. The Young Tea Trial Plot owners in districts Kangra and Chamba having holding size of about one acre and who cannot afford to establish tea factories of their own, were given technology to process tea leaves manually. This technology will encourage other small farmers of the area for tea cultivation as they will be able to see themselves and get convinced with the manual processing technique which assures marketable tea product for ready consumption in the local market. In rural areas, where wheat, paddy and other fruit crops are becoming non-remunerative, diversification to tea cultivation will increase their returns and hence pave way for economical upliftment.

2.2.21 Process for natural yellow dye

A novel process has been developed by IHBT to convert a banned toxic plant compound (oil) into a safe natural yellow dye. The developed

product forms basis for a series of yellow coloured dyes some of which are presently not available commercially. These have wide application in flavouring and some of them are also known for their biological activities like anticancer properties etc. Thus a value added product is formed from otherwise a banned oil, affecting India and other Asian countries like Pakistan, Bangladesh, Nepal, Japan and China, where the plant grows in abundance but does not fetch economic returns owing to its toxicity.

2.2.22 Induced structural change analysis in biosystems

Metal induced conformational changes in mitrogenic Achatinin H binding to carbohydrate ligands have been analysed at CLRI and their significance related in immunology. Chromium induced abnormalities in biomolecules and *in vitro* cell proliferation has been investigated and the role of chromium as a possible redox state of carcinogenicity has been emphasized. Metal induced molecular assemblies in collagen and bovine serum albumin and changes in the calcium transport pathways in cell expression have been demonstrated. The role of water and solvation in aggregation and organization of DNA has been evaluated using the application of density functional theory.

2.2.23 Clot specific streptokinase

A laboratory-scale process for the preparation of clot-specific streptokinase has been standardized at IMT. The process entails the culturing of *E. coli* carrying appropriate plasmid DNAs encoding for either recombinant natural-type streptokinase or its different engineered constructs, followed by cell-lysis refolding of polypeptides to their biologically active states, and their isolation at approx. 85-95% purity by chromatographic means. The clot-specific proteins display plasminogen activation property as well as two additional properties viz. time-delayed kinetics of plasminogen activation in vitro as demonstrated by chromogenic peptide and fibrin clot dissolution assays, together with an ability to bind with human fibrin under conditions wherein natural, i.e. un-engineered streptokinase does not bind to fibrin. Several drug companies have shown interest in commercial exploitation of this process.

2.2.24 Colchicine and colchicoside production

RRL,Jm. has developed an improvised and economical process for the production of Colchicine and colchicoside (colchicine glucosides) Colchicine and colchicoside find use in therapy, agriculture and industry. It is claimed, that the latter is 100 times less toxic than the former. In international market these alkaloids enjoy great demand but are very expensive due to prevailing process of their production. It requires only indigenously available raw materials

2.2.25 Liquid seaweed fertilizer

CSMCRI has developed a liquid seaweed fertilizer (L.S.F.), which is a bio-fertilizer prepared from brown seaweed Sargassum. It is eco-friendly and cost effective. While application of L.S.F. as foliar spray increased crop production from 10 to 30 percent, its application to soil as fertilizer in Jojoba plantation initially enhanced 46 percent growth of seedlings besides 56 percent increase in number of branches. L.S.F. contains trace elements and ingredients like alginates which improves the moisture retaining capacity of soil.

2.2.26 Unique collagens

The information on various kinds of mammalian and avian collagens is mostly available. However little is known about invertebrate and fish collagens that abound in nature. Collagen polymorphism in marine invertebrate tissues has been studied at CLRI with focus on structure-function relationship and molecular evolution. A unique type of collagen has been isolated from rare tissues of crustaceans and molluscs. The uniqueness of the collagen has been established by comparisons to other known forms. It lacks periodicity in fibrillar structure. The molecular characteristics of these unique type of collagens is being studied.

2.2.27 National facility for virus diagnosis & quality control

IHBTs setup has been recognized as national facility for viral diagnoses and quality control of tissue culture raised plants. This facility will help floriculture industry in general and to the exporter and importers of planting materials in particular for diagnoses of virus.

2.2.28 IMT national facilities

The national facilities created at IMT continued to generate interest in users around the country and elsewhere. The facility on Microbial Type Culture Collection & Gene Bank (MTCC) has been upgraded to act as India's only International Depository Authority. It would accept all those microbial cultures which are a subject matter of a patent application. Likewise, the Biochemical Engineering Research & Process Development Centre and Bioinformatics Centre on Protein Engineering continued to cater to the needs of industry, academic institutions and research organisations.

2.2.29 Identification of differentially expressed *Vibrio cholerae* genes

The importance differentially expressed host genes following *V. cholerae* infection has been emphasized by IICB from several lines of evidences. Two different approaches have been taken to identify in vivo expressed genes following *V. cholerae* infection into host. Using RAP-PCR strategy, five differentially expressed transcripts were identified and subsequently cloned and sequenced. One clone containing the murE gene when transformed into cholerae 569B grew better than that of wild type *V. cholerae* 569B strain in ligated rabbit ileal loops. In an alternative approach DNA macrochip containing 92 recombinant cosmids covering 90% of *V. cholerae* 569B genome were hybridized with cDNAs synthesized from in vivo and in vitro grown *V. cholerae* total RNA. The results demonstrated that the global transcription profile approach might be a powerful method for identification of differentially expressed transcripts under in vivo conditions.

2.2.30 Summer training

CBT continued providing summer training in various aspects of biotechnology for a period ranging from 6 to 8 weeks. In 2000-2001 35 students underwent training during the period and had exposure to various scientific techniques, handling of sophisticated equipments and preparation of scientific project reports.

2.2.31 Workshop on Respiratory Allergy

A workshop on "Respiratory Allergy: Diagnosis and Management was organised by CBT in collaboration with VP Chest Institute. Twenty medical post graduates from different parts of the country were trained during the workshop in various aspects of allergy diagnosis, treatment and related aerobiology. The faculty was from various Institutes in the field.

- A special training programme of six months for the students from Birla Institute of Technology and Science (BITS), Pilani, in two batches was organized by CDRI in the area of modern biotechnology.

- The M.Sc. (Microbiology) students from Barkatullah University, Bhopal were provided training at CDRI for six months on specialized techniques and instrumentation in the field of microbiology.

- IMT conducted summer training programme for M.Sc. (Biotechnology) students from Universities of Pune, Panjab, Punjabi, Guru Nanak Dev, Birla Balika Vidyapeeth, Devi Ahilya, Calicut, I.I.T., Kharagpur, Jawaharlal Nehru, Nagarjuna, Delhi, etc. A total of 31 students underwent this training.

2.2.32 Workshop on bioinformatics

CIMAP organized a workshop on Introduction to Bioinformatics in Medicinal and Aromatic Plants which was co-sponsored by DBT. A number of special lectures were arranged for the benefit of participants. Hands-on sessions were conducted for the trainees on internet, web resources on biological sciences and on- and off-line data base searching. Twenty participants from various R&D institutes situated in northern part of the country participated in the workshop.

2.2.33 Workshops on biodiversity

CIMAP conducted three workshops on biodiversity covering the essential theoretical and practical concepts on *ex-situ* conservation, inventorization and characterization of genetic resources. The participants were exposed to modern molecular techniques like, DNA fingerprinting, including RAPD and AFLP mapping and exposure to gene sequencing, while adopting holistic biosystematics approach of diversity assessment. In all, 53 participants from various parts of country including the states of

Maharashtra, Goa, Tamil Nadu, Karnataka, Gujarat, Punjab, Meghalaya, Madhya Pradesh, Jammu & Kashmir, Haryana, Bihar and Uttar Pradesh, participated in these workshops.

2.2.34 National seminar on the frontiers of R&D in medicinal plants

CIMAP conducted a national seminar on the frontiers of Research and Development in medicinal plants. The aim was to initiate debate on past-present-future scenario in mediculture and related industry. Over 300 research scientists, engineers, personnel from user industry, entrepreneurs and students attended the seminar. Sixty oral and 188 poster presentations were made in 10 technical sessions during the three day period of seminar. A number of suggestions/recommendations for sustainable R&D and business in the field of medicinal and aromatic plants and their related products were made during the seminar.

2.2.35 IPR-literacy challenges for the millennium

A three day workshop on IPR literacy was organised at IHBT. Seventeen participants attended the programme including scientists, Govt. officials and entrepreneurs. Participants gained hands-on experience on patent search, filing procedures and details of national and international agencies dealing with patents and patent laws.

2.2.36 Training course on heavy metal poisoning

A three day training course on heavy metal poisoning with special reference to mercury was organized at ITRC. The course was sponsored by NTPC and attended by fifteen General Managers of NTPC and trainees including CMOs, Asst. CMOs and specialists in NTPC hospitals at Shaktinagar, Vidyant Nagar, Obra, Talcher & Dadri. The objective of the course was to create awareness and impart skill amongst doctors of NTPC on identification, diagnosis and management of sickness related to heavy metals exposure.

2.2.37 Workshop on application of IT in biosciences

A two day workshop on applications of information technology in biosciences was organized by RRL,Jm. It was Ist workshop of its kind in J&K where the application of information technology in biological sciences was emphasized during the two days activity. For the participants both theoretical and hands on sessions were arranged. Topics such as introduction to computers, operating systems, scientific documentation, sharing of resources, email & internet welcoming, bibliographic, patent search and CD ROM based databases were demonstrated and taught.

2.3 CHEMICAL SCIENCES & TECHNOLOGY

2.3.1 Dichlorofluorobenzene

IICT has developed an ecofriendly process for 2,4 Dichlorofluorobenzene (2,4DCFB), an important intermediate for anti bacterials like Norfloxacin, Ciprofloxacin etc., using dichlorobenzenes available as by-product from M/s HOCL plant. The process is non-hazardous and replaces the expensive solvents by cheaper solvent such as dimethylformamide.

2.3.2 Esfenvalerate

A novel process for esfenvalerate, a broad spectrum synthetic pyrethroid having high specificity and low dosage, has been developed by IICT. The process obtains(s) fenvaleric acid by kinetic resolution and the undesirable isomer is fully recycled. The resolved acid is converted into diastereomeric mixture from which Esfenvalerate is obtained by induced dynamic kinetic resolution.

2.3.3 Pyrazinamide

IICT jointly with SPIC R&D Centre, is developing technology for pyrazinamide, an anti TB drug. The first step of synthesis of methyl pyrazine (2 MP) in the multi-tubular catalytic reactor has been completed and work is in progress for conversion of methyl pyrazine in a single tube reactor to cyanopyrazine and finally to pyrazinamide. The catalysts for the two steps reaction have also been developed by the institute.

2.3.4 Perfluoro octanoic acid

CECRI has developed an electrochemical process for the production of perfluoro octanoic acid by the electrochemical perfluoronation of

octanoyl chloride. The chemical process involves the electrolysis of octanoyl chloride, anhydrous hydrofluoric acid medium using nickel anodes and cathodes. Perfluoro octanoic acid and perfluoro cyclic ethers formed as dense fluid during electrolysis were separated from the AHF electrolyte and processed to separate the two products.

2.3.5 Phenanthrene

CFRI has developed a process for purification of crude phenanthrene and converting the refined product to 9;10 phenanthrenequinone through liquid phase oxidation. The basic engineering for 100kg/day capacity plant has also been worked out in association with an engineering company.

2.3.6 Homobrassinolide (HBR)

Brassinosteroids are a class of steroidal phytohormone with high growth promoting and antistress activity. Although several chemical routes are reported for the synthesis of HBR, they were not suitable for large scale commercial production. NCL has developed a cost effective, ecofriendly process for the synthesis of (22S, 23S)-Homobrassinolide (HBR) under a project sponsored by a private firm. The technology has been marketed.

2.3.7 Synthesis of block copolymers of Poly Ethylene Glycol (PEG)

Redox polymerization is a unique technique in which an oxidizing agent and reducing agent react resulting in the formation of an active free radical capable of initiating vinyl polymerization. For the first time it has been established at CLRI that the use of a polymeric reducing agent along with an oxidizing agent for vinyl polymerization results in the formation of a block copolymer. The reducing agents studied are PEG of several molecular weights (from 200 to 20000) with Ce^{4+} as an oxidizing agent. The salient feature of this particular redox system is its homogeneity in aqueous medium and its applicability at low temperatures, which avoids side reactions such as homopolymer formation. The block copolymerization kinetics has been studied with respect to different monomers like acrylonitrile, acrylamide, methyl methacrylate, etc. as well as by changing the oxidant (Ce^{4+}/Mn^{3+}etc.).

2.3.8 An improved process for removal of Ca^{++} ion impurity in brine

The production of industrial grade salt requires removal of Ca^{++} ion impurity from the brine. The conventional methods are not fully successful to remove ca^{++} ions. As an alternate root use of marine cyanobacterial strains was explored at CSMCRI. Their survival in the subsoil brine with variable density was checked. Simultaneously ca^{++} uptake was also estimated. Nearly 80% of the ca^{++} was removed from the brine under laboratory scale experiments. Lyngbya being the euryhaline species was taken for the field experiments at the experimental salt farm. A PCT/US-patent has been filed on the removal of calcium from brine by cyanobacteria.

2.3.9 Industrial grade salt from subsoil brine

Subsoil brine differs from sea brines with respect to the chemical composition and salt recovered from subsoil brines are unsuitable for industrial consumption. Based on solubility data of the systems NaCl – $CaSO_4$ – $CaCl_2$ – H_2O and NaCl – $CaSO_4$ –H_2O, an eco-friendly route is worked out at CSMCRI for the recovery of industrial grade salt from subsoil brines integrating the process with recovery of marine chemicals like magnesium and potassium compounds, bromine etc. The process would be beneficial to those salt manufacturers who produce salt from subsoil brine, an added benefit being that the process would in the ultimate be integrated to recovery of marine chemicals economically.

2.3.10 Spiral elements for large scale desalination plant

CSMCRI has developed 20 cm x 1 meter spiral elements based on Thin Film Composite (TFC) PS - PA membrane, which would accommodate 39 sq. meter membrane area and produce about 20,000 liters/day water output under standard test condition and remove 95% of salt. The 20 cm diameter spiral module is currently the world standard in RO plants. The indigenous development would enable to manufacture large-scale desalination plants at a lower capital cost and as a result the cost of water will also be significantly reduced. Besides being useful in providing potable water it would also be useful in treating waste water in refineries, fertiliser and power plants ensuring water reuse concurrently,

reducing to a large extent thus the effluent problem.

2.3.11 Furfuryl alcohol plant

A 75 tonnes/annum furfuryl alcohol plant based on the technology developed by IICT has been commissioned in Andhra Pradesh. The project was partially funded by Department of Scientific & Industrial Research (DSIR) under its PATSER scheme.

2.3.12 Gas cracker plant

A 5kg/hr gas cracker pilot plant for cracking alkanes to alkenes is being set up at GAIL's Petrochemical Complex at Pata jointly by IICT, GAIL & IIT, Kanpur. The pilot plant will be compact, skid-mounted unit and will have a built-in flexibility to operate over a range of capacities around the design value.

2.3.13 Unified theory of tanning

CLRI has proposed a new unified molecular theory for tanning. The thermal stabilisation of collagen by variety of molecules has been traced to the long range ordering introduced by the tanning species by correlations of variation in D-periodicity in Atomic Force Micrographs of tanned specimen with increase in shrinkage temperature. The stabilisation of collagen against collagenase on reaction with tanning substances has been assessed by correlating quantitatively the ratio of collagenase promoted hydrolysis of tanned collagen fibres with the inhibitor for bacterial collagenase. This theory is being extended to a variety of inorganic and organic substances.

2.3.14 Formaldehyde and chromium free leathers

Technologies currently employed for tanning skins/hides are highly eco-sensitive. It has been shown that Cr (III) is toxic to the human system at higher dosage levels. A chromium-iron based tanning salt has been developed by CLRI where partial replacement of chromium with iron has been achieved. The product exhibits 90% exhaustion of Cr as well as iron. A high-exhaust (>90%) chrome syntan without formaldehyde has also been developed for direct application on delimed pelts.

2.3.15 Special NMR probe

Application of NMR imaging technique to map the topological distribution of fluorocarbon derivatives in matrices has been worked out at CLRI. A special NMR probe has been designed for fluorine imaging and feasibility of fluorine imaging in leather matrix has been established. It is now possible using the tools and techniques developed to detect both hydrocarbon and fluorine signals in the same matrix. Two-dimensional and three-dimensional imaging systems for fluorine signals for both quantitative and topological assays are being developed for wider applications.

2.3.16 ECONCL process

NCL has developed a batch/ continuous process designated as ECONCL to treat the black liquor effluent from pulp & paper mills. The presence of lignin and other organics in the effluent contributes to the high level of COD (Chemical Oxygen Demand) and makes it difficult for the aqueous effluent to be disposed off. In the ECONCL process due to chemical and physical changes lignin and other organics from the aqueous stream gets precipitated. The precipitate settles at the bottom leaving the clarified water above, which is suitable for reuse in the plant or can be disposed in the surface water. The lignin fraction is removed and filtered to reduce its water content and can be used for various purposes. In a single step the process reduces colour, BOD, COD and total dissolved solids thereby reducing total pollution load and saving energy upto 50% in subsequent anti oxidation in the treatment plant. The process is covered by patents.

2.3.17 Ultrafiltration membrane for water purification

NCL has developed and patented an ultrafiltration membrane having pores small enough to exclude virus and bacteria to yet porous to water at 0.5 bars pressure. The membrane has 5-log reduction for virus and 7-log reduction for bacteria. The flat sheet membrane is wound in the form of a spiral module and fixed in a housing which can be used individually or coupled together to a prefilteration device, for filtering water. The life of the membrane has been found to be more than three years under normal conditions. Several

UF devices, for use in diverse field conditions were made and supplied for trials. The technology for the membrane device has been licensed to a Pune based firm.

2.3.18 Arsenic monitor

NCL has developed an arsenic monitor kit for measuring arsenic in drinking water. The kit is highly sensitive as it can detect arsenic at concentration levels of 5 PPB. It does not use any electric source and thus can be used even at village level. Cost of the kit is less than Rs. 5000 and cost of a test is Rs. 20 only. NCL was fabricating 100 kits for use by the villagers of West Bengal. NCL has also developed field test kits for monitoring nitrates and fluorides in drinking water.

2.3.19 HRD efforts by CLRI

CLRI continued to provide vocational and professional training programmes for the benefit of the leather industry. Seventy persons received diplomas and certificates. These training programmes are conducted at CLRI and the regional centers of CLRI at Ahmedabad, Calcutta, Jalandhar and Kanpur. Strengthening of under graduate and postgraduate degree courses in leather technology and footwear science and engineering continued. About 50 students graduated from Anna University through educational programmes.

2.3.20 IICT-BITS (Pilani) integrated MS in chemical technology

This off campus course offers Master's degree in chemical technology from BITS, Pilani for sponsored employees of IICT with a minimum of two year's work experience and possessing B.Sc. and Diploma in Engineering. The six semester programme covers subjects like engineering mathematics, thermodynamics, transport phenomena, computer-aided analysis and design, catalysis and reaction engineering, etc.

2.3.21 Instrumental methods of analysis for forensic scientists

IICT and the National Institute of Criminology & Forensic Science (NICFS), New Delhi jointly conducted two-weeks Workshop-cum-Training on 'Instrumental Methods of Analysis for Forensic Scientists'. About twenty three scientists from State & Central forensic science laboratories participated in the programme.

2.3.22 Safety management courses

IICT organised a risk based safety management course for BPCL, POL depot managers. Twenty five participants from the company attended the course.

2.3.23 Training programmes on polyolefines

Four training programmes on polyolefins were conducted by NCL for Reliance Industries Ltd. Two programmes were meant for junior management cadre and two programmes for the middle management of the company.

2.4 EARTH SCIENCES AND TECHNOLOGY

2.4.1 Microtectonics in the neotectonically active part of the Himalayan wedge

C-MMACS has initiated work towards the understanding of kinematics of deformation in the Himalayan mountain belt from the point of view of critical wedge theory which is emerging as the contemporary paradigm for understanding deformation in sedimentary wedges that evolve into a mountain belt in compressive regimes like the Himalayas. Work on the Darjiling-Sikkim-Tibet (DaSiT) Himalayan wedge has revealed that the middle part of the wedge is the location for neotectonic deformation as evident from earthquake hypocenter data and geologic evidence. Deformation microstructures developed in the quartz grains from the sandstone in the South Kalijhora Thrust (SKT) sheet close to the Main Boundary Thrust indicate that dislocation creep was due to the dominant quasi-plastic deformation mechanism here. These quasi-plastic deformation microstructures were overprinted by microfracturing, related to elastico-frictional deformation, throughout the SKT sheet. These observations point to the fact that the deformation mechanisms changed fairly rapidly (in geological time-scales) from quasi-plastic during the initial stages of propagation of the SKT to elastico-frictional deformation mechanism at approximately the same depth. This points to fairly rapid erosion in the DaSiT wedge over the SKT sheet which probably led to the subsequent duplex formation in the middle part of the wedge.

2.4.2 Equivalent continuum analysis of jointed rocks

A simple practical method has been developed at C-MMACS to characterize the strength and stiffness of jointed rock masses. This method utilizes the concept of an equivalent continuum where the joints in the rock mass are taken into account through joint factors. The approach has been validated against experimental results for jointed rock masses with different joint fabrics and joint orientations and also with the results from explicit modeling of joints using FEM.

The model has been applied to calculate the deformation around a large power station cavern in shyloite rock at 200 m depth. The results match the observations to reasonable accuracies.

2.4.3 Acoustic emission monitoring

NGRI has developed a rapid multi-channel data collection system to elucidate the dynamics of fault nucleation using AE hypocenters under conditions of constant stress (creep) loading. These conditions yield a better approximation to low strain rate condition in the Earth and allow for both quasi-static and dynamic crack growth to occur. This would assist in a better understanding of earthquakes and rock bursts.

2.4.4 Seismic structure of the Indian shield

For the first time upper the stratigraphy of the upper mantle, beneath the central Indian shield has been investigated by NGRI using teleseismic 'P' waves recorded at Geoscope station at Hyderabad. Based on the analysis of P waves 297 earthquakes, a seismic discontinuity at 90km depth was inferred. The two principal mantle discontinuities inferred at depths of 406 and 659 km, which were close to the global average.

2.4.5 Lithospheric flexure associated with Krishna – Godavari basin

Gravity anomalies constrained by seismic data have been used by NGRI to examine the long term mechanical properties of the lithosphere beneath the Krishna – Godavari basin. The results suggested that the lithosphere, which was weak, during the early rifting stage has gained strength during sedimentation. The on shore dipping double gravity anomaly at the margin reflected a weak rifted continental lithosphere abutting a strong oceanic lithosphere. Comparison with the results of the similar investigations for the Bengal basin in the north and Cauvery basin in the south suggested increasing strength for the lithosphere from north to south.

2.4.6 Gas hydrates

NGRI under the on-going programme on gas hydrates processed more than 2000 line km of multichannel seismic data of Kerala-Konkan offshore region using advanced processing software and interpreted the seismic section to demarcate potential gas hydrate bearing zones.

2.4.7 Influence of river Indus on shelf sedimentation

Based upon the analysis of about 10,000 line km of echosounding and bathymetric data and variations in mass accumulation rate along the NW continental margin of India (between Kori creek and Mumbai), it has been deduced by NIO that in the northern region (in the vicinity of the river Indus) the shelf-break occurs at a shallower depth. The gradient of the continental slope is also reduced from the northern region to the southern region. Rate of sedimentation is observed to be higher in the northern area which reduces southwards. From the above results it may be deduced that the main source of terrigenous detritus along the NW continental slope is from the Himalayan river Indus, with negligible supply from the peninsular rivers, particularly on the outer-shelf/upper-slope regions of the southern area between Daman and Mumbai. Evidently, this leads to the piling up of the sediments on the slope, narrowing its width, fills the shelf, and also buries the physiographic features. High terrigenous supply is also found to induce the mass/gravity transfer due to piling and re-suspension of sediments on the shelf edge. Based upon the gradient of the slope, its width, and occurrence of exposed physiographic features, the areas which are under the intense influence of Indus sedimentation have been schematically demarcated.

2.4.8 Modeling the Gulf of Kachchh

The Gulf of Kachchh is a semi-enclosed embayment where the tidal forcing play a dominant role in driving the waters. Also, the open

ocean waters of the Arabian sea across the western boundary interact with the Gulf significantly. A 2-dimensional hydrodynamical model has been developed by NIO to simulate the tides and currents in the Gulf. Several runs of the model have been carried out to test its efficacy in reproducing tides and currents in the computational domain. The model is validated by comparing the simulated currents with the measured currents off Vadinar, Sikka and Mundra. The results showed good agreement between the measured and simulated tides and currents. The circulation showed a net transport towards Kandla along the northern rim of the gulf with a tendency to re-circulate, forming a clockwise circulation. On the contrary, the particles dropped in the central and western half of the Gulf, showed a net movement towards north, and then towards west along the northern rim of the Gulf, forming an anti-clockwise circulation. The western part of Gulf showed an inflow off Okha (southern Gulf) and outward flow off Chachhi (northern Gulf), forming a cyclonic circulation in the open boundary. The residual circulation also revealed the presence of several eddies in the Gulf.

2.4.9 Phosphatic nodules

A sediment core collected from a bathymetric high off Goa on the western continental margin of India has yielded phosphatic nodules at various subsurface depths. The nodules are <1-5 cm in size, have carbonate flourapatite (CFA) as a single authigenic mineral phase, are free of detrital inclusions and have very high P_2O_5 content (30%). In addition, soft and hard phosphatic nodules have also been recovered by NIO from the eastern continental margin of India.

2.4.10 Study on phosphorites

Detailed investigations conducted by NIO on the quaternary phosphorites recovered from the continent margin off Chennai have indicated that these were laminated phosphatized microbial mats consisting of mechanically deposited clastic particles or of molds. SEM studies revealed that the laminated phosphate matrix is made up of thin sheets of tightly packed apatite globules, densely packed intertwined microfilaments. Cell-like structures resembling coccoid cyanobacteria or their botryoidal aggregates are common. Carbonate fluorapatite (CFA), low-magnesium and high-magnesium calcite are the major minerals. The microbial mats were most probably formed on the outer shelf during conditions of low sea level in which the microbial processes played a major role in direct phosphatisation of the mats.

Detailed investigations on two types of high-grade Pleistocene phosphorites recovered from the western margin of India indicate that these were also comprised of hard, grey nodule composed of CFA and calcite as major minerals.

2.4.11 Marine archaeological exploration in Bet Dwarka

Archaeological explorations in Bet Dwarka by NIO revealed a circular lead ingot and an amphora pottery along with triangular and prismatic stone anchors at a water depth of 6 m opposite to the present day jetty. Intact bowl, and other early historic potsherds were found opposite to Khuda Dost Dargah at 4 - 6 m water depth. The amphora and the circular lead ingot of this type are reported for the first time from Indian waters. At Somnath, more than 20 single holed stone objects, triangular and prismatic stone anchors were noticed at 6-12 m water depth on the north-western side of present Somnath temple.

2.4.12 Automatic mechanical load tester for PV modules

NPL developed automatic mechanical load tester for PV modules has been set up at Solar Energy Centre (SEC), Gwai Pahari. PV modules were tested at simulated wind, snow, ice loads under static and dynamic load conditions.

2.4.13 Free air carbondioxide enrichment facility (Mid-FACE)

NPL has developed a medium-size Free Air Carbondioxide Enrichment Facility (Mid-FACE) for simulating the emission of carbondioxide gas in the atmosphere over an open field. This has been made available for use to agricultural scientific community of South Asia.

2.4.14 Primary standard of radiance

The primary standard of radiance, the black body source is being installed at NPL. With this facility becoming operational, NPL will be ranked amongst the few laboratories in the world which possess such a precise, highly stable, high

temperature source. This source can be used as a primary standard of radiance for pyrometry and in the optical, ultraviolet and infrared spectral regions.

2.4.15 Portable relative humidity (RH) generator

A portable relative humidity generator based on two-pressure principle has been developed at NPL. Presently RH (at ambient temperature) in the range of 10-95% can be generated. Efforts are being made to incorporate temperature control so that RH at an elevated temperature can be generated. This has enabled calibration services of hygrometers (RH range 10-95%) to be provided.

2.4.16 Programmes conducted by CMRI:

- *Five-day course on electrical maintenance* procedure for explosion proof and flameproof equipment, statutory requirements thereof and prevention of oil fire.
- Course on mine environment, safety and health.
- Four-day executive development programme on stability analysis and ground control for underground coal mines.
- Executive training programme on recent advancement in underground climatic engineering, pressure balancing and cryogenic technology to improve ventilation and safety in mines.
- A workshop on review of existing mining and environmental policies, legislations, standards and mechanisms for monitoring compliance.

2.4.17 Basin modelling course

A contact course on basin modelling was organised under SERC programme of the Department of Science and Technology (DST) at C-MMACS. The course was open to post-graduate students, researchers and teachers with a background in earth sciences. Eleven participants were selected for the course and they represented universities, research institutions and government organisations. This course brought out the applications of mathematics in basin modelling and exploration for natural resources such as oil, gas, groundwater etc.

2.4.18 International training course on ocean remote sensing

A 3-day international training course on ocean remote sensing was organised by NIO prior to the Pacific Ocean Remote Sensing Conference (PORSEC). The training course was aimed at equipping Indian Ocean rim countries to build up capabilities to utilise the vast potential and opportunity of ocean remote sensing in ocean color, microwave remote sensing and high resolution data utility for coastal studies. In all 28 trainees participated out of which 7 were foreign participants from Vietnam, Indonesia, Mauritius and Iran.

2.4.19 Mass spectrometry workshop

The Ninth Workshop on Mass Spectrometry was conducted at NIO during 12-16 December. The Workshop jointly organized by NIO and Indian Society for Mass Spectrometry (ISMAS), Mumbai. The workshop, attended by 150 specialists from India and overseas, covered different areas of application of mass spectrometery in food, agriculture and defence.

2.5 ENGINEERING SCIENCES & TECHNOLOGY

2.5.1 Silicon micromachining technology

Anisotropic etching characteristics of silicon have been extensively used for realizing a variety of microstructures for different applications. Aqueous alkaline etchants show preferential etching in certain orientations. A three component etchant based on KOH, water and 2-propanol was employed by CEERI to fabricate long and deep microchannels with smooth side walls and bottoms in (110)-oriented silicon wafers. These microchannels can be used as heat sink for the realization of high power laser sources but, such channels could also be used in many other applications/areas as well.

2.5.2 Seismic data recorder and analyser

CSIO has developed a state-of-the-art intelligent seismic data recorder and analyser along

with user friendly software for signal processing and seismic signal analysis. The seismic signal analysis software helps the user to quickly detect various parameters of the seismic event. The signal analysis software has also been found suitable for study of vibration and in site selection of buildings from consideration.

2.5.3 Snow data acquisition system

Management of snow avalanche disaster requires study of various snow parameters like snow temperature at various layers, snow depth, snow pressure, strain, ambient temperature etc. Among all these, the temperature measurement at various layers of snow is very important. Because the sudden change of temperature at various layers of snow helps in prediction of snow avalanche. CSIO has developed a low power consuming, portable, stand alone 28 channel data acquisition system for snow temperature profiling.

2.5.4 Glow discharge lamp – atomic emission spectrometer

CSIO has developed a glow discharge lamp atomic emission spectrometer that has a large linear calibration curve, minimum background and matrix effect, surface and depth profile analysis capabilities alongwith analytical capabilities of determining traces, in conducting and non-conducting samples. The development has the potential to convert direct reading spectrometer which may otherwise become obsolete to be retro fitted with the glow discharge lamp and enhance their capabilities.

2.5.5 Portable stack opacity monitor

A portable stack, opacity monitor has been developed at CSIO. It is a low cost, high volume, electro-optical instrument, which can be used for monitoring pollution emanating from stacks & chimneys. The smoke opacity is measured in percentage as per ISO-14000. The instrument is based on the principle of attenuation of collimated beam of light emanating from a halogen lamp. It is calibrated by standard neutral density filter and measures the smoke opacity from 0 to 100%.

2.5.6 Semi-automatic pick & place machine

CSIO has developed a semi-automatic pick and place machine (SAPP) for Fine Pitch and Standard Surface Mount Devices (SMDs). It is a low cost, high precision, vision guided, computer controlled electro mechanical machine has an assembly speed of upto 600 components per hour.

2.5.7 Tea-leaf plucking machine

IHBT in collaboration with CMERI has developed a tea-leaf plucking machine. The machine employs a scheme where the plucked leaves are collected in a collection bag with the help of an integrated blower. It uses an air-cooled, 2 stroke 40.6cc petrol engine capable of developing 2 HP at 7200 rpm and a cutter bar length of 1200 mm, these together generate a harvesting capacity of 1 hectare/day. Most of the parts of this light-weight, robust and durable machine have been made out of aluminium and can be carried by two persons along the hill slope.

2.5.8 5 MW S-band pulsed klystron

The design and development of Klystron RF power of 5.0 MW and average power of 10 kW operating in S-band) has been made for the first time in the country. This involves design and development of parts/sub-assemblies and development of complex technologies. The operating beam power is 130 kVx95. A first lab prototype has been tested upto beam voltage of 100 kV with stable peak RF power of 3.5 MW.

2.5.9 Helix TWTs

Design was carried out by CEERI for the helix slow-wave structure and 4-stage depressed collector to achieve overall efficiency in Space Traveling Wave Tube (TWT). These TWTs would be used for satellite transponders as high power amplifier. The complete design of parts with dimensional details was handed over to BEL for its fabrication.

2.5.10 60 HP tractors

Development of agricultural machinery to suit the indigenous needs and conditions has been a continuing activity of CMERI. It has now designed a 35 HP tractor upgradable to 60 HP with features suited to Indian farm terrain and local implements. The knowhow has been licensed to a firm in Punjab.

2.5.11 Construction plaster

CBRI has developed an improved construction plaster by blending hemihydrate,

anhydrite (II) and soluble anhydrite in different proportions. This gives a compressive strength of 15-17 Mpa. It could be used in both type of plastering i.e. finish coat and base coat. It gives highly glossy surface and replaces "neeru" used over coarse plastering. The construction plaster can be blended with exfoliated vermiculite or perlite aggregates for making lightweight thermal insulative plasters. It is envisaged that the use of this type of plaster will consume large quantities of waste phospho and fluorogypsum.

2.5.12 Fibre reinforced composite shuttering

Fibre reinforced composite sheets have been developed by CBRI for use as an alternative material for wood and plywood shuttering. FRP had demonstrated their superiority over wood and its derivatives such as plywood, hard/chip wood etc. in such a way that they are ready for immediate use and do not require a finishing process, thereby reducing the cost of labour at site. They are lightweight, smooth, corrosion resistant, water-proof, easy to release and are expected to have more reuse cycles.

2.5.13 Utilization of marble dust in production of building bricks & blocks

A huge quantity of marble slurry waste is produced in processing of marble blocks for making slabs and tiles. This marble waste in powder form (marble dust) causes serious problem of health hazards and environmental pollution. CBRI has developed building bricks and blocks from the marble dust. CBRI developed CBRICK Machine and block making machine have been utilized for the casting of bricks and blocks. This has been done under a study supported by the DSIR.

2.5.14 Seismic design of reinforced concrete framed buildings

A knowledgebase seismic design software incorporating guidelines on: assuring the symmetry of mass and stiffness distribution; avoiding hinge formation at junctions and columns; providing energy absorption capacity, and avoiding structural discontinuity etc. developed at SERC has been tested and validated. The software was advantageously used in evaluating the safety of buildings in Ahmedabad after the recent earthquake.

2.5.15 Behaviour of RC beam column joints under cyclic load reversals

SERC, Madras conducted studies under a project sponsored by Board of Research in Nuclear Sciences to establish a database on the behaviour, strength and ductility of existing reinforced concrete beam-column connections used in Nuclear Power Plant (NPP) structures.

2.5.16 Coating system for high strength steel

CECRI has developed a coating system for application over high strength steel for protection against aggressive environment especially marine environment. The main problem tackled was the adhesion of the coating to the substrate material as the surface profile of the material was to be kept at very low value. An integrated system was developed which could give excellent adhesion to the basis metal without affecting any of the properties of the material.

2.5.17 Galvanized and zinc based alloy coated reinforcing bars

A systematic performance evaluation has been carried out by CECRI for the galvanized rebars with and without chromate treatment in tropical marine environment. This elaborate study utilized various electrochemical techniques such as potential time studies, electrochemical impedance spectroscopy, linear polarization and gravimetric method. The performance was evaluated under dynamic loading conditions using cantilever model slabs inter cracked condition. The effect of galvanizing on the rebar was compared with the uncoated rebars in different exposure conditions, namely laboratory, marine and marine cum industrial environment.

2.5.18 Teaching package on structural steel design

A teaching package on structural steel design, to improve the knowledge of competence of civil engineers and teaching faculty of engineering colleges, was developed by SERC, Madras in collaboration with IIT, Chennai and Anna University, Chennai. The project was sponsored by Institute for Steel Development and Growth (INSDAG), Kolkata.

2.5.19 Passive control method for structures subjected to seismic loads

Passive energy dissipaters, may be economical and efficient in reducing the dynamic response of a given structure to seismic excitation. Viscoelastic (rubber based) and elastoplastic (metal based) types of passive energy dissipaters have been developed at SERC.

2.5.20 Pradhan Mantri gram sarak yojana

The Prime Minister launched a nationwide 'gram sarak yojana programme'. The objective of the programme is to provide all weather road connectivity to all rural habitations with a population of more than 500 people by the year 2007. In this endeavour the Ministry of Rural Development, Govt. of India, has designated CRRI as the Principal Technical Agency for providing technical guidance to all the States and Union Territories of India. Design and specification of rural roads in diverse locations and the associated, training of field engineers and implementation and monitoring of the various phases of the programme are to be overseen by CRRI. CRRI organised a series of workshops on Rural Road Connectivity at Chennai, Kolkata and Guwahati with the active participation of various state level and regional level institutions. Various Universities and IITs, Regional Engineering Colleges and State Engineering Research Cells were identified for networking purpose. In the first existence standard formats have been developed for preparation of packages for the construction of rural roads connecting rural habitations with population of 1000 and for preparation of master plan of rural road network at the block level.

2.5.21 Pavement component layers properties

CRRI has developed a numerical scheme and a software package using FORTRAN 77 for determination of stresses, strains and displacements at any point in a multi-layered road system for a given surface load. Good comparison of the surface displacements given by the model and the experimental results obtained with Falling Weight Deflectometer (FWD) was obtained.

2.5.22 Traffic simulation model for Indian roads

CRRI has developed a traffic simulation model incorporating all types of roads and vehicles available in India. The model incorporates operating speeds, level of service, highway capacity and safety condition of the proposed roads and enables determination of the optimal road geometrics. The model has been validated using extensive field data collected from all the terrains of the country.

2.5.23 Traffic and transportation studies of Amravati

CRRI has carried out traffic and transportation studies of Amravati city to identify the current problems of traffic and to project the future needs of transportation. In the first phase, short term solutions for improving the traffic operations on the existing road system have been worked out. For the second phase, various surveys were conducted to analyse the travel needs of the residents. On the basis of data collected, travel simulation models are being developed to predict the travel needs and plan for the requisite transport system.

2.5.24 Software for design and maintenance of flexible pavements

CRRI has developed a software for design and maintenance of flexible pavements, both for new construction and for existing pavements. For existing pavements structural adequacy is checked and overlay provided if found inadequate as per guidelines of IRC-81, 1981, for new pavement the thickness is found using IRC 37, 2000.

2.5.25 Disaster knowledge network

Under GOI, UNDP umbrella programme, a 'Natural Disaster Network' which is a network of networks has been established at CRRI. The network will facilitate an interactive, simultaneous dialogue with all the players, major and minor both, within country and outside, dealing with natural disasters.

2.5.26 Training programmes by CRRI

CRRI organised various customised training programmes at various locations in the country at the request of user agencies:

- Quality improvement programme for the laboratory technicians of Contractors and supervision consultants engaged in NHAI project in North-South and East-West corridors;

- Training programme on traffic management for the personnel of Delhi traffic police;
- Design, construction and quality control of flexible pavements with special reference to rural roads for the engineers of Deptt. of Rural Development of Govt. of M.P.;
- Materials, design, construction and quality control for flexible pavements including road drainage in high rainfall hilly region for engineers of Mizoram, PWD, Aizwal;
- Materials, design, construction, quality control for flexible pavements and bridge works for engineers of Assam, PWD, Guwahati;
- Highway design and management (HDM-4) for the engineers of Ministry of Communication, Royal Govt. of Bhutan, Bhutan;
- Preparation of master plan for rural roads, Nagaon, Assam;
- Materials, design, construction, quality control for flexible pavements for the engineers of Mizoram, PWD, Aizwal; and
- For the engineers of Border Roads Organisation, Silchar.

2.5.27 Training programme on evolving an environmental vision

NEERI organised one day training programme on evolving an environmental vision for small scale industries with the support of Small Industries Development Bank of India. The training course was attended by more than 75 participants and 25 invitees from industrial, educational and marketing sectors.

2.6 FOOD SCIENCE & TECHNOLOGY

2.6.1 Acoustic enhancement of transmembrane flux

Acoustic field is employed for the enhancement of transmembrane diffusion of solute generally for drugs across skin. However no reports are available of the application of this principle for the enhancement of solvent flux in food sector. CFTRI established that enhancement of solute diffusion across membrane is due to the dependency of solute diffusion coefficient on process parameters like temperature and fluid flow; and the enhancement in solvent flux is based on the turbulence created in the boundary layer adjacent to the membrane, which in turn enhances the flux. This was demonstrated clearly by carrying out the experiments with concentrated non-Newtonian liquids. It gave insight into a new mechanism that occur in membrane process in presence of an acoustic field. The efforts may lead to development of strategies to tackle problem of low fluxes in membrane processes.

2.6.2 Enhanced phase demixing by microwave field

Aqueous phases demix slowly during aqueous two-phase extraction due to their close physical properties. There exists a need for development of a process for the enhancement of demixing rates so that expensive centrifuges can be replaced. CFTRI has applied microwave field for the aqueous two-phase dispersions and found that demixing rates are enhanced considerably. This method offers a simple alternate process that can be made continuous so that an efficient recycle reactor can be designed. It gives insight into the demixing process by throwing light on the relative contribution of the two processes, namely droplet coalescence and retardation of droplets by continuous phase.

2.6.3 Wheat flour fortification

A sizeable percentage of Indian population is malnourished. Fortification of staple food like wheat flour with vitamins and minerals is most effective tool to combat malnutrition problem. One third of the wheat produced in the country is consumed in the form of staple traditional foods after processing of wheat into 'atta' in small plate mill 'chakkis', CFTRI has developed for the first time a process to fortify the wheat flour at small scale chakki level. Separate nutrient pre-mixes containing iron, calcium and B-vitamins for different wheat products have been developed. Process of flour fortification ensures uniform delivery of nutrients into milled products. Different traditional and bakery products like bread, biscuit and chapati prepared from fortified flour have been found highly acceptable. The fortified milled products have storage stability of minimum four months.

2.6.4 Speciality biscuits

In the country over 50% of the population particularly above 40 years suffer from several diet related diseases. Low fat and high fibre food products are helpful in such disorders and are thus in demand. Most of information on `Health Bakery Products' is patented abroad. CFTRI is endeavouring to generate knowledgebase in this specialized area. Studies have been conducted to develop high dietary fibre and low fat biscuits. Biscuits thus developed using additives contained as high as 20% of bran flour and as low as 7% fat. The product has all the necessary quality attributes.

2.6.5 Mini Dhal mill – out reach to Indian rural areas

Mini Dhal Mill developed by CFTRI has the uniqueness of having three operations in a single unit i.e. dehulling of pulses, aspiration of husk and separation of Dhal, run by 1 HP single phase motor. It is an efficient replacement for traditional pulse milling units like chakkies, plate mills or hullers used for similar purpose. The Mini Dhal mill has changed the pulse milling activity in rural sector by giving better recovery of good quality Dhal (75-78%) and fillip to custom milling practices. The Mini Dhal mill is suitable for efficient dehulling of bold pulses like tur, Bengal gram, peas, etc. The quality of Dhal is comparable to that from large scale Dhal mills. Thirty-five manufacturers have obtained fabrication license from CFTRI and more than 400 pulse producing farmers are using this mill. The development of the unit has triggered pulse processing activity in rural areas as many schemes are declared by the Directorate of Agriculture, Ministry of Agriculture and Co-operation and by the respective State Governments for propagation of Mini Dhal mills in the rural areas. It has also been selected for country wide propagation under UNDP project and over 200 machines have been distributed.

2.6.6 Bitterless protein hydrolysate from soy flour

Hydrolysis of legumes or flour converts long chain proteins of higher molecular weight into peptides of low molecular weight which have better digestibility. CFTRI has developed a new process for production of bitterless protein hydrolysate from soy flour. It utilizes a by-product which was otherwise discarded as a waste in other existing processes. The process has been scaled up for commercial utilization.

2.6.7 Natural food colour from Monascus sp.

Microbes are increasingly recognized as a natural source of food colouring substances. Parent strain and mutants of *Monascus purpureus* have been worked out at CFTRI for the production of colour pigments. The protocols for separation of orange pigments have been standardized. Stability studies have been carried out for the pigments produced by mutants of *M. purpureus* at different temperatures and pH levels. Large scale trials were under progress.

2.6.8 Shelf life extension through biopreservation

The process for biopreservation of vegetables has been standardized at CFTRI using a potent bacteriocinogenic culture of *Lactobacillus plantarum*. Processed vegetables are packed in unit packs and have a minimum shelf stability of six months at ambient temperature. The fermented vegetables can be consumed as such or used in the preparation of culinary food items. The lactic acid bacterial preservation is beneficial as it: improves nutritive value, palatability and digestibility; suppresses food borne pathogens and spoilage bacteria; and requires no chemical preservatives.

2.6.9 Micro propagation system for *Decalepis hamiltonni*

Decalepis hamiltonni is used extensively in various ayurvedic formulations and for preparing pickles. CFTRI has discovered insecticide property in the aromatic roots of this plant and attributed the biological activity to 2-hydroxy 4-methoxy benzaldehyde. The plant is an endangered species and its cultivation practices are not yet established. There is inadequate supply of its root biomass. To overcome the problem CFTRI has worked out micropropagation protocol for root biomass generation using accelary / terminal buds. A novel method using ethylene inhibitors for pronounced rooting has also been developed.

2.6.10 Raw mango cutting equipment for pickle industry

CFTRI has developed a variety of raw mango cutting equipments viz., gadget for cutting

with stone & without stone, a cutting machine for splitting mango in two halves and a slice cutting machine. All the four gadgets involve novelty and ease of use. The gadgets offer efficiency and are made up of S.S. 304. The small scale pickles industries will be benefited by the development as these equipment could raise their productivity.

2.6.11 Analogue of natural whisky lactone and coconut aldehyde

IHBT has developed a simple and convenient method for preparing an analogue of natural whisky lactone and coconut aldehyde by transforming a chemical compound from a plant which grows abundantly in wild. Whisky lactone is found in traces in plants and several methods for its preparation have been reported but none of them is of industrial importance. The technique developed by IHBT is novel, economical and preparation of the analogue can be undertaken at commercial scale with ease. Analogue of whisky lactone is found in high quality alcoholic beverages Napolean whisky, Jamaica and cognac etc., as fragrance ingredient, insect pheromones etc. Coconut aldehyde is responsible for flavouring a wide range of food stuffs including baked goods and confectionary.

2.6.12 Analysis of food materials and samples

Over 2400 food samples from various sources both in the private, public and government sector were analyzed at CFTRI for quality evaluation to national/international standards. This quality certification helped the industry to adopt good manufacturing practice to achieve excellence and to augment the international trade, thereby facilitating greater returns.

2.6.13 Programmes conducted at CFTRI:

- Masters degree in food technology - a two year programme leading to the award of M.Sc. (Food Technology) Degree from University of Mysore. Twenty-four students from different states of India were admitted to the course during the year. Food industry in the country is immensely benefited by this programme in terms of meeting the requirements of adequately trained professionals.

- Certificate course in milling technology - a 10 months course specially designed for training of professionals to cater to the needs of roller flour milling industries in India and other developing countries. Twenty one students deputed from the flour milling industries in India, Ethiopia, Ghana, Kazakhistan, Mongolia, Uganda and Vietnam have completed the course. This course is one of its kind not only in India but also in whole Asia.

- Ph.D. Programmes - thirty five students registered for Ph.D. in subjects related to Food Technology.

- Short term projects - as a part of curriculum in most of the Universities and Engineering Colleges, the students have to undertake a short term project of 4-6 weeks to one year duration in an outside institute / organization. CFTRI offers the training to such students in its various R&D departments. One hundred and twenty four students were trained for a period of four weeks to one-year duration under this programme during the period under report.

- Short term training courses - a total of 37 courses during the year were organized of 1-2 weeks duration on different aspects of food science, food technology and food engineering. In these 413 participants were trained from industry, R&D institutions, Government agencies and universities.

2.7 INFORMATION SCIENCE & TECHNOLOGY

2.7.1 Blasting software

A blasting software (Exploedge) has been developed by CMRI alongwith Tata Infotech Ltd. for modulation and optimization of rock blasting using commercial explosives. Various input and output parameters of Exploedge were tested at a colliery of TISCO. Based on the experimental results a number of measures have been suggested by CMRI for effective day-to-day drilling and blasting operations.

2.7.2 Rock formation - analysis of geo-technical properties

CMRI has developed an object oriented data base management system for analysis of data pertaining to geo-technical properties of rock formation. This software is useful for scientific planning of a longwall panel, estimating support resistance and understanding the caving behaviour of the overlying rocks.

2.7.3 Condition monitoring of bearings

A software has been developed at CMRI for condition monitoring of bearings. This software is expected to be helpful for maintenance engineers in keeping data on bearings, condition monitoring observations and to evaluate, display and plot the bearing performance indices.

2.7.4 CD-ROM databases

INSDOC has updated the following databases available in CDs:

- **National Union Catalogue of Scientific Serials in India (NUCSSI) Database:** It is a valuable information product which helps in locating the availability of about 41,000 S&T serials in the country. The database covers nearly 2,23,000 holdings data of over 423 S&T libraries in the country. A user friendly menu-driven retrieval software helps in searching the database on city/region, title, subject, keyword, individual library holdings. The database on CD helps the library professionals to rationalise acquisition policy of serials by encouraging resource sharing and economise their serial subscription.

- **Indian Patents (INPAT Database):** INPAT on CD-ROM is a bibliographic database which provides information on nearly 47,000 records on patents granted in India from the year 1972 to June 2000. The database can be searched by a variety of parameters including keywords, applicant and inventor names, patent number, international classification code and country name. This is the first comprehensive electronic database on Indian patents.

- **Indian Science Abstracts (ISA) 1990-1999:** This is a cumulative machine readable database of Indian Science Abstracts for the period 1990-1999. Twenty four issues of ISA are published every year and this CD-ROM database covers 10 years data having about 2.7 lakhs records. This database is an excellent replacement for hardcopy of ISA resulting in considerable saving in shelf space and providing electronically searchable information on Indian Science. The database covers original scientific research work published in about 1000 Indian journals.

2.7.5 INSDOC-KIT abstracting

INSDOC has entered into an agreement with the Royal Tropical Institute (KIT) of the Netherlands to contribute bibliographic data to KIT's TROPAG database. KIT provides a monthly list of titles of articles published in Indian journals for which INSDOC prepares full bibliographic details (cataloguing, indexing, abstracting) in a format defined by KIT. A total of about 1000 records were processed during the year.

2.7.6 Research Journals

NISCOM continued to provide communication links amongst members of the scientific research community through publishing of thirteen scholarly journals of international repute. The total number of papers published were 1409 and the total number of pages printed in the research journals were 8519. In order to acquaint young research scientists with frontline research areas special issues were brought out on specific themes of contemporary relevance. The various special issues brought out were: Materials Science: Trends and Future (*Indian Journal of Engineering and Materials Sciences*, April-May 2000), Super-symmetry Breaking (*Indian Journal of Pure & Applied Physics*, June 2000), Results from First Five Years of Operation in MST Mode (*Indian Journal of Radio & Space Physics*, Aug. 2000), Photosynthesis Research in the Post-genomic Era (*Indian Journal of Biochemistry & Biophysics*, Dec. 2000), Accelerator Technology (*Indian Journal of Pure & Applied Physics*, Jan-Feb. 2001), Indicators of Industrial Innovation: Perspective (*Journal of Scientific & Industrial Research*, March 2001) and Environmental issues: Technology Options for Textile Industry (*Indian Journal of Fiber & Textile Research*, March – June 2001. To keep the scientific community abreast with the current developments in different areas of

science and technology. Advance Abstracts of the journals were brought out regularly and sent to various R&D departments, research institutes and universities in addition to major abstracting, indexing and current awareness services.

2.7.7 IGNOU study centre

INSDOC Headquarters and its Regional Centre, Chennai have been identified as the *Programme Study Centre for the diverse* programmes of Indira Gandhi National Open University (IGNOU), New Delhi, namely, Master *of Library and Information Science (MLIS)*, Certificate in Computing (CIC), Diploma in Computer in Office Management (DCO), Bachelor *in Computer Applications (BCA), Master in* Computer applications (MCA). INSDOC conducted counseling sessions, practical training/ *seminars for the various courses of the above* mentioned programmes. In all 3500 students were trained for various programmes of IGNOU.

2.8 MATERIAL SCIENCE & TECHNOLOGY

2.8.1 Biomimetic synthesis of nano sized inorganic materials

Nano sized inorganic materials possess exotic and unique physical and chemical properties. They are however difficult to produce chemically on a large scale. Various routes of synthesis of these materials suffer with poor control over size, morphology and agglomeration. Biomineralization has been found to be good approach in the synthesis of nano materials. Biomineralization, whose examples can be found in nature, is based on the in situ nucleation and oriented growth of inorganic crystallites in a bio polymeric matrix. These crystallites are characterized by uniform size, morphology, orientation and hierarchical structures and exist without agglomeration. Depending on the function of a biological organ different polymorphs of the same mineral are produced under almost similar conditions. In NML, it was successfully demonstrated that the strong acidic polysaccharides involved in the biomineralisation can be replaced by commonly available water soluble polymer's hydrogels which not only provide a pre organized matrix but also chelates the cations through a combined effect of secondary bonding and physical entrapment. It has also been established that the nano sized cages present in the quaternary structures of commonly available proteins can be exploited as the nano sized reactors for the chemical synthesis of inorganic nano crystallites. The protein cages being formed as a result of hydrophobic and hydrophilic interactions regulate the morphology and orientation of the precipitated phase.

2.8.2 Carbon nanotubes synthesis

Carbon nanotubes are new generation materials with nanometer dimensions. Carbon nanotubes were prepared at NPL both as cathode deposit as well as deposits inside the chamber by applying DC arc discharge technique by using special graphite electrodes developed in-house.

2.8.3 Molecular self-assembly

Photo-dimmerized bilayer films of amino propyl triethoxy silane (APTES) attached with cinnamoyl moieties have been shown to produce good uniform planer orientation of nematic liquid crystals. NPL has grown such ordered, densely packed bilayer assembly by self-assembly (SA) technique on indium-tin oxide (ITO) coated glass substrates and quartz plates. The bilayer film was photo-dimmerized by irradiating it with a linearly polarized UV-light to create an ordered anisotropic surface structure at the glass substrate, which in turn forces the uniform alignment of liquid crystals. The alignment direction is governed by the polarization direction of the UV-light and can be varied locally. Liquid crystal display cell were made and line patterns with a resolution of ~20 micron have been successfully stored.

2.8.4 Coal for steel, power and domestic use

- CFRI was involved in planning, monitoring and supervising the supply of washed slurry from the mini-flotation plants installed on the basis of CFRI know-how to Burnpur Steel Plant. The washed product from the flotation plants was used partly as a substitute of imported coal, by IISCO as suggested by CFRI.

- CFRI was involved in the standardisation of the procedure of sampling and analysis at the unloading points of thermal power plants, washability studies on different non-coking

coals including dry deshaling studies by selective drop breakage tests and experimental rotary breaker.

- CFRI was involved in the construction/ supervision of 48 Soft coke oven developed with pusher system, for private entrepreneurs.

2.8.5 Seismograph calibration facility

A well equipped facility for the calibration of seismographs has been developed at CMRI during the year. This facility would be specially helpful to the mining industry of seismographs for safe blasting operations in mines, tunnels and other excavation and construction work.

2.8.6 Flyash based zeolites

NEERI has developed a process for production of flyash based zeolites (FAZs). Three zeolite phases viz. zeolite-A, zeolite-X and zeolite-Y have been identified with calcium binding capacity ranging between 500-600 meq/100g, 360-380 meq/100g and 400-500 meq/100g respectively. The high value of CBC for zeolite-A indicated its potential as a substitute for phosphatic detergent builder. Work was in progress to develop zeolitic membranes to target some selective toxic pollutants such as nitrate, chromate and arsenate etc.

2.8.7 SMC sulphide ore beneficiation plant: productivity improvements

Under North Eastern Region Development programme, RRL, Bhubaneswar undertook the task of improving the metallurgical process of the Sikkim Mining Corporation (SMC) Plant at Rangpo. The grade of copper has been improved to 24% in comparison to 18-19% Cu that was being produced in the plant. The Zn grade has also been improved to above 35% with recoveries exceeding 55%. Training to the operators was also imparted so that the results are consistently reproduced taking into account the wide fluctuations in the assay of the metal in the feed.

2.8.8 Pig iron low shaft furnace technology

A low shaft furnace of 25 ton/day capacity based on NML technology for the production of pig iron has been installed and commissioned for a client at Bhilai. The furnace has been operated to produce pig iron successfully from low grade indigenous raw materials.

2.8.9 Refractory balls for cokeless cupola

NML has successfully transferred the technology of making refractory balls developed by it to a Jamshedpur based entrepreneur for commercial exploitation. These refractory balls are used as load support and heat exchanger in the NML developed cokeless cupola. These refractory balls have given satisfactory performance during trial runs of cokeless cupola at NML pilot plant as well as Agra demonstration foundry.

2.8.10 Gallium recovery from bayer liquor

The use of ion exchange resin for gallium recovery from alkaline solution at RRL, Bhubaneswar has revealed that the chelating resin recovered gallium even from lean solutions (i.e. 100 mg/l) which was hitherto not possible by any technology known so far. An ion exchange column has been designed to produce 2 g/day/cell for gallium. Data has been generated on this column based on 1000 litre of bayer liquor collected from NALCO. With the growing demand for gallium worldwide, the necessity of providing an alternate technology for gallium metal is imminent. Gallium recovery from bayer liquor of alumina could be a promising step in this direction.

2.8.11 Skill-cum-technology upgradation programme for women entrepreneurs

NML organized a Skill-cum-Technology Upgradation Programme (STUP) for women entrepreneurs at Davanagere, Karnataka on production and marketing of gift items made from low cost materials in collaboration with CSIR Polytechnology Transfer Centre, Bangalore and in association with District Industries Centre, Davanagere and CSIR Rural Development Cell, New Delhi. It was sponsored by Small Industries Development Bank of India. A number of promising women entrepreneur participated in the programme and benefited by diverse techniques demonstrated for production of gift items from industrial material waste as well as cheaper low quality materials.

2.8.12 International symposium on processing of fines

An international symposium on processing of fines was held at NML. It provided a platform to diverse participants from different academic institutes, R&D organizations and industries, in India and abroad for exchanging their views and experiences in the field of national resources conservation and environmental pollutions control leading towards richer and cleaner millennium.

2.9 SOCIETAL SCIENCE & TECHNOLOGY

2.9.1 Iron making process used by tribals of India

Tribals of India produce iron for making implements by experience using locally available ores and charcoal made of sal wood. Today this art is on the verge of extinction. NML has made efforts to document and develop the process further. NML has established two prototype furnaces, namely Bishunpur type of Chhotanagpur region and Bastar type of Chhattisgarh region for experimentation and further development. Scientific data with respect to temperature profile, thermodynamics and kinetics, ore and charcoal characterization etc. have been generated. Design modifications have been done (without losing cultural identity of the furnace) to utilize the waste heat. The conventional strenuous foot driven skin made bellows have been replaced by mechanical device for ease of operation. The modifications have shown encouraging results in respect of yield, productivity and efficiency of the furnace.

2.9.2 Technology package for rural blacksmiths

Hand forging is the commonly used method by artisans in rural areas to make agricultural implements and tools. But the availability of the raw material varies from region to region that results in inferior quality products in terms of composition, hardness and wear resistance. NML has designed and developed a model to assess the quality of these products and also to provide S&T inputs to practicing blacksmiths. A technology package has also been developed that involves the preparation of standard raw materials of desired carbon level (backyard steel), forging and heat treatment schedule of 0.6-1.0% carbon steel, design and fabrication of fuel efficient furnace and mechanical hammer and demonstration and training of artisans. NML has imparted training to the supervisors and the associated artisans of the various field trials. The package has been highly acclaimed by the associated field groups.

2.9.3 Strategic Expansion of Carcass *Utilisation and Recovery for* Employment (SECURE): for expansion *of carcass recovery systems*

As a part of the resource augmentation efforts, CLRI had commissioned 31 fallen carcass utilization plants under the Leather Technology Mission and the Integrated Rural Development Progamme (IRDP) of the Government of India. Technology has been down sized to meet the needs of the artisans. Bankability has been established for a processing capacity of 3-4 fallen animals per day. As a part of the resource mobilization efforts of CLRI, a strategic expansion of the existing units is being done. Stakeholders have been consulted for working out a viable plan for strategic expansion of carcass utilization and recovery for enabling rural employment. Problem areas have been identified. Effective carcass mobilization mechanisms, technology packages for fuller utilization of carcass byproducts, machinery operation are being put in place.

2.9.4 Marrying tradition & technology in leather products: Shanthiniketan bag

In the changing global market scenario, ethnic products of long Indian tradition could be challenged on account of productivity disadvantages. Traditional products made by hand would need to compete with machine made product with cost advantages. A step has been taken by CLRI to identify some of the important ethnic products of Indian strength and develop technological measures to mechanize their production without loss of aesthetic value. An example is the Shanthiniketan bag. Now it is possible to produce the bag based on technological methods required for large-scale production. A similar effort has earlier been made for Kolhapuri chappal as well. These have been achieved through synergy of tradition with technology by CLRI.

2.9.5 Fashion forecasting for leather and garment colours

India now leads in fashion forecasting of leather colours at Modeurop. Forecasts of the leather colours for the year 2002 have been made. Of the total number of 19 colours forecasted for shoe trends in 2002, 14 are from India. Of the total of 10 colours forecasted for garments, 9 are from India. The shade cards for the year 2002 are being made for the world by India. A Modeurop Material Bank has been established at CLRI, with support from the National Leather Development Programme, for the potential exporters to source leather for sample preparations of new products. The forecasting exercise has also included trend forecast for designs and products.

2.9.6 Foot care solutions

Footwear is now a consumer product. CLRI has developed specialized footwear for foot care through special process and product innovations. These include footwear for diabetic and flat foot. These address special needs of people and are specifically customer oriented.

2.9.7 Energy efficient multi purpose biomass drier

RRL, Bhubaneswar has developed an energy efficient multi purpose drier which can dry food grains, food materials and industrial products and raw materials in a temperature range of 50°C to 200°C by using biomass as fuel. Drying is carried out in a complete pollution free environment. Due to very high thermal efficiency it saves energy in drying of various materials. It can be operated in all weather condition including rainy seasons. The device can replace electrically operated drier.

2.9.8 Electronic device for disinfecting drinking water on-line

ITRC has developed a device which could be used on-line for disinfection of water from *E. coli* and faecal coliforms based on the principle of anodic oxidation. The device would be useful in providing safe drinking water continuously to small community, nursing homes & clinics, schools, restaurants etc. at a flow rate of approximately 500 litres/ hour. The device has been patented.

2.9.9 Low cost water filter

RRL, Bhubaneswar has developed a low cost water filter for filtration of raw turbid water into clean drinking water at a domestic scale. It is done through a terracotta filterdisc called terafil. Terafil is made of a mixture of clay, sand and sawdust. This is sintered at high temperature which creates micro porous structure. This terafil plate can be fitted with any container to serve as domestic water filter. All sediments and suspended particles alongwith significant quantity of excessive heavy metals and minerals like iron, nickel chromium, lead, fluoride etc. are also separated during filtration.

2.9.10 Garden for the blind

NBRI has developed under its newly launched eco-education programme, a garden for the blinds in the Botanic Garden campus of the Institute. In this garden a wide variety of plants which bear either fragrant flowers or have aromatic rough leaves have been planted so that blinds can enjoy the beauty of the plants by way of smell and touch. Braille system has been used to educate the visually impaired persons for describing the features and plants.

2.9.11 Cultivation of Himgold

The extension activities carried out by IHBT have led to extensive cultivation of Himgold, a variety of *Tagetes minuta*, in northern plains of Punjab, Haryana, Uttar Pradesh and Uttranchal. Farmers of these states were earlier growing this as rabi crop which failed to produce quality seed material for standard quality oil. Studies at IHBT revealed that autumn winter crop practice in northern region produced quality seeds of high germination capability (>75%) and standard quality of essential oil with balanced ratio of three monoterpene ketones. The seeds were given to growers at different locations in North India for its multiplication. With IHBT knowhow on cultivation, processing and quality evaluation around 3.5 tons of Tagetes oil is produced annually in the state of Himachal Pradesh alone.

2.9.12 Essential oil formulation coated urea in water-logged paddy fields

CIMAP looking into the promising results of natural product coated urea in enhancing herb

and essential oil yield of menthol mint, fertiliser use efficiency and inhibition of urease and nitrification, made efforts to verify the efficacy of the technology in farmers' field. Coated urea was applied to transplanted rice in 0.25 hectares of area and another part of same area was applied with non-coated prilled urea for comparison. It was established that fertiliser N use efficiency could be augmented by coating urea with natural essential oil by-product. About 25-35% of the urea N can be saved for the same targeted yield through this technology. The average fertiliser utilization efficiency also increased by 20-40%.

2.9.13 Fly ash use in agriculture

CFRI demonstrated fly ash soil amendment technology developed earlier on a large scale in farmer's fields/wasteland, in the vicinity of different thermal power plants in different soil types and climatic conditions on the cultivation of different crops and plantation of different plant species. The beneficial effects of fly ash/pond ash was demonstrated in improving the growth and yield of cereals, vegetables and cash crops; improving the fertility status of soil; lesser incidence of pests and weeds; early maturity of crops; and better workability in the field with no adverse effect on soil profile and field/ground water.

2.9.14 Program for women centred development

A programme on women centered development in footwear trade sponsored by Science City, Chennai was organized by CLRI at the Common Facility Centre (CFC), Perambur. About 150 women from the Arundhathiar community engaged in footwear production participated in this programme. Awareness on gender specific issues, skill based production, quality in footwear production, marketing opportunities for footwear made by the artisans, finance mobilisation mechanisms, investment opportunities was provided. Hands on practical training was also provided on footwear machinery at the Perambur commissioned under Leather Technology Mission. As a result of the awareness programme many of the artisans enrolled for the CFC membership.

III. RESEARCH AND DEVELOPMENT BY INDUSTRY (RDI)

The plan scheme "Research and Development by Industry" was approved with an allocation of Rs.1.40 crores for the IX plan (1997-2002). The broad objectives of the scheme are to:

- bring in-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and Scientific and Industrial Research Organizations (SIROs);
- promote R&D initiatives of the industry and SIROs;
- ensure that the contributions made by the in-house R&D Centres and SIROs dovetail adequately in the overall context of technological and industrial development.

The scheme on Research and Development by industry covers the following areas:

A) In-house R&D in Industry

B) R&D by Scientific and Industrial Research Organisations (SIROs)

C) Fiscal Incentives for Scientific Research

Activities and achievements in each of above areas are presented below:

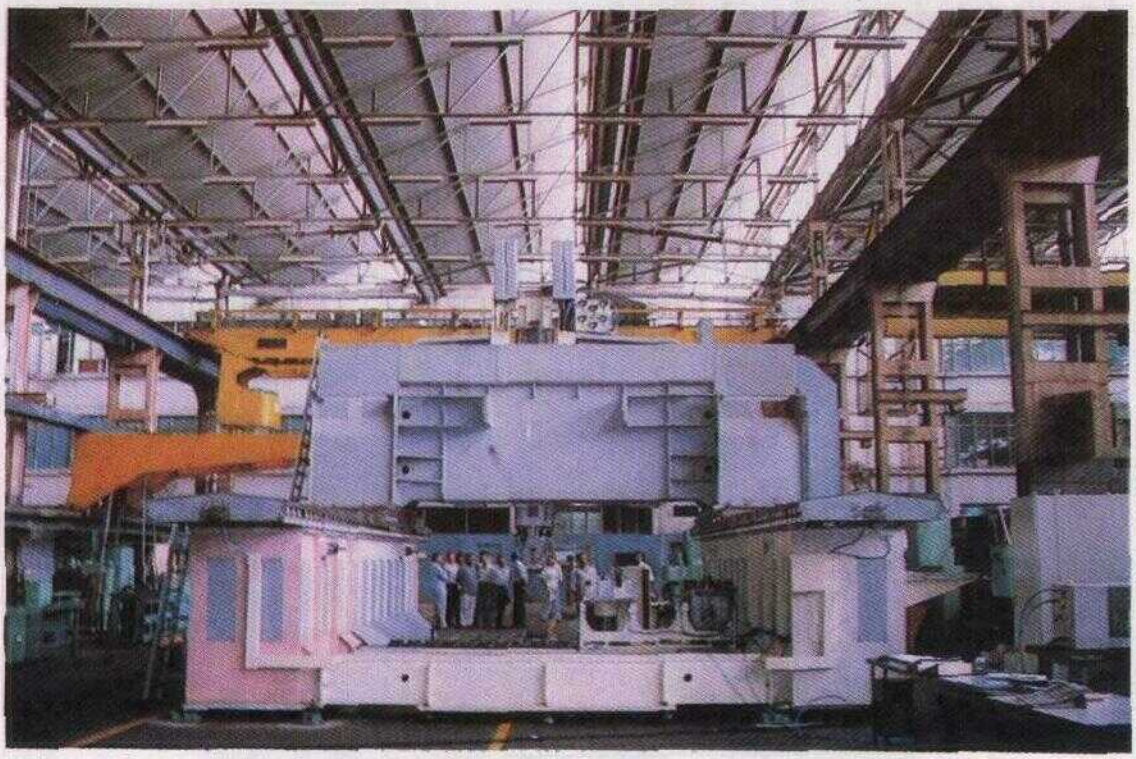
III.(A) IN-HOUSE R&D IN INDUSTRY

1. RECOGNITION OF IN-HOUSE R&D UNITS

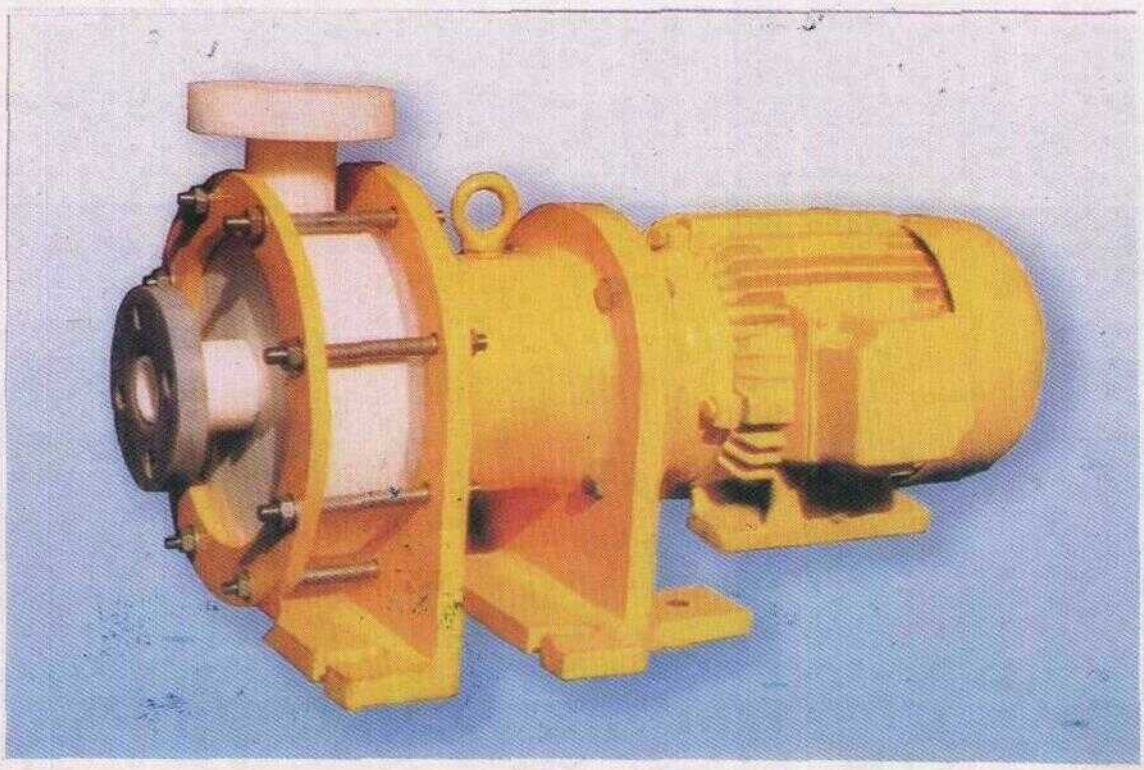
A strong S&T infrastructure has been created in the country. This covers a chain of national laboratories, specialised R&D centres, various academic institutions and training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures have been introduced from time to time, to meet the changing industrial and technological requirements of the industry. The Government has been giving special attention to promotion and support to industrial research in industry. Several tax incentives have also been provided which encourage and make it financially attractive for industrial units to establish their own in-house R&D units.

A scheme for granting recognition to in-house R&D units in industry is operated by the Department of Scientific & Industrial Research. The incentives and support measures presently available to recognised in-house R&D units include: income-tax relief on R&D expenditure as per Income-tax Act; weighted tax deduction for sponsored research programs in approved national laboratories, universities and IITs; weighted tax deduction on in-house R&D expenditure in chemicals, drugs, pharmaceutical (including clinical drug trials), bio-technology, electronic equipment, computers, telecommunication equipment and manufacture of aircrafts and helicopters; accelerated depreciation allowance on new plant and machinery set up based on indigenous technology; customs duty exemption on goods imported for use in Government funded R&D projects; excise duty waiver for 3 years on goods designed and developed by a wholly Indian owned company and duly patented in any two countries from amongst India, USA, Japan and any country of the European Union; exemption from price control for bulk drugs produced based on indigenous technology; 10 years tax holiday to commercial R&D companies; financial support for R&D projects; National Awards for outstanding in-house R&D achievements and commercialisation of results of public funded R&D, besides other indirect benefits.

The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the line of business of the firm, such as, development of new technologies, design and engineering, process/ product/ design improvements, developing new methods of analysis and testing; research for increased efficiency in use of resources, such as, capital equipment, materials and energy; pollution control, effluent treatment and recycling of waste products.



III.A.1 5-Axis CNC Gantry & Vertical ram type plano Machining Centre



III.A.2 Seal-less magnetic drive pump

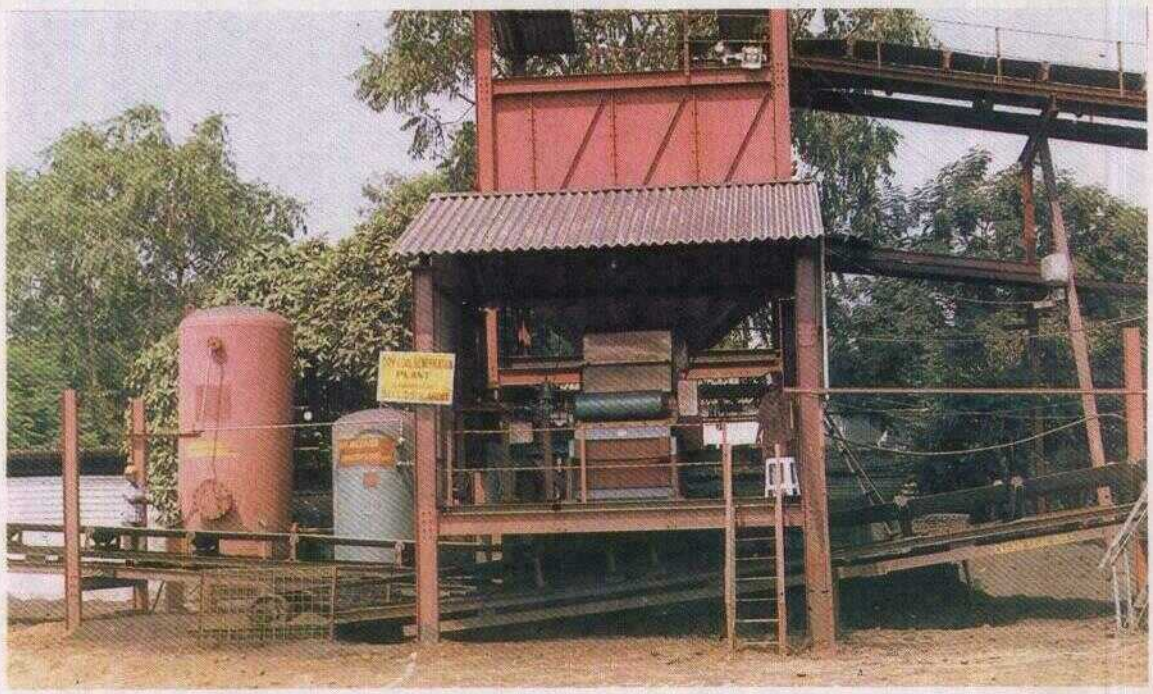
III.A.3 Components of endoskeleton below – knee artificial limb

III.A.4 Reporter Radar

III.A.5 Catalyst Manufacturing unit

III.A.6 DSIR National R&D Awards (2001) Winners

III.A.7 Shri B.S. Rawat, Union Minister of State for S&T, addressing the delegates at the inaugural session of the 15th National R&D Conference



IV.1 Pilot demonstration plant of ARDEE for online Detection and Removal of Stones from Coal

The R&D activities are expected to be separate from routine activities of the firm, such as, production and quality control. The in-house R&D units should have staff exclusively engaged in R&D and headed by a full-time R&D manager who would have direct access to the chief executive or to the board of directors depending upon the size of the unit.

Number of in-house R&D units recognised by DSIR has increased steadily from about 100 in 1973 to about 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1100 in 1990 over 1200 in 1995 and thereafter is hovering around 1200; and was 1140 as on December 2001. Of these nearly 1050 are in the private sector and the remaining units are in public/Joint sector. A revised and updated 'Directory of Recognised in-house R&D Units' was brought out during November 2001. This Directory lists 1132 recognised in-house R&D units, giving registration number, name and mailing address of the company, location of the in-house R&D unit(s) and validity of DSIR recognition.

For the purpose of recognition, the R&D units have to apply to DSIR as per standard proforma. The proforma and other details about the scheme are available with the department and are issued on request. The proforma is also available at DSIR website. The applications, after initial scrutiny in the DSIR, are circulated for comments to various other departments/agencies such as concerned administrative ministries, DCSSI, CSIR, ICAR, ICMR, ICAS, DBT, DCPC, DOT, DRDO, MIT and NRDC. The units seeking recognition are visited, if need be, by expert teams comprising of representatives of DSIR, as well, as outside agencies, like, administrative ministries, CSIR, NRDC, ICAR, ICMR, DRDO, DOE, DOT. IITs and local educational and Research Institutions before they are taken up for consideration. In order to obtain first hand information on R&D activities of the applicant firms discussion with the chiefs of the R&D unit and executives of the firm are also held in DSIR in many cases. During the discussion outside experts are invited and their comments are sought. The applications along with comments from outside agencies, visit reports, and the Department's own evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary DSIR. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR based on its evaluation of R&D infrastructure and R&D activity of the applicant firms.

During the year 2001, the Screening Committee met 12 times and considered 125 applications for recognition; 73 R&D units were granted fresh recognition and 60 applications were rejected.

The pendency at the end of December 2001 was 60. A statement giving month-wise receipt, disposal and pendency of applications for recognition of in-house R&D units is given at Annexure III.A.1.

During the year 2001, over 350 discussions/ meetings were held with heads of in-house R&D units and a number of in-house R&D units wherever necessary were visited by expert teams to obtain first hand assessment of the R&D work, infrastructural facilities and other claims made by the in-house R&D units.

2. RENEWAL OF RECOGNITION

Recognition to R&D units is granted for a period ranging from 1 to 3 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months) of the date of expiry of the recognition. Applications received for renewal of recognition are circulated to CSIR, NRDC and/or the concerned administrative department of Government of India for comments. The applications are examined in DSIR taking into account the inputs received from other agencies for taking suitable decision on their renewal. During 2001, 460 in-house R&D units were due for renewal of recognition beyond 31 March 2001; of which 368 applications were received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 352 R&D units. Recognition granted to 14 companies could not be renewed because their R&D performance was not up to the mark and the remaining two applications are pending for want of additional information. A statement showing month-wise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given at Annexure III.A.2.

3. ZONAL DISTRIBUTION OF IN-HOUSE R&D UNITS

The in-house R&D units are distributed throughout the country. There are around 180 units

in the Northern Zone (Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir), around 90 units in Western Zone (Rajasthan and Gujarat), around 440 units in the Central Zone (Maharashtra, Madhya Pradesh and Orissa), around 340 units in the Southern Zone (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and around 90 units in the Eastern Zone covering Bihar, West Bengal, Assam and other north eastern states.

4. R&D EXPENDITURE

The expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81 it was of the order of Rs. 300 crores. In 1985-86, it was of the order of Rs. 500 crores. It is estimated that the present R&D expenditure of the 1140 recognised R&D units is of the order of Rs.2350 crores. The share of public and joint sector is about 21 % and that of private sectors about 79%. 80 in-house R&D units spend over Rs. 5 crore each on R&D, 213 in-house R&D units spend between Rs. 1 crore to Rs. 5 crore each per annum on R&D. The list of these R&D units is given in Annexure III.A.3 and III.A.4 respectively.

5. R&D INFRASTRUCTURE

The in-house R&D Centres have created impressive infrastructural facilities for R&D including sophisticated testing facilities, laboratory equipment and pilot plant facilities. Analytical facilities such as HPLCs, IR spectrophotometers, UV-Vis spectrophotometers, NMR spectrometers, electron microscope, particle size analyzer, high temperature test and evaluation facilities, CAD-CAM facilities, EDM's, greenhouse and tissue culture laboratory facilities are available with many in-house R&D units.

6. R&D MANPOWER

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76 about 12,000 R&D personnel were employed by recognised in-house units; by 1981-82 the figure was over 30,000. The present estimated manpower for the 1140 in-house R&D units is around 50,000 out of which around 17,500 R&D personnel are employed in public sector in-house R&D units and around 32,500 R&D personnel are employed in the private sector In-house R&D units. Of the total 50,000 R&D personnel, around 2700 are Ph.D's, 16,500 Post Graduates, 14,000 graduates and the rest are technicians and support staff.

7. SECTORWISE BREAK-UP OF IN-HOUSE R&D UNITS

A broad sector-wise break-up of the recognised in-house R&D units is as below:

Chemical and Allied industries	430
Electrical and Electronics industries	290
Mechanical Engineering industries	200
Process industries (Metallurgical, Refractories, Cement, Ceramics, Paper, Leather and others)	160
Agro and food processing industries and others	60

8. IN-HOUSE R&D UNITS: OUTPUT

Some of the R&D achievements reported by the recognised in-house R&D units are listed below:

Chemical and Allied Industries

- Development of DNA molecular weight marker (100 bp and 500 bp ladders) produced by complete digestion of individual plasmid clone DNAs with particular restriction enzymes.
- Development of strains and process for production of lipistatin/orlistat and anti-obesity drugs.
- Development of resins for solid phase organic synthesis and peptide synthesis required for solid state organic chemistry, combinatorial chemistry, proteomics and peptidomics as well as high throughput screening technologies.
- Development of gugulsterones – enhancement of content, benzophenones from garcinia, tetrahydrocurcumin, tetrahydropiperine and rosemary extract containing carnosic acid, rosmarinic acid, boswellic acid and ursolic acid.
- Development and commercialization of bulk drugs, such as, glycopyrolate, Usp 24 (Anti-cholinergic), meloxicam NSAID (Anti

inflammatory), lefunomide (Anti-rheumatic), ticlopidine (cardio-protectant).

- Development of pharmacologically and biologically active component containing carotenoids and micro nutrients of carrots and their formulations, trade named "CAROFIT".

- Development of process for production of pyrogen free hydroxy ethyl starch (HSE), a modified starch derivative, used for plasma volume expansion.

- Development and commercialisation of IBR Vaccine (ABRIVAX).

- Development and commercialisation of electro discharge machining fluid, insulation fluid for X-ray tubes and de-aromatized low odour solvent for two stroke engine oils.

- Development of high performance carbon black ADIT 379 for truck tyres and new generation high performance carbon black ADIT 221 for passenger car radial tyres.

- Development of pearl pigments for cosmetics, invitation cards, saree printing, soaps and shampoos.

- Development and commercialisation of dry spun micro-denier acrylic fibre, dry spun acrylic fibre and tow and dry spun acrylic staple fibre.

- Upgradation and commercialisation of amino acid based bio-derived fertilizer (Suryamin); commercialization of lactic acid & calcium lactate technology.

- Standardisation and commercialisation of 14 natural dyes from lac dye, Kammela, red sandal wood, gall nuts, acacia etc; development of herbal lipstick from the herb Rattan-jot.

Electrical and Electronic Industries

- Development of Motor Control Technology (for Permanent Magnet Synchronous Motors Sensorless, Brush-less DC Motors with three Sensors and AC Induction Motors based on intelligent drives and software) for export to USA, UK, Europe, Japan and China.

- Design and development of de-activators for cellular application, command guidance unit, radio proximity fuse to detect enemy targets like aircrafts and missiles ranging in RCS from 0.1 sqm to 2sqm; radio altimeter; telemetry transmitters for transmission of telemetry data in platforms such as missiles, aircrafts, balloons etc.

- Design and development of Radar Video Generator (RVG) & Scenario Simulation Generator (SSG) for reporter radar; Composite Communication System (CCS) MK-II for Naval ships for all internal and external communication facilities.

- Development of Digital Instantaneous Frequency Measurement (DIFM) system using vertical transition technology; Frequency Tunable Local Oscillator (FTLO) using the scheme of multiply-filter-mix technique; RF front end and RF Mux; and built in test unit for defence application.

- Commercialisation and upgradation of lab scale technology for the manufacture of GPS integrated with fish finder radar.

- Development of head up display for Light Combat Aircraft (LCA) for data concentrator.

- Development of 1.2 mm low voltage CMOS process technology; 0.8 mm CMOS process technology; 1.2 mm BHCMOS process technology, visible CCD Linear imager technology and various products including ASICs for strategic sector.

- Design and development of cor-DECT WLL product technology.

- Design and development of Micro Controller Based Governor (MCBG) for diesel electric locomotives for Indian Railways.

- Development and commercialisation of test equipment based on microprocessor technology for measurements of multi layer nickel thickness & interlayer electrochemical potentials.

- Development and commercialisation of 50 Ohms RF flexible communication cable.

- Design and development of silver oxide zinc primary pile type battery using in-built gas generator for activation to meet stringent dynamic and acoustic requirements for Missile programme.

- Development of fibre technology nickel cadmium battery 24 V, 25 AH for Indian Airforce / Indian Navy for use in frontline aircrafts; silver oxide zinc cell type HR 40 for GSL programme for VSSC, ISRO; silver oxide primary battery for DRDO IGMDP project.

- Design and development of trace micro elemental determinates for determination of xenon-krypton, hydrogen, nitrogen and oxygen gas in metal and ceramics for atomic research.

- Development of 200 Ah & 400 Ah for sealed batteries for SPV, UPS, telecom and railway applications.

- Development and commercialization of off-line power, low insulation fault locator system for overhead lines/signature analyser with sophisticated software facilities; DC earth fault locator with station earth resistance tester.

- Development of technology for the manufacture of double ended metal halide lamps.

Mechanical Engineering Industries

- Design and development of advanced composite structural components for light combat aircraft (LCA).

- Design and development of landing gear for LCA and ALH program; aircraft systems for the light combat aircraft (LCA) and their integration.

- Design and development of advanced state-of -the -art test rigs for aerospace structures and systems.

- Design and development of vacuum brazed plate fin type compact heat exchangers for environmental control system (ECS) for aircraft cabin cooling and secondary power system (SPS) for Light Combat Aircraft (LCA) Programme.

- Design and prototype development of modular high-density infrared heating panel for simulation testing of space components for DRDL.

- Design and development of CNC twin spindle internal grinding machines; high speed CNC lathe "Spinner - 10".

- Design and development of 5-Axis CNC gantry type plano-milling centre with built in roto spindle for getting the C-Axis rotation for the heads in the vertical ram.

- Indigenous development of a new technology for refurbishment of combustion chamber liners for the damaged gas turbine components.

- Development of "MOBILITE" the endoskeletal type below-knee artificial limb.

- Development of energy efficient axial flow FRP fans for five specific industrial applications such as cooling towers, air cooled heat exchangers, textile mills, humidifiers, radiator cooling fan for railway diesel locomotives and mine ventilation.

- Design, development and commercialisation of five-colour offset printing machine with four colour printing on one side and single colour printing on backside simultaneously.

- Design and development of 18 tonnes single arm & 35 tonnes double arm electro hydraulic die cutting machines for cutting leather, rubber, plastic and emery sheets.

- Indigenous development of magnetic drive pumps, agitators and magnetically actuated valves. These novel parts are totally devoid of 'SEAL' and has 'ZERO' leakage.

- Design and development of auto emission control catalytic converters.

- Design and development of vertical cantilever shaft pump to handle high temperature molten salt (Zirconium Chloride and Aluminium Chloride). for critical application of Department of Atomic Energy (DAE).

- Development of unique lubrication system called pumpless lubrication system to reduce emission from 2-stroke engine vehicles, LPG kits for two wheeler, three wheeler and genset application to run on bi-fuel mode of operation and CNG kit for 3-wheeler application to run on bi-fuel & dedicated mode of operations.

- Development of new power train (engine, gearbox and rear axle) for commercial vehicles.

- Design and development of assy & crimping mcs for power boosters of car brakes.

- Development and commercialisation of light weight portable power packed water cooled and air cooled diesel engine series.

- Development of a new ultrasonic metal welding machine to improve the efficiency of the solar thermal collectors.

- Development of car wheel rim manufacturing technology for next generation cars with indigenous materials.

Processing Industries

- Process development of dent resistant grade steel after establishing the optimum chemistry, processing parameters and critical property evaluation.

- Development of electro-flotation technique for separation of hydro-carbons from effluent water from oilfields.

- Process development and commercialisation of technology for a semi continuous process for the manufacture of various grades of methane sulphonic acid (MSA).

- Process development and commercialization of technology of an anti thrombotic agent, ticlopidine hydrochloride.

- Process development of non-infringing technologies for ACE (angiotensin converting enzyme) inhibitors: fosinopril, benazepril, lisinopril, captopril, enalaprilmaleate.

- Development and commercialisation of liquid phase redox process and catalyst for the treatment and removal of hydrogen sulphide, a highly toxic and corrosive gas released by refineries, natural gas processing industries and a number of chemical processing industries.

- Development of dynatest air sampler for quantification of aerial count of bacterial content in air samples; compact anaerobic workstations.

- Development of methodology for characterisation of Indian coal for coal type, coal rack and chemical composition of its organic and in-organic constituents by computer aided petrographic image analysis.

- Development of a process known as 'Sweetening' for enhanced productivity and alumina production and reduced specific input consumption.

- Process development of coir and jute composites and high-density panel boards as wood substitute.

Agro and Food Processing Industries

- Design, development and establishment of commercial plant for azadirachtin extraction and development of afloatoxin free technical & formulations.

- Development of novel process for neem azal without crushing neem seed kernel into powder using preferential solubility for obtaining high purity azadirachtin with minimum impurities.

- Standardisation of techniques for multiplication of Trichogramma Chilonis, an egg pest for control of sugarcane borers.

- Design, development and commercialisation of computer controlled juice flow stabilization system in sugar mill.

- Development and release of Genetic Male Sterile (GMS) and Cytoplasmic Male Sterile (CMS) based hybrids of cotton for wider adaptability across the agro-climatic zones for both irrigated and rainfed conditions with good tolerance to sucking pests and boll worms.

- Development and release of newer hybrids and varieties of tomato, chillies, okra, onion, brinjal, watermelon, gourds, capsicum and sorghum with improved disease resistance.

- Development and release of newer hybrids of rice, wheat, jowar, bajra, maize, barley and sunflower.

- Development of techniques to ensure the improvement in feed efficiency and growth rate simultaneously for poultry.

9. IMPORTS MADE BY R&D UNITS

The recognised in-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities. These include: NMR, GLC, IR, HPTLC, high speed centrifugal counter current and droplet counter current chromatographs, Beta Scope, Perkin-Elmer GC-FTIR system, FT-NMR spectrometer, Inverted phase contrast fluorescence microscope, 4 channel 100 MHz Oscilloscope, Microsheen Digital Opacity reflectometer colour image analysis system, laser based particle size analyzer, digital distortion analyser, dielectric loss analyser, X-ray spectrophotometer, ASIC development system, CAD and stereo zoom microscope, transmittance, reflectance, Karl Fischer Titrator, UV-Vis dual beam spectrophotometer, trinocular phase contrast microscope, cryptometer colour computer for colour matching, CO sensor and filter, fractional distillation unit, total organic carbon analyser, heat transfer oil, rapid prototyping machine, EDM, microprocessor double ended inertia dynamometer, computer controlled eddy current dynamometer, CAD System logic analyser, fibre optics evaluation kit, Intelligent universal programmer.

10. OTHER BENEFITS AVAILED BY THE RECOGNISED R&D UNITS

The Department provides assistance to recognised in-house R&D units in a number of ways, such as cases of industrial R&D units requiring allotment of special controlled materials for R&D, permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries and disposal of imported R&D equipment/instruments and pilot plant produce are examined for making suitable recommendations to concerned agencies.

A number of cases regarding locational clearance with respect to expansion of R&D have been dealt with. A number of applications regarding disposal of R&D equipment and also, pilot plant produce; and permission for allotment for controlled materials required for R&D were examined and the decisions of the Department conveyed.

11. COMPUTERISATION OF DATA ON IN-HOUSE R&D UNITS

Names, addresses and also location of in-house R&D units as well as validity of recognition of the recognised in-house R&D units are computerised and updated. As on 31 December 2001, there were 1140 in-house R&D units recognised by DSIR.

12. CONFERENCE, AWARDS & PUBLICATIONS

a) 15th National Conference on in-house R&D in Industry

Department of Scientific & Industrial Research (DSIR) organised the 15th National Conference on in-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) on 22-23 November 2001 in New Delhi. The theme of the Conference was "Life Sciences and New Business Opportunities". The Conference had four technical sessions viz. Opportunities offered by cutting edge technologies in Bio sciences; Enabling Mechanisms for Biotechnology - Role of State Governments; Clinical Research and Financing R&D and Business in Life Sciences. Attended by over 400 delegates from industry, , national laboratories, IITs and universities, Scientific and Industrial Research Organisations (SIROs), consultancy organisations, Government departments, the Conference was inaugurated by Shri Bachi Singh Rawat, Minister of State for S&T on 22 November 2001 in FICCI Golden Jubilee Auditorium. The Minister presented the DSIR National Awards for Outstanding in-house R&D Achievements (2001) to 10 industrial units. The Minister also released the DSIR special publication " Outstanding in-house R&D Achievements - 2001".

b) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of industry towards innovative research and technological development, the National Awards for R&D Efforts in Industry were instituted in 1987 by the Department of Scientific & Industrial Research. These awards are in the form of silver shields and are presented along with citations at the inaugural session of the annual National Conference on in-house R&D in Industry. So far, 123 companies have won the DSIR National R&D *Awards for Outstanding in-house* R&D Achievements.

Following is the list of the award winners in the year 2001:

Chemical and Allied Industries

Indian Oil Corporation Ltd., Faridabad

Electronic Industries

Bharat Electronics Ltd., Bangalore

Mechanical Engineering Industries

Tratec Engineers Pvt. Ltd., Gurgaon

HMT Machine Tools Ltd., Hyderabad

Kweng Alloys Pvt. Ltd., Bilimora

New Materials

The Tata Iron & Steel Co. Ltd., Jamshedpur

Pollution Control & Environmental Protection

Gujarat Narmada Valley Fertilizers Company Ltd.,

Narmadanagar jointly with Engineers India Ltd., New Delhi.

Technology Exports

SK Dynamics Pvt. Ltd., Roorkee

Technology Absorption

Vatanu-Cool Rotrayvanes Ltd., Pune

Successful Commercialisation of Public Funded R&D

Mohana Orthotics and Prosthetics Centre, Chennai

c) Outstanding in-house R&D Achievements - 2001

The DSIR publication "Outstanding in-house R&D Achievements (2001)", covering the award winning achievements of 10 companies was released during the inaugural session of the 15th National Conference on in-house R&D in Industry on 22 November 2001.

d) In-house R&D in Industry - Information Update

As the number of in-house R&D Centres has increased while the activities of DSIR have also diversified significantly with respect to in-house R&D units, it was felt appropriate to devise a quick communication system between DSIR and in-house R&D units. Accordingly, the DSIR *started bringing out a quarterly Information Update* on in-house R&D in industry on a regular basis since April 1988. The Information Update intended to provide a fast communication link between DSIR, in-house R&D units and SIROs and serve to disseminate useful and important information relevant to R&D in Industry. During 2001-02, four issues of in-house R&D in Industry were brought out in April, July, October 2001 and January 2002. These have been widely disseminated to industry, SIROs Government Departments, missions abroad and others and were well received.

III(B). SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

1. INTRODUCTION

Scientific Research Associations, Institutions, Universities and Colleges which undertake research in the areas of Medical, Agricultural, Natural and Applied Sciences and Social Sciences have been seeking approval under section 35 (1) (ii) or (iii) of the Income-tax Act, 1961 if they wish to obtain donations from industry or other sources. The organisations notified under the section obtain benefit to the effect that any sum obtained by them for research purposes is wholly exempted from the levy of Income-tax U/s 10(21) of Income-tax Act. The donors who pay sums to such notified organisations were allowed deductions from their income to the extent of donations up to the financial year 1999-2000. From 1.4.2000, this deduction has been raised to 125% of the donations given for scientific research.

Prior to 1 June 1982, ICAR, ICMR or ICSSR were the Prescribed Authorities for approving research organisations for notification by the Ministry of Finance in the areas of Agricultural Sciences, Medical Sciences and Social Sciences respectively. With effect from 1 June 1982, Secretary, Department of Science & Technology was designated as the single Prescribed Authority to deal with approval of all the above areas. Consequent to the creation of Department of Scientific and Industrial Research, Secretary, DSIR was designated as the single Prescribed Authority for approval U/s 35 (1)(ii)/(iii) of Income-tax Act, 1961.

Through an amendment by the Direct Tax Laws (Amendment) Act, 1987, effective from 1 April 1988, certain provisions under section 35 inter-alia were deleted. Government however, reintroduced the provisions withdrawn earlier under section 35 of the Income-tax Act with modifications by Direct Tax Laws (Amendment) Act, 1989 w.e.f. 1st April, 1989. The Prescribed Authority for Section 35 was the Director General (Income-tax Exemptions) in concurrence with Secretary, Department of Scientific & Industrial Research.

The Ministry of Finance, Department of Revenue, Central Board of Direct Taxes vide their notification S.O.No.500(E) dated 25th June, 1999 has made the following amendment in the Income-tax Rules through 22nd Amendment in the Rules.

In the Income-tax Rules, 1962 in rule 6 in sub-rule (1) for the words, brackets and figure "sub-section (1)" the words, brackets and figure "clause (1) of sub-section (1)" shall be substituted.

In Appendix II to the Income-tax Rules, 1962, in Form No. 3CF, in the Notes occurring at the end:

A) in Note 2, for the words "Prescribed Authority", the words "Central Government" shall be substituted:

B) for Note 3, the following Note shall be substituted, namely:

"This application form (in triplicate) should be sent to the Central Board of Directed Taxes through the Commissioner of Income-tax having the jurisdiction over the applicant."

C) for Note 4, the following Note shall be substituted, namely:

"The applicant is also required to furnish any other particulars or details required by the Central Government."

Further to the notification mentioned above, the Ministry of Finance, Department of Revenue, Central Board of Direct Taxes issued a circular No. 778 dated 20th August, 1999 laying down the procedure dealing with applications for approval under clause (ii) & (iii) of sub-section (1) of section 35 of the Income Tax Act, 1961; which is reproduced as under:

"The Finance Act, 1999, has made amendment in section 35(1) of the IT Act, 1961, by which the approval under section 35(1)(ii) and section 35(1)(iii) of the IT Act shall be granted by

the Central Government instead of prescribed authority {Director General of Income Tax (Exemption), in concurrence with Secretary, Department of Scientific and Industrial Research}. Subsequently consequential changes have also been made in Rule 6 of IT Rules 1962 and form 3CF vide Gazette Notification dated 25.6.99.

It has been now decided that henceforth, the following procedure shall be adopted for dealing with the pending as well as fresh applications for approval under section 35(1)(ii) and 35(1)(iii) of the IT Act, 1961.

A) Fresh applications for approval under section 35(1)(ii) & 35(1)(iii) for assessment year 2000-2001 onwards shall be filed in Form 3CF with Central Government.

B) All applications pending with DGIT(E) as on 25.6.99 i.e. the date of Gazette notification of amendment of Rule 6 of Income tax Rules 1962, for approval under section 35(1)(ii) & 35(1)(iii) pertaining to assessment year 2000-2001 or subsequent year shall stand transferred to Central Government.

C) DGIT(E) in concurrence with Secretary, Department of Scientific and Industrial Research shall continue to be the Prescribed Authority for approval of cases under section 35(1)(ii) & 35(1)(iii) pertaining to assessment year 1999-2000 or any earlier year.

D) Approval already granted by the Prescribed Authority under pre-amended section 35(1)(ii) & 35(1)(iii) for assessment year 2000-2001 or any subsequent year, prior to 25.6.99 i.e. the date of Gazette of amendment of Rule 6 of Income tax rules, 1962, shall continue to be valid and no further notification or approval from Central Government shall be required in such cases for those assessment years."

2. RECOGNITION OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROs)

The DSIR had launched a scheme of granting recognition to Scientific and Industrial Research Organisations (SIROs) in 1988. SIROs recognised by DSIR are eligible for Customs Duty Exemption and Excise Duty Waiver in terms of notification Nos. 51/96-Customs dated 23.7.1996 and 10/97-Central Excise dated 1.3.1997 respectively.

The DSIR has brought out Guidelines for Recognition of Scientific and Industrial Research Organisations (SIROs), which give procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional SIROs having broad based governing council, research advisory committee, research personnel, infrastructural facilities for research, well defined, time bound research programmes and clearly stated objectives of undertaking scientific research, are considered eligible for recognition by DSIR. The investments of surplus funds not needed for immediate research should be in accordance with the Income-tax Act, 1961.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an Inter- Departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Sciences Research (ICSSR) and University Grants Commission. The recommendations of the Screening Committee are put up for approval of Secretary, DSIR. The recognition is effective from the date of approval of Secretary. Retrospective approval is not granted.

During the period January 2001 to December 2001, the Screening Committee met 4 times and recommended 22 cases for recognition as Scientific and Industrial Research Organisations under 1988 Scheme of DSIR. These include 19 cases in the natural and applied sciences, agricultural and medical sciences and 3 cases in the social sciences. List of these SIROs is furnished at Annexure III.B.1 and III.B.2.

Recognition granted to SIROs is for duration ranging from 1 to 3 years. The SIROs are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of recognition). Such applications received for renewal of recognition are examined by Research Review Groups by involving representatives from ICAR, ICMR, CSIR and ICSSR depending on the area. Based on the evaluation made by the

Research Review Groups, renewal of recognition is granted to SIROs.

At present there are 551 SIROs duly recognised by DSIR; of these, 205 are in the area of natural and applied sciences, 165 are in the area of medical sciences, 38 are in the area of agricultural sciences, 123 are in the area of social sciences and 20 are universities/colleges. Of these 551 SIROs, the renewal of recognition beyond 31.3.2001 of 27 SIROs is under consideration for want of further information/ clarification. DSIR has brought out a directory of recognised Scientific & Industrial Research Organisations in November 2001.

The SIROs have employed qualified scientists and researchers and have also established good infrastructural facilities for research. They have developed new processes, procedures, techniques and technologies and also filed several patents. They have also organised seminars/ symposiums/workshops and published research papers/ reports/books.

III(C). FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

1. INTRODUCTION

Government have evolved, from time to time, fiscal incentives and support measures to encourage R&D in industry and increased utilisation of locally available R&D options for industrial development. The union budgets for 1996-97, 1997-98, 1998-99, 1999-2000, 2000-2001 and 2001-2002 have introduced a set of new incentives to encourage investments in R&D by industry.

Fiscal incentives and support measures presently available include: (a) income-tax relief on R&D expenditure; (b) weighted tax deduction for sponsored research; (c) weighted tax deduction on in-house R&D expenditure; (d) customs duty exemption on capital equipment, spares, accessories and consumables imported for R&D by approved institutions/SIROs; (e) excise duty waiver on indigenous items purchased by approved institutions/ SIROs for R&D; (f) ten year tax holiday for commercial R&D companies; (g) excise duty waiver for 3 years on goods produced based on indigenously developed technologies and duly patented in any two of the countries out of India, European Union (one country), USA and Japan; (h) accelerated depreciation allowance on plant and machinery set-up based on indigenous technology; (i) price control exemption on domestic R&D based bulk drugs; (j) customs duty exemption on imports for R&D projects supported by Government.

2. DEPRECIATION ALLOWANCE ON PLANT AND MACHINERY SET UP BASED ON INDIGENOUS TECHNOLOGY

Government have introduced a system of allowing accelerated depreciation in respect of blocks of assets and rationalised the rate structure by reducing the number of rates as also by providing for depreciation at higher rates.

Secretary, Department of Scientific & Industrial Research, Ministry of Science and Technology, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed for the plant and machinery using indigenous know-how. Guidelines have been issued for making applications for obtaining the aforesaid certificate. All such applications received are examined in the department, and discussions and technical visits to verify the claim are made to the plants by expert teams. Based on a detailed examination, certificates in deserving cases are issued for eligible expenditure.

During the year 2001, 5 certificates involving Rs. 5743 lakhs on cost of plant and machinery were issued by DSIR. Details are given at Annexure III.C.1.

3. CUSTOMS DUTY EXEMPTION ON GOODS IMPORTED FOR USE IN GOVERNMENT FUNDED R&D PROJECTS

The Union budget for 1996-97 introduced the provision of customs duty exemption on specific goods imported for use in R&D projects funded partly by any Department of the Central Government and undertaken by the company in their in-house R&D unit recognised by DSIR. A certificate from the ministry or department, as the case may be, funding the research project stating the essentiality of the item(s) in each case at the time of importation would make the item(s) eligible for duty free import for that R&D programme by the company.

During the period January-December 2001, 11 certificates worth Rs. 125.85 lakhs for import of capital equipment and consumables/materials for R&D projects, supported by DSIR, were issued.

4. REFERENCE UNDER SECTION 35(3) OF I.T. ACT, 1961 REGARDING SCIENTIFIC RESEARCH

In the implementation of various incentive schemes for the promotion of research and development, the Income-tax Act, inter-alia, provides that expenditures made on capital

equipment and related to research activities are allowed to be written off 100% in the year in which the expenditures are incurred. The Government has however, provided that if a question arises under *section 35 of Income-tax Act, 1961 as to whether* and, if so, to what extent any activity constitutes or constituted or any asset is or was being used for scientific research the Central Board of Direct Taxes would refer the question to the Prescribed Authority. Director General (Income-tax Exemptions) in concurrence with Secretary, DSIR is the Prescribed Authority for deciding such cases. On receipt of the reference in DSIR, the department collects information/. background regarding the description of the activity claimed as scientific research, date of commencement of the relevant projects, date of completion of research work as also the results obtained from the specific project. After obtaining all these details, the matter is examined in DSIR. In case where it is considered necessary, a team of technical experts is constituted for on the spot appreciation of the research work done at the premises of the company. After receiving the technical assessment report from the visiting team, a discussion is also normally held so that the point of view of the Company is taken into account before arriving at a decision. After completing the processing of the case in the above fashion, the case file is placed before the Secretary, DSIR for giving a decision. The Secretary, DSIR gives his decision by setting out a reasoned order duly signed by him, which is communicated, to Director General (Income-tax Exemptions).

During the year, recommendations of Secretary were sent to DG (ITE) in the case of two companies namely M/s Hero Cycles Limited., Ludhiana and M/s Madras Cements Limited., Rajapalayam.

5. APPROVAL OF COMMERCIAL R&D COMPANIES

In order to promote research and development activities in the commercial research and development companies, the Finance Act, 2001 provided for a ten-year tax holiday under section 80-IB(8A) of the Income-tax Act, 1961, to approved companies, whose main objective is scientific and industrial research. This incentive is available to any company that has as its main objective, activities in the area of scientific and industrial research and development and which has been accorded approval by the Prescribed Authority. Secretary, Department of Scientific & Industrial Research is the Prescribed Authority for this purpose vide Gazette notification no. S.O.85(E) dated 31 January, 2001, issued by *Department of Revenue, Ministry of Finance.*

The tax holiday is available to any company whether new or existing, which is accorded approval by the Prescribed Authority at any time after the 31st day of March 2000 but before the 1st day of April 2003. The 100% deduction for a ten-year period commences from the assessment year relevant to the previous year in which the approval by the Prescribed Authority is accorded to such a company.

During the year 2001, requests for approval as R&D companies were considered.

6. EXCISE DUTY WAIVER

The notification no. 15/96 dated 23 July, 1996, introduced the provision of exemption of all goods falling under the Schedule to the Central Excise Tariff 1985 (5 of 1986) from the whole of the duty of excise leviable thereon provided such goods are manufactured by a wholly Indian owned company, such goods are designed and developed by such Indian company, the goods so designed and developed are patented by such Indian company in any two countries from amongst India, USA, Japan and any one country of the European Union, for a period of 3 years from the date of issuance of certificate to the effect by DSIR.

During the year 2001, two requests received from the industrial R&D units were considered.

7. CUSTOMS DUTY EXEMPTION TO RECOGNISED SIROs

All Scientific and Industrial Research Organisations recognised by DSIR are eligible for Customs Duty Exemption on the import of scientific equipment, instruments, spares, accessories as well as consumables for research and development activities and programmes.

The procedure for issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions has been formalised. A Committee has been set up in DSIR to examine the applications received from SIROs. The committee normally meets once in a fortnight to examine the

requests. The recommendations of the Committee are put up to the Head of the RDI Scheme, for approval.

During the year 2001, around 864 essentiality certificates were issued for claiming customs duty exemption on import of scientific equipment, accessories and components, including consumable items. The value of scientific equipment instruments and the consumables was over Rs. 45 crores.

8. EXCISE DUTY EXEMPTION TO RECOGNISED SIROs

All Scientific and Industrial Research Organisations (SIROs) recognised by DSIR are eligible for Excise Duty Exemption on the purchase of scientific and technical instruments, apparatus, equipment (including computers); accessories and spare parts thereof and consumables; computer software, Compact Disc - Read Only Memory (CD-ROM), recorded magnetic tapes, micro films, microfiches; and prototypes for research and development activities and programmes.

This provision was introduced by Ministry of Finance (Department of Revenue) vide notification No. 10/97-Central Excise dated 1 March 1997. The procedure for issuing essentiality certificates to SIROs for obtaining the Excise duty exemptions has been formalised. A Committee has been set up in DSIR to examine the applications received. The Committee normally meets periodically and essentiality certificates are issued with the approval of Head of RDI Scheme.

During the year 2001, 139 essentiality certificates for a total amount of Rs. 199 lakhs were issued for claiming Excise Duty Exemptions.

9. REGISTRATION OF PUBLIC FUNDED RESEARCH INSTITUTIONS AND OTHERS

Public funded research institutions, universities, IITs, IISc, Bangalore; Regional Engineering Colleges, (other than a hospital) are eligible for availing customs duty exemption on import of equipment, spares and accessories and consumables for research purposes. The pass book scheme which was hitherto operated by the Department of Science and Technology and the Ministry of Human Resources Development is superseded by a simple registration with the Department of Scientific and Industrial Research. The ceiling on the value of goods imported for R&D is also removed and the head of the public funded research institutions/organisations duly registered with DSIR can certify the R&D goods for duty free import as per the notification No. 51/96-Customs dated 23 July 1996. As per the Government notification No. 10/97-Central Excise dated 1.3.1997, the public funded research institutions, universities, IITs, IISc, Bangalore, Regional Engineering Colleges, registered with DSIR are also eligible for central excise duty waiver on purchase of indigenously manufactured items for scientific research purposes.

The procedure for registration of public funded research institutions, universities, IITs, IISc, Bangalore; Regional Engineering Colleges has been reviewed during the year 1998-99 and an inter-departmental screening committee has been constituted for recommending the registration. The Committee met 3 times during this year and considered 38 applications from various public funded research institutions.

During the year 2001, 31 registration certificates were issued to such public funded research institutions, universities, IITs, IISc, Bangalore, Regional Engineering Colleges for availing customs duty exemption on import of scientific equipment, spares and accessories, consumable items and central excise duty exemption on indigenous purchases for Scientific Research Purposes. Apart from these, 10 public funded research institutions, which are already registered with DSIR for availing customs duty exemption were issued certificate of registration for availing central excise duty exemption on indigenous purchases.

The registration to public funded research institutions and others is granted for maximum period of 5 years. The institutions are advised to apply for renewal of registration well in advance of the date of expiry of the registration. During the year 2001-2002, 635 institutions were due for renewal of registration. The department received 505 renewal applications, which were processed on individual files and approval of Secretary was obtained, based on consolidated note. Registration to 9 institutions could not be renewed as it was

found research performance of these institutions was not satisfactory.

10. APPROVAL OF IN-HOUSE R&D CENTRES AND CERTIFICATION OF EXPENDITURE UNDER SECTION 35(2AB) OF INCOME-TAX ACT, 1961

Finance Bill 1997 introduced a sub-section (2AB) in Section 35 of the Income-tax Act, 1961. This sub-section was introduced in order to encourage research & development in drugs, pharmaceuticals, electronic equipment, computers, telecommunication equipment, and chemicals. The sub-section provided for weighted tax deduction of a sum equal to one and one-fourth times of any expenditure incurred on scientific research (not being expenditure in the nature of cost of any land building). The weighted tax deduction was further raised to 150% by the Finance Act, 2000. The in-house Research and Development facilities of the companies engaged in the business of manufacture or production of the above said items should be approved by the 'Prescribed Authority' i.e. Secretary, DSIR. Also, the company should enter into an agreement with the Prescribed Authority for co-operation in such research and development facility and for audit of the accounts maintained for that facility. Through a separate notification no. 11112(F.No.225/192/99/ITA.II) dated 27 October, 1999, manufacture of aircrafts and helicopters was included in the list eligible under this subject.

The provision was introduced for expenditure on R&D incurred up to 31st March 2000. The Ministry of Finance, Department of Revenue, Central Board of Direct Taxes, notified the provision vide Notification No. S.O.259 (E) dated 27 March 1998. Finance Bill 1999 introduced in Lok Sabha on 27 February 1999 extended this provision till 31 March 2005. The sub-section was further amended by the Finance Bill 2001, to include expenditure on in-house R&D by units engaged in the business of biotechnology, as well as cover expenditure on clinical trials, filing of patents under Indian Patent Act (1970) and obtaining regulatory approvals, for weighted tax deduction @ 150% under Section 35 (2AB) of Income-tax Act.

During the year 2001, about 21 applications were received. Secretary, DSIR who is designated as the Prescribed Authority under section 35 (2AB) of Income-tax Act, 1961, approved in-house R&D centres of 12 companies. Agreements of cooperation for research and development were signed with these companies on behalf of the Secretary, DSIR.

IV. PROGRAMME AIMED AT TECHNOLOGICAL SELF RELIANCE (PATSER)

1. OBJECTIVES OF PATSER

The objectives of the scheme "Programme Aimed at Technological Self Reliance (PATSER)" include :

A) Supporting industry for technology absorption, development and demonstration.

B) Building indigenous capabilities for development and commercialisation of contemporary products and processes of high impact.

C) Involvement of national research organisations in joint projects with industry.

2. ACTIVITIES

The activities under PATSER include the following :

2.1 Financial Support to Research, Development, Design and Engineering (RDDE) Projects of Industry:

The Department provides on a selective basis partial financial support to Research, Development, Design and Engineering (RDDE) projects to be proposed by industry in the following areas:

- Development and demonstration of new or improved product and process technologies including those for specialised capital goods, for both domestic and export markets.

- Absorption and Upgradation of imported technology.

The partial financial support by DSIR in the above areas primarily covers prototype development and pilot plant work, test and evaluation of products flowing from such R & D, user trials etc. Bulk of the cost of the project is met from industry's resources.

The Department under PATSER Scheme has so far supported about 120 R&D projects of Industrial units. These projects cover products and processes in various important industries such as metallurgy, electricals, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives. Number of projects have been completed so far since inception of the scheme.

During the year, a number of new R&D projects of industry were supported on partial financial support basis. The Department had invited, through advertisements in leading newspapers, project proposals for technology absorption, development and demonstration from industrial units whose in house R and D Units are recognised by DSIR. During the year, more than 80 responses from industrial units seeking further details about the scheme, indicating their technology development projects were received by the Department. Till December 2001 these proposals were evaluated for aspects such as their novelty, commercial potential, track record of executing agencies and collaborating agencies (wherever associated) and based on this, 12 projects were submitted for consideration of the Technical Advisory Committee to PATSER for partial financial support by DSIR. More projects are likely to be considered by TAC in the period January - March 2002.

"Technopreneur Promotion Programme" (TePP) is jointly operated by DSIR under its PATSER Scheme and DST under its Home Grown Technology Scheme of TIFAC to tap the vast innovative potential of the citizens of India. During the year, till December 2001, 8 projects have been supported and about 7 more projects are expected to be considered for support during the period January – March, 2002. Some of the completed projects during the year are tiltable innovative bullock cart, mortocycle driven sprayer, diagonal inverter for operation microscope, bullock operated generator with accessories etc.

The highlights of various projects under PATSER Scheme during the year are as given below:

A. COMPLETED PROJECTS

2.1.1 Delta Agro Chemicals Ltd., Serinarasannapalem, Krishna Dt., A.P.

The Project by Delta Agro Chemicals Ltd., Krishna on 'Development of Process for Manufacture of Furfuryl Alcohol by Hydrogenation of Furfural' has been supported by DSIR with a financial support of Rs. 18.5 lakhs out of a total Project outlay of Rs. 45 lakhs. Technology has been demonstrated at pilot plant level and trial runs are under way. The project has been completed.

2.1.2 Gujarat Narmada Fertilizer Corporation Ltd., Bharuch

The Project by Gujarat Narmada Fertilizer Corporation Ltd., Vadodara on 'Development of Liquid Phase Oxidation Process for Hydrogen Sulphide and Recovery of Sulphur from Sour gases' has been supported by DSIR with a financial support of Rs. 100 lakhs out of a total Project outlay of Rs. 207 lakhs. Indigenous catalysts developed in the project were successfully demonstrated in ONGC, Hazria. The project has been completed.

2.1.3 Hindustan Zinc Ltd., Udaipur and CSIR, New Delhi

The Project by Hindustan Zinc Ltd., Udaipur, and CSIR, New Delhi, on 'Installation of Nickel Extraction Technology Proving Plant for Recovery of Nickel From Chromite Overburden' has been supported by DSIR with a financial support of Rs. 100 lakhs out of a total Project outlay of Rs. 1000 lakhs. Trial runs have been undertaken in the pilot plant. The project is completed.

2.1.4 J S L Industries Ltd., Vadodara and Electrical Research and Development Association (ERDA), Vadodara

The Project by J S L Industries Ltd., Vadodara, in collaboration with Electrical Research and Development Association (ERDA), Vadodara on 'Upgradation of Air Circuit Breaker' has been supported by DSIR with a financial support of Rs. 13.75 lakhs out of a total Project outlay of Rs. 34 lakhs. Prototypes with 50 KV Short Circuit rating have been successfully developed and tested. The project has been completed.

2.1.5 Khandelwal Laboratories Ltd., Mumbai

The Project by Khandelwal Laboratories Ltd., Mumbai, on Phase-I for testing and evaluation of 'Enzymes for Bleaching and Softening' has been supported by DSIR with a financial support of Rs. One lakh out of a total Project outlay of Rs. 2 lakhs. The project has been completed.

2.1.6 Maini Materials Movements (P) Ltd., Bangalore

The Project by Maini Materials Movements (P) Ltd., Bangalore on 'Research, Development, Design and Engineering of World Class In-plant Material Handling Equipment for Global Market' has been supported by DSIR with a financial support of Rs. 55 lakhs out of a total Project outlay of Rs. 144 lakhs. All prototypes of various in-plant material handling equipment as per Euro norms were developed and demonstrated. The project has been completed.

2.1.7 P M T Machine Tool Automatics Ltd., Pune

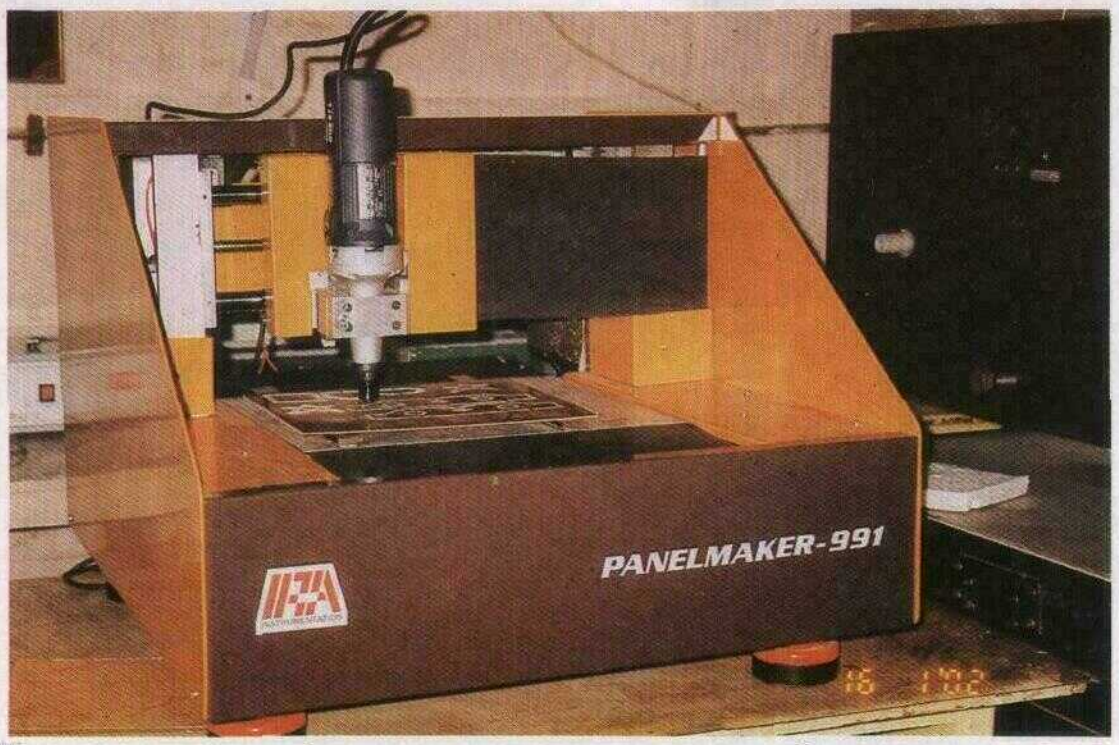
The Project by P M T Machine Tool Automatics Ltd., Pune on 'FIGT Internal Grinding Machine With 4 Turrets' has been supported by DSIR with a financial support of Rs. 46 lakhs out of a total Project outlay of Rs. 148 lakhs. The prototype machine has been developed and the project has been completed.

2.1.8 Punjab Tractors Ltd., Chandigarh

The Project by Punjab Tractors Ltd. on 'Development of IGBT Based SSDC Controllers For Fork Lift Trucks' has been supported by DSIR with a financial support of Rs. 10 lakhs out of a total Project outlay of Rs. 31.8 lakhs. The project has been completed.

2.1.9 S. M. Electronics & Services Ltd., New Delhi, (Now known as SM Telesys Ltd.,) and Centre for Development of Advanced Computing, Pune

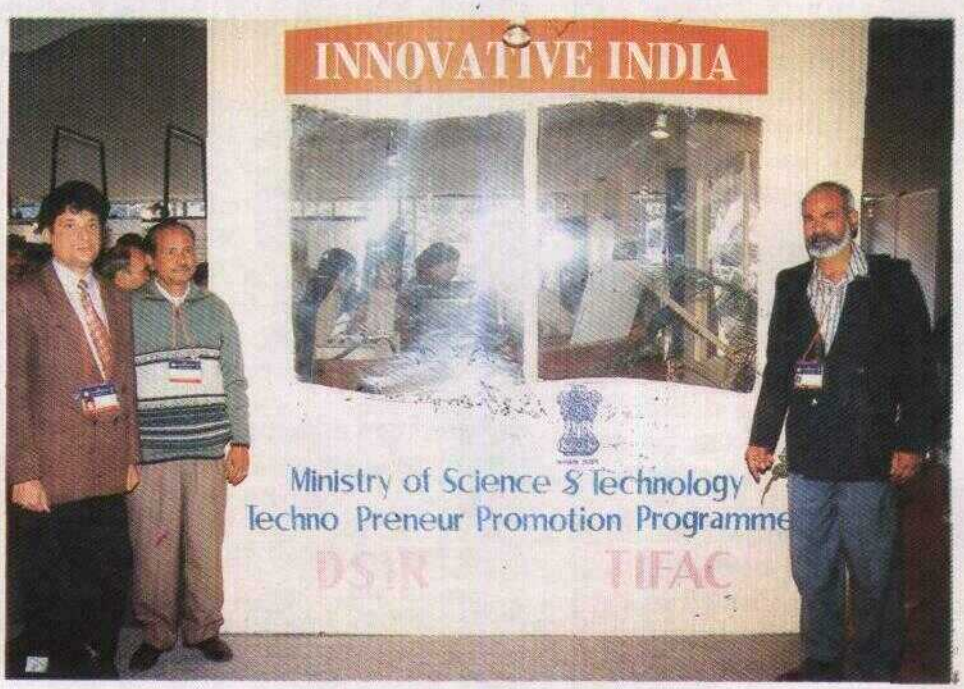
The Project by S. M. Electronics & Services Ltd. on 'Development of Multilingual



IV.2 ***CNC Plastic Panel Maker under development by Instrument Research Associates (P) Ltd., Bangalore***

IV.3 ***High Frequency Submersible Pump set under development by PSG Industrial Institute, Coimbatore***

IV.4 TePP Project on Fire Fighting Robot under development



IV.5 A view of INNOVATIVE INDIA pavilion during Indian Science Congress, 2002 at Lucknow

Pagers' has been supported by DSIR with a financial support of Rs. 36 lakhs out of a total Project outlay of Rs. 80.48 lakhs. Pagers for Hindi, Marathi, Kannada and Tamil have been developed and the project has been completed.

2.1.10 Triveni Structurals Ltd., Naini

The Project by Triveni Structurals Ltd., Naini, on 'Development of EHV Self Supporting & Guyed Type Transmission Line Towers' has been supported by DSIR with a financial support of Rs. 20 lakhs out of a total Project outlay of Rs. 86 lakhs. Prototypes have been developed. Project has been completed.

B. PROJECTS ACTIVITIES COMPLETED

2.1.11 CBRI, Roorkee/ CPRI, Bangalore

All the activities in the project for development of various products such as tiles, bricks and other items based on Marble Waste of Rajasthan with DSIR support of Rs.11.5 lakhs (Rs.6.5 lakhs to CBRI, Roorkee and Rs.5.0 lakhs to CPRI, Bangalore) undertaken by CBRI, Roorkee and CPRI, Bangalore have been completed. Rajasthan Govt. has shown considerable interest in the project.

2.1.12 Dolphin Industrial Cooperative Society Ltd., Vizianagaram

The Project by Dolphin Industrial Cooperative Society on 'Development of Glazing on Terracotta Clay Products' has been supported by DSIR with a financial support of Rs. 27 lakhs out of a total Project outlay of Rs. 55.33 lakhs. Erection of demonstration plant has been completed under the project and trial runs have commenced. The project has been completed.

2.1.13 Indus Natural Products Pvt. Ltd., Pune, and National Chemical Laboratory, Pune

This is a joint project of M/s Indus Natural Products Pvt. Ltd., Pune and National Chemical Laboratory, Pune is for `Development of Technology for L(+) Tartaric Acid, and Salts or Derivatives thereof, Pectin and Fruit Sugar from the Fruit of Tamarind' with DSIR support of Rs. 16.5 lakhs out of total project cost of Rs. 33.00 lakhs. The present project tartaric acid is proposed to be manufactured from a totally new raw material tamarind. The process developed by National Chemical Laboratory, Pune and has been scaled up to a pilot plant scale of 350 kg. raw material per batch basis by M/s Indus Natural Products Pvt. Ltd., Pune. Pilot plant trials and other related activities have been completed.

2.1.14 Karnataka Hybrid Microdevices, Bangalore

The Project by Karnataka Hybrid Microdevices, Bangalore on 'Innovative Microelectronic Packaging Technology for automobile underhood applications' has been supported by DSIR with a financial support of Rs. 38 lakhs out of a total Project outlay of Rs. 101 lakhs. Pilot plant has been set up and prototypes of hybrid circuits have been developed and tested by Lucas-TVS.

2.1.15 National Research Development Corporation (NRDC), New Delhi and Aesthetic Technologies, Kolkata

The joint project by National Research Development Corporation and Aesthetic Technologies on 'Interactive Multimedia for IPR Training' has been supported by DSIR with a financial support of Rs. 20 lakhs out of a total Project outlay of Rs. 40 lakhs. Project activities have been completed and a comprehensive software package on IPR has been developed.

2.1.16 Semiconductor Complex Ltd. (SCL), Chandigarh and Centre for Development of Advanced Computing (C-DAC), Pune

The joint project of M/s SCL, Chandigarh and C-DAC, Pune is for development of ASIC (Application Specific Integrated Circuit) for Indian languages computing system GIST II and the related card involving DSIR support of Rs. 30 lakhs out of total project cost of Rs. 50 lakhs. The ASIC has been fabricated at SCL.

2.1.17 Praj Industries Ltd., Pune

The Project by Praj Industries Ltd., Pune, on 'Development and Demonstration of Energy Efficient Drying Systems' has been supported by DSIR with a financial support of Rs. 24 lakhs out of a total Project outlay of Rs. 49.5 lakhs. The pilot

plant of the ring dryer has been developed and various feed materials have been tested in the pilot plant to establish parameters for efficient ring dryer system.

C. PROJECTS NEARING COMPLETION

2.1.18 Ardee Business Services Pvt. Ltd., Vishakhapatnam

The Project by M/s. ARDEE business Services Pvt. Ltd., Vishakhapatnam, on 'RAMDARS-Coal dry Beneficial system' has been supported by DSIR with a financial support of Rs. 70 lakhs out of a total Project outlay of Rs. 147.3 lakhs. Pilot plant is under extended testing at SCCL.

2.1.19 Ashok Leyland Ltd., Chennai and Electronics Research Development Centre of India, Thiruvananthapuram

The joint project of M/s.Ashok Leyland Ltd., Chennai and Electronics Research Development Centre of India, Thiruvananthapuram for 'Development of Hybrid Electric Vehicle With Vector Controlled Induction Motor for Propulsion' has been supported by DSIR with a financial support of Rs. 45 lakhs out of a total Project outlay of Rs. 134 lakhs. Prototypes have been developed and the company exhibited the Hybrid Electric Vehicle in the Auto Expo 2002 in Delhi.

2.1.20 Atcom Technologies Ltd., Mumbai

The Project by M/s. Atcom Technologies Ltd., on 'Technology Development of Microbalance of 200gm Capacity With 1.0 mg Accuracy and High Dynamic Range' has been supported by DSIR with a financial support of Rs. 28.5 lakhs out of a total Project outlay of Rs. 76.3 lakhs. The prototype has been developed and tested at NPL, New Delhi. A number of prototypes have been developed and are under testing for customers evaluation.

2.1.21 BILT Chemicals Ltd., Secunderabad

The Project by BILT Chemicals Ltd., on 'Development of Technology for Tetra Bromo Bisphenol-A (TBBA) on a Pilot Plant Level' has been supported by DSIR with a financial support of Rs. 350 lakhs out of a Project outlay of Rs. 1436 lakhs. IICT, Hyderabad has been collaborating in the project. Both the pilotplants at Ankleshwar and Karwar have been set-up and trials have been carried out. The project is in advanced stages.

2.1.22 Bharat Earth Movers Ltd., Bangalore and Electronics Research & Development Centre (ER&DC), Thiruvananthapuram

The Project by Bharat Earth Movers Ltd., Bangalore and ER&DC, Thiruvananthapuram, on 'Development of Unified Electronic Controller for Off-Highway Dump Trucks' has been supported by DSIR with a financial support of Rs. 16.5 lakhs out of a total Project outlay of Rs. 33.6 lakhs. Prototypes have been developed and field trials are being undertaken.

2.1.23 Fluidtherm Technology Pvt. Ltd., Chennai

The Project by M/s Fluidtherm Technology Pvt. Ltd., Chennai on 'Developing a Novel Heat Treatment Furnace' has been supported by DSIR with a financial support of Rs. 50 lakhs out of a total Project outlay of Rs. 149.3 lakhs. The project is progressing well.

2.1.24 H M T, Bangalore

The Project by H M T, Bangalore on 'Development of State-of-the-art Machining Centre' has been supported by DSIR with a financial support of Rs. 75 lakhs out of a total Project outlay of Rs. 197 lakhs. The cutting trials at the user's end for various tractor components have been completed. High speed cutting trials on aluminium auto components are in progress.

2.1.25 I B P Co. Ltd., Gurgaon

The Project by IBP, Gurgaon (with the assistance of CMRI, Dhanbad) on 'Development of Heat Resistant Explosives' has been supported by DSIR with a financial support of Rs. 18.5 lakhs out of a total Project outlay of Rs. 65.4 lakhs. Field trials of Heat Resistant Explosive has been completed at 80° C and 100° C. The project is in advanced stages.

2.1.26 Indchem Research and Development Laboratory (IRDL), Chennai, and Semiconductor Complex Ltd. (SCL), Chandigarh

The joint project by IRDL, Chennai, and SCL, Chandigarh, on 'Development of MPEG-2 Decoder has been supported by DSIR with a financial support of Rs. 70 lakhs out of a total Project outlay of Rs. 185 lakhs. The design work has been completed.

2.1.27 Intra Industries, Pune

The Project by Intra Industries, Pune, on 'Development of 22.5 KVA Inverter for Railways' has been supported by DSIR with a financial support of Rs. 21.8 lakhs out of a total Project outlay of Rs. 63 lakhs. The prototype has been developed.

2.1.28 MATA Foundation, Imphal

The Project by MATA Foundation, Imphal and RRL Trivandrum on 'Integrated Pilot Demonstration Plant for Spice Processing' has been supported by DSIR with a financial support of Rs. 60 lakhs out of a total Project outlay of Rs. 135.5 lakhs. The project is in progress.

2.1.29 Mecpro Heavy Engg. Ltd., New Delhi

The Project by M/s.Mecpro Heavy Engg. Ltd., New Delhi on 'Efficient Extraction plant' has been supported by DSIR with a financial support of Rs. 35 lakhs out of a total Project outlay of Rs. 95 lakhs. The prototypes of equipments have been developed and have been installed in the plant. The performance testing & trials in the plant have been completed.

2.1.30 P S G Industrial Institute, Coimbatore

The Project by PSG Industrial Institute, Coimbatore, on 'Development of Frequency Converter/Controller and High Frequency Submersible Motor Pump Sets For Irrigation' has been supported by DSIR with a financial support of Rs. 6 lakhs out of a total Project outlay of Rs. 13 lakhs. The motor for this pump has been specifically designed, fabricated and tested at full load. The pump and controller has been designed and developed. This project is likely to create a good demand in the agricultural sector.

2.1.31 Priya Bricks (P) Ltd., New Delhi

The Project by Priya Bricks (P) Ltd., on 'Development and Demonstration of Stiff Extrusion Technology for Extruding Solid, Perforated and Hollow Building Blocks' has been supported by DSIR with a financial support of Rs. 45 lakhs out of a total Project outlay of Rs. 97.8 lakhs. The plant has been commissioned and different types of bricks has been produced in the automatic plant. The bricks produced in the plant are under testing at IIT, Delhi.

2.1.32 Semiconductor Complex Ltd. (SCL), Chandigarh and Electronic Research & Development Centre (ER&DC), Thiruvananthapuram

The joint project by S C L, Chandigarh and ER&DC, Thiruvananthapuram, on 'Development of ASIC based STD-PCO has been supported by DSIR with a financial support of Rs. 32.5 lakhs out of a total Project outlay of Rs. 99.64 lakhs. The project has resulted in successful development and demonstration of FPGA (Field Programmable Gate Array) based STD PCO machine. Technology Transfer activities have also been initiated by ER&DC. The project is in progress with respect to ASIC.

2.1.33 Southern Petrochemical Industries Corporation Ltd., (SPIC), Chennai and Indian Institute of Chemical Technology (IICT), Hyderabad

The joint project by SPIC, Chennai, and IICT, Hyderabad on 'Development of Process of manufacture of Pyrazinamide' has been supported by DSIR with a financial support of Rs. 219.5 lakhs out of a total Project outlay of Rs. 520 lakhs for treating tuberculosis. The project is in advanced stages.

2.1.34 Tamilnadu Zari Ltd., Kancheepuram

The Project by Tamil Nadu Zari Ltd. on 'Establishment of a Technology Demonstration Facility for Super Fine Wire Drawing of Silver Alloy for ZARI Application' has been supported by DSIR with a financial support of Rs. 19 lakhs out

of a total Project outlay of Rs. 69.96 lakhs. The project activities have been completed.

2.1.35 Turbotech Precision Engineering Pvt. Ltd., Bangalore, National Aerospace Laboratories, Bangalore and Shakti Sugars, Erode

The joint project being executed by Turbotech Precision Engineering Pvt. Ltd., Bangalore in collaboration with NAL, Bangalore and Sakthi Sugars, Erode is for the development of low cost gas turbine (LCGT) generator set of 500 KW power class, with multi fuel capability (biogas, piped natural gas and diesel fuel) involving DSIR support of Rs. 87.37 lakhs out of total project of Rs.361 lakhs. The prototype of Low-cost Gas Turbine System has undergone no-load test successfully. The LCGT system is undergoing final trials at full load at TurboTech's Turbine Testing Centre, Nelamangla.

2.1.36 United Telecoms Ltd., Bangalore

The Project by United Telecoms Ltd., Bangalore. on 'Design & Dev. Of ADSL (Asymmetric Digital Subscriber Line)' has been supported by DSIR with a financial support of Rs. 55 lakhs out of a total Project outlay of Rs. 127 lakhs. The prototype has been developed and its application being demonstrated.

2.1.37 Webel Electronics Ltd., Kolkata

The Project by Webel Electronics Ltd. on 'Development of Computerised Braille Transcription Systems for automatic and speeded transcription of English and Vernacular texts' has been supported by DSIR with a financial support of Rs. 16 lakhs out of a total Project outlay of Rs. 32 lakhs. The project is under progress.

2.1.38 Zen Technologies Ltd., Secunderabad

The Project by Zen Technologies Ltd., Secunderabad on 'Interactive Small Arms Training Software - Intensive computer based training aid meant to help trainees to perfect advanced marksmanship skills including skills based on judgement and reflex' has been supported by DSIR with a financial support of Rs. 60 lakhs out of a total Project outlay of Rs. 138.7 lakhs. Prototype is under going testing & trials.

D. PROJECTS UNDER PROGRESS

2.1.39 ACE Designers Pvt. Ltd., Bangalore

The Project by Ace Designers Pvt. Ltd., Bangalore on 'Development of P.C. based CNC Machining system' has been supported by DSIR with a financial support of Rs. 35 lakhs out of a total Project outlay of Rs. 99.13 lakhs. The PC based CNC system has been fitted on the lathe machine and trails are being undertaken.

2.1.40 Anirox Pigments Limited, Kolkata

The project of M/s Anirox Pigments Limited, Calcutta (works at Dhanbad) is for `Development of Stable Oil in Water Ink Emulsion, Based upon Water Reducible Nigrosine Dyes for Ink Jet Computer Printers' with a DSIR support of Rs. 50.00 lakhs out of a total project cost of Rs.147.00 lakhs. The firm at present is engaged in the production of Nigrosine Dye which finds many applications, one of which is in ink industry. The project is in progress.

2.1.41 Atcom Technologies Ltd., Mumbai

The Project by M/s. Atcom Technologies Ltd., on 'Development of Load cells' has been supported by DSIR with a financial support of Rs. 68 lakhs out of a total Project outlay of Rs. 149 lakhs. The prototypes of different types of load cells have been developed and are under testing. The dead weight machine for testing accuracy of the load cells has been developed by NPL, New Delhi and supplied to Atcom Technologies Ltd. The project is in progress.

2.1.42 Autopal Industries Ltd., Jaipur

The Project by Autopal Industries Ltd., Jaipur, on 'Development of Metal Halide Lamps Including ARC Tube And Electronic Control Gear' has been supported by DSIR with a financial support of Rs. 50 lakhs out of a total Project outlay of Rs. 145 lakhs. Development of the ARC tube has already been achieved under the project. The project is in progress.

2.1.43 Bharat Earth Movers Ltd., Bangalore

The Project by Bharat Earth Movers Ltd., Bangalore on 'Development of Cast Crank Shafts' has been supported by DSIR with a financial support of Rs. 27 lakhs out of a total Project outlay of Rs. 67 lakhs. The prototype of the S.G. Iron

CrankShaft fitted in an Engine has completed all tests satisfactorily. The prototype of Austempered Ductile Iron (ADI) Crankshaft has been developed and will be tested for engine endurance test. The project is in progress.

2.1.44 Bharat Heavy Electricals Ltd., Bangalore

The Project by Bharat Heavy Electricals Ltd., Bangalore on 'Development of ASIC Based Energy Meter' has been supported by DSIR with a financial support of Rs. 23 lakhs out of a total Project outlay of Rs. 46 lakhs. The project is in progress.

2.1.45 Bharat Pumps and Compressors Ltd., Allahabad

The Project by Bharat Pumps And Compressors Ltd., on 'Development of Twin Casing Fly Ash Slurry Pump' has been supported by DSIR with a financial support of Rs. 25 lakhs out of a total Project outlay of Rs. 60 lakhs. The material specimens have been sent to IIT, Delhi for testing and design has been frozen. Prototype fabrication is in progress.

2.1.46 Canpex India, Pune

The Project by Canpex India, Pune on 'Setting Up of Pilot Plant For Production of 1T/day High Purity (72-80%) Calcium Cyanamide' has been supported by DSIR with a financial support of Rs. 35 lakhs out of a total Project outlay of Rs. 120.74 lakhs. The project is in progress.

2.1.47 Castron Technologies Ltd., Dhanbad

The Project by Castron Technologies Ltd., Calcutta on 'Development of Indigenous Technology for Phenanthrene and 9:10 Phenanthrenequinone' has been supported by DSIR with a financial support of Rs. 35 lakhs out of a total Project outlay of Rs. 77 lakhs. The project is in progress.

2.1.48 Central Electronics Ltd, Sahibabad

The Project by Central Electronics Ltd., Sahibabad on 'Development of Digital Axle Counter' has been supported by DSIR with a financial support of Rs. 70 lakhs out of a total Project outlay of Rs. 146 lakhs. The 2 x 2 digital axle counter has been fabricated, tested and one prototype which has been installed between Delhi Mathura route, is functioning well. The prototype of 2 x 2 and 2 x 3 digital axle counter are under development . The project is in progress.

2.1.49 Elkay Chemicals Pvt. Ltd., Pune

The project of M/s Elkay Chemicals Pvt. Ltd., Pune is for `Development of Next Generation Amino Silicon based on hydrosilation technology' with a DSIR support of Rs.30.00 lakhs out of a total project cost of Rs.83.00 lakhs. The hydrosilation process avoids import of silicones - a costly material. The formulations of amino silicones find applications in textile finishing, personal hygiene, etc. The project is in progress.

2.1.50 Farcom Cable Systems (P) Ltd., Bangalore

The Project by Farcom Cable Systems (P) Ltd., Bangalore and CPRI, Bangalore on 'Development of Flame Retardant Low Smoke Material For Wires and Cables for Shorting Applications' has been supported by DSIR with a financial support of Rs. 50 lakhs out of a total Project outlay of Rs. 104.5 lakhs. The project is in progress.

2.1.51 General Exports & Credits Ltd., New Delhi and Dalmiya Centre for Biotechnology (DCBT), Coimbatore

The Project by General Exports & Credits, New Delhi, in collaboration with Dalmiya Centre for Biotechnology, Coimbatore, and Indian Institute of Chemical Technology, Hyderabad, on 'Development of Azadirachtin-A Technical from Neem Seeds Kernels and its Formulations' has been supported by DSIR with a financial support of Rs. 65 lakhs out of a total Project outlay of Rs. 248.97 lakhs. IICT, Hyderabad has been entrusted with the task of designing and engineering of the pilot plant. The project is in progress.

2.1.52 Inovative Communications System Ltd., Hyderabad

The project of Innovative Communication System Ltd., Hyderabad for "Development Voice Enabled Web" has been supported by DSIR with a financial support of Rs. 13.50 lakhs out of total

project cost of Rs. 51.14 lakhs. The project is in progress.

2.1.53 Instrument Research Associates Pvt., Ltd, Bangalore

The Project by M/s.Instrument Research Associates Pvt., Ltd, Bangalore, on 'Design and Development of prototype making of CNC controlled plastics Switch board panel maker' has been supported by DSIR with a financial support of Rs. 8 lakhs out of a total Project outlay of Rs. 21.5 lakhs. Basic fabrication of the machine has been completed and software development and interfacing witht he controller is being carried out. The project is in progress.

2.1.54 Maharashtra State Seeds Corporation Ltd.,Akola

The Project by Maharashtra State Seeds Corporation Ltd. on 'Development and Testing of Mini Dry HCl Gas cotton seed delinting plant.' has been supported by DSIR with a financial support of Rs. 31 lakhs out of a total Project outlay of Rs. 93 lakhs. The project is in progress.

2.1.55 MATA Foundation, Imphal

The project of MATA Foundation, Imphal and CFTRI, Mysore on integrated pilot demonstration plant for fruit processing has been supported by DSIR with a financial support of Rs. 100 lakhs out of total project cost of Rs. 319.79 lakhs. The project is in progress.

2.1.56 NATCO Pharma Ltd., Secunderabad

The Project by NATCO Pharma Ltd., Secunderabad, on 'Development of pilot level anaerobic reactor to pharmaceutical waste' has been supported by DSIR with a financial support of Rs. 30 lakhs out of a total Project outlay of Rs. 98 lakhs. The project is under progress.

2.1.57 *National Aluminium Company Ltd.*, (NALCO), Bhubaneswar

The Project by NALCO, Bhubaneswar on 'Recovery of Gallium from Sodium Aluminate Liquor' has been supported by DSIR with a financial support of Rs. 217 lakhs out of a total Project outlay of Rs. 1277 lakhs. The project is in progress.

2.1.58 Organic Coatings Limited, Mumbai

The project for '(i) Water-based flexo inks used for absorbent stock (craft paper) and coated stock (art paper, etc.); and (ii) UV radiation curing inks used for coated stock and non-absorbent substrates such as PVC, Polyester, etc.' has been taken up by M/s Organic Coatings Ltd., Mumbai with a DSIR support of Rs.25.00 lakhs. The total project cost is Rs.91.585 lakhs. The flexo inks will be used in packaging materials, composite films, aluminum foils, plastic and paper labels, wall covers, envelopes decoration materials and other specialized papers. Similarly, radiation curing inks are energy efficient as well as improves the life of specialty paper product such as currency notes, etc. The project is in progress.

2.1.59 Orient Software Pvt. Ltd., Bangalore

The Project by M/s.Orient Software Pvt. Ltd., Bangalore on 'Development of system for aiding in the intelligent computer aided design for casting' have been supported by DSIR with a financial support of Rs. 25 lakhs out of a total Project outlay of Rs. 53.68 lakhs. The project is in progress.

2.1.60 Parag Fans and Cooling Systems Ltd.,Dewas

The Project by Parag Fans and Cooling Systems Ltd., Dewas on 'Development Of Energy Efficient Fan System' has been supported by DSIR with a financial support of Rs. 28 lakhs out of a total Project outlay of Rs. 72 lakhs. The prototype fans of 1400 and 1600 mm sizes have been designed and fabricated using the FRP. Both the fans have been tested on the conventional fan systems. The fabrication of 1400 mm fan system has been completed and tested in-house and fabrication of 1600 mm fan is in progress. The project is in progress.

2.1.61 Pennwalt India Ltd, Mumbai

The Project by M/s.Pennwalt India Ltd, Mumbai, on 'Coating of chemical process equipment with fluoropolymers and other high performance powders' has been supported by DSIR with a financial support of Rs. 20 lakhs out of a total Project outlay of Rs. 67.05 lakhs. The project is in progress.

2.1.62 Praj Industries Ltd., Pune

The Project by M/s Praj Industries Ltd., Pune on 'Development and Demonstration of BIOMAC - Mechanised Accelerated Biocomposting Technology' for treating, at pilot plant level, distillery effluents and for producing bio-compost material, has been supported by DSIR with a financial support of Rs. 49 lakhs out of a total Project outlay of Rs. 117 lakhs. The pilot plant has been commissioned and performance trials has been completed successfully. The project is in progress.

2.1.63 S B Electro-Mechanicals (P) Ltd., Pune

The Project by M/s. S B Electro-Mechanicals (P) Ltd., Pune on 'Development to Complete the RADAR Level Gauging Systems' has been supported by DSIR with a financial support of Rs. 16.49 lakhs out of a total Project outlay of Rs. 34.62 lakhs. The project is in progress.

2.1.64 S M Creative Electronics Ltd., Gurgaon

The Project by M/s. SM Creative Electronics Ltd., Gurgaon on 'Development of Miniature DC/DC Convertor for Line Cards' has been supported by DSIR with a financial support of Rs. 10 lakhs out of a total Project outlay of Rs. 28.6 lakhs. The project is in progress.

2.1.65 Sankar Sealing Systems (P) Ltd., Chennai

The Project by M/s. Sankar Sealing Systems (P) Ltd., Chennai, on 'Development and Indigenising of Asbestos Free Cylinder Head Gaskets for TATA Indica Diesel Cars' has been supported by DSIR with a financial support of Rs. 27 lakhs out of a total Project outlay of Rs. 69.7 lakhs. The project is in progress.

2.1.66 Semiconductor Complex Ltd. (SCL), Chandigarh and Bharati Telecom Ltd. (BTL), New Delhi

The Project by M/s. SCL, Chandigarh and BTL, New Delhi, on 'Development of Technology For Production of Single Chip Telephone ICs and Telephone Instruments Based on Single Chip Telephone ICs' has been supported by DSIR with a financial support of Rs. 35 lakhs out of a total Project outlay of Rs. 89 lakhs. The project is in progress.

2.1.67 Semiconductor Complex Ltd. (SCL), Chandigarh and S M Electronics & Services Ltd., New Delhi (Now known as SM Telysis Ltd)

The Project by M/s.SCL, Chandigarh and SMES Ltd., New Delhi, on 'Development of Bilingual Pager based on ASIC' has been supported by DSIR with a financial support of Rs. 40 lakhs out of a total Project outlay of Rs. 94.9 lakhs. The project is in progress.

2.1.68 Semiconductor Complex Ltd. (SCL), Chandigarh and Shree Pacetronix Ltd., Indore

The Project by M/s. SCL, Chandigarh and Shree Pacetronix Ltd., Indore, on 'Design & Development of Indigenous Pacemaker Based on Single Chip and The Programming Unit' has been supported by DSIR with a financial support of Rs. 40 lakhs out of a total Project outlay of Rs. 90 lakhs. The project is in progress.

2.1.69 Shyam Telecom Ltd., New Delhi

The Project by M/s. Shyam Telecom Ltd., New Delhi on 'Design and Development of Remote Energy Metering System (REMS)' has been supported by DSIR with a financial support of Rs. 54 lakhs out of a total Project outlay of Rs. 147.8 lakhs. The project is in progress.

2.1.70 T C M Ltd., Bangalore

The Project by M/s. TCM Ltd., Bangalore on 'Development of Carbon-di-oxide Route for the Manufacture of Barium Carbonate' has been supported by DSIR with a financial support of Rs. 30 lakhs out of a total Project outlay of Rs. 140 lakhs. The project is in progress.

2.1.71 Tamilnadu Petroproducts Ltd., Chennai and Indian Institute of Petroleum (IIP), Dehradun

The Project by M/s. Tamilnadu Petroproducts Ltd., Chennai, in collaboration with IIP, Dehradun, on 'Manufacture of Long chain (C10-C14) Alcohols by oxidation of N-Paraffin in

the production of Linear Alkyl Benzene(LAB)' has been supported by DSIR with a financial support of Rs. 55 lakhs out of a total Project outlay of Rs. 134 lakhs. 40-45% conversion of N-paraffins into secondary alcohols, per pass, at a selectivity of about 95% has already been achieved in the project through the use of novel catalysts and the work at IIP, Dehradun has resulted in 6 patent applications. *The work at IIP, Dehradun, is completed.*

2.1.72 Trident Industries Ltd., Noida

The project by M/s Trident Industries for Development of optical pickup for CD mechanism has been supported by DSIR with a financial support of Rs. 40 lakhs out of total project cost of Rs. 128 lakhs. The project is in progress.

2.1.73 United Telecoms Ltd., Bangalore

The project of United Telecoms Ltd., Bangalore for "Development of ATM Access Multiplexer" has been supported by DSIR with a financial support of Rs. 40.50 lakhs out of total project cost of Rs. 134.90 lakhs. The project is in progress.

3. CUSTOMS DUTY EXEMPTION FOR GOVERNMENT FUNDED R&D PROJECTS

In pursuance to Customs Notification No.50/96 Customs dated July 23, 1996 for Customs Duty Exemption on components, consumables, equipments etc. used in R&D projects supported by Government, 12 Customs Duty Exemption certificates for nearly Rs.126 lakhs worth of components and consumables under 7 technology development projects supported under "Programme Aimed at Technological Self Reliance" scheme of DSIR have been issued.

4. TECHNOPRENEUR PROMOTION PROGRAMME (TePP)

Under "Technopreneur Promotion Programme" (TePP), jointly operated by DSIR under its PATSER Scheme and DST under its Home Grown Technology Scheme, to tap the vast innovative potential of the citizens of India, financial support is provided to individual innovators having original ideas to convert them into working models, prototypes, etc. It is expected that 15 projects would be supported during 2001-2002 under TePP activities. Besides these, a number of projects supported earlier have successfully been completed and commercialised during the year viz. Low Cost Tilting Bullock Cart, *Innovative Cotton Stripper, Motorcycle Driven* Sprayer, Kushal Sprayer, Bullock Operated Generator, Diagonal Inverter for Operation Microscope etc.

5. OTHERS

The DSIR participated in a 5 days Exhibition under the theme of **"TECH VISION - 2002"** organised during Indian Science Congress – 2002 (ISC-2002) from 3rd to 7th January, 2002 at Lucknow University, Lucknow. A number of innovators supported under TePP scheme exhibited their achievements with the help of product prototype/ models, charts, etc. in an exclusively created stall, viz. **"INNOVATIVE INDIA"**. The basic aim of the 'INNOVATIVE INDIA' stall was to diffuse and disseminate various information about the DSIR activities among concerned scientific groups and to develop innovative and creative inquisitiveness among them to harness their vast innovative talents.

6. EXPECTED OUTPUTS AND BENEFITS

The completed technology development projects supported under PATSER Scheme have resulted in significant technological and commercial returns to the industries concerned such as cost reduction, higher quality, improved products and processes as well as foreign exchange savings, while building up the R&D capabilities of the industrial units. The on going projects are expected to result in high commercial / societal impact and will lead to commercialisation and *utilisation of `state of the art' technologies. There* have been useful interactions and linkages with other concerned Government departments, National Research Organisations and users during evaluation, approval and implementation of various projects supported under PATSER scheme.

V. SCHEME TO ENHANCE THE EFFICACY OF TRANSFER OF TECHNOLOGY (SEETOT)

The "Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)" covers the following programmes :

A) *National Register of Foreign Collaborations* and Technology Management (NRFC & TM)

B) Transfer and Trading in Technology (TATT)

C) *Promotion and Support to Consultancy* Services (PSCS) which also includes the Consultancy Development Centre (CDC)

Activities and achievements of each of the above programmes are presented here.

V(A). NATIONAL REGISTER OF FOREIGN COLLABORATIONS (NRFC) AND TECHNOLOGY MANAGEMENT(TM)

1. PREAMBLE

The "National Register of Foreign Collaborations and Technology Management" (NRFC & TM), which is an ongoing Plan Scheme, continued its operations during the year 2001-2002. It has completed a number of programmes that were targeted for the year.

2. OBJECTIVES AND ACTIVITIES

The main objective of the Scheme is to facilitate efficient acquisition and management of technology in the country. The following major activities are carried out under NRFC & TM:

- Compilation and analysis of data on approved foreign collaborations.
- Undertake studies in select areas.
- Provide assistance in the effective transfer of technology process and efficient management of technology.
- Co-ordinate with Ministries and other organisations.
- Organise interaction & awareness programmes on technology related issues.

Major programmes and activities that have been undertaken under the NRFC & TM scheme may be grouped under the following categories:

- Compilation and analysis of data on approved foreign collaborations:
- Studies on issues relating technology development and management of technology:
- Programmes focusing on collaborative work in the area of TM with academic institutes
- Training programmes on varied issues related to TM for the benefit of industry, academic institutes, R&D organizations and others
- Case studies covering specific management of technology aspects in respect of manufacturing and research organizations
- *Industry-institute networking*

Issues relating to Technology Management are steadily gaining importance. As a result, the focus on Technology Management oriented activities has been on the rise and so have Programmes and related activities in this area. The Division has been working in close association with technical and management institutes, universities, research organizations, major industry units and associations, Government Departments and bodies both at the State as well as the Centre, industry training institutions, small and medium enterprises, entrepreneurs, international bodies and consultancy organizations. During the year, in addition to a number of on-going activities, some more need-based programmes and activities have been taken up.

3. COMPILATIONS AND ANALYSIS OF DATA ON APPROVED FOREIGN COLLABORATIONS APPROVAL

The Division has been bringing out an annual compilation of foreign collaborations approved during a year, regularly the last many years. These compilations include information relating to the names and addresses of the Indian and foreign collaborators and the specific item of collaboration. The publication is only one of its kind and is much sought after as an authentic record of foreign collaborations approvals in the country. Compilation for the year 2001 is in progress.

4. STUDIES ON TECHNOLOGY DEVELOPMENT AND MANAGEMENT

A) A study on "The Essential and Medicinal Plant Species in the North Eastern Region – Their present Status and Strategy for Development," has been taken up. This study is being conducted through the North Eastern Industrial and Technical Consultancy Organisation (NEITCO), Guwahati. The basic objective of the study is to collect information on essential and medicinal plant species, their present status with regard to their availability, production, commercial utilization etc. The study has covered identification and systemization of plants with potential medicinal and biocidal value, listing their uses, estimation of the available quantity, their commercial utilization, estimation of the present level of technology being utilized for preparation of medicines from the herbs or plants and sources of improved technologies and equipment, both indigenous and imported. The study has also suggested strategies for utilization of plant species for commercial purposes and for the economic benefit of the region as a whole. The study has been finalised. The major finding of the study are discussed below :

The entire North East has a vast reserve of medicinal plants, and a rich culture of folk medicine. As such there are good prospects for setting up Allopathic, Ayurvedic and Homeopathic drugs manufacturing units based on the medicinal plants in the Region. Certain industries may be developed which will not only be economically viable but will also help in the economic upliftment of the region.

Some of the medicinal plants available in the region and used in Homeopathy are Abroma augusta, Achyranthes aspera, Alliumcepa, Acalypha indica, Aloe vera, Boerhavia diffusa, Cantella asiatics, Cannabis sativa, capsicum annum, cassia sophera, Emblica officinalis, Ficus rellgiosa,Magnifera indica, Ocimum sanctum, R. Serpentina, Saraca indica, Tinospora cordifolia etc. etc.

Most of the medicinal plants used in preparation of Ayurvedic medicines are available in the region but are scattered with no commercial plantation. Some of the suggestions made in the report are as under:

- Need for mass production of rooted cuttings and seedlings of key species for home gardens which need to be encouraged.
- Cultivation of medicinal plants through registered growers to be enhanced.
- Organised and commercial cultivation of threatened, rare and endangered species of economic value.
- Dissemination of information on appropriate cultivation methods by giving training.
- Collection centres with storage and preservation facilities may be created.
- Imparting training for harvesting, storing and packing of medicinal plants for marketing.
- Establishment of Data Centres Statewise and Regional.
- Preparation of inventory of medicinal plants and their medicinal and other economic values.
- Development of suitable cultivation and propagation technologies for important species.
- Encouraging use of tissue culture for growing the disease free high yielding plant species and also for mass propagation of species.
- Research may be undertaken for mechanization of Traditional Ayurvedic production process for optimum yield and better quality of products.

B) A study The Status of Minor Forest Produce (MFP) Based Industries in the State of Madhya Pradesh has been taken up. The study has been conducted through the Madhya Pradesh Consultancy Organisation Ltd., Bhopal. Since the study was initiated before the bifurcation of the then state of Madhya Pradesh, the data, findings etc. relate to both the states i.e. Madhya Pradesh & Chattesgarh, wherever, state is referred hereafter, it refers to the states of Madhya Pradesh & Chattesgarh. The major objective of the study is to gather information and analyse the occurrence and availability of commercially important MFP in each agro climatic zone of the State of Madhya Pradesh & Chattesgarh. It has analysed the present methods of collection, grading, pricing and marketing mechanisms for the MFP and suggested how to improve the effectiveness and identified commercially viable enterprises based on available MFP. It has also assessed the export and indigenous market potential for MFP based products, identify suitable technologies for manufacturing MFP based products and assess the viability of commercial plantation of MFP species found suitable for commercial exploitation. The report has also identified potential project opportunities together with sources of appropriate technology, for ready guidance of prospective entrepreneurs. The study has been finalised. A broad synopsis of the study is discussed below:

Generally the term MFP is considered to be synonymous with medicinal and aromatic plants, but in reality the term MFP includes wide array of products from plant and animal kingdom having varied uses. As per one classification, MFP covers nine broad and seventeen sub categories of products. The nine broad categories are comprised of :

- Edible Plant and plant parts.
- Fatty oils (Edible & Non edible)
- Gums, Resins, Oleo-resins, Seed Gums etc.
- Medicinal Plants
- Tans and dyes
- Fiber & Flosses including grasses
- Bamboos & Canes
- Petroleum substitutes
- Misc. MFP (Products of animal & plant origin, Floral & decorative crafts etc.)

The spread and depth of MFP sector, in terms of different MFP categories and myriad of products in each such category is so vast that it is generally not feasible for any single study to do full justice to the entire MFP sector while covering all its relevant aspects. Although every plant found in nature is useful in one or other way, but even if one has to account for only those MFP, which are of some commercial importance, then even this list will run into thousands. Just to give an example our traditional system of medicine alone recognizes some 1000-1500 plant species, associated with curative properties. The plants yielding essential oils are close to 3000 and at least 300 of these are of commercial importance. Thousands of plants yields gums and resins and several hundred of these are utilized to produce items of trade. Natural dyes are produced from close to 100 plants and like wise many plants yield edible products, minor oil, pesticides etc. This is in addition to hosts of alkaloids, flavonoids, tannins, glycosides, Terpenes etc. which could be extracted from these plants and further value added products down the chain.

There are more than 500 different MFP available in the state of Madhya Pradesh and Chattisgarh. State Government through its various enactment's from time to time has restricted private trading in few commercially important MFP, with a view to save villagers from exploitation by middlemen. These MFP are termed as Nationalized MFP and includes : Tendu Leaves, Harra, Sal seed, Salai Gum, Kullu Gum

Rest all MFP are termed as Non-nationalized and are allowed for free trade and any individual is free to collect these in any quantities for domestic and commercial consumption.

The responsibility for collection and marketing of Nationalized MFP rests with M.P. State Minor Forest Produce Co-operative societies (PFCs), 80 district Unions and the Federation at apex level. From time to time Federation also trades in Non-nationalized MFP, but their role in this is quite limited.

Most of the trade in Non-nationalized MFP is conducted through private traders. Over a period of time the network of private traders has developed into a well knit structure consisting of

hundreds of traders at villages, blocks, tehsils and district headquarters.

The village trader either makes MFP purchases on his own or at the instance of some bigger traders, in which case he gets a negotiated price for the quantity collected. Depending on the market dynamics, the material collected at various centers either flow to the bigger traders based at other trading centers or to the traders located at two wholesale MFP trading centers of the state viz. Katni and dhamtari, or it may even be directly dispatched to traders out side the state.

The system of barter is still prevalent in most of the tribal pockets of the state. Usually it is the raw salt, which is used for the barter.

Other major findings of the study are:

- Although more than 500 different types of MFP are available in the state, but the commercial trading takes place only in case of 80-85 MFPs.
- Almost 2.25 lakh tonnes of various MFP are being traded in the state.
- In terms of value the total amount of MFP traded in the 25 districts surveyed is around Rs. 190 crores. The eastern region accounts for 85% of this trading volume.
- The top 10 MFP contributed around 75% of the total trading volume, the rest 75 MFP contributed just 25%. The top 10 MFP (Non-nationalized) of the state are: Lac, Tamarind, Mahua, Mango, Char, Safed Musali, Aonla, Kaladana, Ashwagandha, Cashew.
- Based on the data of 25 districts, the total trade in Non-nationalized MFP for the entire state can safely be estimated to be of the order of Rs. 253 crores and if the trade in nationalized MFP is also included then the total trade generating from the state in MFP sector will be around Rs. 750 crores.
- There are 538 industrial units in the state engaged in manufacturing MFP based value added products.
- Almost 60% (323) units manufacture herbal durgs. 80% of these units were located in western region of the state.
- Indore, Gwalior and Jabalpur are three important centers where most of these herbal drug units are located.
- The herbal drug units of the state manufacture almost all type of herbal medicines such as Antipyretc & analgesics, Anti diarrhoea, Anti malarial, Blood purifiers, Anti alergic, Anti T.B., Cough Syrups, Laxatives, Diuretics, Pain killers etc.
- The next largest group of units manufacture edible items based on Mango, Tamarind, Honey, Ber, Char and Bhilawa. Most of these units were small in size
- Herbal cosmetics is another important sector, which had presence of almost 34 units, including three well known national brands viz. Dabur, Baidynath and Ayur herbals.
- Lac and lac products manufacturing, though only concentrated in an around Bilaspur district, is also an important MFP based activity of the state.
- Four important industrial clusters were identified during the survey. These are Pharma units at Indore, Honey production units in Raigarh, Lac in Bilaspur and Babool seed powder at Blha, Bilaspur.
- Most of the units of the state are not capital intensive in nature and are based on simple technologies, except few big units such as till oil extraction in Mandsour district and few Phyto-chemicals units at Indore & Gwalior which are capital intensive in nature and which deployed sophisticated manufacturing technologies.

For the benefit of entrepreneurs, a few project profiles have also been given in the report

C) With a view to assist in the development and increased use of environment friendly Biodegradable Plastics & other eco friendly materials it was considered desirable to undertake a study on "Technology Status and Prospects of

Biodegradable Plastics in India'" which interalia includes status of Biodegradable Plastics in terms of technology development, commercial ventures, processes employed etc. in the Indian context, world wide status of this industry, gaps, problems etc. as well as identifying the segments where usage of conventional plastics can be replaced with Biodegradable Plastics & other agricultural ingredients. Accordingly, a study on the subject was entrusted to Consultancy Development Centre, New Delhi.

The study has been based on extensive desk research and field survey. The report covers the National and International Scenario of Biodegradable Plastics, the status of technology, products & manufacturers, availability of standards for testing Biodegradable plastic products, supply demand status, availability of raw materials and the on going developments in the area of Biodegradable plastics. Highlights of the report are discussed below.

Material life cycle analysis has become imperative in choosing the right polymer for a given application. In a breakthrough, which could help to minimize the environment pollution created by synthetic wastes, technology is developed for biodegradable plastics

Biodegradable plastic degrades from the action of naturally occurring microorganism such as bacteria, fungi and algae and thus solves the solid waste management problem of plastic.

Major raw materials for production of biodegradable plastics are Starch (corn, cassava, soyabean) Starch Esters, Synthetic aliphatic polymers (PLA, PCL, PHBV, PHB, polyaspartic acid etc) Chemicals (Lactic Acide, Ethylene, Acetic Acid, Poly glycol Acid) Proteines (chitin & chitosan)

Some of the processes of commercial importance are:

- Starch based – PCL polymer
- Poly Lactic acid (PLA) polymer
- Poly Vinyl alcohol
- PHBV Production by Bacterial Fermentation
- Aliphatic/Aromatic Co-polymer

Most of the units internationally are producing biodegradable plastic on PLA-based process.

Commodity plastics in India account for about 85 percent of total plastic consumption with engineering and other plastics accounting for the balance. The consumption of plastic in 2001-2002 is expected to be 4.2 million tonnes and is expected to increase to 7.6 million tonnes at the end of 10^{th} five-year plan.

There are only two indigenous biodegradable plastic manufacturing units identified in the country. The scale of operation of these units is very low as they are having difficulty in marketing due to no publicity.

Demand for biodegradable plastic in India is estimated to be 46,000 t/yr and is likely to go upto 96,000 t/yr in 2006-07 on the basis of a 15% penetration level of potential segments. The effect of MSW (Management & Handling). Rule 2000 with cut off date of 31.12.2003 for providing composting facilities for organic waste will generate thousands of tonnes of demand for biodegradable garbage bags and bin-liners. Their effect is not included in the current projection.

Bio-fiber is the most important renewable resource and modern polymer technology should focus on natural resources for production of degradable polymer. Jute is one of the most common bio-fiber having high tensile modulus and low elongation at break.

There is no proven indigenous technology for production of biodegradable plastic. Central Tuber Crops Research Institute (CTCRI) has developed a process by mixing the polymer (LDPE) with starch made from tapoica and a soluble chemical agent to produce eco friendly palstic.

Indian Researchers are mostly working on Blending starch with polyolefims (PE/PP and their Co-polymers) to produce environmentally degradable plastics. This blending technology however has not developed to the commercial scale.

Awareness programmes on the illeffects of plastics and promoting the concept of biodegradable plastics may be held. Indian standards for biodegradable plastics may be evolved. Further R&D work on biodegradable plastics need to be undertaken. The need for setting up testing facilities for testing of biodegradable plastics.

D) A study on the status of Technology Management Education in India that was assigned to the Educational Consultants of India Ltd. Noida has been completed. A gist of the study follows:

In the present era of globalization and rapid changes, corporate strategies world over are being increasingly technology driven. Effective management of technology results in distinctive corporate technological competence, which can become a primary tool for achieving competitive advantage. In this backdrop, education and training in Technology Management assumes considerable significance in a country like India. Information presented in the report is on the basis of responses received from educational institutions, industrial training institutions, and industry units.

Of the educational institute respondents, involvement in TM education varied from significant to substantial as they offered dedicated programmes, specializations / specialization packages or streams or else full-fledged courses in TM. The remaining were either not involved or the involvement was nominal to negligible in cases where no TM related courses were offered. In line with the trend in other countries such as USA, TM education is largely concentrated at the post-graduate level. Both part-time as well as full time programmes are being offered. IGNOU and AIMA offer education through open/distance learning mode.

The courses offered by a large number of institutes included the general course on TM, Management of R&D, Strategic Management of Technology, Technology Forecasting etc. Most of the research topics also pursued similar issues.

A number of short term modules or Management Development programmes that are being offered at the institutes are oriented towards professional development activities.

Non availability of adequate faculty and teaching material including TM related case studies were found to be major bottle necks faced by most institutes. Another hurdle expressed was that TM specialization is not much in demand as it did not provide attractive placement or job opportunities and compensation.

Most of the respondents intended to utilize their strength in TM programmes by offering short term training modules, encouraging industry-institution interaction and further strengthening the course structure/content and research base.

Industrial training institutes also deal with TM related subjects. Industry organizations send their executives for training in TM related areas, in which the top management generally took keen interest. However, many industry organizations do not rely on academic institutions for training on these aspects, and instead approach consultants.

Recommendations made in the study include measures for expanding the horizons of TM education, creation of wider awareness, inclusion of TM in educational curricula, development of programme curriculum, courses and syllabi, focus on TM in part time programmes offered in institutes, design of short term modules and courses, encouraging research in TM related areas, overcoming the shortage of course material and case studies, augmenting faculty development, and the setting up of a TM development Centre.

E) Vegetable dyes are gaining considerable significance in view of the pollution aspects related with chemical dyes. A technology status study on the Potential of Vegetables Dyes Industry in the Country has therefore been taken up the study has been entrusted to U P Industrial Consultants Ltd., Kanpur. The scope of the work for the study involves Identification of various plants which are useful for production of vegetable dyes, assessment of the availability of plants type & quantity their cultivation process to maintain ecological balance, current demand pattern of vegetable dyes in India and international market. The study also covers sector wise demand pattern covering the sectors of textile, paper, foodstuff and leather industry. It also includes identification of sources of manufacturing technology both from India and abroad and also the need for technological development, evaluation of the existing manufacturing capabilities, preparation of twenty project profiles based on potential

market and raw materials availability, study and assessment of the potential for creation of exclusive vegetable dyes manufacturing complex at appropriate locations. The study is being finalised.

F) A technology status study on Guar based industries in the country has been taken up. This has been entrusted to U P Industrial Consultant Ltd., Kanpur. The scope of work would involve analysis of the production and distribution trends of Guar seeds, sources and availability of raw materials consumed by the Guar Gum Industry, trends in the growth of guar based industries in the country with particular reference to installed capacity, capacity utilisation, products-mix, production, etc., performance of the selected guar based industries in the country so as to ascertain their problems relating to the availability of raw materials, availability of technology, need for technology development, scope for expansion/ diversification, exports and the likely growth of the market size during the next 5 years. It would also assess the technological level of the existing manufacturers vis-à-vis the requirement so that the product range is made globally acceptable and competitive and also assess gaps in technology in use and availability of the suitable plant and machinery/equipment, etc. The study is in progress.

G) A study on 'Innovation in Infrastructure Sector in India' has been taken up. The objective is to study innovation aspect of infrastructure sector, assess the extent of innovation achieved and its contribution to national development. Measures taken up by concerned agencies to enhance the 'innovativeness' of the infrastructure sector would also be examined. The status of technology in use in traditional infrastructure sectors as well as emerging infrastructure sectors, gaps in technology in comparison with the state of art for use elsewhere, and analyzing the role of innovation in these sectors, giving adequate coverage to specific technological dimensions associated with each sector; are among the issues that would be covered. The study is under progress.

H) A study on 'Women Representation in Corporate R&D' has been taken up. The objective is to examine the determinants of women leadership in various corporates. Both socio-cultural factors relating to women leadership in Science and Technology areas, as well as linkages between the National culture and organizational processes and practices would be analyzed. Reasons for slow growth of women professionals in Research and Development fields, factors relating to organization culture and leadership that influence performance of women, specific gaps in our corporate industries, strengths and failings of women employed in these industries are among the issues that would be covered. The study is in progress.

I) A study on 'Influences of Integration of Technological Strategies with Business Strategies of Large Public Sector Organizations and their Small and Medium Scale Suppliers'. The specific impact on the technology strategies and strategic vision as well as the spin off effects on its vendors and ancillaries would be analyzed. The study has been initiated.

J) A study on 'Disputes in Technology Transfer – case studies' is under progress. The study would analyze causes of disputes, the manner of settlement and then bring out issues which lead to disputes and give suggestions for avoiding them. The best possible course of action in the event of a dispute and the remedies available to the parties would also be presented.

K) A study on 'Electronic Industries Cluster of Karnataka' has been taken up. Rapid technological developments in electronics has spurred industry development in many parts of the country. In and around Bangalore a large number of electronic industry units dealing with telecommunication products, consumer electronic products and industrial and strategic electronic products have come up. The economic liberalization process, and rise of Information Technology has affected the Electronics Industry drastically. Two specific sectors, which have growth potential have been taken up for the purpose of this industry. Specific measures to boost these sectors in addition to identification of technology gaps would be the high-lights of this study.

5. PROGRAMMES FOCUSSING ON COLLABORATIVE WORK IN THE AREA OF TM WITH ACADEMIC INSTITUTES

A specific thrust is to be given to TM related aspects in academic institutes. Quite a number of academic institutes are taking deep interest in these issues. A number of them have now instituted full term courses devoted to these issues. Others have introduced modules on important TM aspects. Many have conducted orientation programmes for their faculty and students and others have organized specific interaction meets and discussion forums for participants drawn from industry, research and other organizations. The Division has actively collaborated with a few of these institutes to catalyze their efforts in the sphere of TM.

Work taken up with IIT Bombay, IIM Calcutta, IIT Delhi, ASCI Hyderabad and other academic institutes covering many areas like modules and sessions on TM aspects, specific industry case studies, newsletters, research work etc has yielded useful outputs.

Specifically, under a Memorandum of Understanding with the School of Management at IIT Bombay, many targeted activities have been taken up. A research study on "R&D effectiveness in Indian industries" is nearing completion. A quarterly publication covering on-going developments in the realm of TM is being brought out. Two studies on the management of technology aspects of select companies are underway. Workshops and seminars on seminal issues of TM have been organized, which have been deeply appreciated.

A Management Development Programme on R&D Management was organized at IIM Calcutta in association with the Division consecutively the third time this year. In addition, a research study is also being taken up at the Institute.

Association with the IIT Delhi has been in the form of technical support to their master's programme on management as in the past.

A similar association with IIT Roorkee was continued during this year too.

In addition, a specific study report assigned to the IIT Delhi is currently underway.

A Programme on 'Capability Building in TM' in association with ASCI Hyderabad is into its fourth phase. A number of programmes and activities have been taken up. Seminars on important emerging TM issues have been organized for the benefit of senior industry executives. A bibliography of recent articles and papers has been brought out. Case studies on three select manufacturing organizations are being completed. A manual on 'Negotiations for Technology Transfer' has been completed.

A National Seminar on 'R&D Management' was supported at IIT Kanpur.

In addition, the Division has organized specific programmes with RECs, other Universities and technical and management institutes across the country, during the current year. In the process, it has sensitized importance for need-based course modules on TM issues through their specific interactions with these academic institutes. The Division has also involved members drawn from AIMA, industry, MHRD, AICTE and others in such interactions to relay the importance of TM aspects.

The Division has assigned research studies to different institutes on various aspects of TM inclusive of BITS Ranchi, XLRI Jamshedpur, TA Pai Management Institute Manipal, PSG Institute of Management Coimbatore.

6. TRAINING PROGRAMMES ON VARIED ISSUES RELATED TO TM FOR THE BENEFIT OF INDUSTRY, ACADEMIC INSTITUTES, R&D ORGANIZATIONS AND OTHERS

Imparting training on specific issues of technology management and creating an awareness of importance of technology related issues in every aspect of decision making has been one of the focus areas of the Division. It has been actively taking steps to advance and promote learning in various fields of technology management. In this connection, different packages tailor-made to suit the individual needs of soliciting organizations has been one of the major features of the training packages offered. During the year, training programmes have been organized in association

with different academic institutions and universities, research organizations, industry related institutions and others.

- A Programme on 'Management of Innovation and Technology Change' was organized in association with Rajiv Gandhi Praudyogiki Vishvavidyalaya of Madhya Pradesh at Bhopal.

- A training programme on 'Technology and Innovation Management' was organized in association with CII, Southern Region at Tiruchirappalli.

- The Division has associated with GRD Institute of Management in the organization of a National Seminar on 'Technology Management'.

- A training programme on 'Technolo-Entrepreneurship' was organized in association with Maharashtra Council for Entrepreneurship Development and IIT Bombay at Pune.

- Programmes on 'Technology Management Issues' have been organized at RECs located at Durgapur, Allahabad, Jamshedpur and Hamirpur. With this the Division has been able to enhance awareness on Technology Management related issues in 15 RECs across the country, during the past few years.

- In addition a training programme of two weeks duration for trainers was organized at Calicut Regional Engineering College. Delegates were not only from institutions in Kerala but were also from the neighbouring States of Karnataka, Andhra Pradesh and Tamil Nadu.

Emerging issues and new 'sunrise' technologies require a special focus. The Division has been constantly endeavouring to factor this aspect and some programmes have been designed to specifically address this.

- A programme titled 'Managing Bio-technology Growth: Top Management Workshop' was organized in collaboration with ASCI at Hyderabad.

- A programme on 'Management of Intellectual Property Rights' was organized in association with Madhya Pradesh Consultancy Organization Ltd., and Chattisgarh Industrial and Consultancy Organization Ltd.

- A National Seminar on 'Creativity and Innovation' was organized in association with Raipur Institute of Technology.

In order to focus on the specific needs of the small scale sector, a five day training programme specially suited to the requirements of the SMEs sector was organized at Hyderabad in association with ASCI, UNIDO and CII.

7. CASE STUDIES COVERING TM ASPECTS IN RESPECT OF MANUFACTURING AND RESEARCH ORGANIZATIONS

It is important to study and analyze the manner in which technology is managed in companies in the Indian scenario. Such studies are important firstly for pedagogic use. Management Institutions that have ventured to teach specific modules in Technology Management have very little Indian case material to bank upon. These studies also provide also useful inputs to consultants and executives from industry. The Division has been focusing on this issue and a number of case studies relating to different manufacturing and research organizations have been taken up in recent years.

These studies inter-alia cover the specific technology strategy of the company studied, the manner in which the technology strategy is dove-tailed with its business plans continually, the manner in which technology scanning and forecasting is done, its R&D Management strategy, the methodology it adopts for acquisition of new technology, the schemes employed for protection of technology, its strategic decision making on issues related to acquisition or development of new technology, technology decisions in its marketing strategies and other such issues revolving around technology management.

During the year, three case studies have been completed. Five more case studies are in progress.

8. INDUSTRY-INSTITUTE NETWORKING

Under a Memorandum of Understanding (MOU) with the Karnataka Council for Technological Upgradation – a joint effort of the Government of India and the State Government of Karnataka – a number of activities related to Technology Management have been initiated. The programme is currently in its first phase. The activities include specific cluster study reports, bringing out of a periodic publication, the organization of training programmes and workshops on specific Technology Management related issues and awareness generation programmes.

A study taken up on the Cashew Processing Industries Cluster in the State of Karnataka by the KCTU under the above MOU has been completed, a gist of which follows:

Cashew has been an important revenue generating plant and about 75% of the world production of cashew kernels is contributed by India.

A number of units involved in Cashew Processing are located in Karnataka. These units contribute considerably to the economy of the State. This industry has the ingredients of integrated rural development and as such is important for our country. The industry is labour oriented and women are predominantly employed. The industry is mostly located in rural areas, where otherwise employment is scarce. Yet, a manufacturing process is involved.

Cashews are generally processed without the use of any chemical. Cashew processing involves roasting of cashew nuts to enable shelling of nuts and extraction of kernels. One of the earliest technologies used was roasting through natural heat from the sun. It is still prevalent in many of the units. Drum and pan roasting were techniques used later to extract the kernel from the nut. Oil bath roasting became prevalent once the use of cashew nut liquid became known, the extraction of which was easier using this technique. The steam process, involving roasting by direct application of steam to dry nuts is also currently in use. For detachment of the skin, scrapping with a blunt instrument by skilled labour is the most commonly used method. This is done after drying of the kernels using hot air drying. The final stages include segregation in different grades and then packing.. As human labour is involved at various stages of cashew processing, hygiene has become an important consideration. The basic machinery required include: boiler, steam roasting chamber, hot air dryer, cutting machine and vibrating type filling machine.

Brazil, Vietnam, and Mozambique are amongst the leading producers of Cashew in the World, apart from India. Indian cashew has established a strong market presence around the globe. There are known to be 33 grades of cashew, of which India offers 26 grades.

The industry has currently a net installed capacity of 7,00,000 metric tonnes per annum and it is expected that that an additional capacity of 2,00,000 metric tonnes will be created in a couple of years hence.

The Cashew Export Promotion Council of India located at Quilon in Kerala is responsible for promoting the export of cashews from the country. There are Cashew Research Stations located at Madakkathara and Anakkayam in Kerala and Bapatla in Andhra Pradesh, which are dedicated to improving the yield of cashew. Apart from these, the State Agricultural Universities located in the cashew producing regions are also working on various aspects of cashew cultivation. Central Food Technology Research Institute (CFTRI) at Mysore has done some work in the area of cashew processing.

The CFTRI has developed a prototype drier based on infrared radiation for continuous drying in a cycle of 60 to 75 minutes. The major advantage is that the entire kernel gets uniformly dried as the infrared radiation penetrates the kernel. In conventional heating method, this drying is not uniform leading to a hard exterior of the nut.

The cashew processing units have realized that packaging is also an important aspect. Proper packaging offers several advantages like better product protection, longer shelf life and re-cyclability. The system is a fully integrated one that includes assorting and quality inspection conveyor, dust and foreign matter removal, filling, settling, weighing and hermetic sealing in a high vacuum chamber after suitable inert gas flushing. Such a system at par with the state of art in the

world is in use in some of the units. Some units conduct frying tests to test the quality of roasting and ensure uniform roasting of desired quality. Besides, anti infestation and disinfestation measures are also undertaken in the units.

The study has suggested a few measures to make the industry cluster more competitive. Suggestions include measures for modernization of machinery, linkages with suitable R&D organizations, knowledge enhancement. low cost automation, process upgradation, standardization and quality improvement. The setting up of an experimental station and special export processing zone and a functional industrial estate are being thought of as long term measures to boost the industry.

A TM Centre has been established at PSG Institute of Management, Coimbatore. The objective of the Centre is mainly to act as a resource base for TM related activities for furthering knowledge in the filed of TM. The Centre would thus serve to provide information on an on-going basis in respect of TM related issues. An industry locus has been selected for the purpose so that close linkages between industry, technical, management and research organizations can be forged effectively.

A number of activities are being taken up at the Centre which include: counseling and training for development of human resources for implementation of TM programmes; undertaking of studies focusing on specific industry related issues; providing services and guidance to small and medium enterprises in business innovation and TM; conducting seminars and workshops to enable interaction between different interest groups; enhance TM capabilities in select SME clusters and introduction of TM related modules at the post graduate level at the institute to enable fresh students imbibe essential aspects of TM so that they are better equipped to cope up with the competitive situation they would face; publications on different TM aspects for increased knowledge sharing and others.

Apart from enhanced awareness of TM issues through periodic newsletters, focused training programmes and guided lectures, practical implementation of TM aspects addressing the specific needs of local industry are also being taken up at the Centre.

Keeping in view the promotion of Indian Capabilities and experiences in the field of Technology Management, two workshops were organized in association with APCTT at Ulaanbaatar in Mongolia and Cebu City in the Philippines. These Workshops focused on several emerging TM issues and were well attended and appreciated by the participants, who were senior executives and officers from the respective Government Departments, industry, research and academic institutions in the two countries.

9. INDUSTRIAL TECHNOLOGY

The industrial technology activities have historically been dealt by DSIR wherein proposals received from Secretariat for Industrial Approvals (SIA) for grant of Letter of Intent (LOI) and / or Foreign Collaborations (FC) with or without import of capital goods, extension of Foreign Collaboration by Indian entrepreneurs, foreign entrepreneurs / organisations, from Non-Resident Indians (NRIs) and those willing to set up 100% Export Oriented Units (EOU). During the post-liberalisation period, this is continued based on proposals received. The following are the broad highlights:-

A. Industrial Licensing

About 115 proposals for grant of Letter of Intent / Carry-on-Business, Extension of Letter of Intent etc. were received during the year. 16 meetings of Licensing Committee were held by SIA during 2001.

B. Meetings Concerning Foreign Collaborations and Others

The department received around 580 proposals from Secretariat for Industrial Approvals. These excluded such proposals involving foreign investment, which were directly considered by the Foreign Investment Promotion Board. During the year, the Department participated in the 16 meetings of the Project Approval Board and 5 meetings of the Board of Approvals for 100% Export Oriented Units held by SIA.

V(B). TRANSFER AND TRADING IN TECHNOLOGY (TATT)

1. OBJECTIVES

The TATT scheme mainly aims to promote technology intensive exports including export of technologies, projects and services. The measures adopted include:

- Supporting studies aimed at documentation and analysis of India's technology export capabilities in select sectors, technological requirements of other countries, technology export related policies and associated IPR issues, etc.
- Publicity and dissemination of Indian technological capabilities through workshops, trade fairs, delegations and video films;
- Supporting demonstration of exportable technologies, overseas as well as within India;
- Supporting Small and Medium Enterprises (SMEs) for value addition and export production;
- Facilitating linkages between R&D institutions and industry in hi-tech areas for technology trade and exports.

2. BACKGROUND

The TATT scheme became operational during the year 1986-87 through a cell set-up in DSIR for this purpose. A number of programmes and projects aimed towards its objectives were completed during the 7th Five Year Plan. A re-organisation of schemes took place at the beginning of 8th Five Year Plan, when TATT scheme became a part of SEETOT programme and the Technical Advisory Committee was reconstituted. The thrust of the projects during 1985-1992 has been towards documenting our technological expertise and capabilities, preparation of technology profiles of select developing countries, and enhancing export efforts in the area of technology transfer through seminars/workshops, and video films. The focus during the 8th five year plan was intended to be generally towards commercialization of exportable technologies through setting up demonstration plants and export market development. Other activities undertaken related to compilation of data on technology exports and promotion of export of technology intensive services. However, DSIR did not receive many proposals from the industry or R&D institutions for demonstration plants. Since beginning of 9th plan period, programmes have been evolved mainly to project our technology related capabilities. These included compilation and dissemination of technology export related publications and encouraging exporting organisations including R&D institutions to participate in international trade fairs in India and abroad. A Technical Advisory Committee was reconstituted during 1997-98 to guide and advise as regards the implementation of the scheme. Eight meetings of the Technical Advisory Committee have been held till December 2001.

3. HIGHLIGHTS OF ACHIEVEMENTS DURING NINTH FIVE YEAR PLAN

The following activities have been completed during the first four years of Ninth Five Year Plan.

- A report of the "Task Force on Promoting Technology Exports from India", set up under the chairmanship of Shri N. Vittal in June 1997 was released in January 1998.
- Studies Completed:
  - Capabilities for Export of Non-conventional Technology Intensive Services.
  - Policy Measures for Accelerating Technology Related Exports in Select Countries.
  - Export Potential of Indian Technical Know-how in Institution Building and Manpower Training for Construction Industry in Nepal and Bangladesh.

- Compendiums/Newsletters brought out:
  - An annual Compendium on Technology Exports was brought out since 1998 in association with IIFT.
  - Quarterly Newsletter on Technology Exports is being published since July 1998 in association with IIFT.
  - A monthly newsletter on "IPR for Six Export Oriented Industrial Sectors" is being published since June 2000 in association with WITT.
- Institutional Mechanism
  - Technology Export Development Organisation (TEDO) was setup by DSIR and CII jointly in March 2000.
- Trade Fairs and Expositions
  - A Technology Pavilion has been setup jointly with India Trade Promotion Organisation (ITPO) during the India International Trade Fair at Pragati Maidan, New Delhi every year since 1997 to promote and disseminate the technology related export capabilities of our organisations including R&D laboratories and institutions. Around 125 organisations have participated in the Technology Pavilion during 1997 to 2000. More than 1000 business inquiries were generated in the Technology Pavilion for the participating organisations.
  - Support for participation of CSIR laboratories in Indian Industrial Products & Technology Expositions (INDIATECHs), organized by Engineering Export Promotion Council, was provided. Three laboratories each were supported during INDIATECHs at Lagos, Nigeria in April 1999, Colombo, Sri Lanka in January 2000 and Cairo, Egypt in September 2000. Five laboratories, TIFAC and NRDC were supported during INDIATECH at Caracas, Venezuela in July 2001.
- Seminars/Workshops organized:
  - ESCAP seminar on National Policies and Technological Capability Building in Developing Countries in 1997.
  - "Technologies from India" in 1998 and 1999.
  - Seminars on "Enhancing Export Competitiveness" in 1999.
  - "Export Potential of Indian Technical Know-how in Institution Building and Manpower Training for Construction Industry in Nepal" at Kathmandu in 1999.
  - "Policy Measures for Accelerating Technology Related Exports in Select Countries" in 2000.
  - Role of Technology in Enhancing the Growth and Export Production of SMEs in 2000.
- Technology Demonstration
  - Demonstration of solar photovoltaic technologies and systems in select countries for export market development by Central Electronics Limited. The exports of CEL increased 6 to 8 times as the result of this project.

4. PROJECTS/ACTIVITIES DURING THE YEAR 2001-02

Details of some of the projects/activities completed or in progress during the year under report are given below:

4.1 Publication on Technology Exports and Exportable Technologies

The publication contains information on technologies actually exported as well as technologies having potential for exports. The publication analyzes the data on technology exports and exportable technologies and highlights export trends in terms of sectors, destinations etc. Besides containing details such as brief company profile, details of exportable technologies available with the company, preferred mode of technology transfer, preferred export destinations etc, there is a

separate section giving details of technologies actually exported. The publication serves as a ready source of reference to foreign customers who are looking for technology business partners from India. The target audience for the publication includes foreign embassies/missions in India, Indian embassies/ missions abroad, foreign business delegations visiting India and Indian delegations going abroad, exporting organisations and consultancy companies. The publication is being brought out annually, in association with Indian Institute of Foreign Trade, New Delhi. Publication containing information and data, pertaining to the year 1999-2000, on about 200 technology intensive organisations was being finalized during the year.

4.2 Newsletter on Technology Exports

A quarterly Newsletter on Technology Exports, initiated during the year 1998-99 was continued. The Newsletter is being compiled by IIFT under the guidance of Editorial Board, comprising of representatives from DSIR, IIFT, Exim Bank, Ministry of External Affairs, ITPO and Waterfalls Institute of Technology Transfer. The Newsletter includes a lead article and details on technology export related policies, global technology and India's technology developments, joint-ventures, India's achievements in technology exports, technology offers and requests etc. The Newsletter has been greatly appreciated by industry, embassies/missions and other export promotion councils. A special issue of the Newsletter, marking the successful publication of 12 quarterly issues was brought out during the year.

4.3 Technology Trade Pavilion 2001 at India International Trade Fair, New Delhi, Nov 14-27, 2001

The objective of setting up a Technology Trade Pavilion was to promote display and dissemination of information related to technological capabilities, products and technologies of companies and organisations including R&D laboratories, product design institutes and academic institutions. The Technology Trade Pavilion was setup jointly by Department of Scientific and Industrial Research (DSIR) and India Trade Promotion Organisation (ITPO) for the fifth time in succession since 1997. The space in the Technology Trade Pavilion was offered free (cost shared equally by DSIR & ITPO) to the R&D laboratories and organisations engaged in technology intensive business, thereby encouraging them to exhibit their technology export capabilities. A space of 1000 sqr. mtrs. was reserved in Pragati Maidan this year for the Technology Trade Pavilion as against 500 sq. mtrs in the earlier years.

Around 80 organisations, both from public and private sectors including national R&D laboratories participated in the Technology Trade Pavilion. These included the laboratories of Council of Scientific and Industrial Research, Central Pulp & Paper Research Institute, Central Mine Planning and Design Institute Ltd., Shriram Institute for Industrial Research, Central Electronics Limited, HEG Limited, Central Ground Water Board, National Research Development Corporation, Mecpro Heavy Engineering Ltd., Indian Oil Ltd., Technology Export Development Organisation, Asian and Pacific Centre for Transfer of Technology and Techno Telemedicine and Telehealth Care Ltd., etc. The participating organisations in the Pavilion displayed their technological capabilities through models, prototypes, interactive computer based displays, charts, machinery/product samples, etc. Awards for best displays were recommended to Indian Oil Ltd., Central Mine Planning and Design Institute Ltd. and All India Herbal Research Association. Technology Innovation awards were recommended to Techno Telemedicine and Telehealth Care Ltd., HEG Limited and M.R. Morarka-GDC Rural Research Foundation. A special Appreiciaton Certificate was also recommended to AB Initio Corporation.

The Technology Trade Pavilion helped in promoting one-to-one interactions and business negotiations between the participating organisations displaying their technology intensive products, technologies, machinery, services, etc. and potential customers of Indian technology and services. These interactions, including interaction between R&D system and industry, generated many business enquires, besides creating awareness about our technological capabilities.

4.4 Seminar on International Trade Opportunities in Technology, September 7, 2001, Pragati Maidan, New Delhi

The seminar was organized jointly by Department of Scientific and Industrial Research

(DSIR) and India Trade Promotion Organisation (ITPO), as a precursor to the Technology Trade Pavilion setup at India International Trade Fair, Pragati Maidan, New Delhi during November 14-27, 2001

The objectives of the seminar were three-fold, viz. (i) to project India's select technological capabilities and internationally tradable technologies; (ii) to create awareness among Indian suppliers of technologies, projects and related services about the technological needs of some of the other countries; and (iii) to discuss strategies and policy measures for promoting international technology trade.

The Seminar was attended by around 200 delegates from industry, consultancy organisations, export promotion agencies, R&D laboratories & institutions, government departments, academic institutions, including representatives from around 20 foreign embassies/missions.

The opening session featured keynote address by Shri Udayant Malhoutra, President & Managing Director, Dynamatic Technologies Ltd., Bangalore and inaugural address by Dr. D.N. Tiwari, Member Planning Commission.

Dr. Tiwari also launched the Technology Export Development Organisation (TEDO) website, immediately after his address. The website has been designed to serve as a technology export promotion tool. Presently, it hosts information on about 120 exportable technologies and technology intensive products/projects/services from 72 companies and R&D organisations.

The Seminar seemingly helped in creating awareness, particularly among foreign embassies/missions, about our technological capabilities and some of our exportable technologies, projects and services. It also provided up-to-date information about the technological developments in some of the other countries. A forum was provided for interaction among the Indian entrepreneurs, industrialists, scientists and managers and representatives of foreign embassies/missions. The initial contact established through this Seminar is likely to help in long term interactions between the industry and R&D counterparts of India and other countries.

4.5 Technology Export Development Organisation

The main objective of the Technology Export Development Organisation (TEDO) - a Cell jointly setup by DSIR and CII, is to promote and support technology and technology intensive exports through collaborative efforts of government, industry, research & academic institutions, financial institutions and other export promotion agencies. The first Advisory Committee meeting of TEDO was held under the chairmanship of Secretary, DSIR on August 18, 2000. Several Executive Committee meetings were held to plan the focus areas and activities of TEDO. It was decided that TEDO would initially focus on four areas, namely Agro/Food Processing, Light Engineering, Indian Systems of Medicine and Homeopathy and Chemicals and Pharmaceuticals. The nature of activities planned include studies, training/awareness programmes, missions, fairs and seminars, technology demonstrations, etc. During the first year of TEDO operations: a TEDO brochure was printed; an interaction meeting on "Indian System of Medicine & Homeopathy: Export Opportunities" was held on 15th March 2001 in which Special Address was delivered by Secretary, Deptt. of ISM&H; a report on "Indian System of Medicine & Homeopathy: Export Opportunities" was prepared; and a TEDO website - TechBizIndia.com - was designed.

The schedule and quantum of TEDO-activities, as proposed in the Agreement, needed to re-prioritized and re-planned subsequent to discussions during the Executive Committee meetings, held periodically. This had been necessitated due to the dynamic nature of opportunities and market in the area of technology related exports and also, due to the need to allocate a realistic budget for the planned activities. However, the activities continue to be focused in four major categories, viz. (a) Technology Export Information Services, (b) Training, (c) Trade Fairs & Technology Demonstrations and (d) supporting industry initiatives on technology related Joint Ventures abroad.

The second meeting of the Advisory Committee was held on August 1, 2001 under the chairmanship of Secretary, DSIR. TEDO work plan for the year 2001-02, as agreed during the Advisory Committee meeting includes activities such as: development/maintenance of TEDO

website; industrial mission on Indian Systems of Medicine to select countries; Technology Pavilion at Technology Summit, Hyderabad; TEDO Pavilion at India International Trade Fair: 2001, New Delhi; reports on Agro-food processing, light engineering and chemicals/pharmaceuticals; and preparation of technology profiles.

4.6 Indian Industrial Products & Technology Exposition (INDIATECH-2001)– Caracas, Venezuela, July 18-21, 2001

The above Exposition was organised by Engineering Exports Promotion Council (EEPC) with the support of DSIR and other organisations. DSIR supported the participation of 5 CSIR laboratories (CLRI, IIP, CMRI, IICT and CDRI), TIFAC and NRDC in the above Exposition by offering them free space. Ministry of Commerce and Embassy of India at Caracas actively coordinated the organisation of the event. The objective of DSIR support for the participation of national laboratories from the CSIR system in the Exposition was to provide an opportunity for interactions between R&D and industry of both the countries.

A Seminar on "India and Venezuela – Partners in Technology and Business" was also organised on July 19, 2001 with the support of Indian Embassy at Caracas and under the co-sponsorship of Venezuela's Petroleum Holding Company. The Department of Scientific and Industrial Research (DSIR) offered technical support for the seminar.

4.7 Newsletter on IPR for Export Oriented Industrial Sectors

Waterfalls Institute of Technology Transfer (WITT), New Delhi has been commissioned to bring out 24 monthly Newsletters: "IPR for Industry", focusing on 6 areas viz. leather, sports goods, foundry, knocked down furniture, machine tools and locks. The objective of these newsletters is to create awareness about Intellectual Property Rights among technology based Small and Medium Enterprises. It is hoped that the newsletter would help SMEs in taking advantage of the latest technological trends contained in patents, designs, etc. for improving their technological capabilities and enhancing their export production. The monthly newsletters are being published regularly since June 2000.

4.8 Enhancing Awareness on Industrial Property Information through Workshops

The objective of this project is to disseminate the knowledge and information compiled in the Newsletter – "IPR for Industry" through workshops, involving the concerned industry sectors. A curtain raiser workshop was held on October 19, 2001 at New Delhi to sensitize the concerned industry associations. Workshop on Machine Tools was held on November 9, 2001 at Bangalore. This workshop was organized in association with Centre Manufacturing Technology Institute (CMTI), Bangalore and was attended by about 50 participants. Workshop on Foundry was held on November 24, 2001 at Coimbatore. This workshop was organized in association with Institute of Indian Foundrymen and Coimbatore District Small Scale Industries Association (CODISSA) and was attended by around 80 participants. Workshop on Leather was held on December 6, 2001 at Chennai. This workshop was organized in association with Central Leather Research Institute and was attended by around 80 participants. Other three workshops on sports goods, locks and furniture are planned during January-March 2002.

4.9 Awareness Programme on Technological Needs of SMEs for East African Students

The objective of the programme being organized by All India Management Association (AIMA) is to create awareness among African students studying engineering in India about the opportunities available for setting up their own enterprises back home based upon the Indian SMEs experience, technology and machinery. It is expected that the students undergoing these programmes would emerge as Indian goodwill ambassadors upon return to their countries. The African Embassies are being requested to sponsor the students for the programme.

4.10 Awareness Programme on Opportunities for Promoting High Value Added Exports

The objective of the programme was to create awareness among exporters and students about export-import procedures, opportunities, challenges, value added exports and market. The programme was organized by International Institute of Foreign Trade and Research (IIFTR) at Indore during October 12-13, 2001. The programme was attended by around 30 exporters.

4.11 Feasibility Study for Export of Indian Technical Know-how in Institution Building and Manpower Training for Construction Industry in Sri Lanka

The study aims at identifying the potential for export of Indian expertise and know-how in institution building and manpower training for the construction industry in Sri Lanka. It is also planned to identify specific business opportunities for Indian institutions, companies and agencies in construction sector. The first meeting of the Project Evaluation Committee was held to discuss the draft report prepared by NICMAR, on the basis of desk research and published literature. A revised draft report, including inputs of field survey in Sri Lanka was being finalized.

4.12 A Strategic Approach to Strengthening the International Competitiveness of Knowledge Based Industry

The objectives of the research proposal are to study: India's export structure in terms of its knowledge intensity compared to some of the South East Asian countries; emerging patterns of FDI inflows and the participation of MNCs in knowledge based industries; outward investments by Indian enterprises in knowledge based industries; export oriented manufacture by MNCs; etc. and draw up strategies for strengthening the international competitiveness of knowledge based industries in the country. It is also envisaged under the proposal, to conduct detailed industry studies in 5 knowledge based sectors. The project is being carried out by Research and Information System for the Non-Alligned and other Developing Countries in four phases. The Phase I focuses on collection of secondary data and carrying out preparatory work for quantitative analysis. Phase II focuses on quantitative analysis of published literature. Phase III focuses on field survey. Phase IV focuses on final analysis and report writing. Two discussion papers were prepared based on Phase I and Phase II and discussed in a discussion meeting.

4.13 Study to idendify the Potential for Technology Transfer to Bangladesh in Jute & Jute Diversified Products

The study aims at identifying specific projects regarding technology transfer to Bangladesh in the jute and jute diversified products. A draft report prepared by West Bengal Consultancy Organisation Ltd. (WEBCON) was discussed in an Evaluation Committee Meeting and subsequently finalized. The study suggests that there is lot of potential for India and Bangladesh to jointly target the global export market in the jute and jute diversified products.

4.14 Centre for International Trade in Technology

The main objective of the Centre is to conduct research on the emerging issues relating to technology trade agreements of WTO and other international arrangements such as, TRIPs, TBT, GATS, etc. and to identify specific technology related export opportunities for India and to develop training expertise in the area of technology export management. The Center is being projected to act as a "Think Tank" for research and policy related issues on technology transfer and trade. An agreement on the Centre between DSIR and IIFT was signed on June 4, 2001. Under the Agreement, DSIR would provide grant-in-aid to the Centre for a maximum period of three years for salary of faculty/staff and programmes/activities. A brochure on the Centre has been printed and a colloquium on technology exports was organized.

4.15 Exportable Technologies from Small and Medium Enterprises of Maharashtra

Maharashtra Industrial & Technical Consultancy Organisation Ltd. (MITCON), Pune has been entrusted to prepare 20 comprehensive profiles of exportable technologies in the 3 chosen sectors, viz. food processing, light engineering & electrical and chemicals & pharmaceuticals from SMEs in the State of Maharashtra. The profiles

would cover information on techno-commercial details of the technology, details of the organisations offering the technology, illustrating their competence and details of the foreign markets for the technology. The report on technology profiles was under finalization.

4.16 Miscellaneous

Interactions with technology related organisations were continued and strengthened and advisory services were rendered as required. During the year, the technology related exports have increased in absolute terms as well as a percentage of the total exports.

A technical paper on "Emerging Areas of Value Added Exports in Indian Perspective" was presented during the Executive Development Programme on "Challenges and Opportunities for Promoting High Value Added Exports", held on October 12-13, 2001 at Indore.

5. TECHNICAL ADVISORY COMMITTEE

Seventh and Eight meetings of the Technical Advisory Committee for the TATT and the Consultancy Schemes of DSIR were held during the year. The Technical Advisory Committee noted the progress of work under the two schemes and advised on the proposals received for support as well as future activities. Projects, studies and other activities recommended by the Technical Advisory Committee were taken up for implementation.

V(C). PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

1. OBJECTIVES

The objectives of the Scheme include:

- To promote and strengthen consultancy capabilities for both domestic and export markets.
- Support to Consultancy Development Centre (CDC) and other promotional organisations related to consultancy.
- Human Resource Development including fellowships to bright and promising engineers as apprentices with eminent consultancy organistions, arrange training etc.
- Support R&D efforts of consultancy organisations and commercialisation of indigenous technologies.
- Organise Seminars, Workshops, etc. and document consultancy capabilities.
- Create awareness among users of consultancy.

2. ACTIVITIES

Some of the programmes/activities carried out during the year till December 2001, are briefly indicated below:

(a) Documentation of Consultancy Capabilities and Experience

36 reports on consultancy capabilities in specific industrial sectors as well as at state level have been printed so far under the scheme. These reports have been widely disseminated.

In addition to above, the following studies were at various stages of implementation/ consideration.

(i) Study on role of Consultants in R&D and Innovation

With a view to enhance the interactions of R&D laboratories in CSIR system with consultants and widely disseminate their technological and consultancy capabilities to industry and also to explore nature and extent of involvement of external consultants in R&D and Innovation activities of CSIR labs, this study was commissioned at NISTADS. The study is completed and the final report was under print. The study examines potential of R&D through consultancy for consultancy development in R&D organisations, and in nutshell covers – specific technical areas, nature of services provided, Intellectual property generated, period of consultancy, amount involved, nature of clients, export of R&D services, R&D collaborations and future prospects, etc. Information on issues related to the involvement of consultants in R&D and innovations have been collected through a structured questionnaire as well as from field visits.

(ii) Study on Consultancy Needs for improving performance / upgradation of Textile Industry in UP

With a view to have insight of consultancy capabilities available in the state of Uttar Pradesh for Textile Industry and to study consultancy needs for improving performance and upgradation of this sector, this study was assigned to UP Industrial Consultants (UPICO), Kanpur. The study is expected to suggest a total package in terms of consultancy needs for revival and improving performance of Textile Industry so that it can face the global competition. The data collection was under progress.

(b) Promotion of Design Engineering Service Centres and Consultancy Clinics

Though India has developed considerable consultancy capabilities in several areas, consultants need to develop design and engineering capabilities in specific industrial sectors, particularly in the context of globalization, and thus become more competitive. These capabilities would also be useful in commercialising and marketing of indigenous technologies. Also, consultants and consultancy services need to be utilised optimally not only by big and medium

industries, but by the small-scale industries as well. Keeping these objectives in view DSIR has evolved programmes for promotion of Design and Engineering facilities in specific sectors, such as food processing, textile etc. and Consultancy Clinics to support SMEs particularly those located in clusters. The following centres/clinics have been supported/under consideration.

(i) Consultancy Clinic for Textile Industry at Bhilwara

With a view to provide doorstep professional services for textile industry in particular and other industries in general, this consultancy clinic is set up by Rajasthan Consultancy Organisation Ltd. (RAJCON) at Bhilwara. The clinic started operations, and clients started availing the services of the clinic. However, the progress slowed down due to management problems at RAJCON. DSIR reviewed the project and it was decided to utilise services of Institute for Labour Development (ILD), Jaipur which was also an IFCI supported organisation for developing skills and provide consultancy in the textile sector. However, it could not materialise because of their internal administrative aspects. Now new CMD has taken over RAJCON and efforts are being made to reactivate the clinic.

(ii) Consultancy Clinic for Lime Kiln Industry at Katni

With a view to provide doorstep professional services for lime kiln industry in particular and other industries in general, this consultancy clinic is set up by Madhya Pradesh Consultancy Organisation Ltd. (MPCON) at Katni. The clinic has started operations. Awareness campaigns have been started for clients, and clients are availing services of the clinic. The clinic has also started revenue generation by way of its services.

(iii) Other Proposals

Similar proposals from other organisations such as National Productivity Council, Gandhinagar, Madhya Pradesh Consultancy Organisation etc. were under active consideration for consultancy clinics for different SME clusters. A few proposals for setting up of Design & Engineering and Consultancy Services centres for areas such as Small Hydropower Development etc. were also under consideration.

(c) Institutional Programme Support

DSIR has been supporting capital and recurring needs of Consultancy Development Centre (CDC) set up to promote consultancy and implement programmes towards strengthening our consultancy capabilities.

3. REPORTS/PUBLICATIONS/PAPERS

A number of technical papers/reports relating to technology & consultancy, including the following were prepared and presented in various technical fora.

- A paper on "Enhancing Capabilities and Cooperation in Engineering Consultancy in the Asia Pacific Region – An approach" for TCDPAP International Workshop on "Ushering in a New Era of International Cooperation between Engineering Consultancy Industry in the Asia Pacific Region" held in China, October, 2001.

- A paper on "GATS and Consultancy Services in India – Government Policies and Measures" for Fifth National Consultancy Congress on "Implications of GATS in Services Sector" organised by CDC at New Delhi - January 2002.

- A draft report on "Role of Consultants in R&D and Innovation – A case study in CSIR".

4. ADVISORY SERVICES

Advisory services were made available to various consultancy related organisations, Departments and Organisations in relation to their programmes and activities. Following are examples of participation.

4.1 Committees

- Govering Council, Executive Committee, Membership Committee, Awards Committee for Excellence in consultancy, Review and Technical Committees of 5th National Consultancy Congress of CDC, Bye-laws and CDPA committees of CDC.

- Consultancy Committee of FIEO
- Boards of Directors of U.P. Industrial Consultants Ltd., Kanpur and Rajasthan Consultancy Organisation Ltd., Jaipur.
- Board of Governors of NICMAR, Bombay.
- Governing Council of CEAI.

4.2 Seminars/Workshops/Meetings

- Technical and organising committees for Fifth National Consultancy Congress organised by CDC at New Delhi in January 2002.
- Technical and Organising Committee for Seminar on Impact of WTO on Services Sector in India organised by CEAI, at New Delhi in January, 2002.
- Various Committees of IIFT and IGNOU, New Delhi.
- EDP Programme on Dehydration of Fruits & Vegetables organised by Food Processing Technologies and Service Centre (FPTSC), Kanpur.
- TCDPAP International Workshop on "Ushering in a New Era of International Cooperation between Engineering Consulting Industry in Asia Pacific Region" held in China, October 2001.

5. CONSULTANCY DEVELOPMENT CENTRE (CDC)

5.1 Background

CDC came into being as a registered society in January 1986, and is functioning from its office at India Habitat Centre Complex since May 1994. The centre is managed and guided by a governing Body consisting of representatives of consultancy organisations, R&D institutions, Government Departments, academic institutions, public sector units etc. CDC had a membership of 215 as on 31-3-2001, representing various types of consultancy organisations and individuals connected with the consultancy. The CDC has concentrated mainly on development of human resources, providing computerised data/information services, and strengthening of technological and managerial consultancy capabilities through a scheme known as "Consultancy Development, Promotion and Assistance (CDPA)" Scheme. CDC is providing consultancy/training in ISO-9000 and 14000 Quality Management Systems.

5.2 DSIR Support

An amount of Rs.62.5 Lakhs was provided as grant during 2000-01, and a release of about Rs.125 Lakhs was under consideration during 2001-02. The capital assets at CDC include computer systems with peripherals and accessories as well as some software. This facility is used for collection, analysis and dissemination of data, for training of engineering graduates and for small consultants. It is estimated that these investments have resulted in useful activities for nurturing consultants and users of consultancy for better returns on investments and enhanced earnings of foreign exchange directly and indirectly, besides several other qualitative advantages bringing long term benefits to the country. The centre is equipped with Library facilities for consultants.

A committee was constituted by DSIR to review and formulate the MOA, Bye-laws & Rules etc. of CDC, under the chairmanship of Shri S.B. Krishnan, the Secretary, TDB. The committee has submitted its report to DSIR which is under its consideration.

5.3 Technical Consultancy Development Programme for Asia and Pacific (TCDPAP)

In order to enhance technological and managerial capabilities as well as the export capabilities of consultants, interactions with international organisations – such as World Bank, Asian Development Bank, African Development Bank, International Trade Centre (ITC), UNIDO, ESCAP, APCTT, have been developed and programmes have been arranged for consultants at national and international levels which have proved to be useful to promote consultancy business. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. CDC was again nominated to function as secretariat for TCDPAP upto 2000 AD during its Second Meeting of Advisory/Promotional Committee. The first General Council meeting of TCDPAP held in October 1997 in Dhaka

recommended that TCDPAP should be developed as an independent UN identity. The Second General Council Meeting of TCDPAP was held in Kuala Lumpur, Malaysia during April 2000 in which CDC has been retained as secretariat for TCDPAP for another 4 years w.e.f. September 1, 2000. The Second Executive Committee Meeting of TCDPAP was held in October 2001, in China in which Biennial Action plan for TCDPAP was discussed.

5.4 Activities of CDC

Some of the salient features of the activities carried out by CDC during 2000-01 are as under:

5.4.1 Training

- During the year, CDC organised 6 short term specially structured training programmes on ISO-9000 Quality Management Systems and ISO-14000 Environmental Management System for consultants and small industries managers, to train them in design, development and implementation of ISO-9000 and ISO14000 systems.

- After several amendments and modifications in the syllabus of MS Consultancy Management Programme, the 5th batch of MS Programme which commenced in January 2001 was continued with 11 students, in collaboration with BITS, Pilani..

5.4.2 Consultancy and Facilitation in ISO-9000 QMS

During the year, CDC completed ISO-9000 Facilitation Project of Intercontinental Consultants and Technocrats Pvt. Ltd. CDC obtained two new assignments of Singhania and Partners, Solicitors & Advocates and Delhi Development Authority for getting them ISO-9000 Certification and bring improvements in their functional areas. M/s. Singhania and Partners – Solicitors & Advocates were awarded ISO-9000 Certification. The DDA project was in progress.

5.4.3 Study/Assignments

- A study commissioned by DSIR under its NRFC programme on Technology Status and Prospects of Bio-Degradable Plastics in India was under progress. Draft report of the study was prepared and submitted to DSIR for further evaluation.

- A project assigned by DSIR on Development of TQM Web site was under progress. This 'TQM' Webster is being developed as an Indian portal containing different techniques / tools / concepts etc. of TQM and related Management System. It would provide answers to questions and queries from Industry and trainers, etc. through discussion forums Frequent Asked Questions (FAQ) Sections. It would also provide a gateway to other related information resources on TQM of standard bodies / certification agencies.

5.4.4 Database and Information Services

The database of Consultants and Consultancy Organisations was augmented during the year. About 1000 profiles of Consultants/Consultancy Organisations were updated on a regular basis. A National Directory of Consultancy Services – 2000 was prepared and printed.

5.4.5 Developmental Services

Contact/Interaction Programmes

- Three interaction meets each on Consultancy Opportunities and Emerging Issues in Biotechnology, Synergies in the Development of Modern Drugs and Indian systems of Medicine - opportunities for Industry, Institutions and Consultants, and Intellectual Property Rights and its implications on Industry, R&D and Consultants were organised. Besides, 12 monthly meets on various aspects of consultancy were also organised.

- During the year, CDC had close interactions with the Technical Consultancy Organisations (TCOs).

- The centre continued with the scheme for R&D experts as Associates, to utilise their expertise in various developmental activities useful to consultants.

- The centre continued the scheme for business developments for consultants through a fortnightly bulletin on Consultancy Business Opportunities – A fast Announcement Service, which gives information on project opportunities likely to emerge in India and in global markets for consultants and professionals.

Fifth National Consultancy Congress

- The above Congress was held on 15-16 January, 2002 at New Delhi, with its theme as "Implications of GATS in the Service Sector". The Congress was attended by about 300 Indian and foreign consultants, exporters, policy makers, industry representatives, R&D personnel, and others relevant to consultancy. National Awards for excellence in consultancy were given away in this Congress.

Rating/Grading of Consultants

- A committee was constituted (under the Chairmanship of Shri S.P. Agarwal) for finalisation of criteria and methodology to be adopted for Rating/Grading of Consultants. Two meetings of the committee were held during the years 1998 to 2000. Substantial work was done by the Task Force in this regard and it was further discussed in the meetings of Governing Body of CDC. Scheme is likely to be evolved next year.

Scheme for Skill Upgradation of Consultants

- One consultant was provided financial assistance for attending International Workshop in Overseas countries under the skill upgradation scheme, during the year.

5.4.6 International Cooperation

The second General Council Meeting of TCDPAP was organised in Kuala Lumpur, Malaysia during April 2000 in which CDC was retained as secretariat for a further period of four years w.e.f. September 1, 2000. The office bearers of the General Council and Executive Committee were re-elected to continue office for another term with the exception that representatives from Indonesia, Iran and Korea were replaced by those from Nepal, Philippines, Vietnam in the Executive Committee. This meeting was followed by a three-day workshop on Strategies for Globalisation. 33 papers were presented during this workshop. The Second Executive Committee meeting of TCDPAP was held in October 2001, in Three Gorges, China which was followed by an International Workshop on "Ushering in a New Era of International Cooperation between Engineering" Consultancy Industry in Asia and the Pacific Region.

5.4.7 Publications/Brochures of CDC

- One issue of Newsletter "TCDPAP Focus" was brought out during the year.
- Proceedings of the Interaction Meet on "Business Opportunities in Energy Management in Industrial Sector" were brought out and disseminated.
- Four issues of Quarterly Newsletter "Consultancy Vision" were brought out, and were widely circulated.
- A brochure on MS (Post Graduate) in Consultancy Management Training Programme was brought out.
    - The brochure gives objectives, scope, implementation modalities and guidelines for the programme. The same has been widely disseminated to Consultants, academia and others.
- Brochure on "Technical Consultancy Development Programme for Asia and Pacific (TCDPAP)" were brought out.
    - The brochure gives information about the initiation and establishment of TCDPAP. It further highlights how consultants can avail facilities under this programme.

5.5 Revenue

CDC has made serious efforts to generate revenues on its own. It has earned a revenue of about Rs.93.24 lakhs during the year 2000-01 from services rendered to various agencies, membership, etc.

VI. LINKAGES WITH INTERNATIONAL ORGANISATIONS

During the year, the Department continued to participate in the activities of various international organisations such as UNCTAD, WIPO, UNIDO, ESCAP and APCTT at various levels and fora on issues related to Technology Development and Technology Transfer in co-ordination with other concerned Ministries.

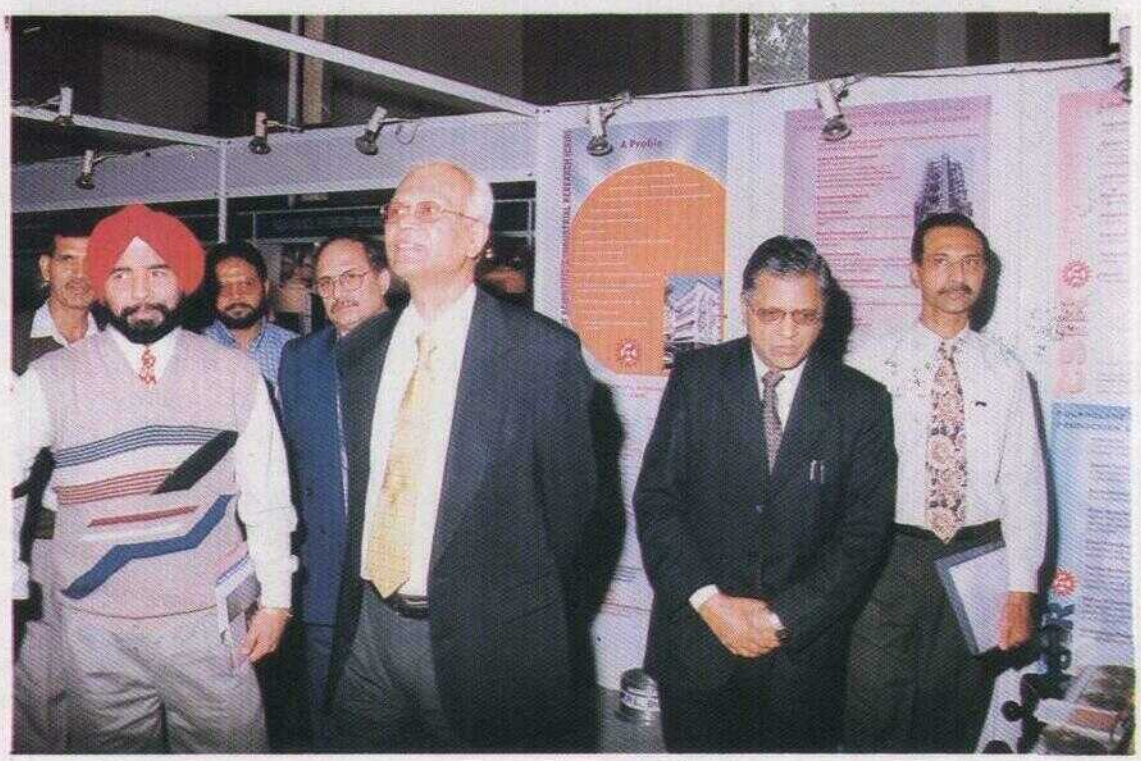
APCTT and ESCAP

The matters pertaining to the Asian and Pacific Centre for Transfer of Technology (APCTT) under ESCAP were dealt with in co-operation with the Ministry of Commerce. The Department of Scientific and Industrial Research continued to play the role of focal point for the APCTT. DSIR helped in preparing a brief covering technological issues for the use of Indian delegation to the 57th Annual Session of ESCAP held in April 2001 at Bangkok.

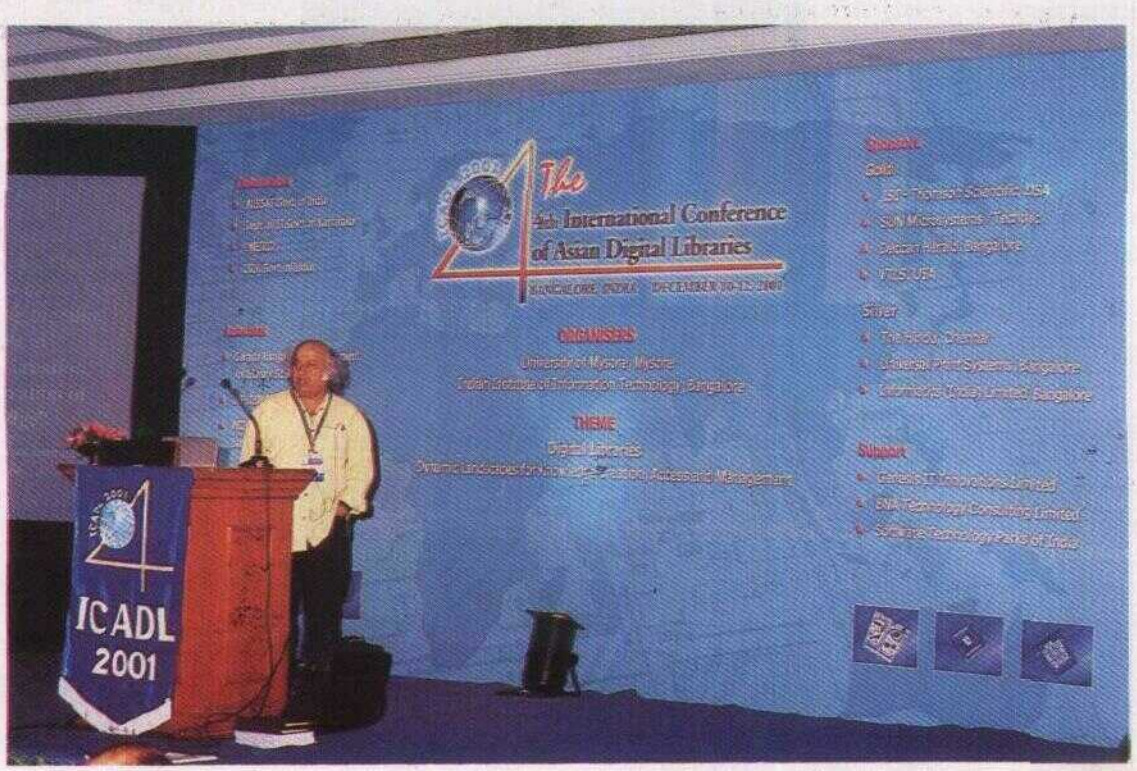
Shri K.V. Srinivasan, Adviser, DSIR participated in the Seventeenth Technical Advisory Committee meeting of APCTT held during 22-24 November, 2001 and the Sixteenth Session of the Governing Board of APCTT held during 26-27 November, 2001 in Shanghai, China. These meetings were attended by participants from China, Indonesia, Islamic Republic of Iran, Republic of Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and others.

Institutional support worth US $ 100,000 in Indian Rupees was provided to the Centre.

Senior officers of the department also participated in various workshops/seminars conducted by the APCTT during the year.

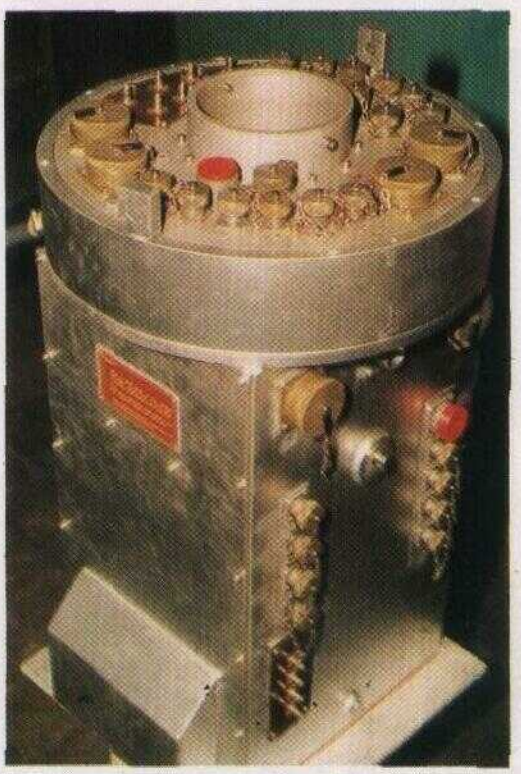


V.B.1 Secretary, DSIR at the CSIR booth in Technology Trade Pavilion, New Delhi



VII.1 Presentation of Indian Scenario on Digital Libraries

VIII.A.1 Dr. Murli Manohar Joshi, Minister of Science & Technology, HRD & Ocean Development releasing CD on IPR on the occasion of Technology Day



VIII.A.2 An awarded invention of the Development of Slipring unit of Monopulse C-Band Radar

VII. NATIONAL INFORMATION SYSTEM FOR SCIENCE & TECHNOLOGY (NISSAT)

1. INTRODUCTION

The increasing role of science and technology in the economic and social development of the country has generated a pressing demand for faster technology transfer to the industries. Apart from providing access to the information generated within the country, an information system is required to draw from the externally generated information to support internal efforts on research and development. Information centres serving the needs of different industries and R & D units, are therefore required to be coordinated and organized into an integrated system to avoid a haphazard growth and duplication of activities and to conform to national and international standards.

The National Information System for Science & Technology (NISSAT) commenced its operations in 1977 with the objectives of organizing information support facilities for a customer base largely dominated by people engaged in research and academics. In tune with the changing global scenario and in pursuance of the national efforts in liberalization and globalization of the economy, NISSAT reoriented its programme activities continually in order to be useful to a wider base of clientele in diverse subjects. Besides establishing the internal linkages between the information industry, its promoters and users, NISSAT has been making efforts to establish a bridge between information resource developers and users in India and other countries.

2. THE BROAD OBJECTIVES

The broad objectives of NISSAT are:

- Development of national information services
- Promotion of existing information systems & services
- Introduction of modern information handling tools & techniques
- Promotion of international cooperation in information
- Development of indigenous products & services
- Organization of skill development programmes
- Proomotion of R&D in Information Science & Technology

2.1 Subject Coverage

The NISSAT programme has the mandate to cover the entire spectrum of science and technology. However, during the process of programme implementation, special care is taken not to dwell upon subjects already being handled by other national programme like the BTIS, ENVIS or an agency like the ICAR. NISSAT solicits the views of other programmes/agencies, which are responsible for a subject under the allocation of their business. NISSAT requests for the expert views of institutions/individuals working on a given subject or its allied areas when required. As a proactive and progressive step, NISSAT has taken the onus on itself to strengthen the library movement in the country through the introduction of modern information technology, tools and techniques.

The main functions under the NISSAT scheme are the following:

i) Strengthening of information services through Information Centres in Science and Technology, Value Added Patent Information Services, National Access Centres to International Database Services, CDROM Database facilities etc.

ii) Development of an Indian S&T Web server (Vigyan) covering a variety of Indian S&T information and establishment of an Internet School.

iii) Development of sector specific websites like Indian Tea, Indian Ocean Data, Indian Food & Technology, Indian IPR Law, IPR on Biotechnology etc.

iv) Promotion of Information resource sharing in Science and Technology through city-based library and information networks with emphasis on web-based information content development.

v) Development of skills in entire gamut of library and information activities and promotion of development of indigenous database activities.

vi) Implementation of National Plan of action on Scientometrics/Bibliometrics and conduct of a series of R&D studies.

vii) Distribution and technical backup services on internationally developed software CDS/ISIS, MINISIS and IDAMS and development and promotion of CDS/ISIS based co-products like SANJAY.

viii) Coordination of international activities in collaboration with UNESCO and ASTINFO.

ix) Development of Information Market - marketing of information, revenue generation, Industry-User Interaction etc. and publication of the NISSAT Newsletter 'Information Today & Tomorrow'.

3. NISSAT CENTRES

3.1 National Information Centres

A sectoral information centre is established on a product, discipline or a mission. Sectoral Centres provide bibliographic as well as factual and numeric information to meet the various information needs of academicians, scientists, technologists, entrepreneurs, management executives and decision makers.

The Sectoral Centres are usually built around the existing information resources and facilities. They maintain extensive collections of published and unpublished documents in the from of books, periodicals, R&D reports, technical reports, standards, patents and trade literature in their subject areas.

A list of the NISSAT initiated National Information Centres in different Sectors is provided in the ***Table 1.***

NISSAT supported sectoral information centres are well equipped with modern information technologies. NICHEM, NICFOS, NICMAS have 64 Kbps lines through radio modems or VSATs. Besides providing documents and preparing bibliographies on request, they offer selective dissemination of information (SDI), current awareness services (CAS), reprographic & micrographic services, industrial and technical enquiry services, technical translation and similar access-delivery services.

Some of the sectoral centres bring out serial publications of digests, indexing & abstracting materials and news highlights. Apart from publishing these in print form, the information is more often computerized.

3.2 Virtual Information Centre

Setting up of a virtual Information Centre at ICICI Knowledge Park, Hyderabad is a three year project being awarded to ICICI Knowledge Park (IKP) for providing a gateway to existing information centres and fast and reliable access to information and interaction among industry, academia and public research institutions in the area of Science & Technology. Initially the information centre would focus on subject areas like biotechnology, pharmaceuticals, chemicals, new materials and IT/telecom. Thrust would be to work in a networking mode thereby assuring optimal usage of existing resources. A Knowledge Network Module has been developed as part of the project. This has information about Knowledge network and knowledge sharing partners. It also has links to Knowledge search, Knowledge news, and knowledge library.

3.3 VAPIS: Value-Added Patent Information Systems

With the changing economic scenario in the country and the impending IPR regime, it is imperative to strengthen the patents information activities in India. The fierce competition faced by Indian industries, the necessity of the awareness of competing innovations and the availability of

TABLE 1 : The NISSAT Sectoral Information Centres

NO.	SUBJECT AREA	ACRONYM	HOST INSTITUTION
1	Food Technology	NICFOS	Central Food Technological Research Institute, Mysore
2	Machine Tools Production and Engineering	NICMAP	Central Manufacturing Technology Institute, Bangalore
3	Textiles & Allied Subjects	NICTAS	Ahmedabad Textile Industry's Research Association, Ahmedabad
4	Management Sciences	NICMAN	Indian Institute of Management, Ahmedabad
5	Marine & Aquatic Sciences	NICMAS	National Institute of Oceanography, Goa
6	Publications on CD-ROMs	NCDROM	Foundation for Innovation and Technology Transfer, ITT, Delhi
7	Tea Manufacturing & Marketing	NICMAT	Tea Board, Kolkata
8	Drugs and Pharmaceuticals	NICDAP	Central Drug Research Institute, Lucknow
9	Chemicals & Allied Industries	NICHEM	National Chemical Laboratory, Pune
10	Leather Technology	NICLAI	Central Leather Research Institute, Chennai
11	Advanced Ceramics	NICAC	Central Glass & Ceramics Research Institute, Kolkata
12	Bibliometrics	NCB	Indian National Scientific Documentation Centre, New Delhi
13	Crystallography	NICRYS	University of Madras, Chennai
14	CD-ROM	NICDROM	National Aerospace Laboratory, Bangalore

* NISSAT financial support is now being provided only to centres listed at S.No.1 to 7 only. The parent institutions have absorbed other centres.

foreign technology has made the patent information vital for the industry.

Considering the expert manpower available in the National R&D systems and the increasing need from industries for technical information, NISSAT established Value Added Patent Information System (VAPIS) at National Chemical Laboratory, Pune on Chemical Sector and Central Manufacturing Technology Institute at Bangalore on Engineering sector to offer specialized value added information services. The services are based on databases pertaining to US, Europe, World, Japan and other patents available on CDROM. Separate subset of the database on Chemicals is located at NCL, Pune and on Engineering in CMTI, Bangalore. VAPIS centre on Biotechnology is established at CCMB, Hyderabad. This Centre is maintaining a website on Indian patents on biotechnology (biotechpatents.org)

3.4 NACIDS: National Access Centres to International Database Services

NISSAT established nine NACIDS facilities in Ahmedabad, Bangalore, Calcutta, Chennai, Delhi, Hyderabad, Mumbai, Pune, and Thiruvananthapuram for providing online facility to access international database services. The NACIDS provide search services from Dialog and STN databases. The centres are gaining popularity in spite of the fact that the users have to pay the full cost of a search. All the centres are now

already established and are absorbed by the parent institutions.

Knowing the success of existing Centres, two more centers are established at Guwahati and Bhopal.

4. INTERNET BASED ACTIVITIES

4.1 Web Servers

NISSAT has moved a step ahead by establishing web sites/servers. The details are given at ***Table 2.***

The Indian S&T web server is intended to provide comprehensive information on S&T development in India and to utilize the facilities to operate an Internet training school. The Internet School will be used to train a multitude of users for effective use of Internet and trainers to act as web publishers and web administrators. The Vigyan website was set up using a SUN Enterprise 250 server with an UltraSparc II processor, 256 MB main memory and 18 GB storage space. The server also has provisions for adding more memory and storage. The server is connected to the Internet through a dedicated 64 Kbps link. The contents of the website are being developed jointly by IISc, NISSAT and content developers funded by NISSAT. Various on-going content Development projects are library materials module, extramural research, expert manpower, S&T News, electronic theses and dissertations, Directory of Indian scientists, etc.

NISSAT has collaborated with the National Law School of India University, Bangalore in setting up a national web site for Intellectual Property Law. The website is a comprehensive site for issues in intellectual property rights in India. The contents have been arranged under various sections like Copyright, Patents, Trademark, Design, Integrated circuits, Traditional knowledge, Trade secrets, Biodiversity and Plant variety, etc.

The site contains judicial decisions of Indian and foreign courts (along with relevant head notes) and a number of well-researched, innovative articles, highlighting recent trends and developments in intellectual property. The site hosts information on International conventions and in due course would provide texts of the Acts

Table 2: NISSAT Supported Webservers/Websites

Subject	Host Institution	Uniform Resource Locator (URL)
Vigyan – Indian S&T	IISc, Bangalore	*http://203.200.16.99*
Intellectual Property Rights	National Law School of India University, Bangalore	*http://www.iprlawindia.org*
Indian Tea	Tea Board, Kolkata	*http://www.indiantea.org*
Indian Ocean Server	National Institute of Oceanography, Goa	*http://www.indian-ocean.org*
MYLIBNET	Central Food Technological Research Institute, Mysore	*http://www.mylibnet.org*
CALIBNET	CALIBNET Society, Kolkata	*http://www.calibnet.org*
Indian Total Quality Management	Consultancy Development Centre, New Delhi	*http://indiantqm.com*
Indian Traditional Textile Design	Dept. of Textile Technology, Indian Institute of Technology, New Delhi	http://indiantextiledesign.com
Knowledge Management - India	Administrative Staff College of India, Hyderabad	http://kmindia.org

relating to all the areas of intellectual property: patents, trademarks, copyright, designs, trade secrets, integrated circuits, biodiversity, plants and seeds, microorganisms. The site would also provide a showcase for events, seminars, job opportunities, available career and education choices, online help and archives of press releases.

A project on development of website on Indian Tea marketing and manufacturing has been initiated, in order to ensure efficient and effective information services at national level on tea. As phase I activities of the project, Tea Board has already designed, developed and hosted a website at http://www.teaindia.org highlighting the tea related information. In Phase I emphasis was on factual database covering directory of tea importers and exporters, tea producers directory, overseas tea importers, tea statistics, tea economies, tea business and trade, tea research, machinery used in tea industry, information on tea cultivation and tea manufacture etc.

The TQM National Website will be a single source for all TQM related information and act as a gateway to all globally distributed information on TQM. It will serve the needs of industry, certification agencies, scientists, engineers, technologists, etc.

Indian Traditional Textile Design Website hosted at http://www.indiantextiledesign.com provides comprehensive information on traditional woven textile designs of India along with the image catalogue.

KM India is a national website supported by NISSAT with an objective to provide all the relevant information on various facets of Knowledge Management. It has electronic newsletter on KM, which can be subscribed by visiting the website. Other items of information available on the site includes the technologies developed by NRDC, CSIR, BARC, DRDO, Space Research, Electronics, Biotechnology, IITs, etc., the Sectoral Trends on Pharmaceuticals, Telecom Services, E-Governance, Financial Services, IT Enabled Services, Software, Media & Advt, and Venture Capital.

5. INFORMATION RESOURCE SHARING

With a mandate to facilitate provision of broad based information services in the country, NISSAT has taken initiatives for promoting resource sharing activities through Library Networks. These initiatives are aimed at ensuring better utilization of S&T information resources, minimization of functional load of information centres and encouragement of motivational factors to a large extent by better means of communication.

NISSAT strives further to develop self-sustaining information systems. With this end in view, NISSAT goes to the extent of setting up general infrastructural facilities like network service centres including hardware, software, manpower, organizational requirements and communication facilities. The participating institutions in a network have to arrange for their own terminal hardware, software, and manpower and to take the responsibility of database development. Of course, NISSAT extends support for training, and common facilities like development of standards, preparation of union catalogues, data conversion and so on. ***Table 3*** provides a list of Network Hosts and network services management bodies.

6. INFORMATION TECHNOLOGY APPLICATIONS

The demand for use of computers ranges from automation of routine management functions in libraries to information retrieval or analysis of global databases. Since the inception, NISSAT had accorded a high priority to all aspects of computer based bibliographic information processing. As a part of the programme, NISSAT acquired proven software packages like **CDS/ISIS** for bibliographic information processing & retrieval and **IDAMS** for statistical data processing. NISSAT subsequently obtained the official rights for distribution of the two packages in India from UNESCO.

As on date, there are about 1860 installations of CDS/ISIS and 64 installations of IDAMS in India. The implementation of CDS/ISIS is monitored regularly through exchange of information, user's group meetings (eight such meetings have been held so far) and periodic surveys.

SANJAY is a package developed by NISSAT in collaboration with DESIDOC to help the libraries and information centres in India to improve their housekeeping and service functions

TABLE-3: NISSAT Sponsored Metropolitan Information/ Library Networks

Network	Host Site	Management	Uniform Resource Locator (URL)
ADINET	INFLIBNET, Gujarat Univ. Campus, Ahmedabad	Society drawing support from INFLIBNET	*http://www.alibnet.org,*
CALIBNET	Regional Computer Centre, Jadavpur Univ. Campus, Kotkatta	Society	*http://www.calibnet.org,*
MYLIBNET	CFTRI, Mysore	Institutional Project	*http://www.mylibnet.org,*
PUNENET	Bio-Informatics Centre, Pune Univ. , C-DAC and NCL, Pune	Institutional Project	*http://www.punenet.ernet.in*

Note : Network services centres provide Online and CD-ROM based search services.

TABLE-4: Project Areas Under National Mapping of Science

Subject Areas (Database)	Participating Institutions
Physical Science (INSPEC)	National Physical Laboratory, Delhi
Medical Sciences	Indian Council of Medical Research, Delhi.
Chemical Science (CHEMICAL ABSTRACTS)	National Chemical Laboratory, PUNE
Agricultural Science (CAB)	M.S. Swaminathan Research Foundation, Chennai
Biological Science (BIOSIS)	M.S.Swaminathan Research Foundation, Chennai
Mathematical Science (MATHSCI)	M.S.Swaminathan Research Foundation, Chennai
Earth Science (GEOREF)	Regional Research Laboratory, Bhubaneswar.
Indian Patent Literature	Delhi University, Delhi.
Social Science (SSCI)	National Social Science Documentation Centre, Delhi.

through automation. The package is totally menu driven and can be used even by non-professionals. The package was released for marketing in September 1995, and till now it has an installation base of 65 sites. During the current year the development of SANJAY under windows environment with LAN support has been completed.

7. DEVELOPMENT OF SKILLS IN INFORMATION SCIENCE AND TECHNOLOGY

Existing library and information science courses cannot keep pace with the rapid developments in the information field; there is a need to supplement these with continuing education programme at various levels. In view of the situation, NISSAT encourages and supports a variety of manpower development programmes which cover topics such as CDS/ISIS, WINISIS, *Internet and Web Designing, TQM in Library* Services, Patent Information for R&D and Industry, ISO 9000 Quality Management System, etc.

8. RESEARCH & DEVELOPMENT AND STUDIES

8.1 Scientometrics & Informetrics in India

In consultation with active participation of the subject specialists, the NISSAT has formulated a plan of action for scientometric and Informetrics studies in India. These studies attempts to map the Indian efforts in science through analysis of Indian contributions to the scientific literature as covered in CDROM databases. As a first step in the implementation of a programme of coordinated research, NISSAT has completed eight projects of National Mapping of Science (year 1990 & 94) using CA, Compendex, Inspec, SCI, Medline+Tropcial disease Abstracts +Embase, Biosis, Georef, CAB, AGRICOLA, ISA databases. The executive summaries of these studies are hosted on Vigyan server. The updating of the *aforesaid studies has taken up during the year as* per details given in ***Table 4***.

As many as four studies have been completed and three are under completion. In addition, two new studies in the field of Social Sciences & Indian Patent Literature have also been initiated.

8.2 Other Studies

NISSAT also promotes and supports research and development and survey studies. The list of such projects/efforts during the year of report is given in ***Table 5***.

9. DATABASE DEVELOPMENT ACTIVITIES

In pursuance of its thrust on contents development, NISSAT encourages indigenous database development activities. Besides library catalogues, union catalogues and lists, the activity could be on subjects in which a global database does not exist, or on subjects in which Indian elements are not properly represented. ***Table 6*** indicates the various projects supported by NISSAT during the period of report.

10. INTERNATIONAL ACTIVITIES

The activities of ASTINFO/UNESCO (Regional Network for the Exchange of Information and Experiences in Asia and the

TABLE-5: Studies / Surveys Supported by NISSAT

Activity	Participating Institution
Database and Annual Publication on Bibliometric Indicators of Indian Science	National Institute for Science, Technology and Development Studies (NISTADS), New Delhi
Holistic improvement of leather workers through information support in selected villages in Tamil Nadu	Central Leather Research Institute (CLRI), Chennai
Assessment of Information Needs of Small and Medium Enterprises in Madhya Pradesh	Madhya Pradesh Consultancy Organization (MPCON), Bhopal
Vidyanidhi (Electronic Theses and Dissertations)	University of Mysore, Mysore
Encoding and Decoding of Graphical Chemical Structures as Commercial Barcodes	National Chemical Laboratory (NCL), Pune
Provision of Library and Information Services on Intranets and Internet	National Centre for Science Information (NCSI), IISc, Bangalore

TABLE-6: Indigenous Database Activities Supported by NISSAT

Database Activity	Participating Institution
Database of Indian Chemical & Pharmaceutical Industries	National Chemical Laboratory, Pune
Directory of manufacture of various kinds of Ferrous and Non-Ferrous and Special Castings	Indian Institute of Foundrymen, New Delhi
Bibliographical database of Indian Scientists	Jawaharlal Nehru University, New Delhi
Indian Sugar Industry	Vasant Dada Institute of Sugar, Pune
Directory of Libraries and Information Centres in Gujarat	Gujarat Granthalaya Sewa Sangh, Ahmedabad
Virus and Virology	National Institute of Virology, Pune
Directory of S&T institutions in India	Indian National Scientific Documentation Centre, New Delhi
Database on Silkworms	Madurai Kamaraj University, Madurai
Directory of Database on Agrochemicals Industry Sector	Indian Institute of Chemical Technology, Hyderabad
Directory of Database on Engineering Faculty	National Foundation of Indian Engineers, New Delhi
SR Ranganathan's work and letters	Institute of Information Studies (IIS), Bangalore
Database on Folk wisdom	Foundation for Information and Communication, Tenali
Database on Indian Traditional Textile Design	Indian Institute of Technology (IITD), New Delhi

Pacific/UNESCO) are closely coordinated with those of NISSAT. The NISSAT Advisory Committee also functions as the National Advisory Committee of UNISIST and the National Advisory Group for ASTINFO. Besides, NISSAT has been included in the Advisory Group to guide preparation of the World Information and Communication Report 1999 prepared by UNESCO.

In collaboration with UNESCO, NISSAT organized a regional workshop on creation and management of Digital resources at Mysore University, Mysore during June 18-22,2001. Twenty-five participants from Indonesia, Bhutan, Maldives, Nepal, Sri Lanka and India attended the workshop.

NISSAT collaborated with University of Mysore for organizing the 4th International Conference of Asian Digital Libraries (ICADL 2001) at Bangalore during December 10-12, 2001. The theme of the conference was "Digital Libraries: dynamic landscapes for knowledge creation, access and management". The goal of ICADL has been to focus the various digital library initiatives, identify and address research issues and challenges especially of interest to the Asian Region. The invited talks and contributed papers offered a picture of the principal issues and concerns in Digital Library research, the major Digital Library initiative in the Asian region, the emerging trends and the main thrust of work in this area.

11. INFORMATION TODAY & TOMORROW (ITT)

NISSAT has been bringing out its *NISSAT Newsletter* -- a quarterly newsletter since the beginning of the programme. Over the years, the format has undergone several revisions in keeping with the changing information scenario. Now, the contents include information on new tools and techniques, events concluded and announcements, interesting Internet sites, new database products and services. With a change in the title, *Information Today & Tomorrow (ITT)*, the quarterly periodical is distributed free to 5000 individuals and institutions. The Internet Edition of ITT, available at *http://itt.nissat.tripod.com*, comes out much before the publication of its print version. One can also browse the back issues from 1995 onwards.

VIII. PUBLIC SECTOR ENTERPRISES

VIII(A). NATIONAL RESEARCH DEVELOPMENT CORPORATION (NRDC)

1. INTRODUCTION

National Research Development Corporation (NRDC) is the principal organisation established by the Government to act as a link between scientific laboratories and industrial establishments for transferring technologies. It is a unique organisation in that it is the only public enterprise wholly dedicated to transfer of technologies from R&D laboratories to industry. What is more, its operations cover the entire spectrum of industrial technologies ranging from chemicals to metallurgy, mechanical engineering, electrical engineering, electronics, biotechnology etc.

The performance of the Corporation continued to be satisfactory inspite of the challenges posed by the economic policy of the Government involving the active promotion of foreign investment and induction of foreign technology into the country under the liberalised industrial regime. During the year 2000-2001, the Corporation's income from its principal source of revenue i.e. Lumpsum Premia and Royalty on the licensing of indigenous technologies to industry was Rs.179.28 lakhs as compared to Rs. 197.18 lakhs during the previous year (1999-2000).

2. PROFIT

The Corporation's endeavour in improving its image and relations with the industry, rational pricing of technology has helped to earn Gross Profit to Rs. 16.15 Lakhs, during 2000-2001 as compared to Rs. 51.97 lakhs during the last year 1999-2000.

The gross income of the Corporation from all sources, including premia and royalties, but excluding Grants-in-Aid, was Rs. 302.83 lakhs as compared to Rs. 385.77 lakhs in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

The intense competitiveness arising out of the several in-house technology transfer organisations/ cells of various R&D organisations has placed the Corporation in a highly competitive and challenging situation. However, the Corporation continued its efforts to identify new technology resources by nurturing long-term relationships with R&D Organizations as well as Universities/Technical Institutes in India and abroad. The number of processes assigned to the Corporation for commercialisation during the year was 22 as compared to 25 in the previous year. Some of the commercially important processes assigned to the Corporation during the year were:

- An Air pollution Control Device
- Manganese Dioxide of Gamma structure
- Nickel Chloride without using Nitric Acid from Nickel directly
- Antidusting Fluid
- Herbal Pesticide
- Process for preparing Furniture and Decorative items
- Brahmyadiyoga for Mental Disorder
- Ayush-55 for Management of Lipid Disorder
- Ponnimilai Chendooram in the Management of Vitilego (Leucoderma)
- Nimbaatiktam with Lajjalu Keram for the Management of Psoriasis

- A Process for the manufacture of Zeolite – A useful as a Detergent Builder
- Aero Microbial for Hospitals

4. MAJOR TECHNOLOGIES LICENSED

Due to economic recession, the Corporation was able to sign only 16 licence agreements during the year as compared to 39 agreements signed in the previous year. Some of the major technologies licensed by the Corporation during the year are:

- Anti Corrosive Treatment for Steel Reinforced Rods
- Platinized Titanium Anodes
- Pollution Control System for Vertical Shaft Lime Kiln
- Glycol Based Antifreeze Coolant (DAFC)
- Test Kit for Microbiological Quality of Drinking Water
- Electrolytic Manganese Dioxide
- Aero Microbial Filters for Hospitals
- A Technique for Wood Plasterisation for making Bent Wood Components
- Azotobacter Biofertilizer Technology For Mulberry

5. TECHNOLOGY DEVELOPMENT PROJECTS

The Corporation has been promoting and financing in collaboration with industry/R&D institutes, technology development projects for setting up pilot/semi commercial/demonstration plants. The Progress on the major technology development projects is given below:

5.1 On-Going Projects:

5.1.1 Thrombinase- a blood clot dissolving agent

Thrombinase, a novel blood clot dissolving agent has been isolated, identified and purified for the first time from a Bacillus species at the Vector Control Research Centre, Pondicherry. The Corporation in collaboration with Malladi Research Centre, Chennai has been carrying out joint development work for further development of Thrombinase at a cost of Rs.80 lakhs. A sum of Rs.18.94 lakhs each towards the Corporation's share of grant and loan has already been released. The Corporation has filed patent applications for the process in India, USA, EPO (Germany, Switzerland, Liechtenstin, Belgium and UK) and patents in USA (US 5434059) & EPO (EP 0624642) have already been granted. The patent granted by European Patent Office has been assigned and registered in the name of the Corporation and the process is on for registering the European Patent Grant in the respective designated countries. The experiments on rabbits and toxicological studies on dogs have been completed. The physico-chemical studies, stability studies and animal toxicological studies have been completed. Action has been initiated for clinical trials on animals. The Corporation has also initiated negotiations with a major Japanese Company for licencing of the know-how and patent rights.

5.1.2 Lithium-Lithium Ion Battery Project

The manufacture of Lithium-Lithium Ion Battery is a multi-agency-funded developmental project of M/s Twenty First Century Battery Limited, Chandigarh costing around Rs.27 Crores based on the patented know-how of M/s. Telcordia Technology Inc., a subsidiary of Bellcore Laboratories, USA. The Lithium-Lithium Ion Batteries have many applications in Cellphones, automobiles, photo voltaics, etc. Keeping in view the vast potential of this battery technology, the Corporation has invested Rs.50 lakhs as equity in M/s. Twenty First Century Battery Limited, Chandigarh.

The Company has already purchased the land and the civil construction work is nearing completion. Orders for all the major process equipments have been placed. Around 70% of the equipments have been received at site and the same are being installed and commissioned. The project is progressing generally as per the schedule and is expected to commence trial production by end of 2001-2002.

5.1.3 Technology Information related Portal – TECHNAHOO.COM

The Corporation being a premier Institute involved in technology transfer, desires to move in and fill up the gap by setting up a technology information related portal which shall provide complete technology related information required, R&D Institutions, industry and particularly to the small & medium entrepreneurs. This shall be first international portal of its kind covering all the technology related information needs of the industry, R&D Institutes, Researchers, etc.

Broadly, the information shall cover :

- Indigenous & foreign technologies available for licensing
- Intellectual Property Rights (IPR)
- Certification/testing Organisations
- R&D Awards Information
- Technology Funding Agencies
- Technical barriers to Trade
- R & D Institutes/Universities
- Individual Experts
- Short term Training Programmes leading to technology transfer

It is proposed to set up independent sub portals on each of the above-mentioned information categories and to integrate them through the base portal "Technahoo.com". Besides this portal shall also provide a E-mail, free web pages, techno watch, job watch, event watch, tech chat sites, etc. the Corporation has identified M/s TeamCube e-Services Pvt.Ltd., New Delhi, a Joint Venture Partner for development of Phase I of the Project – Technahoo.com. In the meantime the Corporation has initiated action for obtaining above information from the concerned organisations.

5.1.4 Interactive Multimedia Training Package on Intellectual Property Rights

In order to provide an effective tool for training on IPR for the benefit of industry, R&D institutes, Government Departments, Educational Institutes, Patent Attorneys/Judiciary, Individuals etc., the Corporation has completed the project an Interactive Multimedia Training Package on IPR in collaboration with M/s. Aesthetic Technologies, Kolkata at a cost of Rs. 40 lakhs wherein the Corporation has invested Rs. 8 lakhs and Aesthetic Technologies has invested Rs. 12 lakhs. The remaining Rs.20 lakhs has been provided by the Department of Scientific & Industrial Research (DSIR), the Administrative Ministry of the Corporation as grant under its PATSER scheme for the project. The Interactive Multimedia IPR Training Package on CD was launched on Technology Day i.e. 11th May, 2001.

The Corporation is expected to make reasonable profits from the sale of CD on IPR Training Package during 2001-2002.

6. PROJECTS SUPPORTED BY DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (DSIR)

DSIR has been supporting technology development projects under its "Programme Aimed at Technological Self Reliance (PATSER)" involving industry, research institutes and consultants. The Corporation has been identified as the agency to manage all matters connected with the intellectual property rights generated in these projects, as also to collect the royalty revenues accruing from the utilisation of the technology by the collaborating Company and also from third party licensing. During the year 2000-2001, the Corporation has earned Lumpsum Premia and royalty amounting to Rs.43.67 lakhs from PATSER Projects. A few of the major projects undertaken during the year under PATSER were:

- Designing, Developing, installing and commissioning of 6 Hi Cold Rolling Mill
- Development of In-plant material handling equipment
- Development of Mobile, Four channel, Modular Ramdars System for Dry Beneficiation of Coal for Demonstration in different coal mines
- Development of 4 axis CNC Cutter and Turbo Grinder
- Development of ADSL (Asymmetric Digital Subscriber Line) System

- Development of Auto Electrical Switches using Rapid Prototyping Facility of Indian Institute. of Science (APDAP)

- Design & Development of Digital Axle Counter for Railway signalling

7. MARKET SURVEYS

Market surveys not only make the technology to be licensed more complete and credible, but also help in assessing the realistic price at which the technology can be licensed. With this object in view, the Corporation continued to carry out market surveys on commercially important technologies through professional market survey agencies for the purpose. During the year, market survey reports on the following items were completed:

- Injection system of coke breeze in Electric Arc Furnace
- Production of low phosphorous steel in Electric Arc Furnace
- Determination of wear in a roll – Profilometer
- Laser based thickness measuring system for flat plates
- Keyless drill chuck
- Automatic recessing head
- Thread rolling head
- Cam indexing unit
- New Design of ballnose end-mill
- Ayurvedic drugs
- Unani drugs
- Portable thermoelectric vaccine chest/cooling box
- Anti-dusting powder
- Semisolid metal processing

8. INVENTION PROMOTION PROGRAMME

The Corporation continued to promote and encourage inventive talent amongst scientists, engineers, industrial workers and students by awarding prizes for meritorious inventions and providing financial assistance for fabricating prototypes setting up pilot plants to prove such inventions.

During the year 2000-2001, the Corporation received 49 proposals for prize awards and 4 proposals for providing financial assistance.

The Corporation announced on Technology Day 2000 i.e. 11th May, 2000 cash awards amounting to Rs.2.65 lakhs for 5 inventions.

World Intellectual Property Organisation (WIPO) Gold Medal has also been awarded for the invention viz. 'Bio Inoculant in Liquid form with Plurality of Strains used as Soil Application or Biofoliar Sprays for Augmentation of Crop Yield'.

Some of the meritorious inventions recognised through awards during the year were:

- Development of Technology and Systems for Slipring Unit of Precision Coherent Monopulse C-Band Radar
- Novel Spray Formulation based on Xanthen Dyes for Detecting Latent Finger Prints
- Three Channel Monopulse Receiver at Ka-Band (Millimeter Waves)
- Direct Gas Fired and Steam Blended Loop Ager System
- "SITRA Enerspin" Drive System for Ring Spinnning & Doubling Machines

8.1 Patent Assistance

Consequent to the globalisation of economy, Intellectual Property Rights has gained significant importance and has become the foremost concern especially for the scientific community and Indian industry. The Corporation is putting more emphasis on providing technical, legal and financial assistance to inventors in drawing up patent specifications, processing their patent applications etc. During the year, the Corporation filed 50 no. of patent applications on behalf of individual inventors and 100 no. of patent applications on behalf of different R&D organisations.

The Corporation has set up an Intellectual Property Rights Consultancy Division. The Corporation organised a Two - day International Seminar and a one- day workshop at Delhi on "Protection of India's Intellectual Wealth in the New Millennium" . The speakers at the Seminar and resource persons of the Workshop were IPR luminaries from Germany, EPO and USPTO – Dr. Leander A. Feiler, Directorate Adviser, EPO; Mr. Garland Stephens of Pennie & Edmonds of USA; Dr. Rer. Nat. Christoph Schon from Henkel, Feiler & Hanzel of Germany; and Mr. Richard P. Berg of Ladas & Parry from USA were there to illuminate the seminar participants with their IPR expertise and provide hands-on problem solving exercises to the Workshop participants. The seminar was attended by 90 delegates and the workshop was participated by 65 techno-enthusiasts belonging to diverse disciplines of science, technology, industry, legal etc. A presentation of the interactive Multimedia CD-package for Training in IPR made by MD, NRDC was well received by all those present.

9. DEVELOPMENT & PROMOTION OF RURAL TECHNOLOGY

The Corporation continued to pursue the programme of Development and Promotion of Technologies appropriate for rural areas. The programme is aimed at bringing the key elements of the innovation chain e.g. development on a carefully selected basis, of new and innovative technologies for use in rural areas, demonstrating them under actual field conditions and interest stimulation through publications and mass media etc. This is being done in association with the local voluntary groups, Govt. agencies, R&D Institutions and others, which are actually engaged in rural development. During the year the Corporation reviewed the functioning of the existing 52 RTDT Centres and assisted in technical aspects wherever required.

10. TECHNOLOGY AND PROJECT EXPORT

Our technologies are appropriate to the needs of many other developing countries. The Corporation, therefore, considers it an important part of its charter to seek out and seize opportunities in those countries for technology and project exports. The worldwide economic recession has affected the Corporation's efforts for export of technologies. However, the Corporation could evince interest in its technologies in several African nations. The Corporation received several delegations from other developing countries during the year. Visits to industries of their interest were also arranged for establishment of projects in their own countries based on technology offers made by the Corporation,. As per the agreement with Social Fund for Development (SFD), Egypt for setting up *two Science & Technology Entrepreneurs Parks* (STEPs) in Egypt, the Corporation has sent the reports on the proposed organisational structure of STEPs, draft MOU's to be signed between the agencies involved and has so far received US$ 125,041 out of the total contract value of US$ 462,990.

The Corporation has submitted a report to M/s Industrial Promotion Services (IPS), Abidjan, Cote d'Ivore on transfer of technologies related to cotton farming, processing and by-product utilisation. IPS after studying the report has expressed their desire to visit India to witness demonstration of the technologies in the Research Institutes. The visit of IPS officials would open up wide opportunities for transfer of technologies from Indian Research Institutes to Ivory Coast through the Corporation.

Foreign Exchange Earnings

The foreign exchange earnings of the Corporation amounted to Rs. 10.90 lakhs in 2000-2001 as compared to Rs. 47.00 lakhs during the previous year.

11. PUBLICATIONS

An important activity of the Corporation is to disseminate information on new processes to industry, entrepreneurs and the general public for the promotion and commercialisation of technologies. One of the means of doing so is through publications of various types. During the year, the Corporation continued to bring out the following regular magazines and publications:

- Awishkar – (Monthly in Hindi)
- Invention Intelligence – (Bi-monthly in English)
- NRDC at Your Service

12. SALE OF DSIR PUBLICATIONS

The Department of Scientific & Industrial Research has entrusted NRDC with the marketing and sale of their publications on Technology Status Studies / Tech.Evaluation Studies / Project Profiles / Consultancy and other Studies and Handbooks of Foreign Collaboration Approvals (1981-90). During the year, the Corporation sold 15 reports valued at Rs. 0.07 lakhs.

13. EXHIBITIONS AND PUBLICITY

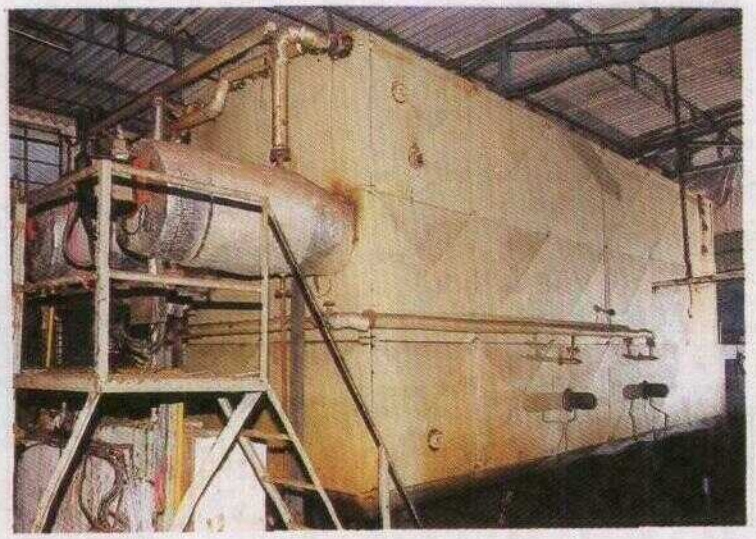
Participation in exhibitions, seminars, workshops, entrepreneurship development programmes etc. are of vital importance for the creation of awareness about the role of the Corporation in technology transfer. The Corporation participated in 12 exhibitions, seminars and get-togethers in India and 1 exhibition abroad, organised by various agencies.

14. HUMAN RESOURCE DEVELOPMENT

The thrust for better utilisation of Human Resources and improvement in work practice continued during the year. In the drive to improve work culture and productivity, employees were exposed to need based training and development programmes. During the year 26 executives and 12 staff of the Corporation were deputed to various training programmes.

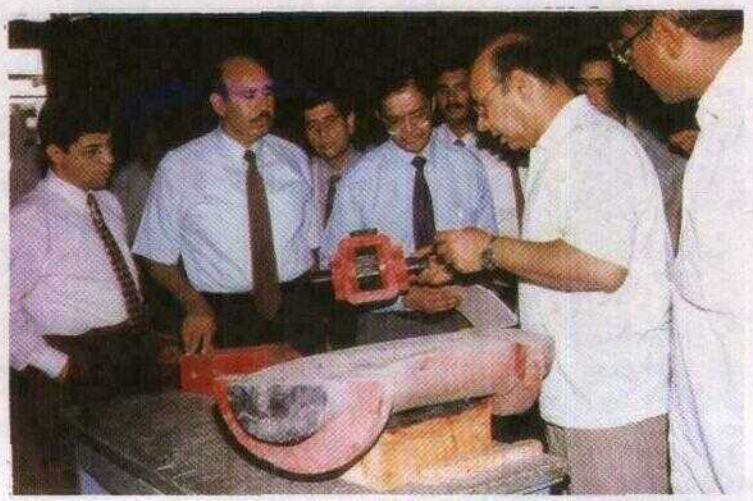
15. IMPLEMENTATION OF OFFICIAL LANGUAGE

The Corporation continued making efforts to implement the provisions of the Official Language Act and Rules framed there under to ensure the continued use of Rajbhasha in its day to day working. Significant progress has been made in the field of correspondence noting and drafting in Hindi. The Annual Report of the Corporation is being published in diglot form in both Hindi & English since 1986-87. To promote Rajbhasha "The Comprehensive Glossary of Administrative Terms (Eng-Hindi)" and English Hindi Dictionaries were distributed among the employees. The employees of the Corporation has also participated in Hindi competitions organized by other Public Sector Undertakings. The employees of the Corporation adjudged among winners in "All India Noting-Drafting Competition" organised by "Kendriya Sachivalaya Hindi Parishad, New Delhi".



VIII.A.3 An awarded invention of the Direct Gas Fired Steam Blended Loop Ager System

VIII.A.4 IPR luminaries sharing their expertise in a Workshop on Protection of India's Intellectual Wealth



VIII.A.5 To setup the Science & Technology Entrepreneurs Parks (STEPs) in Egypt

VIII.B.1 Electrification of tribal village in Chhattisgarh State

VIII.B.2 Equipment for development of process for making pseudo-square solar cells

VIII(B). CENTRAL ELECTRONICS LIMITED (CEL)

1. INTRODUCTION

Central Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in Electronics, with its emphasis on indigenous technology inducted both from its in-house development and the national laboratories. Activities of CEL are focused on three areas:

i) Solar Photovoltaic cells, modules and systems for a variety of rural and industrial applications

ii) Selected Electronic Systems for Railway Safety and Signaling, Impressed Current Cathodic Protection of oil and gas pipelines, Communication, specially VSAT

iii) Selected Electronic Components - Professional Soft Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components

2. PERFORMANCE IN 2000-01

2.1 Operating Results

Production, sales and profit/loss achieved during the year as compared to the previous year are given below:

(Rs. in crores)

	1999-2000	2000-01
Production	53.27	62.26
Sales	55.41	60.72
Profit/Loss	(-) 3.74	(-) 3.02

Operating results for the year 2000-01 showed marked improvement over the previous year and the company has been able to close the financial year with lower losses despite realization of lower prices for solar photovoltaic products.

2.2 Exports

2.2.1 Solar Photovoltaics Group

Export of SPV products worth Rs.34 lakhs were made to Nepal, Nigeria and Zambia. The company has drawn-up action plan to aggressively promote export of solar photovoltaic products at internationally competitive prices using web site and through participation in trade fairs and exhibitions.

2.2.2 Components Group

The Components Group for the fifth consecutive year exported PZT components worth Rs. 17 lakhs to France.

3. OTHER HIGHLIGHTS OF 2000-01

3.1 Technology

Through in-house R&D work, CEL was able to develop/upgrade a number of processes and technologies some of which are as follows:

- Development and user trials for Ni-Zn ferrite material were completed and pilot production of Ni-Zn products commenced.
- As an upgradation of the cathodic protection system, microprocessor based electronic control unit (ECU) was developed and a prototype made

Development and optimization of process development for making 125 mm size pseudosquare monocrystalline silicon solar cells was completed and laboratory scale production started.

3.2 Business

- Based on in-house development of 2 hp solar powered surface water pump, an order for 350 pumps was procured from PEDA. The supply and installation was completed during the year.
- An order for village electrification covering 90 tribal villages in the state of Chhatisgarh valued at Rs. 11 crores was received and work started.
- Augmented capacity of Systems Division was utilized to the full and during the year

800 nos. of single entry analog axle counters vere produced.

- Upgradation and relining of tunnel kiln increasing its capacity for Mn-Zn ferrites to 300 tons per annum was carried out. It has also resulted in savings on electricity and nitrogen gas.
- An order for 6000 nos. of 'C' Band PCMs was procured.

3.3 Future Strategy

During the tenth five year plan, the CEL plans to invest in R&D and plant so as to meet the corporate objectives of being commercially viable and a significant player in its business operations. Some of the significant activities are as follows:

- In the area of solar photovoltaics, develop multicrystalline silicon solar cell technology and put it on the production line as soon as the multicrystalline wafer edges out monocrystalline wafer.
- Develop thin film technology and expand SPV applications as building material specially for roofing, façade and skylight.
- Upgrade solar powered water pumping system of both types i.e. surface and submersible, to 5 hp capacity from the present 2 hp.
- In Systems Division, expand the portfolio of signaling and equipments for Railways with emphasis on export. In the field of cathodic protection systems, backward integration extending to turnkey and consultancy operations starting from site survey is envisaged.
- In ferrites, substantially increase the production of Mn-Zn as well as high permeability and microwave ferrites.
- In the area of strategic electronics, take-up regular production of DF and IFF systems. Also develop new products viz. dielectric resonator oscillator (DRO) and dual mode S-Band high power phase shifter and commercialise them.
- Expand the range of piezo transducers with automatic and underwater applications in focus. Also commercialise high purity alumina (99% and above) products.
- Take-up regular production of Cadmium-Zinc-Telluride (CZT) substrates for which a regular manufacturing plan is being set-up at CEL in alliance

4. FOREIGN EXCHANGE RECEIPTS AND OUTGO

During the year 2000-01, the company spent Rs. 894 lakhs in foreign exchange as against Rs. 435 lakhs in the previous year towards the purchase of capital equipments, raw materials and components and travel etc.

The company earned foreign exchange of Rs.51 lakhs as against Rs.42 lakhs in the previous year from export of its products.

5. ENERGY CONSERVATION

The company being an electronic industry, its operations are not energy intensive. However, through improvement in its tunnel kiln used for manufacturing ferrites which uses a large portion of CEL's electricity consumption, energy requirement per unit of ferrite output has been brought down.

6. PARTICULARS OF EMPLOYEES

In accordance with the Companies (particulars of employees) Rules 1975 read with Sub-Section 2-A of Section 217 of the Companies Act 1956 as amended in 1988, none of the employees of the Company either employed throughout the year or employees for a part of the year under review was in receipt of remuneration more than minimum prescribed in the Rules.

7. IMPLEMENTATION OF HINDI, INDUSTRIAL RELATIONS AND HUMAN RELATIONS

The Company had very cordial industrial relations during the year. Management has also initiated programmes for upgrading the skills of employees.

In order to ensure the use of Hindi, the employees continued to be trained in Prabodh,

Praveen, Pragya Hindi Courses, Hindi typewriting and Hindi Computer. Hindi week was organized on 14.9.2000 to 20.9.2000. Various short time training programmes were conducted for workers and officers during the year. Special workshops on 'Noting and Drafting' and various competitions in Hindi were organized and awards distributed to the winners during the year.

8. WELFARE OF RESERVED CATEGORIES

All Government directives relating to the Reserved Categories such as Scheduled Castes, Scheduled Tribes, the Physically Handicapped, Ex-Servicemen etc. continued to be implemented during the year.

IX. ADMINISTRATION

ADMINISTRATION

The Department of Scientific & Industrial Research was created through a Presidential Notification of January 1985. The Administrative functions of recruitment of personnel, provision of general facilities, redressal of grievances of employees, parliament work and use of Hindi and house keeping jobs except related to cash section are being performed by the Departement of Scientific and Industrial Research. Activities related to promotions of scientific staff and officers (under the flexible complementing scheme) are also looked after by the Department.

The department is also facing a further need for office space. A sum of Rs.3.00 crores has been provided during the 9th Five Year Plan towards creation of support infrastructure, building etc. for the DSIR (other than CSIR) and a programme towards provision of the same is under progress.

2. PROMOTION OF HINDI

DSIR made the following efforts for the use and promotion of Hindi in the official work and implementation of official language policy of the Government:

a) The meetings of the Official Language Implementation Committee were held regularly in DSIR.

b) The Quarterly Progress Report regarding use of Hindi in the Department was sent to the Department of official Language regularly and in time.

c) Under Hindi Teaching Scheme, non-Hindi knowing employees of the Department were nominated for Prabodh, Praveen and Pragya courses.

d) From 1st to 14th September 2001 combined Hindi Pakhwara was observed by the Department of Scientific and Industrial Research and Department of Science and Technology at Technology Bhavan. To promote the use of Hindi in the official work, essay, noting and drafting, debate, painting and quiz competitions were organised in the Department during this period.

e) CDC was inspected to assess the progressive use of Hindi.

f) Two workshops were organised on 7th June, 2001 and 20th December 2001.

The staff strength in the different groups in the Department of Scientific & Industrial Research (other than CSIR & PSUs) as on 1.1.2002 is given below:

	No. of Employees			
	Gen.	SC	ST	Total
Group A (Gazetted)	32	6	1	39
Group B (Gazetted)	5	-	-	5
Group B (Non-Gazetted)	9	3	-	12
Group C (Non-Gazetted)	13	8	3	24
Group D (Non-Gazetted)	4	3	5	12

ANNEXURES

LIST OF CSIR ESTABLISHMENTS

1. Central Building Research Institute (CBRI), Roorkee
2. Centre For Biochemical Technology (CBT), Delhi
3. Centre for Cellular and Molecular Biology (CCMB), Hyderabad
4. Central Drug Research Institute (CDRI), Lucknow
5. Central Electrochemical Research Institute (CECRI), Karaikudi
6. Central Electronics Engineering Research Institute (CEERI), Pilani
7. Central Fuel Research Institute (CFRI), Dhanbad
8. Central Food Technological Research Institute (CFTRI), Mysore
9. Central Glass and Ceramic Research Institute (CGCRI), Calcutta
10. Central Institute of Medicinal & Aromatic Plants (CIMAP), Lucknow
11. Central Leather Research Institute (CLRI), Chennai
12. Central Mechanical Engineering Research Institute (CMERI), Durgapur
13. Central Mining Research Institute (CMRI), Dhanbad
14. Central Road Research Institute (CRRI), New Delhi
15. Central Scientific Instruments Organisation (CSIO), Chandigarh
16. Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar
17. Institute of Himalayan Bioresource Technology (IHBT), Palampur
18. Indian Institute of Chemical Biology (IICB), Calcutta
19. Indian Institute of Chemical Technology (IICT), Hyderabad
20. Indian Institute of Petroleum (IIP), Dehradun
21. Institute of Microbial Technology (IMT), Chandigarh
22. Indian National Scientific Documentation Centre (INSDOC), New Delhi
23. Industrial Toxicology Research Centre (ITRC), Lucknow
24. National Aerospace Laboratories (NAL), Bangalore

25. National Botanical Research Institute (NBRI), Lucknow
26. National Chemical Laboratory (NCL), Pune
27. National Environmental Engineering Resarch Institute (NEERI), Nagpur
28. National Geophysical Research Institute (NGRI), Hyderabad
29. National Institute of Oceanography (NIO), Goa
30. National Institute of Science Communication (NISCOM), New Delhi
31. National Institute of Science Technology and Development Studies (NISTADS), New Delhi
32. National Metallurgical Laboratory (NML), Jamshedpur
33. National Physical Laboratory (NPL), New Delhi
34. Regional Research Laboratory (RRL, BHO), Bhopal
35. Regional Research Laboratory (RRL, BHU), Bhubaneshwar
36. Regional Research Laboratory (RRL, JM), Jammu
37. Regional Research Laboratory (RRL,JOR), Jorhat
38. Regional Research Laboratory (RRL, TVM), Thiruvananthapuram
39. Structural Engineering Research Centre (SERC-G), Ghaziabad
40. Structural Engineering Research Centre (SERC-C) Chennai

STATEMENT ON RECOGNITION OF IN-HOUSE R&D UNITS

Month	Year	Receipts	Cumulative Receipts	Pendency Disposal	Cumulative Disposal	Cumulative pendency at the end of the month
January	2001	18	18	15	15	49*
February	2001	10	28	10	25	49
March	2001	8	36	7	32	50
April	2001	9	45	7	39	52
May	2001	10	55	14	53	48
June	2001	11	66	13	66	46
July	2001	15	81	8	74	53
August	2001	1	82	8	82	46
September	2001	15	97	8	90	53
October	2001	20	117	17	107	56
November	2001	18	135	14	121	60
December	2001	12	147	12	133	60

* Including pendency of 46 applications carried over from the year 2000.

STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS WHOSE RECOGNITION WAS VALID UP TO 31-3-2001

Month	Year	Receipts	Cumulative Receipts	Renewal Applications processed	Cumulative Renewals Processed	Cumulative Pendency at the end of the month
December	2000	49	49	-	-	49
January	2001	206	255	-	-	255
February	2001	30	285	-	-	285
March	2001	32	317	148	148	169
April	2001	20	337	40	188	149
May	2001	10	347	40	228	119
June	2001	8	355	45	273	82
July	2001	9	364	24	297	67
August	2001	1	365	2	299	66
September	2001	3	368	1	300	68
October	2001	-	368	31	331	37
November	2001	-	368	16	347	21
December	2001	-	368	19	366	2

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE MORE THAN Rs. 500 LAKHS

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
1.	ACL Chemicals Limited	834
2.	Alembic Ltd.	692
3.	Asea Brown Boveri Ltd.	1516
4.	Ashok Leyland Ltd.	1165
5.	Asian Paints (India) Ltd.	550
6.	Associated Cement Companies Ltd.	609
7.	Aurobindo Pharma Ltd.	1600
8.	Bajaj Tempo Ltd.	1066
9.	Bharat Earth Movers Ltd.	1194
10.	Bharat Electronics Ltd.	7703
11.	Bharat Heavy Electricals Ltd.	6600
12.	Bharat Petroleum Ltd.	705
13.	BPL Limited	2249
14.	Cadila Pharmaceutical Ltd.	949
15.	Cadila Healthcare Ltd.	1259
16.	Castrol India Ltd.	524
17.	Central Mine Planning & Design Inst. Ltd.	2037
18.	CMC Limited	1097
19.	Colour-Chem Limited	582
20.	Cipla Limited	4092
21.	Crompton Greaves Ltd.	2174
22.	Cummins India Ltd.	1044
23.	Daewoo Motors India Ltd.	570
24.	Eicher Ltd.	2220
25.	Electronics Corporation of India Ltd.	909
26.	Gharda Chemicals Ltd.	663
27.	Glenmark Pharmaceuticals Ltd.	2311
28.	Gujarat State Fertilizers Company Ltd.	549
29.	GEC Alsthom India Ltd.	564
30.	GMM Pfaudler Limited	894
31.	HMT Limited	541
32.	Hindustan Aeronautics Ltd.	14635
33.	Hindustan Lever Ltd.	3731
34.	Hoechst Marion Roussal Ltd.	1169
35.	IPCA Lab. Ltd.	842
36.	Indian Aluminium Company Ltd.	1189
37.	Indian Oil Corporation Ltd.	7716
38.	Indian Petrochemicals Corporation Ltd.	1005
39.	Indian Telephone Industries Ltd.	3860
40.	Kinetic Engineering Ltd.	506

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
41.	Lakshmi Machine Works Ltd.	1187
42.	Larsen & Toubro Limited	1771
43.	Lupin Laboratories Ltd.	4421
44.	MRF Limited	1145
45.	The Maharashtra Hybrid Seeds Company Ltd.	925
46.	Mahindra & Mahindra Ltd.	4135
47.	Maruti Udyog Ltd.	972
48.	Motor Industries Co. Ltd.	1559
49.	Natco Fine Pharmaceuticals Pvt. Ltd.	506
50.	Novarits Enterprises Ltd.	500
51.	Oil & Natural Gas Corporation Ltd.	7116
52.	Oil India Limited	1043
53.	Panacea Biotec Ltd.	1259
54.	Pfizer Ltd.	1423
55.	Premier Instruments & Controls Ltd.	586
56.	The Projects & Development India Ltd.	650
57.	Rallis India Ltd.	872
58.	Ramco Systems Ltd.	2630
59.	Ranbaxy Laboratories Ltd.	6488
60.	Reliance Industries Ltd.	7509
61.	Shantha Biotechnics Pvt. Ltd.	770
62.	Shasun Chemical and Drugs Ltd.	559
63.	Steel Authority of India Ltd.	4832
64.	Southern Petrochemical Industries Corpn. Ltd.	696
65.	Sun Pharmaceuticals Industries Ltd.	2000
66.	Tata Engineering & Locomotive Co. Ltd.	530
67.	Tata Hydro-Electric Power Supply Co. Ltd.	759
68.	The Tata Iron & Steel Co. Ltd.	1350
69.	Tata Sons Ltd.	1842
70.	Tata Tea Ltd.	508
71.	The United Phosphorous Ltd.	650
72.	Tractors & Farm Equipment Ltd.	680
73.	Torrent Pharmaceuticals Ltd.	1611
74.	Unichem Laboratories Ltd.	1097
75.	Venco Research & Breeding Farm Ltd.	658
76.	Venkateshwara Hatcheries Ltd.	1178
77.	Whirlpool of India Ltd.	510
78.	Widia (India) Ltd.	573
79.	Wipro Limited (formerly Wipro Infotech Ltd.)	805
80.	Wockhardt Limited	4025

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF Rs. 100 LAKHS TO Rs. 500 LAKHS

Sl. No	Name of the firm	R&D Expenditure (Rs. in Lakhs)
1.	ARM Limited	228
2.	Aarti Industries Ltd.	215
3.	Advani Oerlikon Ltd.	142
4.	Aerospace System Ltd.	315
5.	Alembic Chemical Works Co. Ltd.	254
6.	Alkali Metals Ltd.	178
7.	Amalgam Leather Pvt. Ltd.	283
8.	Amara Raja Batteries Ltd.	123
9.	Amrutanjan Ltd.	189
10.	Ankur Seeds Pvt. Ltd.	146
11.	Aptech Ltd.	310
12.	Apollo Tyres Ltd.	262
13.	Applied Electro Magnetics Pvt. Ltd.	118
14.	Arvind Mills Ltd.,	101
15.	Astra Zeneca Pharma India Ltd.	281
16.	Atul Limited,	465
17.	Audco India Ltd.	108
18.	Autometer Secheron Limited	157
19.	BASF India Ltd.	130
20.	BPL Engineering Ltd.	125
21.	BPL Limited	315
22.	BPL Sanyo Utilities and Appliances Ltd.	288
23.	BPL Telecom Ltd.	315
24.	Ballarpur Industries Ltd.	111
25.	Balmer Lawrie & Company Ltd.	203
26.	Bata India Ltd.; The	190
27.	Berger Paints India Ltd.	130
28.	Bharat Biotech International Ltd.	115
29.	Bharat Dynamics Ltd.	283
30.	Bharat Heavy Plate & Vessels Ltd.	141
31.	Biocon India Ltd.	381
32.	Bicycle & Sewing Machine R&D Centre	136
33.	Biological E. Ltd.	140
34.	Blue Cross Laboratories Ltd.	122
35.	Brakes India Ltd.	360
36.	Britannia Industries Ltd.	179
37.	Bush Boake Allen (India) Ltd.	477
38.	Camphor & Allied Products Ltd.	174
39.	Carborundum Universal Ltd.	141
40.	Century Textiles & Industries Ltd.	105

Sl. No	Name of the firm	R&D Expenditure (Rs. in Lakhs)
41.	Central Electronics Ltd.	277
42.	Chandras Chemicals Enterprise Ltd.	101
43.	Clariant (India) Ltd.	255
44.	Claris Life Sciences Ltd.	120
45.	Coates of India Ltd.	347
46.	Cochin Refineries Ltd.	211
47.	Concept Pharmaceuticals Ltd.	106
48.	Continental Devices of India Ltd.	150
49.	Core Healthcare Ltd.	143
50.	DCM Shriram Industries Ltd.	237
51.	DE-NOCIL Crop Protection Ltd.	216
52.	DGP Hinoday Industries Ltd.	190
53.	DGP Windsor India Ltd.	112
54.	Dai-ichi Karkaria Ltd.	355
55.	Dhampur Sugar Mills Ltd.,	175
56.	Dr. Reddy's Laboratories Ltd.	284
57.	Dunlop India Ltd.	284
58.	Dynamatic Technologies Ltd.	161
59.	E.I.D. Parry (India) Ltd.	363
60.	Eicher Limited	133
61.	Eicher Motors Ltd.	192
62.	Electronic Research Ltd.	105
63.	Elgi Tread (India) Ltd.	285
64.	Elin Electronics Ltd.	128
65.	Emcure Pharmaceuticals Ltd.	270
66.	Engineers India Ltd.	356
67.	Excel Industries Ltd.	353
68.	Exide Industries Ltd.	368
69.	FDC Limited	222
70.	FGP Limited	142
71.	Fermenta Pharma Biotech Ltd.	202
72.	Foseco India Ltd.	242
73.	GEIL Projects & Services (India) Ltd.	210
74.	Gammon India Limited	128
75.	Garware Polyester Ltd.	167
76.	German Remedies Ltd.	106
77.	Glaxo India Ltd.	315
78.	Global Bulk Drugs & Fine Chemicals Ltd.	450
79.	Godrej Soaps Ltd.	163
80.	Goodlass Nerolac Paints Ltd.	491
81.	Gujarat Communications & Electronics Ltd.	335
82.	Haryana State Electronics Development Corpn. Ltd.	191
83.	Hawkins Cookers Ltd.	100
84.	Heinz India Pvt. Ltd.	217
85.	Herdillia Chemicals Ltd.	106

Sl. No	Name of the firm	R&D Expenditure (Rs. in Lakhs)
86.	Hetero Drugs Ltd.	242
87.	Hindustan Antibiotics Ltd.	252
88.	Hindustan Cables Ltd.	178
89.	Hindustan Copper Ltd.	155
90.	Hindustan Motors Ltd.	327
91.	Hindustan Petroleum Corporation Ltd.	286
92.	Hindustan Photo Films Manufacturing Co. Ltd.	127
93.	Hindustan Telecommunication Ltd.	160
94.	Hindustan Zinc Ltd.	379
95.	Hyderabad Industries Ltd.	149
96.	IBP Company Ltd.	198
97.	ICI India Ltd.	316
98.	IDL Industries Ltd.	202
99.	ITC Limited	398
100.	India Glycols Ltd.	192
101.	India Nippon Electricals Ltd.	133
102.	India Pistons Ltd.	103
103.	India Satcom Ltd.	111
104.	Indian Drugs & Pharmaceuticals Ltd.	243
105.	Ion Exchange (India) Ltd.	149
106.	J.B. Chemicals Ltd.	159
107.	J.K. Drugs & Pharmaceuticals Ltd.	206
108.	J.K. Industries Ltd.	499
109.	Jain Irrigation Systems Ltd.	149
110.	Jaysynth Dyechem Ltd.	273
111.	Jindal Strips Ltd.	190
112.	Jindal Steel Power Ltd.	188
113.	Johnson & Johnson Ltd.	165
114.	Jyoti Limited	312
115.	Jyoti Ceramic Industries Pvt. Limited	139
116.	Khandelwal Laboratories Ltd.	101
117.	Kirloskar Brothers Ltd.	171
118.	Kirloskar Copeland Ltd.	453
119.	Kirloskar Electric Co. Ltd.	125
120.	Knoll Pharmaceuticals Ltd.	345
121.	L&T Komatsu Ltd.	138
122.	LML Limited	366
123.	Lakhanpal National Ltd.	181
124.	Lohia Starlinger Ltd. (Hargovind Bajaj R&D Center)	126
125.	Lubrizol India Ltd.	388
126.	Lucas-TVS Ltd.	218
127.	Lyka Labs Limited	123
128.	Macmet India Ltd.	200
129.	Madras Refineries Ltd.	209
130.	Mafatlal Industries Ltd.	268

Sl. No	Name of the firm	R&D Expenditure (Rs. in Lakhs)
131.	Manali Petrochemical Ltd.	156
132.	Marico Industries Ltd.	310
133.	Mc-Dowell & Co. Ltd.	116
134.	Medicrop Technology India Ltd.	148
135.	Merind Limited	192
136.	Micro Technologies (India) Ltd.	424
137.	Midas Communication Technology Pvt. Ltd.	159
138.	Minda Industries Ltd.	172
139.	Mirc Electronics Ltd.	406
140.	Modi Rubber Ltd.	325
141.	Modipon Limited	274
142.	Mysore Kirloskar Ltd.,	263
143.	National Aluminium Company Ltd.	267
144.	National Mineral Development Corporation Ltd.	472
145.	National Organic Chemical Industries Ltd.	406
146.	Neyveli Lignite Corporation Ltd.	362
147.	O/E/N India Ltd.	100
148.	Orchid Chemicals & Pharmaceuticals Ltd.	455
149.	Otis Elevator Co. (India) Ltd.	123
150.	Parke-Davis (India) Ltd.	153
151.	Philips India Ltd.	495
152.	Pidilite Industries Ltd.	110
153.	Proagro Seed Company Ltd.	185
154.	Procter & Gamble India Ltd.	400
155.	Punjab Tractors Ltd.	383
156.	RPG Life Sciences Ltd.	309
157.	Rane Brake Linings Ltd.	303
158.	Rasi Seeds Ltd.	112
159.	Rashtriya Chemicals & Fertilizers Ltd.	103
160.	Renewable Energy Systems Pvt. Ltd.	128
161.	Resonance Laboratories Pvt. Ltd.	130
162.	Rhone-Poulenc (India) Ltd.	142
163.	S.H. Kelkar & Company Ltd.	118
164.	Sakthi Sugar Ltd.	364
165.	Sami Chemicals & Extracts Ltd.	245
166.	Samtel Color Ltd.	115
167.	Sandvik Asia Ltd.	201
168.	Saraswati Industrial Syndicate Ltd.,	263
169.	Secure Meters Ltd.	163
170.	Seagram Manufacturing Pvt. Ltd.	196
171.	Sekhsaria Chemicals Ltd.	130
172.	Semiconductor Complex Ltd.	304
173.	Shyam Telecom Ltd.	356
174.	Sieflex Robotics Co.	101
175.	Simpson & Co. Ltd.	108

Sl. No	Name of the firm	R&D Expenditure (Rs. in Lakhs)
176.	Siel Compressor Ltd.	100
177.	Smithkline Beecham Pharmaceuticals (India)Ltd.	207
178.	Spaco Carburettors (India) Ltd.	132
179.	Sudarshan Chemical Industries Ltd.	318
180.	Sundaram Brake Linings Ltd.	167
181.	Sundaram Clayton Ltd.	444
182.	Suven Pharmaceuticals Ltd.	170
183.	TVS-Suzuki Ltd.	247
184.	Tamilnadu Petroproducts Ltd.	241
185.	Tata Elxsi (India) Ltd.	145
186.	Tata Refractories Ltd.	241
187.	Technicom Systems (India) Pvt. Ltd.	125
188.	The Apex Electricals Ltd.	152
189.	The Avasarala Tungsten Ltd.	144
190.	The Dharamsi Morarji Chemical Co. Ltd.,	138
191.	The Divi's Laboratories Ltd.	199
192.	The NRC Ltd.	197
193.	The Scooters India Ltd.	252
194.	Thermax Limited	338
195.	Tide Water Oil Co. (India) Ltd.	130
196.	Titan Industries Ltd.	195
197.	Tube Products of India (Unit of Tube Investment of India Ltd.)	196
198.	Travancore-Cochin Chemicals Ltd.,	105
199.	UCAL Ltd.	241
200.	United Catalysts India Ltd.	167
201.	United Phosphorous Ltd.	125
202.	United Telecoms Ltd.	207
203.	Vam Organic Chemicals Ltd.	256
204.	Vatanu-Cool Rotary Vanes Ltd.	178
205.	VIP Industries Ltd.	138
206.	Vera Laboratories Ltd.	118
207.	Voltas Limited	135
208.	Webel Telecommunication Industries Ltd.	107
209.	Wheels India Ltd.	212
210.	Wipro GE Medical Systems Ltd.	100
211.	Wipro Limited	297
212.	Zandu Pharmaceuticals Works Ltd.	255
213.	Zen Technologies Ltd.	231

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS APPROVED DURING JANUARY 2001 TO DECEMBER 2001

AGRICULTURAL, MEDICAL AND NATURAL & APPLLIED SCIENCES

Sl. No.	Name of the Organisation	Approval Valid upto
1.	Gujarat Ecological Society, Vadodara	31.03.2003
2.	National Institute of Secondary Steel Technology, Mandi Gobindgarh	31.03.2003
3.	Shivajee University, Kolhapur, Maharashtra	31.03.2004
4.	Admar Mutt Education Foundation, Bangalore	31.03.2004
5.	Automobile Association, New Delhi	31.03.2002
6.	National Innovation Foundation, Ahmedabad	31.03.2004
7.	Society for Research and Initiatives for Sustainable Technologies for Science and Technology, Chandigarh	31.03.2004
8.	Council of Pushpa Gujaral Science City C/o Punjab State Council for science and Technology, Chandigarh	31.03.2003
9.	Centre for Wildlife Studies, Bangalore	31.03.2004
10.	PSG College of Technology, Coimbatore (A unit of PSG & Sons Charities Trust), Coimbatore.	31.03.2004
11.	ERNET INDIA, New Delhi	31.03.2004
12.	College of Engineering of Gandhi Institute of Technology and Management, Visakhapatnam	31.03.2003
13.	Salim Ali Centre for Ornithology and Natural History, Coimbatore	31.03.2004
14.	The Institute of Mathematical Sciences, Chennai	31.03.2004
15.	SIBAR Charitable Trust, Vijayawada	31.03.2003
16.	Lepra Society, Secunderabad	31.03.2004
17.	Aryavaidyasala, P.O. Kottakkal, Distt. Malappuram, Kerala.	31.03.2004
18.	Vinayaka Missions Research Foundation, Salem	31.03.2003
19.	The Heart Institute of Y.R.Gaitonde Medical, Educational and Research Foundation, Chennai	31.03.2004

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS APPROVED DURING JANUARY 2001 TO DECEMBER 2001

SOCIAL SCIENCES

Sl. No.	Name of the Organisation	Approval Valid upto
1	The Institute of Cost Works Accountants of India, Calcutta	31.03.2004
2	Bhogilal Leharchand Institute of Indology, Delhi	31.03.2003
3	Krishnamacharya Yoga Mandiram, Chennai	31.03.2003

CERTIFICATES FOR CLAIMING ACCELERATED DEPRECIATION ALLOWANCE ISSUED BY DSIR UNDER RULE 5(2) OF I.T. RULES VIDE NOTIFICATION NO.133/342/86-TPL DATED 1.4.1988

Sl. No	Name of the Company	Source of know-how/ Technology	Item of Manufacture	Investment Certified (Rs in Lakhs)
1	Veejay Lakshmi Engineering Works Limited, Coimbatore	South India Textile Research Association (SITRA) and in-house	Two-for-one Twister	188.51
2	Punjab Tractors Ltd., Chandigarh	Central Mechanical Engineering Research Institute, Durgapur and own in-house R&D	Agricultural Tractors, Harvester combine & Industrial forklifts	1792.32
3	Camphor and Allied Products Ltd., Vadodara	In-house	Di-hydromyrcene, Di-hydromyrcenol, Alpha-Pinene Epoxide and Alpha-Campholenic Aldehyde	1050.09
4	Punjab Tractors Limited, Chandigarh	Central Mechanical Engineering Research Institute, Durgapur and own in-house R&D	Agricultural Tractors, Harvester Combine & Industrial Forklifts	1928.48
5	High Polymer Labs Ltd., New Delhi	In-house	Anti-oxidants for Polyolefins	784.17

ABBREVIATIONS USED

ACC	Associated Cement Company
ACE	Association of Consulting Engineers
APCTT	Asian and Pacific Centre for Transfer of Technology
BEL	Bharat Electronics Limited
BHEL	Bharat Heavy Electricals Limited
CBDT	Central Board of Direct Taxes
CDC	Consultancy Development Centre
CEL	Central Electronics Limited
CMPDIL	Central Mine Planning & Design Institute Limited
CSIR	Council of Scientific and Industrial Research
DSIR	Department of Scientific and Industrial Research
ECIL	Electronics Corporation of India Limited
ERDA	Electrical Research and Development Association
ESCAP	Economic and Social Commission for Asia and the Pacific
GSI	Geological Survey of India
HMT	Hindustan Machine Tools
ICAR	Indian Council of Agricultural Research
ICMR	Indian Council of Medical Research
ICSSR	Indian Council of Social Science Research
IIFT	Indian Institute of Foreign Trade
IPCL	Indian Petrochemical Corporation Limited
ISRO	Indian Space Research Organisation
ITI	Indian Telephone Industries
LTM	Lether Technology Mission
MIT	Ministry of Information Technology
NCAER	National Council of Applied Economic Research
NICMAR	National Institute of Construction Management and Research
NIDC	National Industrial Development Corporation
NISSAT	National Information System for Science and Technology
NRDC	National Research Development Corporation
ODS	Ozone Depleting Substances
PATSER	Programme Aimed at Technological Self Reliance
TePP	Technopreneur Promotion Programme
TM	Technology Management
RDI	Research and Development by Industry
SEETOT	Scheme to Enhance the Efficacy of Transfer of Technology
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WIPO	World Intellectual Property Organisation