

ANNUAL REPORT

1997-98



Department of Scientific and Industrial Research
Ministry of Science & Technology
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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 1997-98 the Minister In-charge was Prof. Y.K. Alagh, Minister of State of the Ministry of Power and the Ministry of Science and Technology. At present Shri Murlidhar Manohar Joshi is the Minister In-charge for 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 Council of Scientific and Industrial Research is the premier R&D organisation providing scientific and industrial research for India's economic growth and human welfare. It has a country-wide network of 40 laboratories and 80 field centres covering fundamental and applied R&D in all areas of science and technology and developing and nurturing S&T human resource for the country.

A formidable challenge was posed to CSIR arising from the pegging of the 1996-97 Plan allocation to the 1995-96 level. Despite the financial difficulties, the performance of CSIR during the year was satisfactory. The External Cash Flow increased during the year showing a growth rate of over 15%; the laboratory reserves increased from Rs. 42 crore to Rs. 54 crore, a growth rate of nearly 29%. The upward trend in foreign patents filing continued, the number rising from 58 to 71 but there was a slight dip in the Indian patent filings due to the emphasis on improving the quality of patents filed. The impact factor of research papers contributed increased from 1980 to 2175 with the average impact factor per paper rising from 0.90 to 0.98.

Some of the recent achievements of CSIR covering a wide spectrum are as follows:

NAL, Bangalore is developing a multichannel system for noise control for enclosures like automobiles, aircraft cockpits and air cabins which would also be used for the 14 seaters SARAS aircraft being developed by the laboratory. NAL has set up a quality control assurance unit and worked closely with the R&D and Civil Airworthiness Authority in seeking type certification for the all composite HANSA aircraft. CBT, Delhi has developed a versatile universal polymer support devoid of nucleotidic material and compatible to the existing methods of synthesis and deprotection of oligodeoxyribo and oligobionucleotides. CCMB, Hyderabad has developed an efficient method to isolate and prepare in the pure form, in large quantities, RNasin from discarded human placenta. IICB, Calcutta have identified a unique biomarker on the leukemic blast cells in children. RRL, Jammu has developed a fermentation process for the direct production of free gluconic acid from glucose. A yeast strain useful in screening androgenic steroids has been constructed at IMTECH, Chandigarh by integrating the E.coli B-galactosidase gene in the Ura3 locus. CIMAP, Lucknow has developed a promising genotype of *Mentha arvensis* through cross pollination of Gomti and Kalka and released for commercial cultivation. NBRI, Lucknow has successfully employed genes coding for complete synthesis of about 2000 bp double stranded DNA fragment. In collaboration with the Visva Bharati University, NEERI, Nagpur has taken up the development of biosensor for detection and estimation of organophosphorous pesticide residues in natural waters. A novel approach using a supported Lewis acid catalytic system based on aluminium alkyls is being developed by NCL, Pune for the oligomerization of higher alpha-olefins to suitable lube oil compositions.

IICT, Hyderabad has extracted two new compounds Isobullatacin and Isoquamacin from *Annona Squamasa* and studied their insecticidal activities. Innovative design of solid acids as catalysts for ecofriendly processing of aromatics has been attempted by IICT. CECRI, Karaikudi has developed a 2 tonnes per day bipolar membrane electrolyser consisting of titanium anolyte chamber with baffle type adjustable current distributors and expanded titanium mesh anode surface. IIP, Dehradun has developed an innovative process for production of C₁₀-C₁₈ secondary alcohols through n-paraffins oxidation in liquid phase. CSMCRI, Bhavnagar

has developed an acrylic type amino methyl phosphoric acid type resin for brine purification. IICT has developed an alternate route for development of Lamivudine, anti AIDS drug by totally dispensing with ozone. The development is being patented. A study to identify potential gas hydrates sites was initiated at NGRI, Hyderabad. A high quality synthesis system, useful for the visually handicapped persons as a 'reading' machine, has been developed by CEERI, Pilani. NPL, New Delhi has successfully developed a device for receiving and transmitting standard time in a master/slave configuration, in a telephone network. A 35 mm Mini Pan Camera has been designed and developed at the CSIO, Chandigarh which is suitable for use in low-speed aircraft. CFTRI, Mysore has developed a method for treating the pepper oleoresin having 40-50% piperine by a solvent wash method. CBRI, Roorkee has set up the first indigenous pilot plant for beneficiation of waste phosphogypsum. CRRI, New Delhi has developed interlocking Concrete Block (ICB) pavement technique for special locations such as bus or container terminals, industrial roads, snow bound regions as well as for rehabilitation of old concrete surfacing. NISCOM and INSDOC have brought out a number of publications. CLRI, Chennai has developed an alternative for the conventional sodium sulphide method of dehairing skins. MERADO, Ludhiana has developed and fabricated a 1 TPD expeller for mustard oil. CMERI, Durgapur has designed and developed a stitch binding machine for manufacture of geotextiles which are presently in great demand for stabilisation of erosion.

In the area of basic research, IICB, Calcutta has done work on a new mechanism of mitochondrial import of transfer RNA in *Leishmania*. NCL, Pune has carried out a study of 100 Indians from 14 language groups using mitochondrial DNA site polymorphism as a tool for generic variations. CCMB is investigating the chaperon-like activity of the lens cortical protein α -crystallin. In the area of Chemicals, IICT has developed a novel method of probing biocatalysts. CLRI has done One-pot synthesis of heterocyclic b-Chlorovinyl aldehydes. NIO, Goa undertook studies to ascertain the geological and geophysical characteristics of the seas along the Indian peninsular coastlines.

Work has also been done by various laboratories in the areas of electronics & instrumentation, energy, ecology and environment, food and food processing, housing and construction, minerals, metals and materials.

1.4 The major programmes of the 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) 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.

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

- (a) National Register of Foreign Collaborations (NRFC).
- (b) Industrial Technology
- (c) Transfer and Trading in Technology (TATT).
- (d) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).

IV Linkages with International Organisations

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

VI Public Enterprises viz.

- (a) National Research Development Corporation (NRDC).
- (b) Central Electronics Limited (CEL).

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 1261 units having valid recognition as on 31 March 1998. 256 In-house R&D Centres incurred an annual expenditure of over Rs. 1 crore and above. During the year, 69 in-house R&D centres were accorded fresh recognition and 455 centres were accorded renewal of recognition. During the year 1997-98, 13 publications were brought out; Eleventh National Conference on In-house R&D in Industry was organised; 4 issues of *In-house R&D in Industry Update* were brought out. DSIR National Awards were presented to 6 industrial units.

Scientific Research foundations in the area 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 approval

of SIROs. SIROs approved by DSIR are eligible for notification under 35(1)(ii)/(iii) of I.T. Act 1961 and for availing customs duty exemption on import of equipment. During the year, 27 new SIROs have been accorded DSIR recognition.

New plant and machinery set up based on indigenous technology and duly certified by DSIR is eligible for accelerated depreciation allowance at 40% (as against normal 25%) under Rule 5(2) of I.T. Rules. During the year, 20 certificates involving Rs.6675 lakhs as cost of plant and machinery set up based on indigenous technology were issued by DSIR.

The Government have introduced three incentives related to Commercial R&D companies, Excise Duty Waiver and Customs Duty Exemption on Goods imported for use in Government Funded R&D projects. These are operationalised by the DSIR. DSIR is the nodal department for registration of Public funded research institutions/Universities/IITs/IISc, Bangalore/RECs other than a hospital for availing Customs Duty Exemption in terms of Notification No.51/96 dated 23, July 1996. During the year, 250 such institutions were registered with 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 about 80 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.

The projects in progress include those of M/s Balmer Lawrie & Co. Ltd., Calcutta for the development of a set of machines viz Conical Expanding Machine, Flanging and Curling Machine and material handling system for the manufacture of Conical Open Top Steel Drums; M/s. Kerala Minerals & Metals Ltd. (KMML), Quilon's two projects viz. (a) Recovery of Chlorides, synthetic rutile and heavy metals from the effluent of Titanium Dioxide and (b) Reduction of ilmenite using Sodium Carbonate catalyst in collaboration with RRL, Trivandrum; M/s. Litex Electricals Pvt. Ltd., Pune and Society for Applied Microwave Electronics Engineering and Research (SAMEER), Mumbai for development of Xenon and Krypton filled lamps for laser pumping; M/s C.S. Zircon, Parwanoo for the development of Plasma based dissociation process to manufacture Zirconia; M/s. Central Electronics Ltd. (CEL), Sahibabad for Development and Evaluation of Plasma Etching and Edge Grinding System for Edge Separation; M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad for producing clean steel

through filtration; M/s Punjab Tractors Ltd, (PTL) Chandigarh and M/s Crompton Greaves Ltd. (CGL), Bombay for development of 'state-of-the-art' electronic controller for forklift trucks; M/s Semiconductor Complex Limited, (SCL), Chandigarh and C- DAC, Pune for development of ASIC (Application Specific Integrated Circuit) for Indian languages computing system GIST-II and the related card; M/s Semiconductor Complex Ltd. (SCL), Chandigarh and M/s Bharat Heavy Electricals Ltd. (BHEL), Bangalore for development of the ASIC and ASIC based 3 Phase multifunctional electronic energy meter for industrial applications; M/s Turbotech Precision Engineering Pvt. Ltd. (TPEL) and National Aerospace Laboratories (NAL), Bangalore 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); M/s Andrew Yule & Co. Ltd., Calcutta for development of rough top rubber conveyer belting; M/s Bharat Earth Movers Ltd.(BEML), Bangalore for the design and development of 460 HP Wheel Dozer; and M/s ACE Designers Ltd. and CMTI, Bangalore for development of PC Based CNC System.

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.

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. A compilation of primary data on Foreign Collaborations approved for the year 1996 was brought out. During the year, reports on technology status of various sectors/products like Caprolactam, Polyacetal Resins and Photographic Films were finalised. With a view to enhance capabilities in the area of Technology Management, a programme has been launched. Case studies on two manufacturing organisations have been brought out. Two comprehensive studies on the organisational behaviour of research organisations have been brought out. One manual on Technology Acquisition has been prepared. One lecture by a leading technologist was delivered, documented and printed for dissemination. A module on Management of Technology as a part of the MS course in Consultancy Management was conducted by BITS, Pilani in collaboration with CDC. 6 programmes on Technology Management have been organised during the year.

Under the scheme on Transfer and Trading in Technology, activities supported include, compilation of technology exports and promotion of export of technology intensive services. A study on capabilities for export on non-conventional technology intensive consultancy services from India was carried out through IIFT. A seminar was planned on "Supply Base and External Market Opportunities for some non-conventional type of Technology based services from India". ESCAP seminar on "National Policies and Technological Capability Building in Developing Countries" was held in New Delhi. A task force for Promoting Technology Exports from India was constituted. A theme pavilion on technology export was set up at India International Trade Fair in association with India Trade Promotion Organisation.

The scheme relating to Promotion and Support to Consultancy Services essentially aims to strengthen consultancy capabilities for domestic and export markets. The activities have been mainly towards completing the studies already initiated prior to 1993 towards documenting consultancy needs and capabilities in important industrial sectors and at State levels, and providing institutional and programme support to Consultancy Development Centre (CDC).

CDC was promoted in January, 1986 as a non-profit society, with a view to implement some of the programmes of DSIR. CDC is implementing a programme on Consultancy Development Promotion Assistance (CDPA) scheme, maintains a computerised database on consultants, organises training and human resources development programmes for promoting consultancy, and conducts programmes sponsored by other agencies. DSIR is providing recurring and non-recurring support to CDC. 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. Under the post graduate degree (MS) programme in Consultancy Management in association with BITS, Pilani, 18 trainees of the 3rd batch were undergoing training.

1.8 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 forums on issues related to Technology Development and Technology Transfer in coordination with other concerned Ministries.

DSIR participated in the Thirteenth Technical Advisory Committee meeting of Asian and Pacific Centre for Transfer of Technology (APCTT) and the twelfth session of the Governing Board of APCTT held in Phuket, Thailand.

'Umbrella Agreement' between the State of Israel and Republic of India on cooperation in the field of Industrial and Technological Research and Development came into force.

1.9 National Information System for Science & Technology (NISSAT)

National Information System for Science & Technology (NISSAT) promotes and supports the development of a compatible set of information systems on science and technology and interlinks these into a network to facilitate the effective transfer of latest information to users in all parts of the country.

NISSAT programme continued support to information centres to meet information needs of scientists, technologists and decision makers. The activities of the NISSAT centres were augmented and their services and revenue generation improved. The NISSAT Access Centres on International Databases Services continued services on full cost recovery basis.

Five metropolitan library networks in Calcutta, Bombay, Pune, Ahmedabad and Mysore continued their services related to interlinking of information resources in a metropolitan area. NISSAT established Value Added Patent Information System (VAPIS) at NCL, Pune and CMTI, Bangalore to offer specialised value added information services.

Selective Dissemination of Information (SDI) is provided by institutions by using databases like ADONIS, BIOSIS, BNB, BOOKFIND, COMPENDEX, CHEMBANK, DISCOVER, IFIS, INSPEC, NTIS, TTD, World Research Database and ISDS.

Library automation software programmes viz. SANJAY and TRISHNA were maintained.

The quarterly NISSAT Newsletter viz. Information Today & Tomorrow (ITT) is produced in cooperation with NISSAT centre at CLRI, Madras for dissemination of information activities.

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.

Some of the major technologies licensed by NRDC during 1996-97 include Gallium Metal, Invert Sugar, Glycol Based Antifreeze Coolant, Spice Oleoresins, High Grade Pectin from Lime Peels and Blood Bags. The on-going

projects include Thrombinase, Latex Based products from Cactus, Design and Development of Direction Finder for Fishermen. The Corporation has successfully completed the preparation of 40 project profiles for industrial projects and services for Industrial Project Services, Etheopia.

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 Signaling and Safety, Cathodic Protection Equipment for Oil Pipelines, 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.

2.0 During the year 1997-98, 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 1996-97, BE 1997-98, RE 1997-98 and BE 1998-99 of various Plan and Non-Plan schemes (headwise/broad category wise) is as under:-

(Rs. in crores)

Sl. No.	Head of Development Projects Programmes/Schemes	Actual Expenditure 1996-97			Budget Estimates 1997-98			Revised Estimates 1997-98			Budget Estimates 1998-99		
		Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total	Plan	Non-Plan	Total
1.	Assistance to Council of Scientific and Industrial Research	161.00	283.00	444.00	204.00	282.00	486.00	204.00	360.13	564.13	204.00	406.00	610.00
2.	Technology Promotion Development and Utilisation Scheme	11.74	0.07	11.81	18.35	0.07	18.42	13.11	0.07	13.18	18.35	0.07	18.42
3.	Research and Development	1.45	0.00	1.45	1.95	0.00	1.95	1.87	0.00	1.87	1.95	0.00	1.95
4.	Investment in Public Enterprises												
4.1	Central Electronics Limited	3.05	0.00	3.05	2.50	0.00	2.50	0.50	0.00	0.50	2.50	0.00	2.50
4.2	National Research Development Corporation	0.20	0.00	0.20	0.25	0.00	0.25	0.24	0.00	0.24	0.25	0.00	0.25
5.	Loans to Public Enterprises												
5.1	Central Electronics Limited	2.69	0.00	2.69	2.50	0.00	2.50	0.50	0.00	0.50	2.50	0.00	2.50
5.2	National Research Development Corporation	0.20	0.00	0.20	0.25	0.00	0.25	0.24	0.00	0.24	0.25	0.00	0.25
6.	Secretariat Economic Services	0.02	1.30	1.32	0.20	1.42	1.62	0.19	1.77	1.96	0.20	1.93	2.13
7.	Support to CEL for VRS	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.1	Deduct Expenditure for NRF	-1.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.1	Allocation for Capital Restructuring of CEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.39	20.39	0.00	0.00	0.00
Grand Total		180.35	284.37	464.72	230.00	283.49	513.49	220.65	382.36	603.01	230.00	408.00	638.00

II. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)

1. INTRODUCTION

The Council of Scientific and Industrial Research is the premier R&D organisation providing scientific and industrial research for India's economic growth and human welfare. It has a country-wide network of 40 laboratories and 80 field centres covering fundamental and applied R&D in all areas of science and technology and developing and nurturing S&T human resource for the country. The list of CSIR Establishments is given at Annexure II.1

A formidable challenge was posed to CSIR arising from the pegging of the 1996-97 Plan allocation to the 1995-96 level. Despite the financial difficulties, the performance of CSIR during the year was satisfactory. The External Cash Flow increased during the year showing a growth rate of over 15%; the laboratory reserves increased from Rs. 42 crore to Rs. 54 crore, a growth rate of nearly 29%. The upward trend in foreign patents filing continued, the number rising from 58 to 71 but there was a slight dip in the Indian patent filings due to the emphasis on improving the quality of patents filed. The impact factor of research papers contributed increased from 1980 to 2175 with the average impact factor per paper rising from 0.90 to 0.98.

2. SCIENTIFIC & TECHNOLOGICAL ACHIEVEMENTS

The S&T contributions from CSIR are of value to almost all socio-economic sectors. CSIR carries out R&D and provides services of value not only to industry but also to other sectors of the economy e.g. agriculture, health, energy, rural development, transport & defence. CSIR's assistance to domestic industry is not only by way of relevant/competitive technologies but also through search of raw materials and components, pollution control, productivity enhancement etc. A few of the more significant contributions and achievements are listed in the charts and the write-up.

2.1 Aerospace

2.1.1 Active aircraft noise control

Acoustic noise in the high frequency range is suppressed by using passive absorbing material. Noise in the low frequency range would however need absorbers of abnormal size. Thus an effective way to control this noise is to create and superpose anti-noise on it, called active noise control. This involves picking up the noise and adjusting its phase and magnitude by an adaptive filter so as to cancel the

ambient noise. After detailed studies, NAL has developed a methodology for active noise control using a single channel system. However, real life applications require generating multi-channel noise controllers and appropriate algorithms for the adaptive filters. NAL is accordingly developing a multichannel system for noise control for enclosures like automobiles, aircraft cockpits and air cabins which would also be used for the 14 seater SARAS aircraft being developed by the laboratory.

2.1.2 Ejector ramjet studies

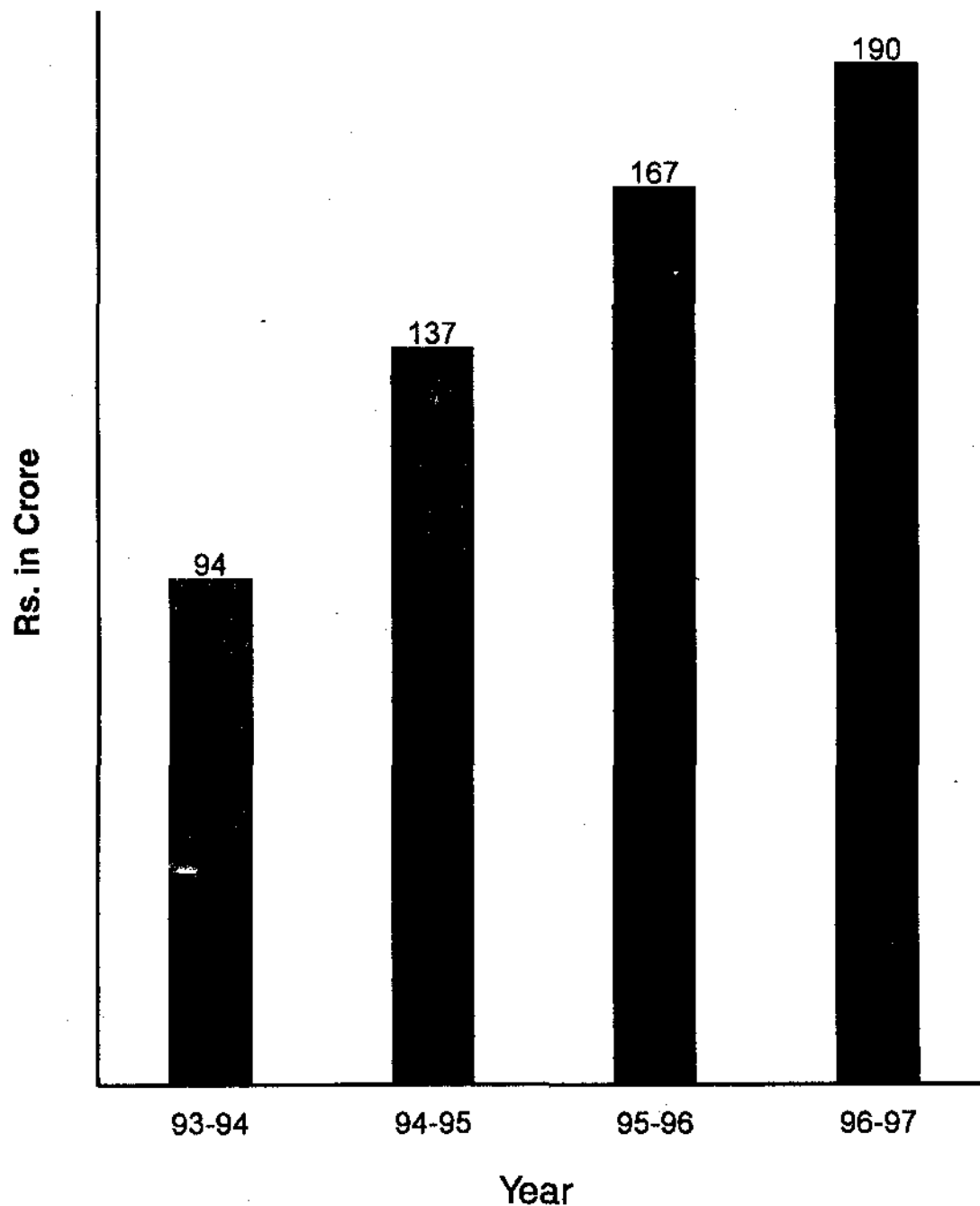
Studies have revealed that best features of rockets and air breathing engines can be combined in a composite engine. High performance ejector ramjets could be employed very effectively in such composite engines particularly when the system is operated in the low speed mode. A complete understanding of the system is essential to design practical propulsion systems based on these concepts. A proof-of-concept experiment was designed by NAL under a project sponsored by VSSC and demonstrated to prove the concept. Ejector ramjet thrust augmentation ratios greater than unity at simulated take-off conditions have been achieved successfully. A test-rig to test such ejectors has been built for conducting extensive experiments and build a database which would be essential for providing design input for designing this type of systems. Also a combustor test facility for ramjets has been set up under a sponsored programme wherein supersonic combustion of both hydrogen and hydrogen aided kerosene has been successfully demonstrated.

2.1.3 Type Certification for two seater aircraft HANSA-3

One factor that threads through different stages of aircraft development is its type certificate, the document which prescribes the quality control and adequate system requirement that enables one to trace any defect to its root cause. The type certificate is thus the bedrock on which all activities relating to the aircraft rest.

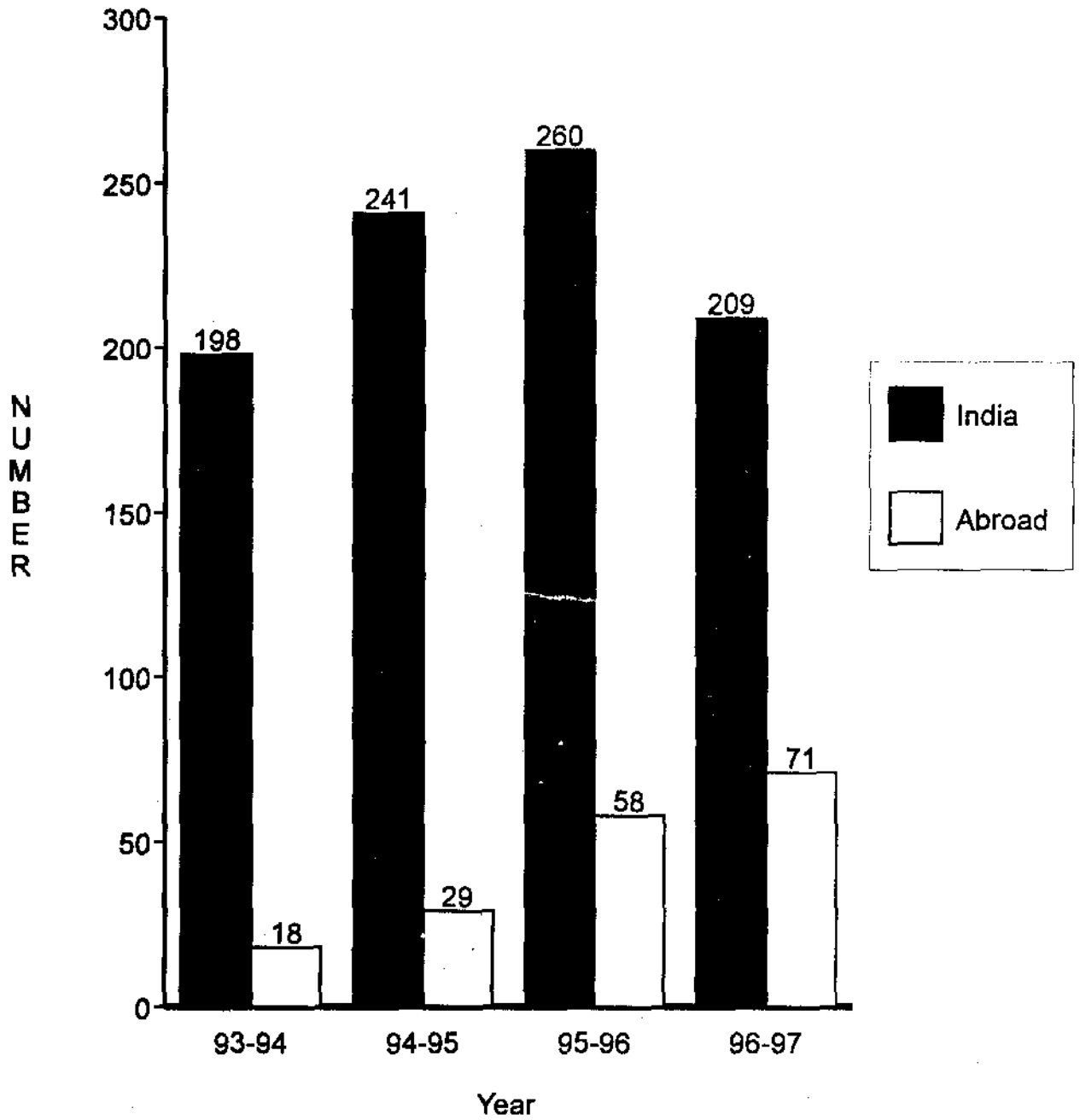
Hitherto, the U.S. Federal Aviation Authority's, Federal Aviation Rules (FAR) - Part 23 were the dominant type certification basis for civil aircraft upto all-up weight (AUW) of 5700 kg, but, in recent times, the European Joint Airworthiness Requirements for Very Light Aircraft (JAR-VLA) has indicated the rational elimination of excessive demands for very light and low-speed aircraft which are

EXTERNAL CASH INFLOW Contract R&D and Consultancy



II.1 External Cash Inflow through Contract R&D and Consultancy

PATENTS FILED



II.2 Patents Filed

otherwise essential for large high speed aircraft involving large masses, velocities and energies. The NAL effort for type certification is centred around the JAR-VLA route. NAL has set-up a quality control and assurance unit and worked closely with the R&D and Civil Airworthiness Department of DGCA in seeking type certification for the all-composite HANSA aircraft. Satisfactory level of quality control in all aspects of HANSA-3 certification has been achieved and NAL has secured approval of DGCA for prototype fabrication and integration of HANSA-3, inspection of composite material/component using NDT methods and chemical tests of matrix and metallic materials. The type-certificate for HANSA-3 is expected by the year end.

2.1.4 Chemical Vapour Deposition (CVD) Diamond Film for Abrasive Applications

CVD diamond film will soon replace the conventional diamond plus resin and diamond plus metal composites for abrasive applications. NAL has initiated work on the development of CVD diamond film under a Indo-German collaborative project based on its in-house surface engineering expertise. The NAL technology takes a hot filament activation route for the deposit of thick films of diamond suitable for industrial applications. The characteristics of film obtained from this method have been found to be extremely attractive and the technology has a good general potential for industrial as well as a few critical aerospace applications.

2.2 Biology and Biotechnology

2.2.1 Universal polymer support for the synthesis of oligodeoxyribo- and Oligoribonucleotides

Solid phase synthesis of DNA and RNA requires at least eight different prederivatised polymer supports. The commercial availability of base labile synthons for DNA and RNA synthesis has necessitated the need to prepare a large number (50-60) of such pre-derivatised polymer supports making DNA and RNA synthesis a time consuming task. CBT has developed a versatile universal polymer support devoid of nucleotidic material and compatible to the existing methods of synthesis and deprotection of oligodeoxyribo and oligoribonucleotides. The universal support obviates the need to prepare a large number of pre-derivatised polymer supports. Patent has been applied for the development in India and USA.

2.2.2 RNasin: inhibitor of ribonuclease

A constant problem facing an experimenter who handles nucleic acids is that of degradation of RNA by the ubiquitously-present enzyme ribonuclease (RNase). It becomes important to use inhibitors that abolish or greatly reduce RNase action. Such an inhibitor called RNasin is commercially available and extensively used. CCMB

developed an efficient method to isolate and prepare in the pure form, large quantities of RNasin from discarded human placenta. This preparation was given to a commercial firm for market analysis survey and technology transfer. Having found this RNasin as excellent cost-competitive inhibitor, the firm has now entered into an agreement with CCMB for technology transfer, and commercial production of this molecular biological inhibitor.

2.2.3 Biomarker for the detection of Minimal Residual Disease (MRD) in Acute Lymphoblastic Leukaemia (ALL)

IICB has identified a unique biomarker on the leukemic blast cells in children. This biomarker serves as a reflection of circulating yet non-detectable leukemic blast cells i.e. for the detection of MRD. The biomarker varies in different stages of the disease i.e. in the acute phase of the disease it is present in very high amounts, decreases with response to chemotherapy and interestingly reappears in relapse. This biomarker is not present in other blood disorders and is unique. This assay developed is simple, sensitive and rapid method and can be performed with 2-3 ml of peripheral blood. It is obtained from the lectin, ATNh (i.e. *Achatina fulica*) snail, by single step purification with high yield (6%) coupled with restricted specificity and long term stability for over two years at 6-10 degree celcius.

2.2.4 Production of free gluconic acid by a genetically altered organism

RRL, Jammu has developed a fermentation process for the direct production of free gluconic acid from glucose using a genetically altered organism - a Tn5 transposonised block mutant of *Gluconobacter oxydans*. The fermentation process has advantage over the known processes in generating the free gluconic acid in one step, without the requirement of pH control and at very low oxygen transfer rate.

2.2.5 Invitro screening system for endocrine disorders

A yeast (*Saccharomyces cerevisiae*) strain useful in screening androgenic steroids has been constructed at IMTECH by integrating the *E.coli* *B-galactosidase* gene in the *Ura3* locus. This screening system involves function based screening of natural or synthetic compounds and thus has a potential advantage over the existing methods and especially in steroid therapy system is of significant value considering the recent use of androgens in AIDS patient to prevent wasting, besides their use in other clinical situations. This yeast strain could also be used in screening of mutations in the androgen receptor gene which impairs normal receptor function that has been implicated to be the cause for endocrine disorders and even prostate cancer. An easy, simple and function based detection system for such disorders is not available at present.

2.2.6 High yielding menthol mint variety 'Himalaya' released for commercial cultivation

'Himalaya' a promising genotype of *Mentha arvensis*, developed by CIMAP through cross pollination of 'Gomti' and 'Kalka' (varieties earlier developed by CIMAP) has been released for commercial cultivation this year. Himalaya combines the high regenerability and oil yielding ability of Gomti and disease resistance properties of Kalka. Himalaya has proved significantly superior to the parent varieties and also to a local cultivar Shivalik in terms of oil yield and menthol content in multi year and multi locational trials. It is also free from all common diseases. The variety is currently cultivated in farmer's field and adopted under the Ambedkar Visheshak Rojgar Yojna of Uttar Pradesh Government. This particular project aims to create 425 direct and 2550 indirect job opportunities within two years.

2.2.7 Pest Resistant Transgenic Cotton Varieties

NBRI had earlier employed genes coding for dendotoxin and cowpea protease inhibitor proteins that are inhibitory to insect growth. This has now been successfully employed for the complete synthesis of about 2000 bp double stranded DNA fragment encoding d-endotoxin protein to develop transgenic cultivators of Indian cotton varieties resistant to bollworms - the major insect pests of cotton. The gene was synthesised in four parts by assembling 8 to 28 oligonucleotides in a single reactor followed by efficient and error-free ligation thereby establishing the possibility of designing the sequence of a dis severed gene and its chemical synthesis and assembly. NBRI also established an efficient protocol for direct organogenesis via multiple shoot induction for 13 different cultivators of *hirsutum arboreum* of cotton to give 10 to 15 shoots/exploit in a single step. This provides a new explant for direct gene transfer in cotton by microprojectile and *Agrobacterium*.

2.2.8 Biosensor for Monitoring of Pesticides Residues

In collaboration with the Visva Bharati University NEERI has taken up the development of biosensor for detection and estimation of organophosphorous pesticide residues in natural waters. The easy to use biosensor provides real-time data on measurements of trace concentrations of organophosphorus pesticide residues in water under real life conditions.

The enzyme has been immobilized using covalent crosslinking with Bovine Serum Albumin (BSA) and glutaraldehyde. Desirable stability, consistency, reproducibility, maximum retention of enzyme activity, and its application on electrode for potentiometric detection have been achieved. Environmental conditions such as pH, temperature, substrate concentration, pesticide concentration and enzyme-pesticide contact time have been optimized for the sensor. The enzyme sensor can be regenerated for reuse

after inhibition with a dilute solution of 2-PAM (2-Pyridine Aldoxime Methiodide).

2.2.9 Aekla - An unbranched variety of Indian henbane (*Hyoscyamus Niger*) developed

CIMAP has released a superior variety of Indian henbane (*Hyoscyamus niger*) a rich source of tropane alkaloids hyoscyamine and hyoscyne which have sedative, mydriatic, antispasmodic and anticholinergic properties. In contrast to the normal plant type including that of earlier variety Aekla, the new variety Aekla is unique because of the most remarkable quantitative changes for a majority of plant traits. It is unbranched, erect and tall with marginally arranged (non-over lapping) larger and thick leaves with pedicillate and andro-or apetalous flowers containing 7-9 bold and dark purple anthers. Being about three times richer in crude drug content, Aekla has the genetic potential of yielding 4-5 times more tropane alkaloids per unit area and input over the local bulk and nearly twice the earlier released variety Aekla. Commercial cultivation of Aekla will help meeting domestic requirement of the alkaloids hyoscyamine and hyoscyne while simultaneously providing better returns for its cultivation in terms of improvements in herbage yield.

2.2.10 New propagation technology for tea

Conventional tea is propagated by single node cuttings. IHBT has succeeded in propagation by 4/8 node cuttings. The cut ends of four and eight node cuttings were treated with different auxins and phenols resulting in 85-90% success in rooting and transfer to field within 9 months. Thus it is possible to obtain healthy plants within 9 months as compared to conventional methods needing nearly 2 years.

2.2.11 Mericloning of citrus fruit plants

A breakthrough in production of citrus fruit plants by mericloning has been achieved at NBRI. Meristem culture for propagation of citrus plants, a sure way of obtaining specific pathogen (particularly viruses) free plants is a welcome alternative to the present globally adopted micrografting technique which is most arduous and time consuming. The breakthrough achieved has been in successfully growing 1-mm-long shoot meristem, excised from field-grown trees of two commercially important citrus species, viz., *C. aurantifolia* and *C. sinensis* by an in vitro strategy and regenerating the shoot meristem by growing them sequentially in a liquid medium of a particular composition followed by their culture on an agarified medium supplemented with different concentrations of growth substances after they picked up growth to about 6 to 8 mm in length. Such regenerated shoots could either be rooted giving rise to individual plantlets or proliferated into enormous number of cloned shoots for the same genetic make-up as that of the mother plant, constituting an invaluable and renewable source of pathogen-free scion material for grafting.

2.3 Chemicals

2.3.1 Poly alpha-olefin

Poly alpha olefins, used as lube oil stocks are synthesised by oligomerizing higher alpha-olefins such as 1-octene or 1-decene using catalytic systems based on boron trifluoride, which is hazardous and environmentally unfriendly. A novel approach using a supported Lewis acid catalytic system based on aluminium alkyls is being developed by NCL for the oligomerization of higher alpha-olefins to suitable lube oil compositions. Reaction parameters have been standardized to obtain oligomers with required specifications at 500 ML/batch scale.

2.3.2 Pesticides from *Annona squamosa* (custard apple)

IICT has extracted two new compounds Isobullatacin and Isoquamocin from *Annona Squamosa* seed and studied their insecticidal activities. Bioefficacy studies on the formulated product have been encouraging with respect to larval survival rate. Field trials on tomato crops have given higher yield as compared to traditional pesticides. The products have great potential as environmentally friendly insecticide for agricultural practices the world over.

2.3.3 Solid acids for nitrations and esterifications

Innovative design of solid acids as catalysts for ecofriendly processing of aromatics has been attempted by IICT. Successful nitration of aromatics with a solid acid catalyst with consistent activity at room temperature has been achieved for the first time. Solid acid catalysts developed by the institute also provide cheaper options for esterification of chemicals used in fragrance industry.

2.3.4 Membrane cell technology for the production of caustic soda and chlorine

CECRI has developed a 2 tonnes per day bipolar membrane electrolyser consisting of titanium anolyte chamber with baffle type adjustable current distributors and expanded titanium mesh anode surface. The cathode chamber is made up of special grade stainless steel with current distributors and catalytic coating cathode. The bonding of these two chambers has been done by electrothermal process which reduces the cost of the bonding and also voltage drop to minimum and baffle arrangement enhances the turbulence and provides uniform electrolyte flow and concentration.

2.3.5 Novel technique for determination of iodine

A new method for determining iodide in food and body fluids based on the novel technique of Ion Chromatography in combination with spectrophotometric detection and determination has been developed. The advantage of the method is that it can differentiate between iodate and iodide, especially in the edible iodised salt, which is usually present as iodate. Applicable to determination of iodide in iodised

salt, urine etc., it will be of use to the manufacturers of iodised salt, consumers and physicians specifically in the diagnosis of goitre.

2.3.6 Pt-Re Skewed Reforming Catalyst

Pt-Re bimetallic catalyst is generally used in semi-regenerative type of catalytic reforming units. IIP had earlier developed a balanced Pt-Re catalyst which is in commercial use in two Indian reformers, one for octane boosting and the other for xylenes production. The catalyst has been working very satisfactorily for the last 7 years. IIP has now developed skewed type high rhenium catalysts used for catalytic reforming which has better activity, selectivity and high stability than the normal Pt-Re. The reforming process temperature is reduced by 5°-6°C with this catalyst which has around 15% more stability.

The scale up of know-how for catalyst production will be jointly carried out with industry who will then commercially manufacture it. The prospective users are the existing semiregenerative reformers in the country. The catalyst has high export potential.

2.3.7 Sweetening Catalysts

The presence of mercaptans in the petroleum products like LPG, naphtha, gasoline, kerosene, ATF etc is undesirable due to their foul odours and highly corrosive nature. Sweetening of petroleum products through catalytic processes use metal phthalocyanine derivatives as catalysts. IIP has developed two sweetening catalysts namely catalyst-I (WS) and catalyst-II (FB). Catalyst-I (WS) is suitable for liquid-liquid sweetening of pentanes, light straight run naphtha and regeneration of alkali in the mercaptan extraction from LPG, pentanes and light straight run naphtha, while catalyst-II (FB) is suitable for sweetening of heavy naphtha, FCC gasoline, ATF and kerosene in the fixed bed reactor containing catalyst impregnated on activated charcoal. Both the catalysts developed have shown better performance than commercial catalysts in model laboratory experiments designed to suit actual refinery conditions. Steps are being taken to test these catalysts in actual refinery operations in one of the refineries in the country.

2.3.8 Process for C₁₀-C₁₈ Secondary Alcohols

IIP has developed an innovative process for production of C₁₀-C₁₈ secondary alcohols through n-paraffins oxidation in liquid phase. These alcohols are valuable feed stocks for production of surfactants. A novel catalyst has been developed which gives selectivity of 90% at 40% conversion per pass in comparison to current processes which give 81-90% selectivity at 15-22% conversion. The development work has been done at laboratory scale under PATSER programme of DSIR along with an industrial partner.

2.3.9 New Low Pressure NMP processes

NMP is the latest generation solvent employed for removal of poly nuclear aromatic hydrocarbons from raw lube oil feed stocks to make better quality lube oil base stocks (LOBS). A new low pressure process for production of NMP has been developed at laboratory scale, using Gamma butyrolactone, (gamma-GBL) as the feed material. In the process gamma-GBL is reacted with Ammonia at Low Pressures in presence of a novel zeolite based catalyst, to produce NMP. The Laboratory studies have been completed and process design and scale-up to 2500 TPA plant is in progress. The process has been developed in collaboration with industry.

2.3.10 Brine purification resin

CSMCRI has developed an acrylic type amino methyl phosphoric acid type resin for brine purification. Presently the demand for these resins is totally met through imports. Bench level studies of brine purification have revealed better performance in comparison to the imported resins which are essentially of styrenic type and involve the highly carcinogenic chloromethyl ether in their synthesis. The know-how is being upscaled to pilot plant level in collaboration with industry.

2.4 Drugs and Pharmaceuticals

2.4.1 Lamivudine by non-hazardous process

Lamivudine is a clinically useful anti-AIDS drug. The present process of manufacture of Lamivudine utilises ozone, a hazardous chemical. IICT has developed an alternate route totally dispensing with ozone. This modification in technology will have tremendous impact on the international price of lamivudine. The development is being patented.

2.4.2 Improved process for simultaneous production of artemisinin and essential oil from *Artemisia Annua*

Artemisinin and its derivatives from *Artemisia annua* plant are important antimalarial drugs because of their activity against resistant strains of *Plasmodium falciparum* and their efficacy against cerebral malaria. *A. annua* is also a good source of essential oil. The essential oil shows dermatological, antimyotic, antimicrobial and specific fungicidal properties. Cultivation of *A. annua* as a commercial crop has now been adopted throughout the world.

In the conventional process for isolation of artemisinin, the non volatile constituent of the plant is used for the production of antimalarial drug while the volatile constituent (essential oil) goes as a waste. An integrated process has now been developed at CIMAP which enables isolation of artemisinin as well as 75% of essential oil. The process offers the advantages of obtaining both artemisinin and essential oil by a single process which dispenses with the removal of fatty material that reduces artemisinin content and the partitioning

step selectively transferring the sesquiterpene into polar phase and the fatty and other impurities in non polar phase for better recovery of both the products and enables recovery of 90% of solvents for reuse. The process is continuous, cost effective and eco-friendly.

2.4.3 Antirelapse antimalarial drug

Phase II clinical trials on an enamine derivative of primaquine, as an antirelapse antimalarial drug developed at CDRI have been concluded. The drug has been found to be much safer than primaquine in patients of plasmodium vivax as indicated by low methaemoglobinemia. The compound will be evaluated for its use as a prophylactic agent against *P. falciparum* malaria.

2.4.4 Production of cyclosporin-A by fermentation process

Cyclosporin A (CSA) is an excellent immunosuppressive drug needed for organ transplant surgery. Studies at RRL-Tvm. on production of CSA using *Tolypcladium inflatum* B-58 were directed towards a viable and economically feasible fermentative method of production. The impact of various physical and chemical process parameters were optimized and encouraging results were obtained. Medium supplementation with an amino acid further improved CSA synthesis by the fungal strain. A whole cell immobilized bioreactor was designed to study the biotransformation efficacy of the bioactalyst embedded in various encapsulation agents. Bioreactor operations were successfully monitored in batch and recycling modes. Efforts are on to negotiate an industrial partner for the technology development and scale up studies.

2.5 Earth Resources

2.5.1 Long-range forecast of rainfall patterns using neural networks

Long-range forecast of rainfall patterns can provide significant boost to the country's economy through advanced planning and crisis (e.g. drought) management. The conventional dynamical and statistical methods however, still do not possess adequate skill in long-range forecast of rainfall patterns, especially at longer than seasonal scales. The cognitive networks developed at C-MMACS have shown considerable skill indication of all-India mean summer monsoon rainfall and provide a general tool for forecast of rainfall pattern at various scales.

2.5.2 Identification of Gas Hydrate bearing regions

A study to identify potential gas hydrates sites was initiated at NGRI under a project sponsored by Gas Authority of India Ltd. The seismic reflection method was used as a possible tool for identifying gas hydrate deposits. Reprocessing of existing seismic data, across the western

continental margin of Mangalore coast, indicate the possible existence of gas hydrates bearing zones.

2.5.3 Detection of weak zones in granites

Under a project sponsored by BARC, NGRI conducted integrated geophysical studies comprising the deep receptivity and electromagnetic sounding to detect the structural inhomogeneities upto a depth of 1 km in granitic terrain of Jaisalmer. The modelling of integrated data indicated the presence of two major structural trends that broadly correspond to weak zones. The study testifies the usefulness of geophysical methods in mapping deep seated structural inhomogeneities in granitic terrain.

2.6 Electronics & Instrumentation

2.6.1 PC based high quality Hindi speech synthesis system

A high quality synthesis system, useful for the visually handicapped persons as a 'reading' machine, has been developed by CEERI. It can also be used for other applications like information retrieval in railways/airlines/tourism industry and toys with voice synthesis. As the speech synthesis systems are language dependent, systems developed elsewhere in the world cannot be directly adopted for Indian languages. The system developed by CEERI is a high quality PC-based parametric speech synthesis system for Hindi using the cascade/parallel format synthesis model. The technology is being extended to synthesise other Indian languages, as well.

2.6.2 On line process control in tea and food industries

CEERI, had pioneered the modernisation of Indian process industries by introduction of on line process control instrumentation leading to cost effective implementation of process technologies and high quality products. Instrumentation developed for sugar, paper, and leather have been successfully implemented by Indian industry resulting in appreciable saving in productivity. CEERI has now introduced on-line control systems for the tea and food industry. These are :

- i. Monitoring and control system for tea withering process : The computer based withering process monitoring and control system developed senses on-line parameters of the leaf in the trough and estimates the % of withering and controls the fan and hot air supply to the trough. The control system incorporates the heuristic knowledge and this in addition to the on-line data makes the decision on the status of the withering process. It is energy efficient with 10% reduction in energy consumption and increases the throughput by reducing the withering time and production of consistent quality tea.

- ii. On-line brix monitoring sensor and system for tomato concentrates and pulps : The system can be used to control the tomato concentrates and other similar products in food processing sector. The system is based on optoelectronic determination of critical angle for the medium of measurement in the range of 0-90 degree brix in three or four ranges. It is cost effective, indigenous instrument for monitoring the most important parameter contributing to the quality of the product. Primarily designed for food processing industries like tomato and mango pulp concentrates, jams, juices, sauce/ ketchup etc., it can also be used in other industries like sugar, paper, pharmaceuticals etc., with slight modification in the sensor assembly and software. Introduction of this automation leads to value addition to the agricultural products and the technology has great potential for export to third world countries.

2.6.3 5 MW S-band Klystron Tube

CEERI has successfully assembled the first prototype of the indigenous 5 MW S-band Klystron tube. This tube, excluding the magnet, weighs about 50 Kg and is 1.2 meters long. The gun collector test module, a device to evaluate the design of the electron gun and collector, has been successfully tested for the rated voltage of 126 KV at CAT, Indore. The tube is a critical component for Synchrotron Radiation Source (SRS) a national facility at CAT, Indore, which has indicated a yearly demand of 2 numbers.

2.6.4 Teleclock for receiving/transmitting time over telephone network

NPL has successfully developed a device for receiving and transmitting standard time in a master/slave configuration, in a telephone network. The system at present incorporates external modems and a bundled software to run the system for receiving/transmitting standard time. This time signal could be that generated by a user in his own premises traced to NPL standard time by using an appropriate code number and by dialling on a normal telephone. The device is being miniaturised for installing in any telephone instrument.

2.6.5 Atomic Force Microscope (AFM)

AFM is rapidly emerging as an important analytical tool for profiling of surfaces from micrometer to nanometer scale which has become important due to the miniaturisation of machines. Besides, as a versatile meteorological tool, the AFM finds, numerous applications in quality control in the optical, semiconductor, magnetic recording industries. The ability to measure three dimensional profiles with nanometer resolution makes the AFM an important tool for inspecting optical disk stampers, measuring line widths on integrated circuit masks and other applications. CSIO has developed

an AFM which is modular, simple in operation and the components can be arranged to calibrate both the z displacements of the piezo and the voltage-to-distance respectively of the detector, which are needed in addition to the cantilever spring constant K_n , for accurate force determination between the tip and surface. Using it CSIO has successfully imaged holographic gratings, micromachined surfaces and some biological molecules such as amino acids, biopolymers such as DNA, macromolecules such as proteins, and even entire cells. Efforts are being made to license the design know-how to industry.

2.6.6 35 mm Mini Pan Camera mounted on UAV - Nishant

A 35 mm Mini Pan Camera has been designed and developed at the CSIO, Chandigarh, which is suitable for use in low-speed aircraft operating at a low altitude, during daylight conditions. The Camera works on the principle of rotating mirror-lens-slit combination and moving film, resulting in recording of a much wider swath of the ground compared to frame strip camera.

The design and development of this camera for Remotely Piloted Vehicle (RPV) was sponsored by the Aeronautical Development Establishment (ADE), Bangalore. Three units of the camera have since been developed and submitted to ADE. The units were successfully interfaced with main Payload Interface Unit and subjected to pre-laid environmental tests prescribed for Unmanned Air Vehicle (UAV). One unit was mounted on 'Nishant 3-4' and its performance during the flight trials was found to be satisfactory.

2.7 Energy

2.7.1 Low cost Cd-Te solar modules

While solar photovoltaics have long been the best option for harnessing solar energy as a clean and abundant source of electrical energy, its wide spread use in large scale PV utilities has been hampered due to high costs. Industrial demonstration of low cost site based solar modules is first such step in India in this direction. NPL has been working to develop commercial level technologies for various cell fabrication steps, researching on new concepts for high efficiency cells and developing new cell structures and materials. As a participant member of a consortium, NPL has promoted pilot line manufacture of low cost polycrystalline Cd-Te solar cell modules. The PACER supported project being implemented by a Pune based private industry is aimed to design and develop a process line for 700 kW annual production capacity to demonstrate its industrial viability. NPL is providing technical guidance, development of certain process steps, process and optimized parameters and materials for solar cell contacts and techniques for encapsulation as well as reviewing international status to decide best economic option.

2.7.2 Technology for CNG Operation of Two-stroke Engine for Three-wheeler vehicle

IIP has developed a simple retrofit technology for conversion of two stroke engines of petrol/diesel run three wheelers to CNG operable engines. CNG engine is smooth, less noisy and about 50% cheaper than gasoline operated engines.

The conversion technology features a separate oil pump lubrication system which sends right quality of oil for various speeds and load conditions. A separate idling circuit causes smooth and stable idling and also makes subsequent starts on CNG easier. The dual-fuel capability has the advantage of either CNG or gasoline operation which adds to the operating range of the vehicle. The conversion technology is unique because so far no technology for CNG operation of three wheeler has been commercially exploited. IIP has successfully demonstrated in Delhi the first CNG three wheeler of the country. The Gas Authority of India Ltd. has sponsored this development and will be a partner in licensing the technology.

2.7.3 Coal water slurry as an alternative fuel

A single step wet grinding process (30 kg/batch) was developed by CFRI and standardised at 30 kg/batch level for the preparation of High Concentration Coal Water Slurry (HCCS) as substitute fuel in retrofit oil fired appliances. A study with coals from North-Eastern region of the country (eg. Challang from Meghalaya and Ledo from Makum field in Assam) showed a distinct advantage of the single step wet grinding process over dry grinding in respect of milling time and slurry viscosity which are reduced by 20-25% and 25-30% respectively.

2.8 Ecology and Environment

2.8.1 Industrial complexing for phosphogypsum fertilizer waste

Under a study sponsored by the US National Science Foundation, in collaboration with the Clean Energy Research Institute, Florida, NEERI is to examine the feasibility of locating and operating an industrial complex comprising phosphatic fertilizer and cement plants within an Environmentally Balanced Industrial Complex (EBIC) at one site in India.

Investigations on beneficiation requirements for phosphogypsum and/or phosphochalk, cost of cement production, and the quality of cement which govern the willingness of cement manufacturers to shift from limestone to by-product Phosphogypsum (BPG) as a calcium source are among the major factors for study. The beneficiation study revealed that the fluoride, sulphate and phosphate concentrations can be reduced to levels permitting cost-effective usage of beneficiated phosphochalk for ordinary portland cement (OPC) and masonry cement manufacture.

The wastewater generated during the beneficiation is treatable, and would meet the regulatory standards with recourse to available wastewater treatment processes.

2.8.2 CETPs for Industrial Estates of NCT - Delhi

The Delhi Pollution Control Committee (DPCC) retained NEERI to design and assist in installation of Common Effluent Treatment Plants (CETPs) in twenty-eight industrial estates in NCT-Delhi, for the Delhi Pollution Control Committee.

The institute conducted extensive field investigations in the industrial estates to assess techno-economic feasibility of CETP installation and keeping in view the reuse and recycle potential of treated wastewater for process usage, the treatment options have been evaluated with suitable physico-chemical, and biological routes. Treatment options have been ranked by salient attributes such as effluent characteristics, annualised costs, reuse potential, land requirements, and process reliability to arrive at the most appropriate alternative for each CETP. The total capital cost of fourteen CETPs for a reusable treated water quality is estimated at Rs.90 crores with an annual O&M cost of Rs. 48 crores. The cost of treated water ranges from 5.93 to 16.05 Rs/m³, which is on par with the cost of municipal water supply in NCT- Delhi for industrial usage.

2.8.3 Wastewater Renovation with recourse to Soil Aquifer Treatment (SAT) System

The SAT system involves wastewater renovation by infiltration through soil matrix under a project sponsored by the Ministry of Water Resources, in collaboration with the Physical Research Laboratory (PRL) and Ahmedabad Municipal Corporation. NEERI conducted controlled experiments with primary settled sewage under different experimental conditions to assess the wastewater renovation efficacy of soil matrix with reference to filtration, adsorption, ion exchange, and biodegradation.

The Pilot Plant with a capacity of 500 M³/day was operated under varying experimental conditions of sewage inflow rate, and flooding/drying cycles to assess the efficacy of the natural riverbed on the removal of Suspended solids, Biochemical Oxygen Demand, Chemical Oxygen Demand, Nitrogen, Phosphate, and bacteriological characteristics. The results established the feasibility and efficacy of the SAT system under the prevailing climatic and physical conditions at the Sabarmati riverbed in Ahmedabad. A mathematical model is now being developed, calibrated, and validated to enable wider application of SAT system in India.

2.9 Food and Food Processing

2.9.1 Biodegradable packaging films from chitosan

Packaging films made out of proteins, polysaccharides and their derivatives are in use in the western countries and

Japan as eco-friendly packaging material. Chitin is one of the abundantly available polysaccharides in nature, which India has in plenty. Thus in R&D aimed at suitable chemical modification of chitin, CFTRI has come out with a number of applications. One modification is cross-linking, which gives thin (5-10 mm) transparent films. The films prepared from the cross-linked chitosan were tough, and possessed excellent tensile/tear strength, both in dry and wet states and thus could be useful as wrapping material for packaging fruits, vegetables and processed foods. Know-how has been developed for chitosan films to replace plastic as food packaging materials for specific applications.

2.9.2 Isolation of piperine from pepper oleoresin

India is a major producer of pepper yet there is no commercially viable process for making piperine, the pungent active principle of pepper, which besides its food application also finds use in pharmaceutical preparations. CFTRI has developed a method for treating the pepper oleoresin having 40-50% piperine by physical process to obtain enriched product having 80-85% piperine which by a solvent wash gives piperine of purity >96%. The process is ready for commercial exploitation. It is expected that the isolation of piperine from pepper will boost its value addition and export earnings.

2.9.3 Xylanolytic enzyme suitable for clarification of non-citrous fruit juice

A xylanolytic enzyme obtained from an edible fungus was used by IICB for clarification of apple and grape juices. The process does not require use of any filter-aid or vacuum filtration for clarification. An Indian patent application has been filed.

2.10 Housing and Construction

2.10.1 Beneficiation of Phosphogypsum

Beneficiated phosphogypsum is a useful substitute for high purity natural gypsum for making different grades of gypsum plasters and plaster products and is eminently suitable for making low cost water-resistant cementitious binders for use in masonry mortars, plastering, building blocks/bricks, fibre reinforced (natural/synthetic) boards etc, thereby conserving cement. However utilization of phosphogypsum is easier after beneficiation. CBRI has set up the first indigenous pilot plant for beneficiation of waste phosphogypsum. The pilot plant which has a capacity to beneficiate one tonne of waste phosphogypsum is complete with all necessary equipment and processing accessories to get ready to use product.

2.10.2 Polymer Modified Cementitious (PMC) Tiles for Buildings

CBRI as part of its R&D efforts to develop innovative building materials based on polymers has developed good

quality PMC tiles using cement aggregate, polymers and some additives. These tiles exhibit improved quality and durability, besides having excellent wear resistance, low porosity and high mechanical strengths. They are cost effective and being fungal resistant are also environment friendly.

2.10.3 Interlocking concrete block pavement technique for special locations

CRRRI has developed Interlocking Concrete Block (ICB) pavement technique for special locations such as bus or container terminals, industrial roads, snow bound regions as well as for rehabilitation of old concrete surfacing. This technique has proved to be good alternative for difficult locations. Properly designed ICB have high dimensional accuracy, high compressive strength, better durability and high abrasion resistance. They are capable of providing a maintenance free surfacing for longer periods at troublesome locations.

2.11 Information Products

2.11.1 The Wealth of India (CD-ROM) Project-AHEAD

NISCOM brings out CDs under the project AHEAD (Asian Health, Environmental and Allied Databases) which is a consortium of 8 Asian countries contributing 9-10 databases, under the sponsorship of IDRC, Canada. The basic disk D2.1 on "Wealth Asia" includes all the published volumes of the "Wealth of India - Raw Material" series and was released in 1995. During 1996-97 information for updates of all the entries of raw material series for a period of five years i.e., 1989-93 was generated and incorporated to produce D2.2 and D2.3 released in December, 1996 and July, 1997, respectively.

2.11.2 Collected works of Eminent scientists on CD-ROM

INSDOC has undertaken a project to preserve the works for posterity of six eminent Indian scientists : Sir Jagdish Chandra Bose, Sir Shanti Swaroop Bhatnagar, Dr. Homi Jehangir Bhabha, Dr. Birbal Sahni, Dr. J.N. Wadia and Dr. Vikram Sarabhai through electronic imaging and recording on CD-ROM.

2.11.3 Popular science periodicals and books

Publication of popular science books under a new series viz. 'Q' series, was launched by NISCOM with the publication of the book titled 'What'. This is a lavishly illustrated book containing 100 mind-boggling questions. The three regular popular science periodicals from NISCOM namely Science Reporter (English, circulation 45,000), Vigyan Pragati (Hindi, circulation 95,000) and Science-Ki-Duniya, (Urdu circulation 10,000) were brought out as per schedule.

2.11.4 Value added patent information service (VAPIS)

A joint project of NISSAT and CSIR for providing value added patent information service was launched at NCL, Pune in the financial year 1995-96. The activities of the centre such as procuring suitable hardware, software databases mostly CD-ROM products in the area of chemical sciences patents information was started after the receipt of funds from NISSAT. The centre has procured CD-ROM products on:

- US Patent Search Claims and Abstracts 1975+
- Patent Images US Chemicals 1990+
- European and PCT International Patent Application Bibliography
- European Patent Application (Images) 1990+
- Patent Bible (US)

To provide the CD-ROM based services 14 Drive CD-NET Tower was commissioned in the Library LAN.

2.11.5 Photo-identity cards

INSDOC had undertaken in October 1994 a project for preparation of Multi-media Photo-Identity-Cards for electorates of 12 Assembly Constituencies of the NCT of Delhi and nearly 10 lakh Photo Identity-cards were prepared. Impressed with the quality of INSDOC's work, the Chief Electoral Officer, Delhi allocated to INSDOC the additional job of preparation of Photo Identity cards for electorate of 50 Assembly Constituencies out of a total of 70. INSDOC has since developed an improved system for preparation and delivery of photo identity-cards on the same day. About 3 lakh photo identity cards have been prepared during 1996-97.

2.11.6 Science and Technology archival resources

As part of a continuing programme of collection, maintenance and dissemination providing archival material on science, NISTADS brought out a collection of 60 reports of various committees constituted from time to time to review and examine the working of CSIR.

2.11.7 Standard time and frequency signals (STFS) service via INSAT

A coded standard time & frequency signal (STFS) broadcast system of high accuracy by NPL using the Indian domestic satellites INSAT-1B and 1D has been regularly broadcast since March, 1988. The usefulness of the STFS broadcast is that these signals can be received reliably anywhere in India and provide an online second level time synchronisation of 10-level frequency calibration. The only other geostationary satellite based time dissemination service in the world is the American GFOS broadcast which gives lower accuracy levels. The STFS has made a significant impact with more than 30 users already availing this service.

The receiving set-up consists of a chicken-mesh antenna, 8 feet or larger in diameter, followed by a Low Noise converter and an FM receiver. NPL has designed and developed a totally automatic microprocessor controlled decoder and has passed on the know-how to three licensees. A collaborative project was undertaken between NPL and ER&DC, Trivandrum to develop a low cost STFS receiving system. The product was launched in 1996. The new design of the STFS receiver is very compact and attractive with several useful features including a 10 Mhz output phase locked to the received STFS to give an accurate frequency reference.

2.12 Leather

2.12.1 Leather Technology Mission (LTM) for sustainable development of the Indian Leather Sector

Under this pioneering Mission a total of 110 projects covering 15 States have been launched of which 46 were completed by January 1997. The progress on some of the activities is as follows:

- Carcass recovery centres : were established at four locations viz. T. Kallupatti (Tamil Nadu), Kalyani (West Bengal), Seahore (MP), Tranaja (Gujarat) and thirteen centres are nearing the completion and commissioning stage.
- Animal health care system : benefits of improved animal health care systems have been demonstrated through a pilot study at Gudur (AP) where 30,000 goats/sheep were provided with pox vaccine and chemicals for deworming resulting in quality improvement in meat, hide and animal growth.
- HRD initiatives : an innovative pedagogic programme has been initiated for imparting education to tannery workers through vocational working using appropriate course modules designed in collaboration with IGNOU, New Delhi.
- Process control and modernisation : three tanneries in Uttar Pradesh and one tannery in Haryana have been modernized using add-on systems.

2.12.2 Non-enzymatic and sulphide free dehairing process

CLRI has developed an alternative to the conventional sodium sulphide method of dehairing skins. The process is non-enzymatic and substitutes sodium sulphide with nickel carbonate. Goat skins were successfully dehaired by the new process, and thereafter made into crust leather by conventional techniques. The process is comparable with sulphide-lime system in terms of duration and efficacy and quality of the dehaired skins.

2.12.3 Cleartan 'AL' & 'CR'

A high molecular resinous product, CLEAR TAN AL with ligating sites, most suited for irreversible binding Al(III) and Cr(III) as well as lowering the excitation energy (responsible for photo oxidation) of the organic molecule has been developed at CLRI, as also a new basic chromium sulphate salt (CLEAR TAN CR) which avoids the formation of low affinity cyclic tetrapositive chromium (III) complex thereby promoting >85% absorption of tanning material.

2.12.4 A novel bone implant - Maxibloc

An osteoinductive and bone filling material - 'Maxibloc' has been developed by CLRI which contains hydroxyapatite and fibrillar collagen. The material was initially tested on tibial defects of dogs. Thereafter clinical trials were undertaken in the defective alveolar bones of human patients at Madras Dental College. Excellent ossification was observed in all the patients with no rejection or foreign body reaction. The ossification was complete within 4-6 weeks.

2.13 Machinery & Equipment

2.13.1 Improved expeller for mustard oil extraction

Mustard oil in its pungent form is widely preferred in many parts of the country. The extraction of mustard oil, in spite of the advances made in expeller technology is still done almost exclusively by traditional means employing wooden ghanis based on outdated method of extraction, that is inefficient and wasteful as the crushing capacity of wooden gahnis is low and oil residue in the cake is high. MERADO, Ludhiana has developed and fabricated a 1 TPD expeller which gives product quality comparing favourably with oil traditionally produced in ghanis in terms of pungency, flavour and taste and has optimised yield on account of low residual oil in the cake, continuous processing, longer life of critical components and hygienic output.

2.13.2 Ion beam microetching & milling equipment

Use of energetic ions and fast atom beam are most advanced concepts in contamination free and well controlled selective microetching and micromilling of materials. NPL has developed an ion beam micromilling equipment, an important facility for preparation of specimens for microstructure analysis by Transmission Electron Microscopy (TEM) and a high efficiency ion source based on a new dual oscillatory discharge concept for this equipment. The ion beam system has been configured for achieving uniform, undiffused, intense ion beams of various gaseous species to achieve a fine, sharp anisotropic and selective microetching/milling of a variety of bulk materials for thickness 100 microns or more for preparing their cross sections for structural analysis in TEM. It has the flexibility

for isotropic rapid and polished etch at varied angles. It incorporates ion beam transmission through etched membrane as new technique to monitor, control and auto-terminate milling process at predetermined level. This feature of the ion beam microetching system developed at NPL is attractive for compound semiconductor, VLSI and electronic devices. Imported equipment of a similar specification costs around Rs.8-10 lakhs. It is expected that the indigenous equipment developed at NPL may cost about 3-4 lakhs. Several electron microscopy facilities spread over R&D labs, IITs and Universities constitute a big market attractive for indigenous production of this equipment.

2.13.3 Stitch bonding machine for manufacture of geotextiles/straw mattresses

CMERI has designed and developed a stitch bonding machine for manufacture of geotextiles which are presently in great demand for stabilisation of erosion habitually occurring in the hill slopes and other vulnerable surfaces and also for the presently popular straw mattresses for homes, hospitals, railway coaches and in hotels as ethnic substitutes for certain items. Developed under sponsorship of private industry the key design feature of the machine is the stitching system to stabilise in place the loose composition and matrix of the filling material, mainly agrowastes such as wheat/paddy straw. The design know-how has been licensed to the sponsor.

2.13.4 First CBRICK Machine released for field demonstration

A user friendly brick shaping machine based on the principle of vibro compaction is yet another R&D contribution of CSIR from CBRI for gainful utilisation of flyash the inevitable atmospheric pollutant from thermal power plants. It provides a cost effective technology for producing bricks from flyash using either cement or lime as binders and is ideal for self employment particularly in the areas around flyash dumps. A machine with capacity to produce 2000-3000 bricks per day requires an initial investment of about Rs.2 lakh. The first machine designed and fabricated wholly at the institute was released to industry on the occasion of the Golden Jubilee of India's independence which coincides with the Golden Jubilee of CBRI.

2.13.5 Powder x-ray diffractometer

A powder x-ray diffractometer has been designed, developed and fabricated at NPL under a project sponsored by DST. It has been thoroughly tested by recording diffraction patterns of a number of materials starting with silicon powder. The diffraction patterns have been on par with the standard data available from the internationally accepted data supplied by joint committee for powder diffraction standard (JCPDS). The data, such as values of interplanar spacing for different

reflections obtained from diffractograms of the indigenous diffractometer was found to be in good agreement with that reported in JCPDS files.

2.14 Minerals, Metals and Materials

2.14.1 Modernisation of coke based cupola for foundries

The world over the foundry industry has been under pressure for mitigation of environmental pollution due to emissions from cupolas. The situation in India is no different since majority of the cupolas in this country use coke as fuel. The emission from such cupolas have been found to contain suspended particulate matters (SPM) ranging from 400 to 3000 mg/m³ with sulphur dioxide content of 200 to 700 mg/m³ whereas the recommended acceptable levels under the Central Pollution Control Board (CPCB) stipulations are 150 mg/m³ for SPM and 300 mg/m³ for sulphur dioxide. Following the Supreme Court's stipulation that the existing foundries take appropriate actions to reduce the environmental pollution level to acceptable levels recommended by CPCB within a specific dateline, NML took up design & development of:

- **Gas cleaning system** : a cost-effective dry gas cleaning system for various sizes of Cupola ranging from 2 tonnes/hr to 25 tonnes/hr capacities. Demonstration units set up at two foundries in the districts of Howrah, provided encouraging results. NML has taken up the work of conversion and installation of Gas Cleaning System for Cupolas of different sizes for industry. The project was taken up on turnkey basis and was valued at Rs.144 lakh. NML completed the assignment within a period of six months and met with the CPCB norms and the deadline. The Gas Cleaning System developed by NML being of a dry type is cost effective.
- **Cokeless cupola** : environment friendly cokeless cupola using liquid fuel or almost sulphur free natural gas which not only reduces the SPM but also brings down the emission of sulphur dioxide within the stipulated limit of 300 mg/m³. The development of total technology package with the process knowhow and engineering design for cokeless cupola was undertaken under financial sponsorship from TIFAC. The NML cokeless cupola has very low pollution, low capital and maintenance cost, easy and better process control and gives excellent quality iron.

2.14.2 Green coke based high density isotropic graphite.

High density high strength isotropic graphite is a recent addition to existing family of carbon products. It refers to a speciality graphite which possesses a bulk density of more than 1.9 g/cm³, bending strength of more than 600 kg/cm², degree of anisotropy of 0.9-1.0 along with a homogeneous and fine microstructure, and finds potential applications as

EDM electrodes, electrodes, electrical brushes and contacts, heaters, crucibles, jigs, hot pressing dies, nuclear graphite, rocket nozzles and moulds for continuous casting of metals and of alloys etc. Its domestic demand is met through imports valued around Rs.10 crore per annum. Extensive work has been done at NPL under sponsorship from industry to develop this graphite from self sintering carbonaceous powder obtained from coal tar pitch by suitable treatment. A graphite with a bulk density of 1.9-2.0 g/cm³, bending strength of 60-90 MPa, shore hardness of 60-80 and electrical receptivity of 1-3 mho has been produced. Technology transfer is being negotiated.

2.14.3 Indian reference materials

Two new certified reference materials of multi-elements in water i.e. copper, iron, zinc in a nominal concentration and nitrate in a nominal concentration had been prepared at NPL. These solutions were sent to sixteen laboratories participating in a programme for measurements. The measurement data received from the laboratories are under compilation and in the process of assignment of true values. NPL participated in the international programme of water proficiency testing organized by National Association of Testing Authorities (NATA), Australia. In this programme twelve samples were analysed for total forty five entities, and values assigned to forty three entities were found to be in the acceptable range.

2.14.4 Decarborisation of pig iron

RRL, Bhu. has standardised parameters for decarborisation of pig iron to make it directly usable for spun pipe manufacture. Experiments were carried out in a tamman furnace (35 KW) using blue dust/mill scale at a temperature around 1450°C to reduce the carbon content in pig iron by 0.5%. The process offers better economics compared to spun pipe grade pig iron with 4% carbon which prevents its direct use, adding to cost.

3. BASIC RESEARCH

3.1 Biology and Biotechnology

3.1.1 A new mechanism of mitochondrial import of transfer RNA in Leishmania

IICB in studying how highly negatively charged RNA molecule traverses two mitochondrial membranes against a membrane potential, observed that Leishmania mitochondria possesses a direct import mechanism for RNA involving membrane-bound receptors and positively charged import channels, distinct from co-import models according to which RNA-carrier complexes are inserted through protein import. As a result of this study, it has become clear that parasitic protozoa such as *Leishmania* has evolved a unique mechanism of mitochondrial tRNA import different from

that used in yeast and higher plants. Further work on elucidation of the molecular details of the process may lead to efficient methods for gene delivery into mitochondria, which are difficult to transfer with exogenous DNA by conventional means.

3.1.2 Study of the Indian population using mitochondrial DNA polymorphism

NCL carried out a study of 100 Indians from 14 language groups using mitochondrial DNA site polymorphism as a tool for generic variations. Twenty nine mitochondrial DNA haplotypes were identified and Unweighted Pair-Group Method (UPGMA) and maximum parsimony trees were constructed using the mitochondrial DNA types. Nucleotide diversity values were calculated using maximum likelihood method. From a study of the shared mitochondrial DNA types and the parsimony tree it was observed that the Indian population is closer to Caucasians and has an admixture with Asians. The north Indian population appears to have a recent admixture of the Caucasian mitochondrial DNA types which is absent in the south.

3.1.3 Chaperone-like activity of a lens protein

Molecular chaperones mediate the correct folding and assembly of several proteins in the cell. Understanding the molecular details of the chaperoning process is thus necessary to devise strategies to control several diseases and also to enhance the yield, solubility and stability of engineered proteins. CCMB is investigating the chaperone-like activity of the lens cortical protein α -crystallin. By using non-thermal aggregation mode, it was possible to discover the temperature dependence of the chaperone-like activity of α -crystallin. By studying the structural aspect of α -crystallin at different temperatures, and under different conditions, CCMB could identify quaternary and tertiary structural perturbations in the molecule, which lead to a concomitant increase in the hydrophobicity. Further studies using carbonic anhydrase, have shown that α -crystallin exerts its chaperone-like function by binding to the aggregation-prone molten globule state of the target protein.

3.1.4 Molecular mechanisms in fungal diseases

Fungal diseases are now emerging as a public health problem. Accordingly, CBT intensified its studies on molecular structure of major allergens/antigens of *A.fumigatus* and host pathogen interactions with respect to lung surfactant proteins. One of the immunodominant allergens was established as being cytotoxic ribonuclease with an IC(50) of 4.5 nM towards eukaryotic cell lines and specific ribonuclease activity of 100,000 units/mg of protein. The ribonuclease activity and cytotoxicity were destroyed by chemical modification of cysteine and histidine residues.

The allergen has structural homology with that of c-sarcin and restrictocin which are being considered for applications in chemotherapy of cancers. However, as these proteins are known to induce allergic reactions, the immunodominant cytotoxic allergen of *A.fumigatus* appears to be a better experimental candidate for application in chemotherapy.

3.1.5 A novel anti-yeast compound of fungal source from *Taxus* sp.

CIMAP has successfully isolated from the *Taxus* tree, fungi capable of producing significantly high concentration of a potent diterpenoid. The new compound inhibited the growth of yeast strains (*Saccharomyces cerevisiae*) even at a very low concentration of 1 microgram/disc. Some of the yeast strains carrying cell division cycle mutations were found to be highly sensitive to this compound. A fast screening procedure for the presence of the fungi in the sterile culture supernatant has been devised using yeast strains. It was seen that both taxol and the fungi were able to inhibit root initiation and elongation in a novel bioassay developed using *Bacopa monnieri* as a model system and were also able to inhibit oomycetous fungi *Pythium* sp and *Phytophthora* sp. These results are helpful to development programmes.

3.1.6 New Stomata discovered

Two special type of Stomata entirely new to the plant kingdom were identified by RRL, Jorhat in *Catheranthus roseus*. These stomata are presently being named as Axillodicytic and Giant Axillodicytic respectively. Also two other stomata previously reported as one single individual have now been observed to be two distinct individual stomata and described as two distinct types. One is pole to pole contiguous with anomocytic arrangement of subsidiary cells and the other is pole to pole contiguous with paracytic arrangement of subsidiary cells.

3.1.7 Genetic diversity in medicinal and aromatic plants through DNA fingerprinting

Molecular markers are important for the authentication of the genotypes of released cultivars of plant species including medicinal and aromatic plants. They are also useful in assessing the genetic variability existing in the gene bank which can be used as a resource of useful genes in any varietal improvement programme. Studies conducted by CIMAP on medicinal and aromatic plants gave interesting findings. Randomly Amplified Polymorphic DAN (RAPD) profile studies of five cultivars of *Mentha arvensis*, indicated a relatedness of the Himalaya variety to Gomti and HY-77 varieties which otherwise were having a greater genetic distance. This is suggestive of the probability of Gomti and Hy-77 being the donors of DNA in the development of Himalaya. Variety Himalaya has been released for commercial cultivation this year. Similarly, RAPD profiles of six different accessions of *Bacopa monnieri* collected from

different parts of the country indicated a high level of genetic diversity. Absence of polymorphic variations was observed in one of the random primers (Primer-A, Lanes 1-6) which demonstrated species-specific monomorphic band.

3.2 Chemicals

3.2.1 Molecular organization in hydrotope assemblies

Transnational cooperation in research has enabled a team of scientist from CCMB, IICT, University of Sydney (Australia), University of Canerbury (New Zealand) and Clark University (USA) to throw new light on molecular organizations in hydrotope assemblies. Findings show that these compounds form open layer assemblies reminiscent of lamellar liquid crystals.

3.2.2 Novel method of probing biocatalysts

A novel method of probing the vicinity of biocatalysts compartmentalized in the water pool of cationic reversed micelles has been developed at IICT.

3.2.3 Experimental Probe for investigations on 2-D crystallisation

Organisation of molecules into structural clusters is a fundamental step in any crystallisation process. The study of amphiphilic molecules in 2-D crystalline clusters on aqueous subphases at CLRI has led to simple models for biomineralisation, preparation on semiconducting nanoparticles and new materials for cloud seeding.

The work of CLRI is the first of its kind in which the polymer is bound solely by the end groups. When such a polymer is tethered to a nonsolvent, it forms a distinct phase and exhibits a characteristic shape with the formation of an insoluble monolayer at the liquid/gas interface. It opens up a new thermodynamic approach in which the polymer while being regarded as a continuous layer of uniform thickness, is assumed to be totally free of solvent interplay. All the contributions to the free energy change of the surface of the liquid due to the polymer is postulated to be additive.

It is thus now possible to predict the general spreading and wetting behaviour of these polymers on gas/liquid and solid/liquid interfaces using the model besides new possibilities in designing controlled wetting of surfaces, regulated coating of substrates etc.

3.2.4 One-pot synthesis of heterocyclic b-Chlorovinyl aldehydes

Heterocyclic compound such as 3-chloro -1-H-pyrole-2,4,-dicarboxaldehyde have biocide potential for applications in leather, agriculture and allied industries. These were synthesised for the first time at CLRI by "One-pot-synthesis". This novel synthetic route for heterocyclic compounds does

away with multistep synthetic routes (involving several reactants for each stepwise reaction) adopted by other researchers.

3.2.5 Protein folding and self assembly

The phenomenon of "Protein folding and Self-assembly" is an intriguing one and to probe this mystery a representative model is lacking. CLRI has synthesised a novel nonionic peptide model for this study. The unique feature of this work relates to the correlation between the thermodynamics of self-assembly of peptide and molecular parameters like conformational preference. The interplay of entropy-enthalpy compensation on overall self-assembly has also been clearly brought out.

3.2.6 Chemical modification of electrodes through self-assembly approach

Modification of metallic surfaces with self-assembled monolayers (SAM) of organo-sulfur compounds has potential applications in a variety of areas such as electrodes kinetics, electrocatalysis, electroanalysis, molecular recognition, sensors, adhesion and non-linear optics. Researches carried out at CECRI, have shown that self-assembly approach could facilitate incorporation of monolayers of reversible hexacyanoferrate redox species on gold electrode that exhibits good electrocatalytic effect on the oxidation of ascorbic acid and hydrazine. Also monolayers of reversible nickel hydroxide moieties could be immobilised on gold surface which showed electrocatalytic influence on the oxidation of glucose. The studies, aim at the development of modified electrodes with functional characteristics in the design of electrocatalysts and novel sensors for molecular recognition.

3.2.7 EMI and conducting polymers

Whilst conventional plastic materials and excellent electrical insulators having resistivities in the range 10¹⁵-10¹⁸ ohm cm, but some electronic applications require them to be conducting. In order to impart conductiveness to these plastics conducting fillers are generally added. CECRI has worked on grafting of conducting polymer like polypyrrole/polyaniline on a Eglass fabric surface resistivity of 1 to 10 Ohm cm. These grafted fabrics are used for making conducting FRP with surface resistivity 2 Ohm cm. The shielding effectiveness obtained in 90dB upto 1MHz.

3.2.8 Study of Photoinduced Electron Transfer Processes

Photoinduced electron transfer processes form the key step in a number of natural and technological processes, such as photosynthesis, artificial solar energy conversion and photoimaging. RRL-Tvm. has been studying the photogeneration of highly reactive radical ion intermediates, as well as the use of liquid/liquid interphases as methods of controlling backelectron transfer associated with these processes that invariably limit their efficiencies. The radicals generated in such processes have been utilized in a variety

of inter and intramolecular carbon-carbon bond forming reactions for the synthesis of various lactams, chromans and chromanones. Efforts have also been made to synthesize among other new pyrilium based sensitizers to increase the efficiency of photoinduced electron transfer and process various electron donor-acceptor substituted butadiene derivatives with a view of developing new organic molecules capable of second harmonic generation. The studies are important in the development of new synthetic methodologies for carbon-carbon bond formation, new materials for electro-optic applications and technology for photoremediation for industrial wastewater.

3.2.9 Thermally stable and catalytically active superacid zirconia catalysts

Iso-butane is important for its use in the preparation of MTBE (Methyl Tertiary Butyl Ether) and iso-octane, the environmentally accepted octane boosters. Also, the nitration of halobenzenes especially chlorobenzene to nitrochlorobenzene is industrially important because of its useful derivatives for pharmaceuticals, intermediates for dyes and agricultural chemicals etc.

RRL, Bhu. successfully synthesised and characterised thermally stable and catalytically active superacid zirconia catalysts to effectively catalyse the isomerization of n-butane to iso-butane and nitration of halobenzenes. The superacid sulphate doped zirconia has been prepared by two different routes i.e., percolation followed by decantation and controlled sulphur impregnation method. The material has been characterized using different modern techniques to know its crystal phase, thermal stability and active centers.

3.2.10 Zeolite and clay based adsorbents and catalysts

Zeolite Clays and Metal Complexes incorporated porous materials are being increasingly used as adsorbents and catalysts for developing ecofriendly and economical processes. CSMCRI has taken-up the development of zeolites and clay based catalysts/adsorbents for specific applications, alkylation of benzene, dehydration of cyclohexanol to dicyclohexyl ether and hydrogenation of aromatics.

Also the possibility of using organo-clays for removing dyes from the effluent was studied along with other methods/adsorbents such as hypochlorite, hydrogen peroxide, zeolite-Y, zeolite-13X etc. The organoclay was found to be more effective for decolorization of effluents.

Meso porous silica and alumino-silicate using different templating agents having surface area of 900 m²/gm was prepared and is being used for encapsulation of complexes for producing catalytic systems.

3.2.11 Inorganic performance complexes

Understanding the role of bridging ligand is necessary to design molecular wire and non-linear optical material. The mononuclear photo/redox complexes have potential for application in catalysis. A series of redox active mixed valence binuclear (donor-acceptor) metal complexes were synthesized at CSMCRI with an objective to investigate the role of bridging ligand in tuning the metal-metal interaction and photoinduced electron transfer process. Further, with the aim to develop photo/redox active transfer metal complex, a series of mononuclear Rh (III) and Rh(II) complexes have been synthesized which show excellent catalytic activity towards electrocatalytic reduction of CO₂ to formic acid.

3.3 Drugs and Pharmaceuticals

3.3.1 Novel pseudo C₂ symmetric HIV protease inhibitors

For the first time, new diaminodiol HIV protease inhibitors (useful for anti-AIDS chemotherapy) containing non-symmetrical aromatic nuclei have been synthesized at IICT. These molecules provide tremendous opportunities to evaluate structure activity relationship not studied so far in anti-AIDS therapeutics.

3.3.2 Azamacrolides

A novel family of alkaloids isolated from Mexican bean beetle pupae were found to be responsible for exciting defence mechanism. These structurally complex molecules are obtained in nanogrammes from insects. IICT scientist have synthesized milligram quantities and submitted for testing to Cornwell University, USA.

3.3.3 Effect of curcumin on certain lysosomal hydrolases in isoproterenol - induced myocardial infarction in rats

The effect of curcumin on lysosomal hydrolases in serum and heart was studied at CLRI by determining the activities of b-glyxueonidase, b-N-acetylglucosamidase, cathepsin B, cathepsin D, and acid phosphatase. Rats treated with isoproterenol showed a significant increase in serum lysosomal hydrolase activities, which were found to decrease after curcumin treatment. Isoproterenol administration to rats resulted in decreased stability of the membranes, which was reflected by the lowered activity of cathepsin D in mitochondrial, lysosomal and microsomal fractions. Curcumin treatment returned the activity levels almost to normal, showing that curcumin restored the normal function of the membrane. Histopathological studies of the infarcted rat heart also showed a decreased degree of necrosis after curcumin treatment. Curcumin could thus be a potential drug, if taken along with diet for protective therapy.

3.3.4 Synthesis of different varieties of peptides and design of molecular recognition induced receptors

A novel design strategy for the synthesis of conformationally constrained cyclic peptides based on the incorporation of semi-rigid aromatic or non-aromatic templates into the cyclic backbone has been delineated at RRL-Tvm. This novel class of cyclic peptides has now been demonstrated to transport selectively, alkali metal ions across liquid bilayer membranes and thus are potentially useful as leads for designing novel ionophoric antibiotics. Totally chiral, multiple armed peptide based dendritic scaffoldings have been prepared and demonstrated as flobular protein mimics.

Novel, Molecular-recognition induced, dicarboxylic acid receptors have been designed and shown to self-assemble in persistently one-dimensional motifs while minimalistic chemical models for Zn-finger proteins designed, synthesised and studied for DNA interactions were seen to be the mimics of Zn-finger proteins.

3.3.5 Primate model for visceral leishmaniasis

A primate model of visceral leishmaniasis/kala-azar for screening of potent leishmanicides and immunophylactics has been standardised at CDRI in the Indian langur (*Presbytis entellus*) which was found to be highly susceptible to leishmania infection and developed symptoms comparable to the clinical situation. This monkey model has recently been adopted by Tropical Disease Resech (TDR) programme of WHO and CDRI has been given the responsibility of evaluating the WHO vaccine.

3.3.6 Studies on factors facilitating wound healing

Wound healing as a normal physiological process is mediated by the generation and expression of different growth factors and angiogenesis. Proteins expressed during normal healing process in guinea pig punch wounds were partially characterised at CDRI and six of the proteins appeared new or overexpressed at the time of active phase of healing. A decrease in peroxides and enzyme and non-enzymic antioxidants in cutaneous wound tissue was observed suggesting that different free radical scavengers or preparations which can elevate the levels of antioxidants insitu can be utilized to facilitate wound healing.

3.3.7 Partially folded intermediates of proteins and their aggregation behaviour

Aggregations of partially folded or misfolded proteins, a potential side reaction in protein folding, both in-vivo and in-vitro has serious implications in biotechnology and biomedical research. The phenomena has been found to be an underlying cause or an associated symptom of several disease pathologies like Alzheimer's disease, Down's syndrome, malignant myeloma and crush injury and a major

problem in the production of recombinant proteins especially in bacterial systems. CDRI conducted structural characterization of a partially folded state of hen egg white lysozyme, a globular protein detected at low pH (1.5). The studies provided insights into the possible features responsible for stabilization of intermediates in folding of hen egg white lysozyme and their aggregation.

3.3.8 Chiral Epoxides

Synthesis of chiral epoxides by catalytic epoxidation of non-functional alkenes has been reported by CSMCRI. Chiral epoxides have potential applications as intermediates for synthesis of complex bioactive molecules such as leukotrien, erythromicine (antibiotics), crivivan (an HIV protease inhibitor) and cromakalin (a high potent antihypertensive) and also as end products like disparlure, the sex pheromone of gypsy moth as ecofriendly pests management agent.

More than 85% enantiometric induction has been achieved for the enantioselective epoxidation of prochiral non-functional alkenes using series of dissymmetric and dehydroacetic acid with resolved diamines as catalysts. The alkenes studied include styrene, substituted styrene, cis stilbene, indene, chromenes, long chain terminal and middle alkenes. The R&D efforts have been directed to develop simpler chiral catalysts, using inexpensive metals and oxidant and robust ligand.

3.4 Earth Resources

3.4.1 Modelling of Arabian sea ecosystem

A coupled physical biological model of Arabian Sea has been developed by C-MMACS to explain the annual cycle in the primary productivity. The biological model consists of phytoplankton, zooplankton, bacteria and four forms of nutrients and the physical model is a versatile Ocean Global Circulation Model. The model reveals the onset of the bloom in July, its persistence in September and its disappearance thereafter.

3.4.2 Assessment of continental and marine gravity

A new approach has been evolved by NGRI for synthesising continental gravity data to identify regional negative bias which masks other anomalies of geological interest in Bouguer gravity. With this approach a new residual anomaly map for any region can be prepared. A new approach for marine gravity data is evolved to identify residual anomalies by separating gravity effects caused by bathymetry topography. The approach helps to identify probable density of sea bottom topographic mass and sea mount etc.

3.4.3 Coastal Ocean Monitoring and Prediction System (COMAPS)

COMAPS is a DOD funded long-term program at NIO, for monitoring the quality of sea water along the coast.

Observations made along 8 transects between Ratnagiri and Mangalore revealed the highest salinity in the northern section of Ratnagiri and Malvan, with depthwise distribution in salinity increasing from surface down wards. The dissolved oxygen concentration however were generally high in surface waters while the bottom water showed oxygen deficiency. Lowest values of oxygen were observed in the northern transects. It was observed that these low oxygen bottom waters were associated with relatively high nutrients, especially nitrite, which is attributed to the residual effect of monsoonal upwelling along this coast, by which oxygen-depleted and nutrient-rich waters from intermediate depths in the Arabian Sea are brought to the surface near the coast. From the observed values of oxygen and nutrients it appears that the presence of nitrite associated with measurable amounts of oxygen in the bottom waters is due to the eastward spreading of the water layer containing primary nitrite maximum in the Arabian Sea.

3.4.4 Geological & geophysical studies of continental margins of India

NIO undertook studies to ascertain the geological and geophysical characteristics of the seas along the Indian peninsular coastlines.

Western margin - Study of closely spaced marine magnetic profiles in the northern Arabian Sea indicated that most of the identified magnetic lineations in the Arabian Sea are segmented by oblique offsets representing pseudofaults associated with paleo-propagating ridges. This suggests that the early territory seafloor spreading in the Arabian Sea was characterised by systematic ridge propagation probably caused due to the influence of former position of the Reunion hotspot on the spreading segment. The analysis of the calcareous deposits on the western shelf of India off Bhatkal at 50-58 m water depth showed that these occur as crust, sheets, cylinders and reddish brown mudstones. Thereby indicating that the particulate matter in the calcareous deposits was initially at the proximity of the coast and cemented by metastable calcites during the ultimate Pleistocene interglacial sea level stands on the shelf. Pedogenic cementation processes overprinted and developed them into eolianites and paleosols during the subsequent late Pleistocene sea level regression.

Eastern margin - geophysical studies of eastern continental margin of India (ECMI) indicated three major lineaments while magnetic modelling indicates a shallow basement at a depth of about 5 km flanked by deeper source both north and south. Geomorphic features such as fault valleys, V-cut channels and sediment slumps are also inferred from high resolution sparkler data along two E-W trending lineaments off Madras and Nagapattanam which provide evidences for recent tectonic activity in this part.

3.5 Electronics & Instrumentation

3.5.1 Novel techniques in FT NMR correlation methods

Novel methods were developed at CLRI to generate

- quantitative information on molecular self-diffusion in liquid-like-multicomponent systems in heterogeneous environments by NMR
- Pure phase multidimensional NMR by a single procedure of reference frequency shift (RFS)

The diffusion measurement method developed results in a fast, two scan protocol to measure the self-diffusion coefficient, D , of each component in a system. This procedure scores over the standard procedure that involves measurement times that are a couple of orders of magnitude longer besides suffering from infirmities in dealing with multi-component systems. Also the novel procedure of RFS for pure-phase multidimensional NMR does away with the need to construct complete rested phase cycles. Hardware requirements of a phase-shifter are avoided. The scheme allows not only two-dimensional work but extrapolation to three and higher dimensional experimental as well.

An international patent for 'A novel device to detect Magnetic Resonance in Time Domain' has been filed. This device incorporates all the advantages of presently used devices eliminating the disadvantages. The device features a single, modern and ergonomic design.

3.6 Energy

3.6.1 Low Temperature Aluminum-electrolysis

Currently aluminum is produced by electrolysis in cells operating at high temperature around 960°C due to high melting point of cryolite in the cell feed aluminum which account for about 50% of energy used in the manufacture of aluminum. CECRI is developing a process wherein cells operate at a lower temperature of 860°-870°C, thereby saving considerable amount of energy.

3.6.2 Influence of surface phenomena on the dewatering of fine clean coal

The economics of coal utilization are critically dependent on solid/liquid separation technology. As energy costs rise, the need for better and efficient solid/liquid separation practice is very important. In a study undertaken by RRL, Bhu. cake moisture content from ultrafine clean coal has been reduced by nearly 5%. From a utility viewpoint, a 1% increase in moisture can offset a 4.5% decrease in ash content. Internationally, this concept has been well adopted for coal preparation.

RRL, Bhu. has worked out direct correlation between the point of zero charge (PZC) with the surfactant solution/ coal system and moisture lowering in the filter cake. The mechanism for dewatering aids has been elucidated.

The significance of this study is immense, keeping in view the tonnages of coal fine treatment in coal preparation plants in India and the advantage of applying surfactant dewatering aids.

3.7 Ecology and Environment

3.7.1 The Asia least-cost Greenhouse gas abatement strategy (ALGAS)

The ALGAS project being implemented by the Alternate Energy Development, Inc., with funding from Asian Development Bank aims at assisting 12 participating countries from the Asian region to reduce the rate of growth in their emissions of greenhouse gases. The ALGAS-India National Work -plan for the preparation of nation GHG inventories is being carried out by the NPL. Two of the three National Technical Experts identified in the areas of 'Emissions from Energy and Industrial Processes' and 'Emissions from Agriculture' are from NPL.

3.7.2 Environmental Impact Assessment - Indian Deep Sea Experiment

India Deep Sea Experiment (INDEX) was initiated by NIO, in 1995, with an aim to assess the environment impact on the marine ecosystem due to seabed mining in the Central Indian Ocean Basin (CIOB). Geological, biological, physical and chemical studies were undertaken to establish the baseline conditions in the area. Close grid bathymetric surveys and analysis of nodules have led to the identification of test and reference areas. Detailed geochemical, sedimentological, stratigraphic, and geo-technical studies conducted on sediments enabled understanding of the benthic conditions, besides the distribution of macro-, meio- and micro- fauna.

Analysis of baseline data on ocean currents indicate variability in the flow field, variation in the thickness of upper oceanic mixed layer and a decrease in surface salinity towards the Southwest part of the CIOB. Surface mixed layer had low concentrations of nitrate and silicate but rapid increase in phosphate nutrients, while the deep waters were characterised by high oxygen and pH and lower nutrient contents. Biological studies revealed that the euphotic zone of the CIOB has fairly rich and diverse fauna.

3.8 Food and Food Processing

3.8.1 Migration studies on plastics

The effects of time and temperature on the amount of migration of additives from Polyethylene terephthalate (PET) was studied along with different food simulants, such as distilled water, 3% acetic acid and 50% ethanol. The amount of extractives leaching at different temperatures ranging from 30° to 70°C have been estimated in the migration studies for time intervals ranging from 1 hr to 30 days. It is

observed that the quantity of extractive is proportional to square root of time (t) upto 70% extraction. Also the extractives increased exponentially with temperature for all the food simulating solvents. For the different food simulates, the maximum extractive value was reached in 25-30 days at 30°C and in 6-12 days at 70°C.

3.8.2 Retarding antioxidation in raw peanut oil

CFTRI in studies directed towards retarding antioxidation in raw peanut oil observed for the first time the synergistic - antioxidant effect of the phospholipidgums-water combination in raw groundnut oil. The studies indicated that the stability of the oil could be improved by the addition of about 0.2% water to raw groundnut oil, enhancing its shelf-life. The importance of moisture content in imparting oxidative stability to raw groundnut oil may hold good for other unrefined vegetable oils also. This observance of the phenomenon has opened up avenues on use of phospholipids as natural food additive. The powerful antioxidant properties shown by phospholipidgums and water combination indicate a possibility of free radical inhibition in biological systems such as membranes (in-vivo). Thus, the free radical inhibition may have health benefits.

3.9 Housing and Construction

3.9.1 Experimental and theoretical investigations on the behaviour of buildings under acoustic loads due to rocket launch

At rocket satellite launch centre, several buildings serve as service structures and are located close to the launch pad. Their design requires understanding the nature of forces acting on the buildings and the structural response. SERC-M accordingly carried out a study at the SHAR centre to study the acoustic pressure characteristics during the PSLV-D3 launch in March 1996. As a result a methodology to quantify the dynamic loads and an empirical expression for the spatial decay of the pressures could be established. Apart from assisting in developing design guidelines for acoustic-loaded buildings, the results have also contributed to methods for analysis of structures subjected to broad-banded pressure loading, such as the acoustic loading.

3.9.2 National study on rural roads

In collaboration with Asian Institute of Transport Development (AITD), New Delhi, CRRRI has carried out a study to develop a systematic and integrated approach to various aspects concerning rural roads. It includes mobilization, additional resources, beneficiary participation, technology transfer, development of optimal standards to minimizing life cycle costs, human resource development, maintenance policies and management.

3.9.3 Wind Climate Studies for Building Designs

Knowledge of wind climate is of paramount importance for designing of buildings with respect to environmental and structural constructions. CBRI undertook extensive investigations on wind climate in India to evolve either unavailable information on seasonal, inter-seasonal and inter-annual variability of wind data, which is useful for identification and regionalisation of homogeneous wind climatic zones for building designs. Data on mean monthly wind speed for a period of fifty-nine years from 1931 - 1990 from 120 stations spread all over the country were procured from I.M.D. and analysed to determine the values of the annual average wind speed, Standard Deviation, Skewness and Kurtosis for each of the stations and the data subjected to rigorous analysis using various multivariate statistical methods to study the variability of wind speed in space and time. The results of all the intensive statistical analysis clearly depicted occurrence of 60 year's wind cycle in India. The findings have been corroborated by the Power Spectral Density functions which were also estimated using the above annual and seasonal average wind speeds.

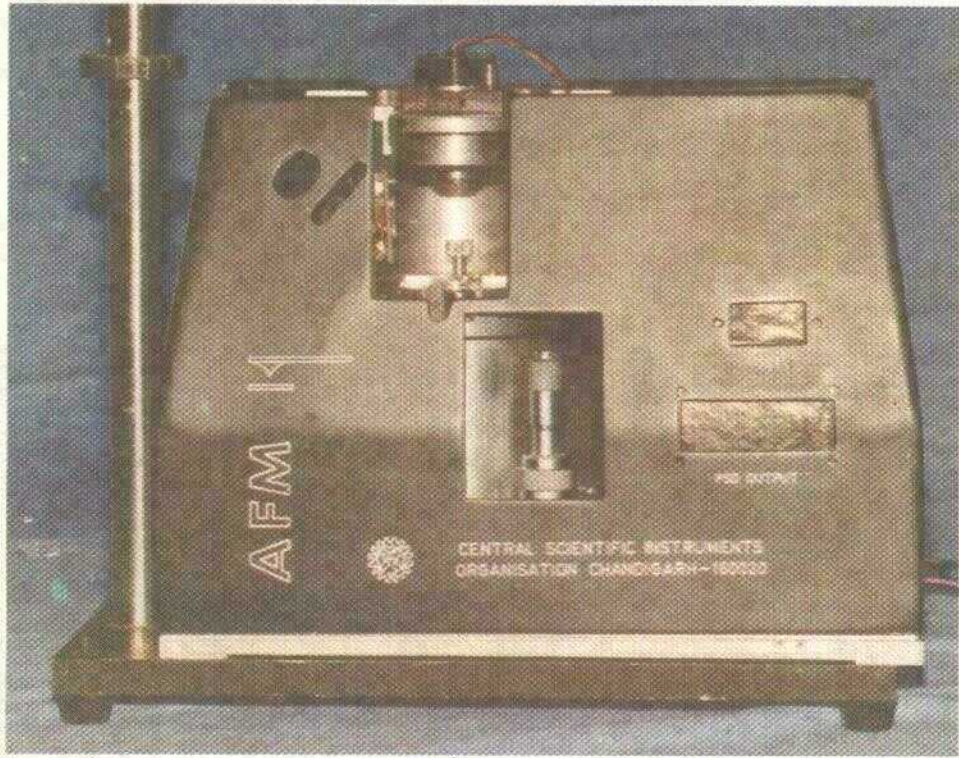
3.10 Minerals, Metals and Materials

3.10.1 Modelling the effect of specimen geometry on the creep behaviour of engineering materials

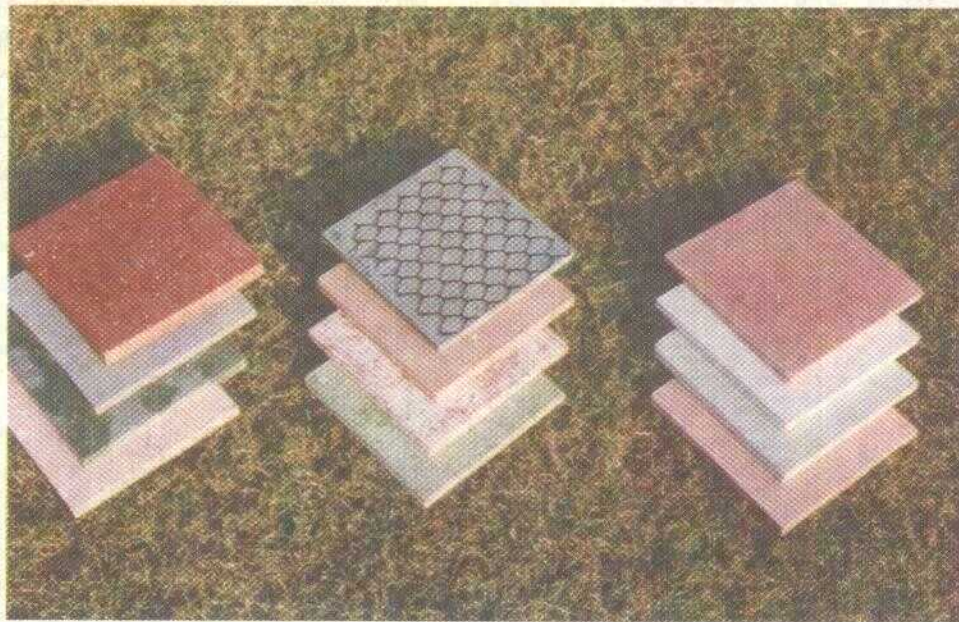
A simple model based approach has been developed by NML to predict the effect of specimen geometry on the creep behaviour of a range of engineering materials. The model uses a set of coupled differential equations relating the evolution of creep strain and loss of section size to environmental interaction. The formulation is based on the assumption that the oxide layer that forms has poor ductility and cannot withstand any plastic strain and therefore it has no load bearing capacity. Material constants required to describe the process can be estimated from an analysis of experimental creep strain-time plots of specimens having varying section size over a range of stress/temperature. Available creep data on steel and superalloys have been used for validation of the model.

3.10.2 High performance materials for mining equipment

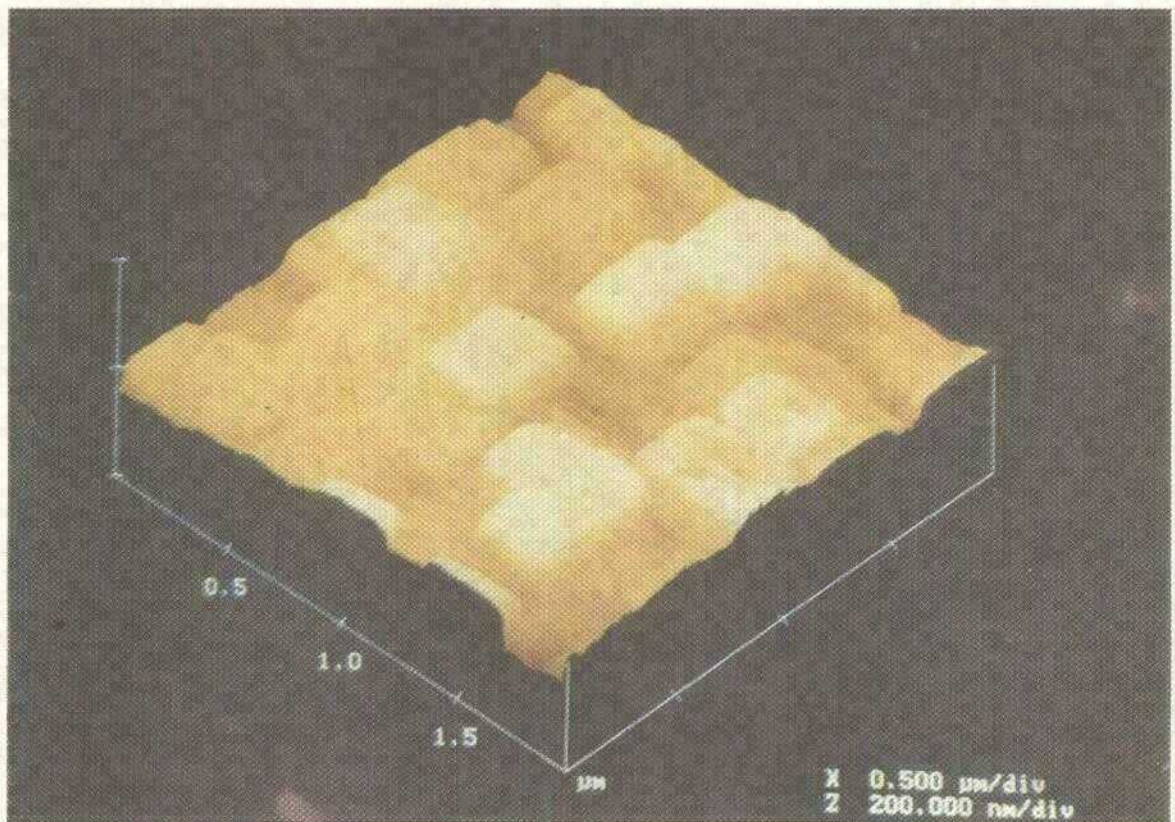
Short life spans of equipment/implements because of higher wear rate is a serious matter of concern for the mining industry. One of the effective methods to improve the life of component is through the design and development of high performance material. Aluminium metal matrix composites and Z-A alloys are found to be light weight, improved wear resistant and other related properties. Under joint sponsorship of Ministry of Mines, Deptt. of Science and Technology & CSIR (RRL, Bhopal) has taken up a project for a development



II.3 Atomic Force Microscope



II.4 Polymer Modified Cementitious (PMC) Tiles for Buildings



II.5 The AFM image of YBCO film grown on epitaxial film of $Ba_{2}LaNbO_{6}$

of cost and energy effective high performance materials for mining equipments. Components being studied are:

- Vortex finder, Refrax Apex Insert for Cyclones and Impeller and Inlet for Sala pumps to be made of Al-alloy composites,

- Bearing for shovel and other mining mechneries to be made of SLIZ alloys,

- Improved materials for grinding balls for ore grinding.

3.10.3 A new perovskite substrate for YBCO superconductor

RRL-Trivandrum has developed a new perovskite substrate material, Ba_2LaNbO_6 (BLNO), for YBCO superconductor. Since the discovery of $YBa_2Cu_3O_{7-x}$ (YBCO) superconductor, there has been wide spread interest in producing this material as thin films with high critical current density for various device applications, in the preparation of which substrates play a vital role. However the high chemical reactivity of YBCO with most of the commonly available substrate materials at the processing temperature imposes severe restrictions on availability of substrate for YBCO

superconductor. Satisfying most of the substrate requirements, BLNO is found to be chemically non-reacting with YBCO even under severe heat treatment ($<950^\circ\text{C}$) and has low dielectric constant and loss factor values making it suitable for microwave applications. The superconducting YBCO film grown on an epitaxial film of BLNO showed excellent superconducting properties and gave a $T_c(0) = 90^\circ\text{K}$ with a transition width of 0.4°K and critical current density of $5 \times 10^6\text{ A/cm}^2$ at 77°K which is three times higher than the previous values reported in the literature.

3.10.4 Kinetics of the reduction leaching of manganese nodules

Rate expressions under various limiting conditions have been derived using the principle of mixed potential (E_m) and mixed current (i_m) for leaching of ground manganese nodules for extraction of metal values at RRL Bhu. The validity of these expressions have been tested by using electrochemical polarisation data determination from pelletized electrodes of MnO_2 and FeS_2 , and also from actual leaching data in acid medium. These results are of practical significance to industrial leaching practices to check the dissolution of Mn and Co.

III. RESEARCH AND DEVELOPMENT BY INDUSTRY (RDI)

The scheme on Research and Development by Industry covers the following activities:

- A) In-house R&D in Industry
- B) Scientific and Industrial Research Organisations (SIROs)
- C) Fiscal-Incentives for Scientific Research

Activities and achievements in each of above are presented here.

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

1. RECOGNITION OF IN-HOUSE R&D UNITS

A strong S&T infrastructure has been established in the country. This covers a chain of national laboratories, specialised R&D centres, various academic institutions, training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures and organizational structures have also been evolved from time to time to meet the changing industrial and technological requirements of the country. The Government have 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 in the Ministry of Science & Technology. The incentives and support measures presently available to recognised in-house R&D units include: Income tax relief on R&D expenditure as per IT Act, 1961; Weighted Tax Deduction for sponsored research; Weighted Tax Deduction on R&D expenditure; Customs Duty Exemption on goods imported for use in Government Funded R&D Projects; Excise Duty Waiver for 3 Years on goods produced based on indigenously developed technologies and duly patented in any one of the countries in European Union and in USA or Japan or in both; Accelerated Depreciation Allowance on plant and machinery set up based on indigenous technology; Exemption from Price Control for bulk drugs produced based on indigenous technology; International R&D collaborations; Financial Support for R&D Programmes; National Awards for Outstanding in-house R&D achievements and

commercialisation of public funded R&D, and other indirect benefits.

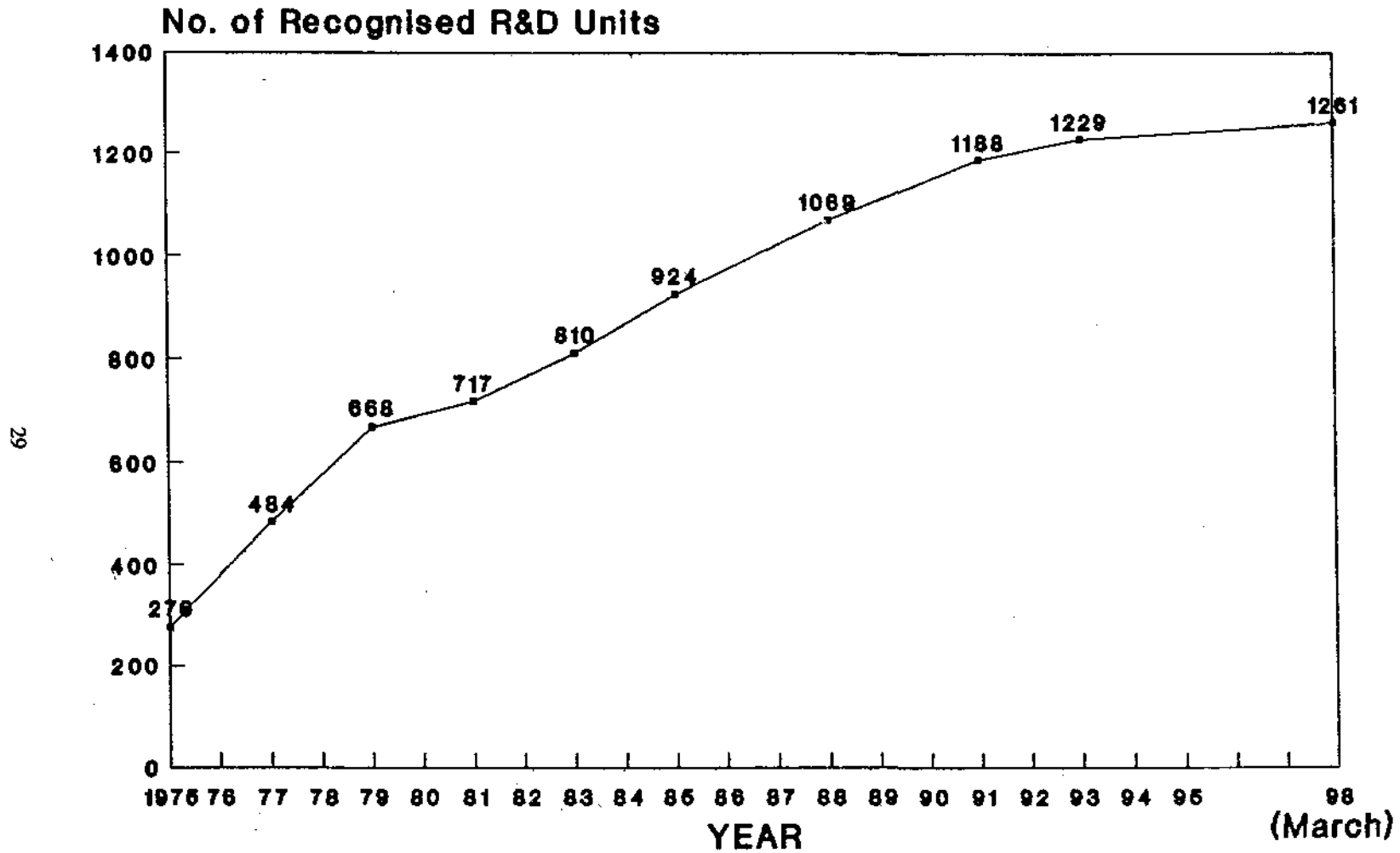
The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the manufacturing activity of the firm. For this purpose R&D would include: efforts for development of new technologies, design and engineering, process/product/design improvements, export promotion, testing and analysis related to these efforts, development of new products or discovering new methods of analysis, productivity research for increased efficiency in use of resources, capital equipment and materials, fuel efficiency, recycling of wastes and research for efficient use of scarce materials.

The R&D activities are expected to be separate from routine activities of the firm such as production and quality control. It is not necessary to have all the R&D activities segregated and located in a separate building. It is appreciated that in-house R&D activities are likely to be intermingled with the activities related to manufacturing in the factory and often part of the production equipment and infrastructure would be utilised to carry out certain aspects of their R&D activity. The in-house R&D units should have some staff exclusively engaged in R&D and there would be full-time Head for the R&D 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 250 by 1975, to over 600 by 1980, over 900 by 1985, over 1100 in 1990 and 1261 as on 31 March, 1998. The growth is also represented in Figure III.A.1. Of these 1261 units, around 135 units are in public sector, 35 in joint sector and the remaining are in private sector. A revised and updated Directory of Recognised in-house R&D units was brought out during September 1997.

For the purpose of recognition, the R&D units are to apply to DSIR as per standard proforma. The proforma and other details about the scheme are available in the DSIR publication "Promotion and support to Indigenous Technology". The applications after scrutiny in the DSIR are circulated for comments to various other Departments/ Agencies such as concerned administrative Ministries, DCCSI, CSIR, ICAR, ICMR, DCPC, DOE, DOT, DRDO

In-house R&D in Industry



and NRDC. The units seeking recognition are normally visited by expert teams comprising of representatives of DSIR as well as outside agencies like administrative Ministries, CSIR, NRDC, ICAR, ICMR, DRDO, DOE, DOT, HTs and local educational and Research Institutions before they are taken up for consideration. The applications along with comments from outside agencies, visit reports, discussion reports along with the Department's evaluation are considered in an Inter-Departmental Screening Committee constituted by the Secretary DSIR. The Screening Committee is presently Chaired by Adviser (RDI), DSIR with members from Department of Chemicals & Petrochemicals, Department of Biotechnology, Department of Telecommunications, Department of Electronics, CSIR, DCSSI, and NRDC along with the DSIR officers. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR for : (a) Granting recognition for a specified period ranging upto 3 years, or (b) for rejecting the application, or (c) for deferring the case for obtaining further details, discussions with the company or visit to the unit for clarification of various points.

During the period January 1997 - March 1998 the Screening Committee met 15 times and considered 122 applications for fresh recognition; 69 R&D units were granted fresh recognition, 5 R&D units were endorsed on the existing letters of recognition in respect of other R&D units of their company and 45 applications were rejected.

The pendency at the end of March 1998 was 26. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D units is given at Annexure III.A.1.

129 in-house R&D units were visited till the end of March 1998 by expert teams for a first hand assessment of the R&D work, infrastructural facilities and other claims made by the in-house R&D units. Also, nearly 375 discussions/meetings were held with heads of 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 Administrative Department for comments. The application is examined in the Department taking into account the inputs received from other agencies and recommended to the Secretary for grant of renewal of recognition for a specified period. During 1997, 504 in-house R&D units were due for renewal of recognition beyond 31 March 1997; of which 455 applications were

received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 446 R&D units. Recognition granted to 58 other Companies was allowed to lapse. All applications received for renewal were dealt with. A statement showing monthwise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given at Annexure III.A.2. During 1998, 528 units are due for renewal of recognition after 31 March 1998; of which, applications from 390 units were received upto 31 March 1998 and 104 applications were processed upto 31 March 1998.

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

The in-house R&D units are distributed throughout the country. There are around 200 units in the Northern Zone comprising of Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir, around 100 units in Western Zone covering Rajasthan and Gujarat, around 450 units in the Central Zone covering Maharashtra, Madhya Pradesh and Orissa, around 360 units in the Southern Zone covering Andhra Pradesh, Karnataka, Kerala and Tamil Nadu and around 150 units in the Eastern Zone covering Bihar, West Bengal, Assam and others.

Majority of the in-house R&D units are located in and around major cities. There are about 330 units in and around Mumbai; about 100 in and around Calcutta; about 100 in and around Delhi; about 105 in and around Chennai; about 75 in and around Bangalore; about 75 around Hyderabad and about 50 in and around Ahmedabad. The reason for such large numbers around these major cities is the fact that several of the industrial units are also located around these cities.

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. 200 crores for over 600 units. By 1985-86, it was of the order of Rs. 500 crores for about 900 units. It is estimated that the present R&D expenditure of the 1261 recognised R&D units is of the order of Rs.1800 crores. The share of public and joint sector is about 35 % and that of private sector is about 65 %. 256 in-house R&D units spend over Rs. 1 crore each on R&D, 350 in-house R&D units spend between Rs. 25 lakhs to Rs. 1 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.

The major R&D units in public sector undertakings are Hindustan Aeronautics Limited, Indian Telephone Industries Ltd., Bharat Heavy Electricals Ltd., Steel Authority of India Ltd., Indian Oil Corporation Limited. Some of the major R&D units in the private sector are Tata Engineering & Locomotive Company Ltd., Reliance

Industries Limited, Ranbaxy Laboratories Limited, Lupin Laboratories Limited, Crompton Greaves Limited, Asea Brown Boveri Ltd., Ashok Leyland Ltd., Mahindra & Mahindra Limited, Larsen & Toubro Ltd., Motors Industries Co. Ltd.,

5. R&D INFRASTRUCTURE

The in-house R&D Centres have created impressive infrastructural facilities including sophisticated instrument facilities and equipment as well as pilot plant facilities for carrying out high level R&D work relating to the areas of manufacturing activities of the firms. It is estimated that the R&D assets possessed by the in-house R&D units are around Rs. 1500 crores at present. Some of the sophisticated facilities available are: HPLCs, gas chromatographs, IR spectrophotometers, UV-Vis spectrophotometers, thermo-analytical equipment, NMR spectrometers, electron microscope, fibre optics evaluation kit, high temperature test and evaluation facilities, creep measuring equipment, prototype development facilities, CAD-CAM facilities, multipurpose pilot plant facilities and a host of others including excellent library facilities.

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 nearly 400 units. By 1981-82 the figure was over 30000 for about 750 units. The present estimated manpower for the 1249 in-house R&D units is around 50000. Of this, there are 2700 Ph.Ds, 16500 post graduates, 14000 graduates and the rest are other qualified personnel.

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

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

i) Chemical and Allied Industries	- 430
ii) Electrical and Electronics Industries	- 325
iii) Mechanical Engineering Industries	- 255
iv) Processing Industries (Metallurgical, Refractories, Cement, Ceramics, Paper, Leather and others)	- 200
v) Agro Industries and others	- 51

8. IN-HOUSE R&D UNITS : OUTPUT

Contributions from the in-house R&D units can broadly be summarised as under :

- Availability of R&D facilities.
- Availability of trained manpower for industrial R&D.
- Interface with public funded institutions.

- Participation in national and international seminars and workshops.
- Papers published in journals/seminars; patents and designs.
- Joint research projects/programmes/sponsored research.
- Pilot plant and semi-commercial plant level investigations.
- Import substitution of materials/components.
- Assist in technology absorption.
- Diversification.
- Technology Improvement/upgradation of technology.
- Assist in technology transfer/negotiations.

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

Chemical and Allied Industries

- Development of zero effluent, energy efficient and low cost alternative process for chemical modification of starch and other polysaccharides ; series of performance chemicals from natural resources of abundant availability in India ; natural sun screens from vegetable oils such as "Pongamol" from Karanja oil ; high performance nickel catalysts.
- Development and commercialisation of process for Fumagillin and Lovastatin, Simvastatin, and Pravastatin.
- Development and commercialisation of Controlled Release Formulations for Arthritis and for Asthama.
- Development of an innovative process for manufacture of complex molecules such as bambuterol, chandonium, fluticasone, lamotrigine, leuprolide, mefloquine, olsalazine, stavudine, tenidap and trimetazidine.
- Development of herbal rubefacient ointment , herbal weight loss drug, herbal hypocholesterolaemic drug, and Gestaforte Bolus (a cattle feed supplement to improve fertility) and Ossofez Suspension(a mineral supplement).
- Development of Resin impregnated poly glass banding tape, Solventless impregnating varnish, Anti tracking finishing varnish, Alkyd vinyl binder for mica product
- Development and commercialisation of Mass Miniature Radiographic film , Medical imaging film, Dental X-ray film, Oscillographic Direct Recording Papers (UV sensitive and panchromatic), Aerographic Duplicating Film and Oscilloscript Paper.

- Development of Deltamethrin, Acrylamide, Metaphenoxy-benzyl alcohol, Permethrin, Triclopyr.
- Development of Di-2 Ethylhexyl Acid, Triethyl Phosphate, N-Dimethylglycine Hydrochloride, Para Quinone Dioxime, Electronic Grade Sulphuric Acid and Potassium and Calcium salt of Cambogia Extract
- Development of Fenbendazole, 3-Acetoxy Acetophenone, Ondansetron, Acyclovir, and Haloperidol.
- Development and commercialisation of paraffins dehydrogenation catalyst DHC-2 ; and Aromatic amines.
- Development of Cold-soluble instant tea process.
- Development of Activated Alumina for removal of fluoride & arsenic from drinking water.
- Development of process for Export quality sandalwood oil without involving redistillation process.
- Development of marine paints for Navy, Antifouling Paints, Fire Retardant Paint for Explosive Godowns , Silicon Sealant for expansion joints, solvent based Acrylic Sealant.
- Design and development of Fibre technology nickel cadmium battery for Automated Guided Vehicle (AGV) application and aircraft application; Silver Chloride magnesium sea water activated battery for underwater application.
- Design and development of 40 W mobile PA system with siren operated on 12 V car/jeep battery.
- Development of PC based boiler stress and service life monitoring system, Electronic governor for diesel engine on WDM2 Loco, 25 KVA three-phase static converter for DC broadgauge electrical multiple unit for Indian Railways.
- Development of image memory system for X-ray, fluoroscopy, and video, surveillance system.
- Development of Public call office monitors, Express money transfer service.
- Development of DSP-based high-speed modem data pump technology, DSP-based speech compression technology for low bit-rate speech coders Yantra; and advanced multi-media notebook computer.
- Development of Microwave based rapid determination of coke moisture.
- Development of noise reduction window airconditioners; Space maker AC for telecom industries.
- Development of large horizontal and vertical induction generators with high run-away speeds for small-hydro applications (1500 KW/3.3 KV/8P, 750 KW/0.44 KV/6P)

Electrical & Electronics Industries

- Design and development of Global positioning system receivers for high dynamics, medium dynamics and low dynamics applications.
- Development of Modular Equipment for command & control applications, Secure facsimile applique unit, Integrated fish finder-cum-navigational guidance system, 100W VHF band III low power TV transmitter, Network management system for IAF satcom earth station.
- Development of Radio Frequency Transreceiver for VSAT applications; Solid State Power Amplifiers (SSPA's) for INSAT-2C.
- Design and development of radio frequency transceiver (RFT) for C-band and extended C-band application.
- Development of V/UHF commn. equipment, identification friend or foe, Radio Altimeter, Automatic Direction Finder, Inter commn. system for LCA programme.
- Design and development of 30 W powerful P.A. Amplifier with 8 channel mixer & 5 band Graphic equalizer 160 W Two zone 80 W + 80 W Public Address Amplifier AC & 12 V DC Battery operation.

Mechanical Engineering Industries

- Design and development of 60 ton rear dump truck; 10T class hydraulic excavator.
- Development of Automated storage and material handling system and Robotics.
- Design and development of Thermo Chemical Conversion Reactor (TCCR) system for the indirect gasification for application as an ETP in pulp and paper/distillery industries.
- Design and Development of multi-axes high precision grinding machine with CNC.
- Development of 6 Axes LISA-1 Robot utilizing proprietary closed loop stepper servo and mines stepping technology for various industrial applications.



III.A.2 Microprocessor Based AVR System



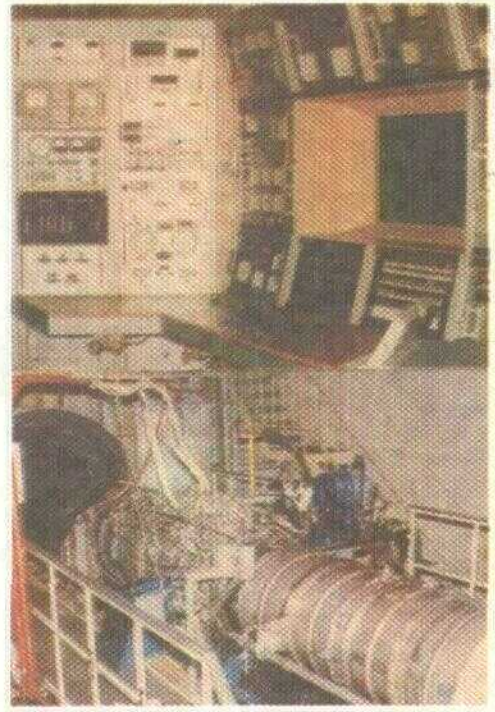
III.A.3 CNC Busbar Punching Machine



III.A.4 Technoprobe Test System



III.A.5 145 KV Gas Insulated Switchgear



III.A.6 RD 33 Engine Test Bed



III.A.7 Internal Grinder with External Facing Head, Twin Spindle

- Design and Development of an advance high speed 4-axes CNC wirecut EDM (Supercut -634), an economical 2-axes wirecut EDM (Minicut).
- Design, Development and fabrication of 60 KW vacuum brazing furnace for aluminium alloys with vacuum brazed Aluminium heat exchanger for air cooling.
- Design and Development of Double ended Double seaming machine, Pre-curling machine, Post mould cooling machine and Conical barrel project.
- Development of on board oxygen generation system for Light Combat Aircraft Program ; vacuum brazing technology for aluminium alloys, numerically controlled spiral cladding machine.
- Development of Defueling valve and uplock for light combat aircraft; 500 KW Steam turbine for cogeneration.
- Design and Development of a dedicated compressed natural gas engine bus chassis for urban transport and school bus.
- Development of Stamp canceling machine, Braille typewriter and embosser.
- Development of Safety Roof Top Ladder, Welding Helmet, Safety Belt, NBC Mask, Foot Operated Blower.
- Design and Development of Hydraulic tyre curing press for passenger car, Vertical chuck loader for truck, DL 250-1340 injection moulding machine.
- Design and Development of Elanza Suitcase range (27" and 31").
- Design and Development of mountain bike for European market with PU foam saddles manufactured by State of the Art vacuum band technology.
- Development of carburettor for 3 wheeler application and 4 stroke motorcycle engine upto 90 CC to meet fuel efficiency and low emission norms.
- Development and commercialisation of the heart valve prostheses.
- Process Development of interstitial free steel for critical EDD application.
- Development of pre-painted coils/sheets for appliances application.
- Process Development of corrosion resistant ribbed bars through cold twisting and TMT routes.
- Process Development for recovery of magnetite from ore tailings of KCC concentrator plant, copper from waste slag tails of KCC concentrator plant.
- Development of an advanced cementitious system for rapid repair of runways.
- Development of air-cured fibre-cement, composite materials, autoclaved fibre-cement composite materials.
- Process optimization of froth flotation circuit at Bhelatand washery, Transformation controlled rolling for hot rolled strips.
- Development of technology for production of Superfining stone, Hi-tech wheels, Hypodermic needle grinding wheels, high Density , high alumina and Zirconia silicate micro-macro grinding machine.
- Development of Eco - friendly mining process of wollastonite & calcite minerals.
- Process Development of extraction of pure calcium, chloride from waste lime sludge.
- Process Development in Bio-degradation of ammonia and nitrate from liquid effluent streams.
- Development of gunniting material for blast furnace upper stack.
- Development of High impact toughened alloys of nylon-6 & their composites. Development of process for manufacture of titanium complex grease.
- Development of process for manufacturing of laminating papers, electrical insulating paper, Bakelite paper from base paper.

Processing Industries

- Process Development of Electrorefining of crude gold; recovery of nickel from anode slag leach residue.
- Process Development for recovery of precious metals from spent refractories of PMR plant and palladium from spent gold electrolyte of PMR plant.
- Design, Development and production of super economical jet Dyeing machine with salient features such as enhanced capacity, low cost, reduced thermal and electrical energy consumption.

Agro Industries

- Development of eco-friendly biopesticide with plant growth promotor, bio fertilizer to improve plant productivity and reduction in Chemicals and Nitrogenous fertilizer inputs.
- Development of Sorghum medium maturity hybrids, Pearl millet (Bajra), Maize hybrids, Tomato hybrids.
- Development of long staple cotton hybrids, sunflower hybrids, hybrid watermelon, hybrid chillies, and hybrid melons.
- Improvement in production of TC banana, vanilla and Tea plants through tissue culture .

- Development of varieties of vegetables and hybrid seeds of mustard.
- Improvement in hatchability of parent breeding stock and broiler body weight.
- Development of Cigarettes using SC Dual and 15/21 mm filter.

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 : Perkin Elmer gas chromatograph; Carl Zeiss Sterio Zoom Microscope Stemi 2000C with 35mm Photomicrography system, Single Beam UV-VIS-NIR Fiber-Optic spectrophotometer for absorbance, transmittance, reflectance, Twist Tester; HPLC/GPC Instruments Shimadzu-10A; SIM DIST Analyser; Saybolt Chromometer; ; Karl Fischer Titrator, Digital Fibrograph with Fibrosampler; Mooney viscometer and moving die rheometer; Mechanical stability test apparatus, Ultra centrifuge with rotor and Refrigerated table top centrifuge; Brightness meter; X-ray diffractometer; UV-VIS Dual Beam Spectrophotometer Film casting unit, cryptometer colour computer for colour matching NMR, high speed centrifugal counter current and droplet counter current chromatographs, fisher Beta Scope , IC Tester/Designer, Curve tracer, Automatic foil endurance tester, Pro Engineering modelling software, CAD System for Design/logic analyser, fiber optics evaluation kit, Intelligent universal programmer, Development system for micro controllers and Laser Power meter, Perkin-Elmer GC-FTIR system, FT-NMR spectrometer, Dissolved oxygen meter, digital model 58, Gallon blender,

Colour image analysis system, Inverted phase contrast florescence microscope, 4 channel 100 MHz Oscilloscope, Microsheen Digital Opacity Reflectometer; Haze Gloss with standards, CO Sensor and Filter, Portable Digital Pneumatic calibrator, Microprocessor controlled glass disc preparation unit; Laboratory attritor; vacuum coating unit with electronic beam gun, Din Abrasion testing machine, Buchi Rotary Evaporators; Cased leaf drier; Score Ratio Tester; Inverted research microscope & zoom stereo microscope.

10. CERTIFICATE OF INDIGENOUS DEVELOPMENT OF TECHNOLOGY/KNOW-HOW FOR BULK DRUGS

Bulk drugs manufactured through process know-how developed through In-house R&D are eligible for exemption from the Price Control for a period of five years after their introduction in the market. The Department examines the requests of the in-house R&D Units for issuance of a

certificate of indigenous technology development for seeking price control exemption. The examination is through detailed discussions, inputs and views of experts in the field of drug development and discovery, technical visits by expert teams. Taking into account the various inputs and also considering the novelty and innovativeness of the process as also the cost considerations, the certificate of indigenous development of process know-how is issued for seeking price control exemption to deserving cases.

During the Year 1997, two certificates of indigenous development of technology/process for manufacture of bulk drugs for seeking exemption from Price Control was issued in respect of the bulk drugs Captopril and Dextropropoxyphene to M/s Wockhardt Limited, Mumbai.

11. 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: cases of industrial R&D units requiring remittance of foreign exchange for deputing experts to attend international symposia and seminars, exhibitions, trade fairs, international R&D collaborations, engagement of foreign experts for R&D and for maintenance/ commissioning of imported R&D equipment requiring such expertise, allotment of special controlled materials for R&D etc. are dealt with.

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 were examined and the decisions of the Department conveyed.

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

Names, addresses and also locations of in-house R&D units as well as validity of recognition of all the recognised in-house R&D units are computerised and updated. As on 31 March 1998, there were 1261 in-house R&D units recognised by DSIR and whose data are entered in the computer.

13. CONFERENCES, AWARDS, PROJECT SUPPORT AND PUBLICATIONS

The EFC Memorandum for the plan scheme Research and Development by Industry for the Eighth Plan Period (1992-97) was approved in 1992 with an allocation of Rs. 4 crores. The scheme is continued in the Ninth Plan period. The broad objectives of the scheme are :

- bring in-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and SIROs;

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III.A.8 40R 350 - Hydraulic Tyre Curing Press



III.A.9 Dr. R.A.Mashelkar, Secretary, DSIR and Director General, CSIR, addressing the Delegates at the Inaugural Session.

IROs;



*III.A.10 Shri A. S. Kasliwal, President, FICCI
Releasing the DSIR Special Publication.*



*III.A.11 Shri N. Vittal, Chairman, Public Enterprises
Selection Board, Addressing the Delegates at
the Valedictory Session.*



III.A.12 DSIR National Award Winners

- 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.

Activities undertaken towards achieving the above are presented below:

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

Department of Scientific and Industrial Research (DSIR) organised the Eleventh National Conference on in-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 23-24 October 1997 in New Delhi. The Focal Theme of the Conference was "50 Years of India's Independence - R&D in Industry in Retrospect and Prospect". Attended by nearly 500 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by Dr.R.A.Mashelkar, Secretary, DSIR and Director General, CSIR in the FICCI Auditorium, New Delhi. Dr.Mashelkar gave away the 1997 DSIR National Awards for Outstanding in-house R&D Achievements to six industrial units. Shri A.S.Kasliwal, President, FICCI released the DSIR special publications "Compendium on in-house R&D Centres (1997)" and "Outstanding in-house R&D Achievements (1997)". The valedictory address was delivered by Shri N.Vittal, Chairman, Public Enterprises Selection Board, New Delhi.

b) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of the industry towards innovative research and technological development, the DSIR had instituted National Awards for R&D Efforts in Industry in 1987. These awards are in the form of shields made of sterling silver and are presented along with citations at the inaugural session of the Annual National Conference on in-house R&D in Industry. During 1988, National Awards were presented to 7 firms; in 1989 to 9 firms; in 1990 to 12 firms; in 1991 to 8 firms; in 1992 to 9 firms; in 1993 to 9 firms, in 1994 to 12 firms, in 1995 to 15 firms, in 1996 to 7 firms and in 1997 to 6 firms for Outstanding R&D Achievements.

Following is the list of the award winners in 1997 :

Chemical and Allied Industries

1. Hindustan Lever Limited, Mumbai

Biotech Industries

2. Ranbaxy Laboratories Limited, New Delhi
3. Thema's Chemicals Limited, Mumbai

Electronic Industries

4. Shyam Telecom Limited, New Delhi

Processing Industries

5. Devrekha Engineers Pvt. Ltd., Surat

Technology Absorption

6. Aerospace Systems Pvt. Ltd., Bangalore

c) Compendium on in-house R&D Centres - 1997

At present there are 1261 in-house R&D units recognised by the Department of Scientific & Industrial Research. Efforts have been initiated to assess the contributions made by these in-house R&D units. While some of them have claimed achievements in the areas of import substitution, technology absorption and improvements to the technologies in use, a more qualitative and quantitative assessment of the same and appropriate corrections are necessary to ensure that the contributions made by the in-house R&D units dovetail adequately in the overall efforts of technological and industrial development. Since 1985, DSIR has brought out publications highlighting the achievements claimed by the in-house R&D Centres. The first publication of "Compendium on in-house R&D Centres" was brought out during 1985 covering 193 in-house R&D Centres, second in 1986 covering 132 Centres, third in 1987 covering 209 Centres, fourth in 1988 in 4 volumes covering 589 Centres, fifth in 1989 covering 188 Centres, sixth in 1990 in two volumes covering 448 Centres, seventh in 1991 in two volumes covering 439 Centres, eighth in 1992 in two volumes covering 384 Centres, ninth in 1993 covering 291 Centres, tenth in 1994 in two volumes covering 491 Centres, the eleventh in 1995 in two volumes covering 376 Centres and the twelfth in 1996 covering 283 Centres.

The Compendium on in-house R&D Centres - 1997 was compiled by DSIR based on the information and material received from 391 in-house R&D Centres along with their applications for renewal of recognition beyond 31 March 1997. This publication in two volumes was released during the Inaugural Session of the Eleventh National Conference on in-house R&D in Industry on 23 October 1997 by Shri A.S. Kasliwal, President, FICCI.

d) Outstanding in-house R&D Achievements - 1997

DSIR had brought out a special publication "Outstanding in-house R&D Achievements (1988 & 91)" during December 1991 covering the award winning achievements of 36 companies. A second publication "Outstanding in-house R&D Achievements (1992 & 1993)" was brought out during November 1993, covering the award winning achievements of 18 companies. A third publication "Outstanding in-house R&D Achievements (1994 & 1995)" was brought

out during November 1995, covering the award winning achievements of 27 companies. A fourth publication "Outstanding in-house R&D Achievements - 1996" was brought out during December 1996, covering award winning achievements of 7 companies. The fifth publication "Outstanding in-house R&D Achievements - 1997" covering the award winning achievements of 6 companies was released during the Inaugural Session of the Eleventh National Conference on in-house R&D in Industry on 23 October 1997 by Shri A.S. Kasliwal, President, FICCI. The information contained in these publications give an indication of the excellent R&D capabilities of some of the in-house R&D centres and their contributions to the industrial development in the country.

e) 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 is 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 1997-98, four issues of in-house R&D in Industry were brought out in April, July, October 1997 and January 1998. These have been widely disseminated to industry, SIROs, Government Departments, missions abroad and others and are well received.

f) Support for Joint R&D Projects

DSIR under the plan scheme "Research and Development by Industry" considers providing catalytic support for industrial R&D projects taken up by recognised in-house R&D units jointly with National Laboratories/Universities/IITs. The projects should be in high priority areas of importance to domestic technology development.

DSIR has approved financial support of Rs. 11.75 lakhs as project grant to M/s. Hormone Research Foundation, New Delhi to conduct developmental studies for producing commercially viable ELISA kits of cortisol, progesterone, testosterone and estradiol. The project is completed and completion report is received in DSIR.

g) Publications

Following 13 publications were brought out during the year 1997-98 :

- i) Compendium on in-house R&D Centres (1997) - Chemical, Processing and Agro Industries and Others
- ii) Compendium on in-house R&D Centres (1997) - Engineering Industries
- iii) Outstanding in-house R&D Achievements (1997)
- iv) National Awards for R&D Efforts in Industry (1997)
- v) In-house R&D in Industry - Information Update (April 1997)
- vi) In-house R&D in Industry - Information Update (July 1997)
- vii) Directory of Recognised in-house R&D Centres (September 1997)
- viii) Directory of Recognised Scientific and Industrial Research Organisations (September 1997)
- ix) Research and Development in Industry - An Overview (October 1997)
- x) In-house R&D in Industry - Information Update (October 1997)
- xi) In-house R&D in Industry - Information Update (January 1998)
- xii) Profile on Scientific and Industrial Research Organisations (1997) (in Press)
- xiii) Proceedings of the Eleventh National Conference on In-house R&D in Industry. (in Press)

III(B). SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

I. INTRODUCTION

Scientific Research Associations, Institutions, Universities and Colleges which undertake research in the area of Medical, Agricultural, Natural and Applied Sciences and Social Sciences seek 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 institutions notified under the section obtain benefit to the effect that any sum paid to them for research purposes is wholly exempted from the levy of Income-Tax. The donors who pay sums to such notified institutions are allowed deductions from the profits and gains of their business.

Prior to 1 June 1982, ICAR, ICMR or ICSSR were the Prescribed Authorities for approving research foundations 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 has been designated as the single Prescribed Authority for approval U/s 35(1)(ii)/(iii) of I.T. 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. 1 April 1989. The Prescribed Authority for Section 35 is the Director General (Income Tax Exemptions) in concurrence with Secretary, Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India.

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

The DSIR has launched a scheme of granting recognition to Scientific and Industrial Research Organisations (SIROs) in 1988 and Secretary, DSIR is the authority for granting such recognition. SIROs recognised by DSIR are eligible for notification under section 35 (1) (ii)/(iii) of

the Income Tax Act, 1961 for availing associated tax benefits. They are also 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) and Approval Under Section 35 (1) (ii)/(iii) of Income Tax Act, 1961, which gives procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional Scientific and Industrial Research Organisations (SIROs) having broad based Governing Council, Research Advisory Committee, Research Personnel, Infrastructural facilities, well defined research programmes and clearly stated objectives of undertaking scientific research are considered eligible for recognition by DSIR.

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), University Grants Commission, and Central Board of Direct Taxes (CBDT)/Director-General-Income Tax (Exemptions). The Committee is presently Chaired by Adviser (RDI), DSIR. The recommendations of the Screening Committee are put up for approval of Secretary, DSIR, who is the concurrent Prescribed Authority for notification U/s 35(1)(ii)/(iii) of IT Act. The concurrence of Secretary, DSIR, is communicated to the Director-General-Income Tax (Exemptions), Calcutta, for notification under section 35 (1)(ii)/(iii) of IT Act.

During the period January 1997 - 31 March 1998, the Screening Committee met 12 times and recommended 27 cases for recognition as Scientific and Industrial Research Organisations and notification U/s 35(1)(ii)/(iii) of IT Act, 1961. These include 16 cases in the Natural & Applied, Agricultural and Medical Sciences; and 11 cases in the Social Sciences. List of these SIROs is furnished at Annexures 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 of 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 Group, renewal of recognition is granted to SIROs and concurrence of Secretary, DSIR is communicated to DG (ITE) for notification of SIROs u/s 35 (1) (ii)/(iii) of I.T. Act, 1961.

At present there are 548 SIROs duly recognised by DSIR. Of these, 195 are in the area of Natural & Applied

Sciences, 169 are in the area of Medical Sciences, 40 are in the area of Agricultural Sciences, 122 are in the area of Social Sciences and 22 are Universities/Colleges. DSIR has printed Directory of Recognised Scientific & Industrial Research Organisations in September, 1997.

The SIROs have employed qualified scientists and researchers and also established good 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 papers/reports/books in several areas.

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 incentives change from time to time. Some of the incentives like weighted tax deduction under section 35(2B) and enhanced investment allowance under section 32A(2B) of the I.T. Act have been discontinued. Similarly preferential treatment in licensing, delicensing of industrial set-ups and commercialisation of indigenous technologies by MRTP companies have been further liberalized and absorbed in the new Industrial Policy. The union budget for 1996-97 and 1997-98 has 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 R&D expenditure; (d) Customs Duty Exemption; (e) Excise duty exemption; (f) Five 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 one of the countries in European Union and in USA or Japan or in both; (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) International R&D collaborations; (k) Direct financial support for R&D Programmes in industry; (l) National Awards for Outstanding In-house R&D achievements and commercialization of public funded R&D; (m) Excise duty waiver to Non-commercial SIROs; (n) Central Excise Duty Exemption to Public Funded Research Institutions/Organisations; (o) Investment of knowledge and know-how in Equity of Private Sector Companies; and (p) other indirect benefits.

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 period January 1997 - 31 March 1998, 20 certificates involving Rs. 6675 lakhs as cost of plant and machinery were issued by DSIR. Details of these cases 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.

4. SCIENTIFIC RESEARCH ASSETS AND ACTIVITIES REFERRED UNDER SECTION 35(3) OF I.T. ACT, 1961

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 should be written off 100% in the year in which the expenditures are incurred. The Government however, provided that in complex cases where the Income Tax Department of the Government is unable to appreciate the technical activity involved in research or the equipment are sophisticated and intricate and the Department is unable to appreciate the use of equipment regarding research, then the matter should be referred to the Prescribed Authority through

CBDT/DG(ITE), Director-General of 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 of Income Tax (Exemptions).

During the year cases of M/s MRF Ltd. Chennai and M/s ICI Ltd. Calcutta were dealt with.

5. APPROVAL OF COMMERCIAL R&D COMPANIES

In order to promote research and development activities in the commercial research and development companies the Union Budget for 1996-97 has proposed to provide for a five year tax holiday under section 80-IA of the Income Tax Act, to approved companies engaged in scientific and industrial research and development activities on commercial lines. 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 dated 26 December, 1996, issued by Deptt. 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 before the first day of April 1998. The 100% deduction for a five 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.

The amendment has taken place from 1st April, 1997 and will accordingly apply in relation to the assessment year 1997-98 and subsequent year.

The Deptt. has approved three companies as commercial R&D company upto 31 March 1998.

6. EXCISE DUTY WAIVER

The Union budget for 1996-97 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 India and in any one or more of the countries of the European Union and in United States of America or Japan or in both, for a period of 3 years from the date of commencement of commercial production. The manufacturer, before commencement of commercial production, should produce a certificate from the Department of Scientific & Industrial Research to the effect that the said goods are designed and developed by a wholly Indian owned company and patented in any one of the countries of the European Union and in United States of America or Japan or in both, to the Jurisdictional Commissioner of Central Excise.

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 was set up with three Directors and one Principal Scientific Officer which meets normally once a week to examine the requests. The Committee's recommendations are put up to Adviser (RDI) for approval.

During the period January 1997 - 31 March 1998, 800 essentiality certificates were issued for claiming customs duty on import of scientific equipment, accessories and components, including consumable items. The value of scientific equipment instruments and the consumables was around Rs. 30 crores.

Some of the major equipment, spare parts and accessories for which essentiality certificates were issued were:

Workstation ARC/INFO with Arcview, Vacuum pump, Rotary axis (4th axis) PLME-3015 laser, Turbo prop flowmeter, Mettler electronic analytical balance, Computer peripherals, Clamp on power meter with calibration traceability, Kodak digital science Edas camera, Microplate reader with softmax-pro software for windows, Sorvall RCSC plus superspeed centrifuge, Autosampler & online degassing system, E4X Turbo sampler digital sampling synthesizer, Chemical abstracts on CD.

Portable Tachometer, Sartorius comparator, electronic mass comparator, Humphrey ultra biomicroscope, Ultra low temperatures freezer, Manual flow controller assembly, Spectra 200 double beam atomic absorption spectrophotometers, Gas chromatograph system, Programmable thermal cycler, JULABO heating circulator, Alfa analysis system, Research Microscope model Optiphot-2 with accessories, Fibrograph, Data color matching system, Brookfield programmable Rheometer, R-124/V Rotavapor with quick action jack, UV-Visible Spectrometer UV/VIS Perkin Elmer, Gradient high performance thin layer chromatography CAMAG system;

Portable planetarium, Microfilm camera for the planetarium & science centre, Uster autosorter 4 testing & analysing installation, Uster Tensorapid 3 MOD 3 tensile testing installation, Uster Classimet 3 MOD CMT yarn fault classifying installation, Uster Fibrograph, Milestone microwave digestion system, Trinocular compound microscope, Micro Rem survey meter, Digital Micromanometer, Mass Flowmeter for Hydrogen, Izod Impact Tester, Orbital Shaker, CNC Die Sinking EDM, Signal Generator, Fluke 105B Scopemeter, 2 Point Dial Bore Gauges 0.200 mm, Schaublin High Precision Lathe, Brooke Field Viscometer, Burner Heads for Butane, Electronic load box with accessories;

Sun work station, Macbeth Colour Eye Spectrophotometer, Surface roughness tester electronic digital readout, High performance liquid chromatography, Maier Knife Grinding Machine with motor, side and ball cement casting machine, Weval Moisture Meter, Digital Contact Thermometer, Cylindrical Grinding Machine, Advanced Fibre Information System for Fibres Testing, Sun Ultra-1 Workstation, Multimedia Projection equipment for planetarium projector, Leica Rotary Microtome, Bioflo IV with thermal mass flowmeter, Nafion Membrane, Turbine flow meter with gas calibration, Canin Corrosion Analyser, Infrared Thermography system with accessories & software;

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 (Deptt. 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 comprising of two Directors and three Principal Scientific Officers has been set up to examine the applications received. The Committee normally meets once in fifteen days and essentiality certificates are issued with the approval of Adviser (RDI).

During the period January 1997 - 31 March 1998, 61 essentiality certificates for a total amount of about Rs. 282.50 Lakhs were issued for claiming Excise duty exemptions.

9. REGISTRATION OF PUBLIC FUNDED RESEARCH INSTITUTIONS AND OTHERS.

The Union Budget for 1996-97 introduced rationalisation of customs duty exemption on import of equipment, spares and accessories and consumables for research purposes by public funded research institutions, universities, IITs, IISc, Bangalore; Regional Engineering Colleges, (other than a hospital) for availing the customs duty exemption. 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 & 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.

The Union Budget for 1997-98 has introduced a provision of Central Excise Duty exemption for Public Funded Research Institutions and others. 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 equipment, spare parts & accessories and consumables for Scientific Research Purposes.

During the period January 1997 - 31 March 1998, 250 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.

IV. PROGRAMME AIMED AT TECHNOLOGICAL SELF RELIANCE (PATSER)

1. OBJECTIVES OF PATSER

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

- (i) Supporting industry for technology absorption, development and demonstration.
- (ii) Building indigenous capabilities for development and commercialisation of contemporary products and processes of high impact.
- (iii) 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, Engineering (RDDE) projects proposed by industry in the following areas:

- a) Development and demonstration of new or improved product and process technologies including those for specialised capital goods, for both domestic and export markets.
- b) 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 80 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.

During the year, a number of new R&D projects of industry were supported on partial financial support basis and the technology evaluation studies in the pipe line are being completed. The Department had invited, through

advertisements in leading newspapers, project proposals for technology absorption, development and demonstration from industrial units whose in-house R & D Units had been recognised by DSIR. Consequently, over 300 responses from industrial units seeking further details about the scheme, indicating their technology development projects were received by the Department. During the year, 39 projects were submitted for consideration of the Technical Advisory Committee of PATSER for partial financial support by DSIR.

The progress of various projects under PATSER Scheme during the year is given below:

2.1.1 M/s Balmer Lawrie & Co. Ltd., Calcutta.

M/s Balmer Lawrie & Co. Ltd., Calcutta has undertaken a project for the development of a set of machines viz Conical Expanding Machine, Flanging and Curling Machine and material handling system for the manufacture of Conical Open Top Steel Drums. This project involves a DSIR support of Rs. 18 lakhs out of a total project cost of Rs. 72 lakhs. The firm has designed, fabricated and assembled the machines. The project has been completed and the plant has been commissioned.

2.1.2 M/s Metallurgical & Engineering Consultants (I) Ltd.(MECON), Ranchi

M/s MECON (I) Ltd. has undertaken a project for development of Hydraulic AGC (Automatic Gauge Control) system with a DSIR support of Rs. 10 lakhs out of total project cost of Rs. 75 lakhs. The project is in progress and the prototype is ready to be tested in a rolling mill.

2.1.3 M/s. Kerala Minerals & Metals Ltd. (KMML), Quilon

M/s KMML is executing two projects viz. (a) Recovery of chlorides, synthetic rutile and heavy metals from the effluent of Titanium Dioxide with DSIR support of Rs. 13 lakhs out of a project cost of Rs. 73 lakhs and (b) Reduction of ilmenite using Sodium Carbonate catalyst in collaboration with RRL, Trivandrum with a DSIR support of Rs. 14.50 lakhs out of the project cost of Rs.75.00 lakhs.

In the first project, about 60-70% of the chlorides would be recovered and these would be used as the feed to acid recovery plant, saving over 7000 MT per year of Hydrochloric Acid worth around Rs. 75 lakhs.

In the second project, the pilot plant work on ilmenite reduction using Sodium Carbonate as the catalyst has been completed at a pilot plant scale at RRL, Trivandrum. Use of this catalyst in ilmenite reduction is expected to lead to reduction in the peak temperature in the rotary kiln by 50°-75°C while attaining reduction efficiency of 96%. The project has been completed.

2.1.4 M/s Triveni Structurals Ltd. (TSL), Naini

M/s TSL is undertaking a project for development of various types of 400 KV and 765 KV Self supporting and Guyed type transmission line towers, with a DSIR support of Rs 20 lakhs out of the total project cost of Rs 86 lakhs. Structural Engineering Research Centre (SERC), Madras is assisting the firm in design and testing of the towers. One prototype of 400 KV guyed wire single circuit 0°-2° Transmission Tower has been developed and has successfully cleared the trials at SERC, Madras. Two more prototypes have been completed awaiting testing. The project is in progress.

2.1.5 M/s Semiconductor Complex Ltd. (SCL), Chandigarh and Centre for Development of Telematics (C-DoT), New Delhi

This joint project is being executed by M/s SCL and C-DOT for the development of Application Specific Integrated Circuits (ASICs) for Line Card and Conference Card of the C-DOT switching system. This project involving a DSIR support of Rs 20 lakhs out of total project cost of Rs 60 lakhs, has been completed with C-DOT Systems group testing and accepting ASICs developed by SCL.

2.1.6 M/s Electrical Research & Development Association (ERDA), Vadodara

The project of ERDA is for the development of 7.5 KW Switched Reluctance Motor (SRM) drive system for variable speed applications having good torque speed characteristics, such as for electric vehicles, textile industry, conveyor systems and mining equipments. This project has been undertaken by Electrical Research and Development Association (ERDA), Vadodara in association with M/s Jyoti Ltd., Vadodara. The controller for the SR Motor is being developed by Electronics Research and Development Centre (ER&DC), Thiruvananthapuram. The prototype of the controller has been developed and interfaced with SR Motor developed by Jyoti Ltd. The project is likely to be closed in 1998-99.

2.1.7 M/s Travancore Cochin Chemicals Ltd. (TCCL), Cochin and Regional Research Laboratory, Trivandrum

M/s Travancore Cochin Chemicals Ltd.(TCCL), Cochin has undertaken a project, in collaboration with Regional Research Laboratory, Trivandrum, for the

development of process technology and a capital goods package for the manufacture of synthetic rutile through a new environment friendly route. This project involves DSIR support of Rs. 71 lakhs out of a total project cost of Rs.193 lakhs. A pilot plant has been set up in TCCL at Cochin, and successfully operated based on new process route. The project has been completed. Metallurgical Engineering Consultants (I) Ltd. (MECON) have prepared a feasibility report for commercial plant of 30,000 TPA capacity for production of synthetic rutile. The report has indicated that such a commercial plant will have a good economic viability.

2.1.8 M/s. Litex Electricals Pvt. Ltd., Pune and Society for Applied Microwave Electronics Engineering and Research (SAMEER), Mumbai

The project of M/s Litex Electricals Pvt. Ltd. is for development of Xenon, and Krypton filled lamps for laser pumping is being undertaken in association with SAMEER, Mumbai. This project involving DSIR support of Rs.8 lakhs out of total project cost of Rs.25 lakhs is in progress. The project is likely to be completed in 1998-99.

2.1.9 M/s. CS Zircon, Kala Amb and Institute of Plasma Research (IPR), Ahmedabad

The project of M/s C.S. Zircon is for the development of Plasma based dissociation process to manufacture Zirconia, in collaboration with IPR, Ahmedabad, a research society under the Department of Science and Technology. This project involves DSIR support of Rs.9.5 lakhs out of a total project cost of Rs.60 lakhs. The project is likely to be completed in 1998-99.

2.1.10 M/s. Central Electronics Ltd. (CEL), Sahibabad

The project for "Development of Hybrid (SPV-Diesel) Pilot power Plant was undertaken by M/s Central Electronics Ltd. with DSIR's support of Rs. 14 lakhs out of the total project cost of Rs. 21 lakhs. The project was initially targetted at meeting the requirements of Defence Radio Relay (RRD) and the Deptt. of Telecommunication's Repeater Station for Rural and Remote Telecommunications Networks. In order to meet the enhanced technical requirements and specifications of DOT, the system was upscaled and its demonstration has been successfully completed at DOT Microwave Repeater Station at Manesar. The project has been completed. The project pertaining to Defence application, however, was not considered technoeconomically feasible to implement.

2.1.11 M/s. Central Electronics Ltd. (CEL), Sahibabad

The project for "Development and Evaluation of Plasma Etching and Edge Grinding System for Edge Separation" was undertaken by M/s CEL, Sahibabad, with DSIR financial support of Rs. 30 lakhs out of the total project cost of Rs. 130 lakhs. The project is nearing completion.

2.1.12 M/s. IBP Co. Ltd., Gurgaon

Four projects for (a) Development of Site Mixed slurry (SMS) Explosives for deep bore-hole applications (b) Adaptation and upgradation of Emulsion Explosive Technology (c) Development of Detonating Card for shaped charges used for perforation of wells in oil fields and (d) Development of Heat Resistant Explosives (with the assistance of CMRI, Dhanbad) were undertaken by M/s IBP, Gurgaon with DSIR support of Rs.41.50 lakhs out of total project cost of Rs 137.00 lakhs. The project on Detonating Card for shaped charges has been completed and the firm has supplied to ONGC the detonating cards for field trials. The firm has filed an Indian patent on the Detonating card. The project on Site mixed slurry has also been completed. The other two projects are in progress.

2.1.13 M/s. FACT, Cochin

The project for development of slow release fertilizers and their application on paddy, banana, sugarcane and coconut crops is being undertaken by M/s FACT in association with Kerala Agricultural University, Coimbatore with a DSIR support of Rs. 12.00 lakhs out of a total project cost of Rs.46.00 lakhs. The sixth crop of paddy has been planted and will be harvested in April, 1998 and trial on other long duration crops such as sugarcane, banana, coconut are in progress.

2.1.14 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project by MIDHANI is for welding of Molybdenum wire to make 20 kg coil. MIDHANI has the capability to make 4 - 5 Kg coils of Molybdenum wires, whereas, the electrical lamps industries require larger coils weighing at least 20 Kgs. A special welding machine has already been developed in the project for this purpose. DSIR support to this project is Rs. 10 lakhs out of a total project cost of Rs. 20 lakhs. The activities in the project have been completed.

2.1.15 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

MIDHANI has taken up a project to produce clean steel through filtration. Currently such steels are being produced through Electro-slag Refining (ESR) route which is relatively expensive. Several filters have been identified for the project and trials are being conducted on them. DSIR's support to the project is Rs. 37.00 lakhs out of a total project cost of Rs. 74.00 lakhs. The project is in progress.

2.1.16 M/s Mishra Dhatu Nigam Ltd. (MIDHANI), Hyderabad

The project for production of wires with high surface

finish has been taken up by MIDHANI with a DSIR support of Rs. 12 lakhs and project cost of Rs. 36 lakhs. Such wires find extensive use in spark plugs and electrostatic precipitators. R&D activities in the project have been completed.

2.1.17 M/s. Tungabhadra Steel Products Ltd., (TSP) Tungabhadra Dam

The project for development of Rubber Seal cladded with PTFE for use in hydraulic dam gates was undertaken by M/s TSP with DSIR support of Rs.9.0 lakhs out of total project cost of Rs.20 lakhs. National Chemical Laboratory (NCL) is assisting the firm in test specifications and other trials. The prototype of the PTFE cladded seal has been successfully developed and test result of Energy Hydraulic gate of Tungabhadra Dam has been satisfactory. The project has been completed.

2.1.18 M/s. Metallurgical & Engineering Consultants(I) Ltd. (MECON), Ranchi and M/s Durgapur Steel Plant (DSP), Durgapur

The project for development of Under Burden Probe for determination of temperature and chemical compositions of hot gases inside the stack of a blast furnace was undertaken by M/s MECON in association with Durgapur Steel Plant with DSIR support of Rs.30.00 lakhs out of total project cost of Rs.82.00 lakhs. The underburden probe has been developed and installed on the blast furnace along with the related instrumentation. The project is likely to be closed in 1998-1999.

2.1.19 Central Power Research Institute (CPRI), Bhopal and M/s G.K. Electricals, Bhopal

The joint project of CPRI and M/s G.K. Electricals, Bhopal is for development of 12 KV load break switches for use in Electrical Sub-Stations involving a DSIR support of Rs.5.5 lakhs out of total project cost of Rs.50.00 lakhs. Second prototype is ready for testing. The project is in progress.

2.1.20 M/s Punjab Tractors Ltd, (PTL) Chandigarh and M/s Crompton Greaves Ltd. (CGL), Bombay

The project for development of 'state-of-the-art' electronic controller for forklift trucks is being undertaken by M/s PTL in collaboration with M/s CGL, Bombay, with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The prototypes have been developed and tested. The project is completed.

2.1.21 M/s Semiconductor Complex Limited, (SCL), Chandigarh and C- DAC, Pune.

The joint project of M/s SCL and C-DAC 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 project is in progress.

2.1.22 M/s. Semiconductor Complex Limited,(SCL), Chandigarh and Electronic Research & Development Centre, Thiruvananthapuram.

The joint project of M/s SCL and ER&DC is for development of ASIC for microprocessor based power controller involving DSIR support of Rs. 50.50 lakhs out of total project cost of Rs. 93 lakhs. The project is in progress.

2.1.23 M/s. Semiconductor Complex Limited, (SCL), Chandigarh and Electronic Research & Development Centre, Thiruvananthapuram.

The joint project of M/s SCL and ER&DC is for development of ASIC and the related STD PCO machine involving DSIR support of Rs. 18.00 lakhs out of total project cost of Rs. 65 lakhs. The ASIC developed is under evaluation. The project is in progress.

2.1.24 M/s. Semiconductor Complex Limited, (SCL), Chandigarh and M/s Indchem Research and Development Laboratory (IRDL), Madras.

The project for the development of ASIC for MPEG-2 (Motion Picture Export Group) Decoder was undertaken jointly by M/s SCL and IRDL with DSIR support of Rs. 70 lakhs out of the total project cost of Rs. 225 lakhs. The project is in progress.

2.1.25 M/s Semiconductor Complex Ltd. (SCL), Chandigarh and M/s Bharat Heavy Electricals Ltd. (BHEL), Bangalore

The joint project of M/s SCL and M/s BHEL is for development of the Application Specific Integrated Circuit (ASIC) and ASIC based 3 Phase multifunctional electronic energy meter for industrial applications involving DSIR support of Rs.23.00 lakhs out of total project cost of Rs.46.00 lakhs. The project is in progress. The ASIC fabrication has been completed. The ASIC is being integrated with the rest of the meter.

2.1.26 M/s. Padmavathy Panel Boards Ltd., Bangalore

The project for upgradation of Rice Husk based plant and development of new variant of reinforced boards and particle board & fire check doors is being undertaken by M/s. Padmavathy Panel Boards Ltd., Bangalore in collaboration with NRDC, with DSIR support of Rs. 23.65 lakhs out of project cost of Rs.95.00 lakhs for one year duration. The upgraded Rick Husk Board plant of 2000 TPD has been commissioned and development of fire check doors and new variants of reinforced boards have been successfully developed. The project completion report is expected to be submitted shortly. The project is nearing completion.

2.1.27 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for design and development of 10 T class Backhoe Hydraulic Excavator (Crawler version and Wheeled version models) is being undertaken by M/s BEML with DSIR support of Rs. 40 lakhs out of project cost of Rs.85 lakhs. The prototypes of crawler and wheeled version have been developed and field trials have been successfully completed. The R&D work under the project has been completed and M/s. BEML is in the process of commercialising the Excavator developed under the project.

2.1.28 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for development of computerised transmission control for off highway dump trucks is being undertaken by M/s BEML with DSIR support of Rs.10.00 lakhs out of total project cost of Rs.30.00 lakhs. The prototype has been successfully developed and has undergone test trials successfully. The R&D work under the project has been completed and M/s. BEML is in the process of commercialising the product developed under the project.

2.1.29 M/s Bharat Earth Movers Ltd. (BEML), Bangalore

The project for development of Cast Crank Shaft used in their heavy duty engines was undertaken by M/s BEML with DSIR support of Rs.27.00 lakhs out of total project cost of Rs.65.00 lakhs. The prototypes of the S.G. Iron and Austempered Ductile Iron (ADI) Crank shaft have been successfully developed and are undergoing testing. The project is in progress.

2.1.30 M/s Turbotech Precision Engineering Pvt. Ltd. (TPEL) and National Aerospace Laboratories (NAL), Bangalore

The project being executed by of M/s TPEL in collaboration with NAL, 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.73 lakhs out of total project of Rs.238 lakhs. The sub-systems of the Gas Turbine system such as turbine and planetary gear box have been developed. The compressor and combustor of the proposed system have been tested successfully at National Aerospace Laboratories, Bangalore. The testing of turbine followed by testing of the full LCGT system will be undertaken shortly. The project is in progress.

2.1.31 M/s Tamilnadu Petroproducts Limited (TPL), Madras and Indian Institute of Petroleum (IIP), Dehradun.

Two projects for (a) development of technology for

Long chain (C10-C14) Alcohols by oxidation of n-Paraffin arising in the production of Linear Alkyl Benzene (LAB) with a DSIR support of Rs. 55 lakhs out of total project cost of Rs. 144 lakhs and (b) development of Multifunctional additives for Fuel oil and Diesel oil with DSIR support of Rs. 34 lakhs out of a total project cost of Rs. 94 lakhs. are being undertaken by M/s TPL, in collaboration with Indian Institute of Petroleum, Dehradun. 49 compounds have been synthesised. These compounds have been evaluated for their multifunctional performance characteristics in diesel and fuel oils. Use of a novel catalyst system has given 40-45% conversion of n-paraffins into secondary alcohols, per pass, at a selectivity of about 95%. The project is in progress.

2.1.32 M/s Encon Thermal Engineers and Indian Institute of Petroleum (IIP), Dehradun

The project of M/s Encon Thermal Engineers in collaboration with IIP, Dehradun, is for development of Natural Gas Fired Industrial Gas Burners having a capacity of 50 and 100 cu. m. of natural gas per hour and involves financial support from DSIR and M/s Gas Authority of India Ltd. (GAIL), New Delhi of Rs. 11 lakhs each out of a total project cost of Rs.30 lakhs. Three types of burners have been designed and fabricated. Setting up LPG Storage and handling facility for trials of burners is in final stage.

2.1.33 M/s Electronic Corporation of India Ltd. (ECIL), Hyderabad and Central Road Research Institute (CRRI), New Delhi

The joint project of M/s ECIL, Hyderabad and CRRI, New Delhi is for the development of a microprocessor controlled Nuclear Moisture and Density Gauge with a DSIR support of Rs.18 lakhs out of a total project cost of Rs.28 lakhs. 5 prototypes of moisture and density gauges will be given to user agencies such as Border Road Organisation and State PWDs for user's trials in construction projects and based on the feed back of the performance of the prototypes, CRRI and M/s ECIL would modify the gauges, if required. The project has been extended till September, 1998 and the first prototype of Moisture and Density Gauge is likely to be ready before April, 1998.

2.1.34 M/s Hindustan Zinc Ltd. (HZL), Udaipur.

M/s HZL has undertaken a project to recover copper sulphate from Zinc plant wastes using solvent extraction technique with a DSIR support of Rs. 40 lakhs out of a total project cost of Rs. 80 lakhs. The project has been completed.

2.1.35 M/s National Mineral Development Corporation (NMDC), Hyderabad and Indian Institute of Chemical Technology (IICT), Hyderabad

The project taken up by NMDC with a DSIR support of Rs. 54.50 lakhs out of a project cost of Rs. 131.00 lakhs, is for development of process for production of pigment grade

ferric oxide from "Blue Dust". The project has been fore-closed due to modifications made in the project parameters. The firm has been asked to submit a fresh proposal.

2.1.36 M/s National Aluminium Company Limited (NALCO), Bhubaneswar

NALCO has taken up a project to develop technology for the production of Special Aluminas and Hydrates which are used in a variety of diverse applications such as grinding wheels, tooth paste, etc. DSIR is supporting the project with a financial grant of Rs. 100 lakhs. The project is under progress.

2.1.37 M/s T. Stanes & Company Limited, Coimbatore

The project of M/s T.Stanes & company is for development of Digested Organic Supplement (DOrS) and its applications in a variety of crops involving a DSIR support of Rs.40.00 lakhs, out of a total project cost of Rs.131.00 lakhs. The pilot plant has been installed at Madurai and production of DOrS has started. The product has been tested in green house as well as IARI's Centres located in several States. R&D work in the project has been completed.

2.1.38 M/s Central Electronics Ltd. (CEL), Sahibabad and Centre for Development of Advanced Computing (C-DAC), Pune

The joint project of M/s CEL and C-DAC is for "development of a Solid State Interlocking (SSI) System for Railways" with DSIR support of Rs. 70.00 lakhs out of the total project cost of Rs. 95.00 lakhs. The project is in progress.

2.1.39 M/s Bharat Earth Movers Ltd.(BEML), Bangalore

The project of M/s BEML is for the design and development of 460 HP Wheel Dozer. This project was approved with a DSIR's support of Rs. 20 lakhs out of a total project cost of Rs. 85 lakhs. The prototype of the Wheel Dozer has been fabricated and is under testing. The project is progressing satisfactorily.

2.1.40 M/s JSL Industries Ltd., Vadodara

The project of M/s JSL Industries Ltd. Vadodara for upgradation of Air Circuit Breakers in collaboration with Electrical Research and Development Association (ERDA), Vadodara was approved with a DSIR support of Rs. 13.75 lakhs out of total project cost of Rs. 34 lakhs. Prototypes with 50 KV Short Circuit rating were successfully developed and tested. The project is in progress.

2.1.41 M/s INTRA Industries Pvt. Ltd., Pune

The project of M/s INTRA industries Pvt. Ltd., Pune for development of 22.5 KVA Inverter for Railways was approved during the year with a DSIR support of Rs. 21.80

lakhs out of total project cost of Rs. 62 lakhs. The project is in progress.

2.1.42 M/s Central Electronics Ltd. (CEL), Sahibabad

M/s CEL has undertaken a project for "Upgradation of the Process Technology for the Production of Single Crystalline Silicon Solar Cells in the existing SPV Plant" with DSIR's support of Rs. 219 lakhs out of the total project cost of Rs.492 lakhs based on laboratory scale technology developed by Inter-University Micro Electronic Central (IMEC), Belgium. The project is nearing completion.

2.1.43 M/s Central Electronics Ltd. (CEL), Sahibabad and Electronics Research & Development Centre (ER&DC), Thiruvananthapuram

The joint project of CEL and ER&DC is for "development and design of SPV Charger for Ni-Cd batteries using Smart charging technology" with DSIR's support of Rs. 24 lakhs (Phase I) out of the total project cost of Rs. 71.80 lakhs. The SPV chargers will find applications for charging the batteries of man-pack/portable Radio sets of the Military and Para-military forces. The project is in progress.

2.1.44 M/s Central Electronics Ltd. (CEL), Sahibabad and CMS Traffic System Pvt. Ltd., New Delhi

The project for the "Experimental Design and Development of SPV Powered Traffic Signalling System" has been taken up jointly by M/s CEL, Sahibabad and CMS, New Delhi, with DSIR's support of Rs. 9.50 lakhs, out of the total project cost of Rs. 19.52 lakhs. The Delhi Traffic Police has also provided financial support of Rs. 2 lakhs for the project. The system has been successfully demonstrated to Delhi Traffic Police and the project has been completed.

2.1.45 Gujarat Narmada Valley Fertilisers Limited (GNFC), Bharuch, Gujarat and Engineers India Ltd., New Delhi

A project to develop the process for removal of Hydrogen sulphide and recovery of sulphur from sour gases was assigned to Gujarat Narmada Valley Fertilisers Limited (GNFC), Bharuch, Gujarat and Engineers India Ltd., New Delhi. The DSIR support for the project is Rs. 100 lakhs, out of total cost of project of Rs. 207 lakhs. The catalyst for removal of Hydrogen sulphide and recovery of sulphur has been demonstrated at ONGC Complex at Hazira. The project is in progress.

2.1.46 ABR Organics Limited (ABROL), Hyderabad

The project for Technology upgradation of polyimide resins and their applications by M/s ABR Organics Limited (ABROL), Hyderabad has been taken up with DSIR support of Rs. 35 lakhs out of a total project cost of Rs. 150 lakhs. The project is in progress.

2.1.47 M/s Southern Petrochemical Industries Corporation Ltd., Chennai and Indian Institute of Chemical Technology, Hyderabad.

Southern Petrochemical Industries Corporation Ltd., Chennai, and Indian Institute of Chemical Technology Hyderabad have jointly undertaken a Project for development of Process for manufacture of Pyrazinamide using catalytic route. The project involves DSIR support of Rs. 195.00 lakhs in a total project cost of Rs. 466.00 lakhs. The project is in progress.

2.1.48 M/s Indus Natural Products Pvt. Ltd., Pune and National Chemical Laboratory, Pune

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. Tartaric acid finds extensive application in beverages, emulsifiers, pharmaceuticals, foods, electro-chemical industry and development and purification of chiral compounds. Most common fruit from which tartaric acid is produced worldwide is grape, whereas in the present project tartaric acid is proposed to be manufactured from a totally new raw material-tamarind. The process has been developed by National Chemical Laboratory, Pune and will be scaled up to a pilot plant scale of 350 kg. raw material per batch basis. The project is in progress.

2.1.49 M/s HMT Ltd., Bangalore

The project for the development of CNC Machining Centre is being undertaken by HMT Ltd., Bangalore and Pinjore with the aim of bringing out a new generation machine tool comparable to international standard. The DSIR's support is Rs. 75 lakhs out of the total project outlay of Rs. 197 lakhs. The project is in progress.

2.1.50 M/s ACE Designers Ltd. and CMTI, Bangalore

The joint project for the development of PC Based CNC System is being undertaken by M/s ACE Designers Ltd., Bangalore in collaboration with Central Manufacturing Technology Institute, Bangalore with DSIR support of Rs. 35 lakhs, out of the total project cost of about Rs. 99 lakhs. The aim of the project is to develop a cost effective, advanced open architecture PC based CNC System for the machine tools. The project is in progress.

2.1.51 M/s Innovation Communications Systems Pvt. Ltd. (ICS), Hyderabad

The project for "Development of Interactive Voice Response System with Multilingual Capability" was undertaken by M/s Innovation Communication with DSIR

support of Rs. 7.00 lakhs out of total project cost of Rs. 23.80 lakhs. The project is in progress.

2.1.52 M/s Webel Mediatronics Ltd. (A Govt. of West Bengal Undertaking), Calcutta.

The project for "development of Computerised Braille Transcription System" was undertaken by M/s Webel with DSIR support of Rs. 16.00 lakhs out of the total project cost of Rs. 32.00 lakhs. The project is in progress.

2.1.53 M/s Enercon Systems Pvt. Ltd., Bangalore

The project for the "development of Centralised Electrical Energy Management System" has been undertaken by M/s Enercon System with DSIR support of Rs. 20.00 lakhs out of the total project cost of Rs. 48.80 lakhs. The project is nearly completed.

3. CUSTOMS DUTY EXEMPTION CERTIFICATES

In pursuance of 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, 39 Essentiality Certificates for claiming customs duty exemption for nearly Rs.286 lakhs worth of components and consumables under 12 technology development projects supported under "Programme Aimed at Technological Self Reliance" scheme of DSIR have been issued.

4. TECHNOLOGY MISSIONS OF MINISTRY OF HUMAN RESOURCE DEVELOPMENT

Another initiative taken by the DSIR is supporting 7 Technology Missions recently launched by the Ministry of

Human Resource Development, in the IITs and IISc. These missions are in hi-tech areas viz. photonics, genetic engineering & biotechnology, new materials, food processing & engineering and integrated design & competitive manufacturing. The DSIR, along with NRDC, is assisting IITs and IISc in spotting the right industrial partner in these missions, and products and in other areas. Patent search, which would be an important input to R&D in each of these missions, is being provided by NRDC. Assistance in patenting, both nationally and internationally, of the products and/or processes generated as an output of the R&D undertaken by the missions, would also be provided by the NRDC. NRDC has already established Centres for providing such assistance in some IIT's and IISc.

5. 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.



IV.1 High Speed CNC Machining Centre developed by HMT Ltd., under PATSER Scheme, displayed at IMTEX-98



VA.1 Dr. R.A. Mashelkar, Secretary, DSIR delivering the inaugural address at the joint DSIR-CII programme on "Technology Management for Competitiveness" held at Pune



V.A.2 Session in Progress during the Workshop on "Intellectual Property Rights - Implications for Industry and R&D" organised jointly by DSIR and the Institute of Entrepreneurship Development, held at Bhubaneswar



V.C.1 ESCAP Seminar on National Policies and Technological Capability Building in Developing Countries

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 (NRFC)
- B) Industrial Technology
- C) Transfer and Trading in Technology (TATT)
- D) 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. Although, Industrial Technology is not a part of the plan scheme, SEETOT, the information emanating out of the activities under Industrial Technology is mainly useful for SEETOT and hence it is covered here.

V (A). NATIONAL REGISTER OF FOREIGN COLLABORATIONS

1. PREAMBLE

The "National Register of Foreign Collaborations" (NRFC), which is an ongoing plan scheme, continued its operations during the year 1997-98. It has completed a number of programmes that were targeted for the year.

2. OBJECTIVES AND ACTIVITIES

The main objective of NRFC scheme is to facilitate acquisition of technology in the country, efficiently. The following major activities are carried out under NRFC :

- Compilation and analysis of data on approved foreign collaborations.
- Undertake analytical studies in select areas.
- Carry out technology status studies covering state of the art technology in use in the country, international trends and other related issues.
- Provide assistance in the effective transfer of technology process and efficient management of

technology.

- Coordinate with Ministries of Industry, Commerce, Finance and others by providing technology data inputs.
- Activities initiated, so far, under the NRFC scheme can be put into following broad categories :
- Compilation and analysis of basic data on foreign collaborations (FCs) approved.
- Analytical studies in selected areas.
- Preparation of reports on technology status in identified sectors/products.
- Organisation of Interaction meets to enhance effectiveness of technology transfer process.
- Programmes for enhancing technology management capabilities.
- Programmes for enhancing awareness of Intellectual Property Systems.

3. FOREIGN COLLABORATIONS DATA COMPILATION

Work of in-house compilation of primary data on foreign collaborations approved, continued during the year. The compilation for the year 1996 was brought out. It contained information such as names of Indian companies, the names of foreign collaborators, products covered under the collaborations, duration, nature etc. The compilation for the year 1997 is in progress.

4. ANALYTICAL STUDIES

Project to study trade related laws of Japan with special reference to technology transfer was commissioned to the National Law School of India University, Bangalore. The study inter-alia aims to analyse broadly the legal system in Japan as it relates to technology transfer. It covers areas like Commercial Law, Contract Law, Commercial Transaction Law, Intellectual Property Rights and Technology Transfer etc. The report is being finalised.

A project to study the Market and Development Prospects of Fruits and Vegetables Processing industries in Eastern and North Eastern Regions and Andaman & Nicobar Islands was taken up. This had been entrusted to West Bengal Consultancy Organisation Ltd., Calcutta. The main objective of the study is to analyse the growth, performance and bottlenecks of fruits and vegetables processing industries in the region; sources, availability and prices of various raw materials with reference to production and marketable surpluses of different types of fruits and vegetables in the region and identifying potential project opportunities with sources of appropriate technology for ready guidance to prospective entrepreneurs. The draft report on the project was discussed in the evaluation committee meeting held in September 1997. The report is being finalised.

5. TECHNOLOGY MANAGEMENT

Technology Management is an emerging discipline that is assuming considerable significance in the current scenario of globalization, international competitiveness and international business strategies. Industry is now acknowledging the importance of managing technology as an independent entity and of devising appropriate strategies to merge the technology and business plans. This being the need DSIR has initiated a number of programmes and activities on the subject for the benefit of industry, R&D organizations, academic institutes, Government departments, consultants and others. These cover case studies, preparation of manuals, bibliographies, organisation of awareness programmes & others.

Case studies on two manufacturing organizations have been brought out. These cover several aspects of Technology Management inclusive of managerial, organizational, technical and personal factors responsible for the technology growth of the organization, the technology management practices, R&D management style, manufacturing and marketing strategies, organizational structure, strategies for sustaining competitiveness and methodologies for implementing new technologies etc. Such case studies provide useful information to policy makers and researchers apart from being useful, pedagogical tools for academicians and serving as a data bank from which useful information can be drawn by industry, consultants and others.

Two comprehensive studies on the organizational behaviour of research organizations have been brought out. These include a holistic analysis of the organizational behaviour based on several aspects including the organizational structure, decision making bodies, formal and informal mechanisms of information exchange, leadership styles, team work, motivation methods, creative process mechanisms, user interaction, organizational strategies and

communication methods. Important lessons have been drawn, which would be useful to other similar organizations; apart from academicians, researchers and others.

One Manual on Technology Acquisition has been prepared. The topics covered include need for technology acquisition, identification of sources for acquisition of technology, technology negotiation and techno-economic issues of technology transfer.

Leading technologists, scientists, managers from varied fields of technology are being invited to deliver lectures on their experiences in managing technology in the organizations nurtured by them under the Distinguished Technologists Lecture Series. One such lecture by a leading technologist has been documented and printed for dissemination.

Two bibliographies on Technology Management have been prepared. One bibliography is devoted to books on Technology Management and is grouped under various broad topics such as Technology and Society, Science and Technology, Technology Forecasting, Research and Development, R&D Management, Managing Innovation, Technological Change, Technology Transfer, Technology Diffusion and Appropriate Technology. The other Bibliography is an annotated one covering recent papers and articles on Technology Management brought out in different national and international journals. This is also grouped in various categories as the former one. Users have found these bibliographies extremely useful.

A module on Management of Technology as part of the MS Course in Consultancy Management being conducted by Birla Institute of Technology & Science (BITS), Pilani in collaboration with Consultancy Development Centre, New Delhi has been inducted during the programme from August-December, 1997. The entire module has been structured, developed and implemented. Subjects such as the key issues in Technology Management, Technology Information, Technology Transfer, role of consultants and Intellectual Property Rights have been covered.

Assistance has been rendered to the Indira Gandhi National Open University (IGNOU), New Delhi in respect of a course on "Management of R&D and Innovation" in different areas including conceptualisation and design of the course, envisaging the subject coverage and specific contents of the different modules. In addition, four units relating to the course have been contributed.

DSIR has instituted awards in different sectors/areas of industry to provide recognition to the efforts of industry towards innovative research, technological development or commercialisation of research results. Since 1988 till 1996,

88 awards have been bestowed. With the objective of carrying out a comprehensive analysis of the status of technology growth in these DSIR National R&D Award winning companies, a report is under preparation. The study would inter-alia cover the performance of the award winning technologies and companies in the various segments over the years, especially with a view to assess the continuous technological upgradation, economic benefits, survival in a competitive environment, factors leading to technological innovation, upgradation, growth or decline of the technologies awarded, impact of the technology on the total operations of the company, strategy of managing technology and other related issues. The study which has been assigned to ASCI is under progress.

6. TECHNOLOGY STATUS STUDIES

6.1 One of the objectives of the NRFC scheme, is to carry out technology status studies covering state-of-the-art of technology in use in the country, international trends and other related issues. The task of preparation of status reports is entrusted to experts/organisations/ professionals/ consultants in respective fields. More than 160 reports have so far been finalised. These are available to industries and other users.

6.2 During the year, reports on the technology status of Caprolactam, Polyacetal Resins and Photographic Films were finalised.

These reports deal, at length, with important aspects relating to these sectors/products. These aspects include: current status of technology, efforts by the industry to absorb and adapt technology, current international trends, technology gaps etc. The reports identify technology gaps in Indian industry. Recommendations for action by industry, R&D institutions, Government and other concerned organisations to bridge these gaps have also been made. Reports on studies under NRFC are being used inter-alia as inputs to the PATSER Scheme operated by the Department.

6.3 The following are the major findings of reports which have been finalised during the year.

6.3.1 Polyacetal Resin

Polyacetal Resin is a versatile engineering polymer material which offers a unique combination of features such as high tensile and shear strength, stiffness, toughness, abrasion resistance, chemical resistance, predictable stress-strain relation, dimensional behaviour, light weight, ease of operation and competitive price. It, therefore, finds use as engineering material in industrial machinery, electrical and electronic devices, automotive and plumbing applications, consumer goods and other miscellaneous

applications. It is produced in two forms, as homo-polymer and as co-polymer. The former has greater mechanical strength while the latter is easier to process and is more durable.

This resin is manufactured by Du Pont, Hoechst Celanese, BASF, Mitsubishi, Asahi and their collaborators world wide. The present world wide manufacturing capacity is of the order of 600,000 tonnes per annum. The expected rate of growth of demand is 5% per annum. In India, the present consumption is less than 5,000 tonnes per annum which is only 1% of the world consumption. However, the demand is expected to grow at the rate of 15% per annum. At present, there is no manufacturer based in India and the total demand is met by imports.

A number of manufacturers intend setting up a manufacturing base in India but this is yet to fructify. Du Pont is setting up a homo-polymer compounding plant in India, apart from an Application Development Centre. It has been brought out in the report that Indian manufacturers should develop those grades of polyacetal resin, which would best suit the local requirements. In addition, independent testing facilities and standards need to be developed. Research and Development work by industry either individually or jointly in association with National Laboratories needs to be taken up for development and indiginization of Polyacetal Resin technology and development of new applications relating to the same.

6.3.2 Caprolactam

Caprolactam is the basic raw material used in the manufacture of Nylon-6 in the form of yarn (NFY) or cords (NTC). Ammonium Sulphate is a by-product obtained in the manufacture of Caprolactam, which is used as a fertilizer. Caprolactam can be manufactured by a number of routes, depending on the raw materials used, among them being Benzene, Toluene and Phenol apart from Ammonia, Hydrogen, Sulphur dioxide and Oleum. The various manufacturing processes are the Allied, DSM, IFP, Scientific Design, Toyo Rayon, SNIA, Union Carbide, Du Pont processes. The contemporary processes used are the UBE process involving the Cyclo-Hexane, Cyclo-Hexanone, Hydroxylamine, Caprolactam and Ammonium Sulphate Units apart from the BASF/ENCO process and the IFP/CIECH process.

The Indian manufacturers are Gujarat State Fertilizer Corporation (GSFC) and Fertilizers and Chemicals Travancore Ltd. (FACT) with a total installed capacity of 120,00 TPA. The total production in India was of the order of 1 lakh metric tonnes in 1995-96. In addition, 10,000-30,000 metric tonnes per year have been imported in the

last five years. The annual estimated demand is 1,20,000 to 1,30,000 MT per year. Indian Standard for Caprolactam is available and the indigenous production meets the desired specifications.

The present world production is around 3.5 million MT per annum. In the international scenario, as the major end product viz., Nylon-6 is being replaced by Polyester, Acrylics and other such material, no major developments in respect of caprolactam are expected in the near future. GSFC has been working in close association with IICT, Hyderabad and NCL, Pune in various areas including catalyst development, spare parts development and development of alternate routes for Oximation. The report brings out that more R&D work need be taken up for development of various catalysts used in the manufacture of caprolactam which are currently being imported as well as for indigenisation of major equipment and spare parts.

6.3.3 Photographic Films

Photographic films consist of an emulsion of a light sensitive material, silver bromide and gelatine coated on to a flexible transparent film. The manufacturing process of photographic films encompasses several activities like the preparation of an emulsion of silver salt, alkyl halide and gelatin, precipitation of the emulsion, washing, chemical sensitization and coating on to a support. Other sophisticated methods have been developed of late. Hindustan Photo Films Manufacturing Co. (HPF) is the sole indigenous manufacturer. There are others who import jumbo rolls of photographic films and X-ray films and later convert, pack and market those. The demand for photographic films is around 40 million rolls per year, while that for X-ray films is around 6 million square metres.

The Eastman Kodak Co., USA; Fuji Photo Film Co., Japan; Konika, Japan and Agfa Gevaert, Germany are some of the international manufacturers. In respect of world-wide developments, there is considerable activity in respect of Coupler Technology leading to development of inhibitors which result in edge enhancement and clarity. X-ray films which can be developed even in day light are among the latest types used in advanced countries. There are no Indian Standards for photographic and X-ray films, but standards for the accessories and the equipment have been formulated. Some of the technology gap areas brought out in the report include development of indigenous technology for colour negative films, quality improvement of black and white films and development of special X-ray films.

7. INTERACTION MEETS AND AWARENESS PROGRAMMES

Six programmes on Technology Management have been organized during the year. They are the following:

- For Kudremukh Iron Ore Company Ltd (KIOCL) on 30 June-1 August, 1997 at Kudremukh
- For Karnataka Association for Small Scale Industries (KASSIA) on 15th July 1997 at Bangalore
- In association with Confederation of Indian Industry (CII) on 26th August, 1997 at Pune
- For University of Roorkee on 20th November, 1997 at Roorkee
- In association with Confederation of Indian Industry (CII) on 6th December, 1997 at Chennai
- For PSG Institute of Management on 8th December, 1997 at Coimbatore

The objective of these programmes has mainly been to appraise organizations of the importance of managing technology as an independent entity, of the intricacies involved therein, devising an appropriate technology strategy and merging the technology strategy with the business strategy. The subjects covered in these programmes included an appreciation of the challenges and tasks in Technology Management, key issues in Technology Acquisition, Contents of Technology Transfer Agreements, R&D Management and others. These programmes were attended by participants from different spheres and have been widely acclaimed.

Four intensive Programmes on Technology Acquisition were organized. One was on Acquisition and Assimilation of Foreign Technology in association with Indian Institute of Management Ahmedabad from 29th July to 1st August, 1997 at Ahmedabad. A similar programme was held at IIM Ahmedabad during 1997 and another at IIM Calcutta during 1998. A fourth programme on the subject was held at Hyderabad in association with the Administrative Staff College of India (ASCI) on 19th August, 1997. The objective of these programmes was to provide information relating to some key concepts, issues and frame works that would be useful in decision making related to technology acquisition. The programmes were attended by a large cross section of top and senior executives from small medium and large enterprises, consultancy organizations and financial institutions apart from scientists and technologists from R&D organizations and academic institutes and corporate trainers; and they have found these programmes very useful. The programmes included subjects like strategies for technology acquisition, government policy on technology import, IPRs and their role in technology acquisition, contents of technology transfer agreements, support for technology transfer & development and others.

Two one day awareness programmes on issues relating to Intellectual Property Rights were organized during the year. The first programme was held at the Indian Institute of Technology, Bombay on 28th June, 1997. The second programme was held at Bhubaneswar in association with the Institute of Entrepreneurship Development, Orissa on 26th November, 1997. The objective of these programmes was to generate greater awareness of issues relating to Intellectual Property Rights and to sensitize industry, R&D organizations, technical institutes, consultants and others about the implications of these rights. The subjects covered included an over-view of the Intellectual Property System, role of patent information in development and transfer of technology, systems and procedures for patenting, assistance in patenting, software protection and other IPR related issues. These programmes have been very much appreciated.

A programme on "Concurrent Engineering: Reducing Concept to Market Cycle Time" was organized at Hyderabad

during February 1998 in association with ASCI. The programme introduced the concept of Concurrent Engineering, techniques used therein and specific applications of the same.

A Lecture on "Experience in Managing Technology at Balmer Lawrie" by Shri S K Sinha, former Managing Director of Balmer Lawrie was organized at Hyderabad on 6th January, 1998. The objective of the lecture was to disseminate the vision and highlights of his experiences of managing technology in a large public sector company for the benefit of senior executives from industry, financial institutions, research & consultancy organizations, academic institutes and others.

Active assistance was rendered in the organization of an International Conference on Management of Technology by Indian Institute of Technology, Delhi during 21-24 December, 1997. Two papers were presented on key subjects.

V(B). INDUSTRIAL TECHNOLOGY

1. INTRODUCTION

The industrial technology deals with the proposals received from Secretariat for Industrial Approvals (SIA) for grant of Letter of Intent, foreign collaboration from Indian entrepreneurs, foreign entrepreneurs/organisations, from NRIs and those willing to set up 100% export oriented project.

The broad activities are (i) receiving and examining proposals for grant of LOI, FC and import of CG, including those for 100% EOU and from NRIs (ii) participating in Approval Committees/Boards such as Licensing Committee, Project Approval Board and Board of Approvals for 100% Export Oriented Units.

2. INDUSTRIAL LICENSING

About 400 proposals for grant of Letter of Intent/ Carry-on-Business, Extension of Letter of Intent etc. were received during the year. The number of proposals have remained almost same as in the last year.

17 meetings of Licensing Committee were held by SIA during 1997. Almost all the meetings were attended.

3. FOREIGN COLLABORATIONS

During the year, the number of foreign collaborations and composite proposals exceeded 1000. Of these, the Department received around 200 proposals from Secretariat for Industrial Approvals as compared to 400 in the previous year. 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 13 meetings of the Board of Approvals for 100% Export Oriented Undertakings held by SIA.

4. INFORMATION/DATA PROCESSING

The Department has a database for Foreign Collaboration proposals and Composite applications since 1988. The data regarding Foreign Collaboration Proposals were updated for the year 1997.

The Department also maintained and updated the software for editing, preparing summary, processing and quick retrieval of the desired information. The software has been developed in-house for above mentioned proposals as well as approvals.

The Department also updated the software for editing, preparing summary, processing and quick retrieval of the information on proposals received under PATSER scheme. The software has been developed in-house for above mentioned proposals as well as approvals. Retrieval of information and updating of databases is continuously done with the help of the above softwares.

5. INTERNET

The Department is a subscriber to X400 Message Handling System of NICNET, the Network of National Informatics Centre. The E-Mail Address for the Department is dsir@x400.nicgw.nic.in. In the year under review, the Department also renewed its subscription to TCP/IP account of Videsh Sanchar Nigam Ltd. The E-Mail address for the Department is dsir@giasd101.vsnl.net.in.

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

1. OBJECTIVES

The TATT scheme mainly aims to promote and support activities towards the export of technologies, projects and services. The measures adopted include:

- Support to preparation of technology profiles of developing countries;
- Support to preparation of reports related to technology export capabilities and experiences in select industrial sectors;
- Publicity and dissemination of Indian 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 exports.

2. ACTIVITIES

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 reorganisation 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 has been generally towards commercialisation 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. Technical Advisory Committee was reconstituted during the year and fresh proposals for support under the scheme were considered. Details of some of the projects/

activities completed or in progress during the year under report are given below:

2.1 Compendium on Technology Exports from India

The work on bringing out a publication, providing ready information on exports of technologies including exports of turnkey and consultancy projects, consultancy exports and export of capital goods was continued during the year. A number of organisations including companies, export agencies and R&D institutions were contacted for soliciting information on exports of technologies and services during 1995-96. The information obtained is being compiled and a publication for 1995-96 is expected to be brought out.

2.2 A study on Capabilities for export of Non-conventional technology intensive consultancy services from India.

A study on export potential of non-conventional technology intensive consultancy services was carried out through IIFT. The study covers six areas, viz. technical education & training, hospitals and specialised health services, printing services, maintenance services, standardisation and quality assurance services and satellite mapping. The study highlights our capabilities to provide technology intensive services in six sectors. The report would include profiles of service providers in each of the six sectors. The study also contains an analysis of the WTO provisions on the general agreement on trade in services and recommends the potential areas where India can take advantage to tap the available opportunities. The draft report on the study was discussed in an evaluation committee meeting and the report is being finalised.

2.3 Seminar on "Supply Base and External Market Opportunities for some non-conventional type of Technology based Services from India".

Above seminar was planned to be held through Indian Institute of Foreign Trade (IIFT), New Delhi. The Seminar was expected to discuss India's Export Potential in 6 types of non-conventional technology based services viz. Super-Speciality Hospitals, Satellite Mapping, Standardisation and Quality Assurance Services, Printing Services, Maintenance and Materials Management Services and Technology Intensive Educational Services. IIFT has conducted a study on the above mentioned subject, which was supported by DSIR. The report on the study was expected to be deliberated

at length during the proposed Seminar. The Seminar was expected to be attended by about 150 participants from Government, Institutions and experts from 6 service sectors.

2.4 Export Market Development for Solar Photovoltaic Technology and Systems in select African Countries.

Central Electronics Ltd., Sahibabad was being supported to conduct a market survey in select African countries such as Uganda, Mauritius and South Africa for supply, installation and commissioning of sample Solar Photovoltaic Systems for demonstration purposes followed by transfer of technology for manufacturing SPV modules and systems. The project covers visits of CEL experts to the African countries to find out the potential and applications for SPV systems and technology and precise specifications of the equipment required in those countries, preparation of market promotion material such as brochures, pamphlets and video films, manufacturing of sample SPV systems based on the precise specifications, supply and commissioning of SPV systems, training of engineers from the African countries, preparation and handing over of technology transfer documentation etc. The sample SPV systems being supplied include SPV stand alone domestic lighting system, SPV stand alone street lighting system, SPV community room system, SPV system for primary health centre, SPV shallow well water pumping system, SPV deep well water pumping system, SPV lantern and portable manpack SPV battery chargers. The project is expected to generate substantial foreign exchange earnings in the form of know-how fees, royalty and sale of SPV modules, systems and components. Publicity material such as brochures and video film have been prepared. SPV systems have been supplied in Uganda. The scope of the project was broadened to cover export market development of SPV systems in a number of South East Asian, Middle East and African countries instead of restricting the export marketing to Uganda and Mauritius alone.

2.5 ESCAP Seminar on "National Policies and Technological Capability Building in Developing Countries", held during 17-19 November 1997 at New Delhi

The 3 - day ESCAP Seminar was organised by DSIR and ITPO with the support of APCTT and CDC during 17-19 November 1997 at India Habitat Centre New Delhi. The inaugural session of the seminar on 17th November 1997 was attended by around 90 participants which included representatives from 10 countries of the ESCAP region, delegates from UNIDO, ESCAP, select government departments, research institutions and industry in India. The participating countries were China, India, Iran, Kazakhstan, Malaysia, Pakistan, Philippines, South Korea, Thailand and Vietnam. ESCAP secretariat prepared 2 regional studies and

supported preparation of 9 studies for regional subgroupings. All the 11 studies were presented by the concerned resource persons and discussed in the seminar. The presentation of studies was followed by presentation of the Country Papers by the country representatives. A visit to the India International Trade Fair, 1997 was organised for the benefit of the delegates on November 19, 1997. The visiting delegates appreciated the Technology Exports Pavilion set up for the first time by DSIR and ITPO in which around 30 companies/organisations participated. A report on the seminar proceedings was prepared which was discussed and adopted in the concluding session on November 19, 1997.

2.6 Task Force for "Promoting Technology Exports from India".

The above task force was constituted in June 1997 with the following terms of reference.

- Examine need and relevance of technology exports and technology intensive exports.
- Drawing lessons from past experiences in technology exports.
- Review of present policy measures for technology exports in India.
- Strategy for enhancing India's contribution in the global technological markets.
- Recommending mechanisms and support systems for speedy implementation of policies and boosting technology exports.

Based upon interactions with industry representatives on 28th July, 1997 at New Delhi, on 6th August, 1997 at Bangalore and on 29th August, 1997 at Mumbai, discussions with other export promotion agencies, meetings of the task force members on 28th July, 1997 and 25th September, 1997 and the guidance of Chairman of the Task Force, a report of the Task Force for Promoting Technology Exports from India has been prepared.

The report suggests a target of Rs. 800 crores (about 50% per cent of technology payments made by India) for technology exports by the year 2002 as a short term goal and a target of 2% share of global technology exports as a long term goal. Some of the important recommendations made in the report are as follows :

- There is an immediate need to establish a Technology Export Promotion Council (TEPC).
- State level certification agencies should be recognised by the Central Government and Standards Certification Authority may be set up.
- Income Tax rebate at the rate of 150 % of earnings from export of pure technology viz. lumpsum fee from know-how export, royalties, etc. and 125 % of the earnings from technology intensive exports including services is recommended.

An annual compendium on technology exports may be brought out.

The Transfer and Trading in Technology (TATT) scheme of DSIR should be considerably strengthened to promote export of technology.

National Research Development Corporation should be strengthened to play a key role in technology exports. A revolving fund of Rs.10 crores per year may be allocated to NRDC for promoting technology exports from small scale units.

- Indian Patent Office needs to be modernised and Indian Patent Act needs to be amended to fall in line with TRIPS agreement under WTO.
- A National Information Infrastructure should be set up to link all manufacturers and exporters.
- Infrastructure facilities such as ports, highways, railways, power, tele-communications etc. need to be made efficient as well as reliable.

2.7 Technology Exports Pavilion in the India International Trade Fair November, 1997

A theme pavilion on technology export was set up at India International Trade Fair November, 1997 in association with India Trade Promotion Organisation. Around 300 sq. mtrs. of floor space was made available to participating companies and R&D Institutions, free of cost, to exhibit their technological capabilities. Around 30 companies and organisations participated in the theme pavilion and generated fairly good response from the visitors. Some of the companies also received enquiries for supply of technologies and services.

3. TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee was re-constituted during the year for the TATT and the Consultancy Schemes of DSIR. The Committee has around 15 representatives from concerned government departments, public sector undertakings, R&D and academic institutions. The committee met during December, 1997 to consider fresh proposals under the two schemes and approved a number of new proposals to be undertaken during the current year and the following year.

V(D) PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

Promotion and support to Consultancy Services was one of the initiatives of the Seventh Five Year Plan and is a continuing activity during the Eighth plan period. The activities have however been modified/undertaken as per the changing requirement in the emerging policy environment.

1. OBJECTIVES

The objectives of the Scheme are:

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

2. ACTIVITIES

The activities under the scheme were reviewed in December, 1992 in the light of the new policy environment. It was decided that the emphasis should hence forth be on support for consultancy for development and commercialisation of indigenous technologies, besides continuing the ongoing activities. At the same time, funding was to be only through PATSER window. Activities during the year were mainly towards enhancing the ongoing programmes as proposals for commercialising technologies were very few. Some of the programmes/ activities carried out during the year till January 1998, are briefly indicated below:

(a) Documentation of Consultancy Capabilities and Experiences

With a view to assess the status of consultancy capabilities in important sectors of economy as well as in almost each of the States in the country, studies had been commissioned through experts/ consultancy organisations and reports were prepared after detailed interactions and

discussions with the concerned agencies. These reports included profiles of consultants, facilities and infrastructure available and recommendations for strengthening consultancy capabilities in the concerned sector or the State.

About 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 status of consultancy services in India

Precise information is not readily available on the overall consultancy capability scenario in the country, at a single point/agency. To fill this gap, this study was taken up with the objective to compile information/data about the credentials and achievements of consultants including their profiles, through Consultancy Development Centre (CDC), New Delhi. The study is in progress.

(ii) Study on policies and incentives available to consultants in other countries.

With a view to have insights of various policies and incentives available to consultants in other countries for the promotion and development of consultancy profession, a proposal of such a study was under active consideration. The study is expected to have information/data of consultants in select developed and developing countries of the world, which will be analysed for the benefits and policy measures to be taken for the promotion and development of Indian consultants. The study is proposed to be taken up through CEAI.

(b) Promotion of Design Engineering 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 towards meeting the challenges of globalization, and thus become more competitive. These centres 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. Several proposals were being examined, including the following :

- * A proposal for setting up of "Design and Engineering" Centre for Food Processing Industry at Kanpur in Uttar Pradesh.
- * A proposal for setting up of "Consultancy Clinic" for Textile Industry at Bhilwara Industrial Estate, Rajasthan.

(c) Institutional Programme Support

DSIR has been supporting the capital and recurring needs of Consultancy Development Centre (CDC) established 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.

- i) Foreign Direct Investment (FDI) and Technology Flows from India, was presented in a Departmental meeting.
- ii) Policies and Measures for Promoting Technical Consultancy Services in India" - for the presentation in the ESCAP - TCDPAP Workshop on "Role of Consultants for Development of Infrastructure" held in October, 1997 in Dhaka, Bangladesh.
- iii) Appropriate Technologies for "Urban Development - Role of Consultants" for publication in the Nagarlok Patrika 1997 to be brought out by Indian Institute of Public Administration, New Delhi. This paper was also presented in the ESCAP - TCDPAP Workshop on "Role of Consultants for Development of Infrastructure" held in October, 1997 in Dhaka, Bangladesh.
- iv) Technical Consultancy Services in India - this article was published in Business Standard dated September 25, 1997 in India.
- v) Initiatives for Promoting Technical Consultancy Services in India - First National Consultancy Congress - Globalization and Opportunities was organised by Consultancy Development Centre (CDC), New Delhi on January 15 - 16, 1998.

Following reports were printed during the year:

- * Consultancy Capabilities in Sugar Industry in India

- * Consultancy Capabilities in Maintenance Services and Industrial Safety
- * Consultancy Capabilities in North-Eastern Region
- * Market potential for export of consultancy services from India

4. ADVISORY SERVICES

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

4.1 Committees

- i) Governing Council, Executive, Membership, and CDPA Committees of CDC.
- ii) Consultancy Committee of FIEO.
- iii) Programme Committee of WASME.
- iv) Board of Directors of U.P. Industrial Consultancy Ltd., Kanpur, UP.
- v) Selection Committee of Consultants for Study on Optical Glasses in India, by DST.
- vi) Expert Committee for viva-voce for the students completing evening certificate course, IIFT, New Delhi.

4.2 Seminars/Workshops/Meetings

- i) Technical and Organising Committee meeting of first National Consultancy Congress of CDC
- ii) First General Council meeting of "Technical Consultancy Development Programme for Asia and Pacific" and its Executive Committee meeting
- iii) Annual General Meeting of FICCI
- iv) Workshop on Promotion of Trade in Services organised by ITC Geneva, CII and Ministry of Industry, Govt. of India
- v) Video Conferencing for Technology Management Module for MBA programme of Indira Gandhi National Open University, New Delhi
- vi) Workshop on WTO - implications to India, organised by ASSOCHAM at New Delhi
- vii) Workshop-cum-training programme on Technology Exports from Export Oriented Units, organised by Confederation of Export Units, New Delhi.
- viii) TMM meeting for Communication, Networking and Intelligent Automation, I.I.T., Kanpur.

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 has a membership of about 170, 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, and has been awarded certificate for ISO-9000 by a Norwegian Company.

5.2 DSIR Support

An amount of Rs. 40 lakhs was provided as grant during 1996-97, and a release of Rs. 20 lakhs is made during 1997-98. The capital assets at CDC include computer system 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.

5.3 Technical consultancy Development Programme for Asia and the 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 businesses. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. The second meeting of Advisory/ Promotional Committee of TCDPAP was held during August, 96 in China in which CDC was again nominated to function as secretariat upto 2000 AD. The meeting was followed by an international workshop on 'Engineering Consultancy for the service of Economic

Development and Technology Transfer'. The first general council meeting of TCDPAP was held in Dhaka, Bangladesh in October, 1997 which was followed by an international workshop on "Role of consultants in infrastructure development". The important recommendation of the first general council meeting was that TCDPAP should be developed as an independent UN identity. The next Executive Committee meeting of TCDPAP is planned to be held in 1998 in Islamabad, Pakistan. Besides, ITC, ESCAP and APCTT and other agencies have supported CDC training programmes in the past.

5.4 Activities

Some of the salient features of the activities carried out by the CDC during 1997 are:

5.4.1 ISO Certification for CDC

During the year, ISO 9002 certificate was awarded to CDC by M/s Det Norske Veritas (DNV) for development and promotion of consultancy profession. The certificate was awarded to CDC on 7th August, 97 at a function presided by Secretary, DSIR & DG, CSIR.

5.4.2 Training

- * During the year, CDC initiated training in ISO 14000 Environmental Management System. Two Programmes were conducted which were well attended
- * During the year 1997-98 CDC is diversifying its training activities by conducting short term programmes for R&D labs, industry etc. The first short term programme on marketing of technologies for R&D institutions was conducted in August 1997 which was inaugurated by Secretary, DSIR & DG, CSIR. The second programme on project management was conducted during November 1997. Both the programmes were well attended.
- * The third batch of the MS Consultancy Management in collaboration with BITS, Pilani commenced in August '97 with 18 students out of which 4 were CDC trainees.
- * CDC organised 7 specially structured training programmes in ISO 9000 Quality Management System in Consultancy, Construction and health care sectors to train various organisations in the sectors in the design, development and implementation of ISO 9000 Quality Management System.

5.4.3 Consultancy in ISO 9000 QMS

During the year, CDC started consultancy in ISO 9000 Quality Management System for organisations for getting ISO 9000 Certification and bring improvements in their

functional areas. Two assignments of Rs. 9.31 lakhs professional fee were in progress. Further 6 assignments of Rs. 16.50 lakhs professional fee were under finalisation.

5.4.4 Study Assignment

The centre has undertaken two study assignments during the year. The study on Externally Aided Projects from UNDP has been successfully completed. The study on status of consultancy services in India from DSIR was in progress.

5.4.5 Database and Information Services

- * The database of Consultants and Consultancy Organisations was augmented during the year. About 1100 profiles of Consultants/Consultancy Organisations were added.

5.4.6 Developmental Services

- * During the year, the Centre started Mega Interaction meets in areas of interest to consultants. 3 meets have been successfully organised till date out of which 2 were outside Delhi.
- * During year CDC had close interaction with the Technical Consultancy Organisations (TCOs). 2 interaction meets were organised in collaboration with Technical Consultancy Organisations (TCOs). TCOs were also involved in the augmentation of database wherein profiles pertaining to regional consultants were obtained through them.
- * The Centre also initiated schemes for R&D experts as associates to utilise their expertise in various developmental activities useful to consultants.

5.4.7 International co-operation

- * The first meeting of the General Council of the Technical Consultancy Development Programme for Asia and Pacific (TCDPAP) followed by 3 day Workshop on "Consultancy in Infrastructure Development" was held in Dhaka, Bangladesh from 13-16 October 1997. The Workshop was attended by 7 member countries which comprised 22 foreign delegates and 5 delegates from Bangladesh. The Workshop had a total of 21 papers presented. The subjects covered a very wide array encompassing country status profiles on consultancy applications in projects of common interest.
- * The proceedings of the 2nd meeting of the advisory / promotional committee of the TCDPAP and of Workshop on "Engineering Consultancy for Service of Economic Development and Technology Transfer" held in August, 1996 in China were brought out.

- * ESCAP Seminar on "National Policies & Technological Capability Building in Developing Countries" organised by DSIR and India Trade Promotion Organisation with the support of APCTT & CDC was held from 17th to 19th November 1997 in New Delhi.

- * The Government of India (Department of Science and Technology) has proposed that CDC can serve as the focal point for promoting Intra - Regional Consultancy contracts and utilization of local consultancy resources, among Science and Technology Policy Asian Network (STEPAN) Member Countries. This proposal was made in the STEPAN workshop on Development of Science & Technology Management, held at Seoul, Republic of Korea, Sept., 24-26, 1997.

5.4.8 Publications/ Brochures of CDC

Brochure on Consultancy Business Development

The brochure gives details of the facilities available at CDC for Business Development of consultancy services. It has been widely disseminated.

Brochure on MS Post Graduate Consultancy Management Training Programme

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)"

The brochure gives information about the initiation and establishment of TCDPAP. It further highlights how consultants can avail facilities under this programme.

Directory of Members

Directory of CDC Members was brought out during the year. This directory gives profiles of 157 consultants/consultancy organisations and listing of another 17 members of CDC.

CDC Newsletter

3 issues of Newsletter on "Consultancy Vision" were brought out.

News Letter on TCDPAP Focus

First issue of the "TCDPAP FOCUS" was brought out and disseminated in India and Abroad. 2nd issue on ESCAP supported TCDPAP Focus was brought out.

First National Consultancy Congress

The above Congress was held on 15-16 January, 1998 at New Delhi, with its theme as "Globalisation and Consultancy Opportunities". The Congress was attended by about 250-300 Indian and foreign consultants, exporters, policy makers, industry representatives, R&D personnel, and others relevant to consultancy.

5.5 Revenue

CDC has made serious efforts to generate revenues on its own towards becoming almost self supporting in the long run. CDC has earned a record revenue of about Rs. 25 lakhs during the year 1996-97 from services rendered to various agencies, membership fee, sale of directories 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 forums on issues related to Technology Development and Technology Transfer in coordination 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 cooperation with Ministry of Commerce. The Department of Scientific and Industrial Research continued to play the role of a focal point for the APCTT. DSIR helped in preparing a brief covering technological issues for the use of Indian delegation to the 53rd Annual Session of ESCAP held in April 1997 at Bangkok.

Shri R.R. Abhyankar, Director, DSIR participated in the Thirteenth Technical Advisory Committee meeting of APCTT held during 23-25 November 1997 and the 12th session of the Governing Board of APCTT held during 26-27 November 1997 in Phuket, Thailand. These meetings

were attended by participants from Bangladesh, China, India, Indonesia, Islamic Republic of Iran, Kyrgystan, Nepal, Pakistan, Republic of Korea, Russia, Sri Lanka, Thailand and Vietnam.

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

Umbrella Agreement

'Umbrella Agreement' between the Republic of India and the State of Israel on Cooperation in the field of Industrial and Technological Research and Development was signed in New Delhi on 30th December 1996 in presence of the President of Israel and the then Prime Minister of India. The Agreement came into Force on 1 December, 1997. It is expected that joint industrial R&D projects may be taken up by interested Indian and Israeli companies for technology development under the above Agreement. It is also expected that broad cooperation among in-house R&D centres in industry in India and those in Israel would take place under the above Agreement.

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 access to information generated within the country, it is also necessary to draw from the externally generated information to support internal efforts on research and development. Information centres that have come up to serve the needs of different industries and R & D units are therefore required to be coordinated and organised into an integrated system to avoid a haphazard growth and duplication of activities and in conformity with national and international standards.

The National Information System for Science & Technology (NISSAT) programme envisages promotion and support to the development of a compatible set of information systems on science and technology and interlinking these into a network. The approach adopted is to bring the existing centres, systems and services to a higher level of operation so that the interests of the national community of information users could be better served. For this purpose, the programme also contemplates experimentation with and introduction of modern information handling tools and techniques and the development of endogenous capabilities.

2. OBJECTIVES

2.1 NISSAT functions with the following objectives :

- * Development of National Information Services
- * Promotion of Existing Information Systems & Services
- * Introduction of Modern Information Handling Tools & Techniques
- * Promotion of National & International Cooperation in Information.
- * Development of Indigenous Products & Services

- * Support to Education, Training and R&D in Information

Strategies

- * Emphasis on Contents Aspects
- * Use of Existing Infrastructural Facilities
- * Commercialisation of Information Services

NISSAT is being implemented through several sub-programmes which include *inter alia* :

- establishment of information centres in specific sectors, subjects and products
- development of information resource sharing systems like library networks, union catalogues and consultative committees
- establishment of international database access centres
- promotion of application of modern information technologies
- development of skills in information technologies and information handling tools, techniques and so on.

3. NISSAT INFORMATION CENTRES

3.1 Sectoral Information Centres

The major instrument for information resource development and dissemination is the information centre which provides bibliographic as well as factual and numeric information on a product, discipline or mission. A series of information centres (Table - 1) were established to create information awareness and to meet information needs of academicians, scientists, technologists, entrepreneurs, management executives and decision makers.

Table - VII-1 : NISSAT CENTRES

No.	Subject Area	Acronym	Host Institution
i)	Leather Technology	NICLAI	Central Leather Research Institute, Madras
ii)	Food Technology	NICFOS	Central Food Technology Research Institute, Mysore
iii)	Machine Tools & Production Engineering	NICMAP	Central Manufacturing Technology Institute, Bangalore
iv)	Drugs and Pharmaceuticals	NICDAP	Central Drug Research Institute, Lucknow
v)	Textiles & Allied Subjects	NICTAS	Ahmedabad Textile Industry's Research Association, Ahmedabad
vi)	Chemicals & Allied Industries	NICHEM	National Chemical Laboratory, Pune
vii)	Management Science	NICMAN	Indian Institute of Management, Ahmedabad
viii)	Marine Science	NICMAS	National Institute of Oceanography, Goa

The Information Centres were built around the existing information resources and facilities. They maintain extensive collections of published and unpublished documents in the form of books, periodicals, research reports, development and trade reports etc., in the relevant subject areas. Besides providing documents and preparing bibliographies on request, they offer SDI, CAS, reprographic, micrographic, industrial and technical enquiry, translation and other services.

3.1.1 The core activities of the NICLAI centre were focused on its development as a national centre for information on leather and allied industries. The areas of specialisation covered are:

- Leather Science and Technology, Footwear, Leather goods, Chemical engineering, collages, polymers, leather economics, biochemistry, etc.

- LESA (Leather Science Abstracts) is being regularly brought out. It also provides wide spectra of services including colour photography, slide making, video coverage. The centre provides CDROM services using BIOSIS and Document Delivery Services. NICLAI brought out seven publications during the period of report. The major databases developed using CDS/ISIS is LESA (Leather Science Abstracts), LECAT (Library Catalogue), PBCLRI (Publication of CLRI), PERHOI (List of periodical holdings of CLRI Library).

- The centre also created E-Mail facility for faster communication. Server facility has been established under ERNET and NICNET. NICLAI is actively participating in the MALIBNET, a cooperative network for effective resource sharing in the region. The centre also provides technical support to MCA students in the preparation of project reports as a part of their curriculum.

3.1.2 NICFOS centre is a Clearing house for all types of

information on food processing in the country and has initiated several information oriented programmes to fulfill the information needs of the food sector. The services provided by the centre include : Documentation services, Reprography, and computer-based SDI services. The regular publications of the centre include : Food Technology Abstracts (monthly), Food Digest (quarterly), Food Patents (quarterly) and Library Bulletin. The centre maintains seven databases on Food technology. Some of the databases serve as supplement to the foreign databases. The centre earned about Rs.5.00 lakhs from its services.

3.1.3 NICMAP is acting as a clearing house of information on Machine Tools and Production Engineering. It earns about Rs.13.79 lakhs from its membership subscription, sale of publications and document supply services. NICMAP maintains about 6 databases on Bibliographical, Statistical and Product categories. The centre is planning to host its data on TIFACLINE of CMC for on-line accessing by users.

The centre has already selected informatics and silver platter to publish and market its product "Metalworking Database CDROM" in the national and international markets.

NICMAP has provided consultancy to African Regional Centre for Engineering Design and Manufacturing (ARCEDEM), NIGERIA to evolve an information strategy for ARCEDEM and set up an information centre there. NICMAP also conducted sensitization programmes in different African countries to make them aware of the modern methods of information storage and retrieval.

3.1.4 The activities of the NICDAP centre include Publication of Drugs and Pharmaceuticals bulletins, document delivery services, query services on industrial R&D and patents, and database development.

The centre provides CDROM based services using Medline, Chemical Abstracts, Popline, Excerpta Medica, International Pharmaceutical Abstracts, Biotechnology Abstracts, Drug information, NUCSSI, PID Environment Asia and Current Contents. The centre also provides on-line services using Datastar - Dialog and STN. The centre has INTERNET connectivity through RENNIC.

3.1.5 Services provided by the NICTAS centre includes Literature Searches, Translation, Reference Service, E-mail facility, and CDROM services using TTD database and colour index. The Centre maintains six databases using UNIFY-RDBMS & Custom made software. NICTAS continued the Publication of TEXINCON and other State-of-art reports.

The centre achieved self-sufficiency since 1994 and established an on-line database search centre.

3.1.6 NICHEM centre continued to perform well during the year 96-97. About 70% of its services are provided for industry, primarily chemical and pharmaceutical industry. The services provided by the centre include reprography, document supply, translations, on-line search and patents. There has been a marked increase in the demand for patents and translation over the previous year. The revenue generation of the centre is Rs.32.42 lakhs including the receipt of Rs.9.04 lakhs from the on-line services.

The centre also set up an internet facility to provide information to the clients, ordering of patents and journal articles, on-line searching etc. The centre has a total of 125 deposit account holders who regularly use the resources made available by the centre.

NCL has an active research group in the area of polycarbonate process chemistry. An integral part of this activity is to track emerging patents in this area world wide and disseminate the information to research groups in an organised way. The centre is publishing a quarterly publication of "Polycarbonate Monitor".

3.1.7 The NICMAN centre was formally inaugurated on 29th November 1996. The centre is providing services using ABI/Inform, EconLit, F&S Predicasts and IMID databases. The centre developed a database consisting of records of current acquisitions, articles and news items from Economic times and Financial Express. The centre took initiatives in publishing its activities and tied up management development programme for extending information services to various programmes.

The centre is planning to provide industry and company information, develop a system for providing on-line delivery system, training in marketing of information products/services and internet technology for the other NISSAT centres, preparation of company profiles and preparation of Management Digest/ Executive summaries.

3.1.8 The NICMAS centre has just started its activities. It is maintaining three databases on Marine Science studies in Indian Ocean having more than 10,000 records, Directory of Indian Marine scientists and Contributions of NIO scientists. The centre provides SDI, CDROM based services, Document delivery and retrospective literature search services.

An Indian National Oceanographic Internet Server(INOIS) has been established under NICMAS. The bibliographic databases available with NICMAS have been transferred into web format and published in INOIS server. The centre has taken up the development of a unique oceanographic search engine "MANTHAN" on the web which would facilitate locating the oceanographic information/ data available on the web.

The future activities of the Centre include development of virtual marine bio-diversity museum over INOIS, on-line ocean building and simulation facility, value added services and facilities on demand to business houses and individuals and on-line teaching and consultancy in oceanography.

3.2 LISFORUM

An Electronic Mail Discussion Forum for providers and users of information services in India, called LISFORUM has been set at NCSI in Nov. 95. LISFORUM provides an E-Mail based electronic forum for its participants to discuss issues of relevance to library and information services. The facility is available to users of ERNET and other networks that have connectivity to ERNET.

3.3 VAPIS - Value-Added Patent Information System

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 competitions, innovations and the availability of foreign technology have 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 and Central Manufacturing Technology Institute at Bangalore to offer specialized, value added information services. The services are based on databases pertaining to US, European, World, Japanese and other patents available on CDROM. Separate subset of the database on Chemicals is located at NCL, Pune and on Engineering in CMTI, Bangalore. The information on patent and IPR legislations, etc. of various countries are located at patent office of CSIR.

The main objective of the centre is to take advantage of the expertise available with the host institutions to add value to patent information and offer such services to industry. The addition of value to patent information is made by analysing contents of the patents. Value addition to patent information involved understanding the contents of patents, and adding to them details of technology options, technology gaps, and other items of crucial information.

The orientation of the centres would be towards market needs with a clear indication of activities, target clientele and revenue earning projections.

4. INFORMATION RESOURCE SHARING

With a mandate to facilitate provision of broad based information services in the country, NISSAT has taken the initiative for promoting resource sharing activities. These initiatives are aimed at ensuring better utilisation 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.

4.1 Library Networks

The ultimate goal of information/library networks is to interlink information resources in a metropolitan area such that users could access information irrespective of its location, format, medium, language script etc. Further, the development of such networks requires actions on several areas such as — training, rationalization of information resource acquisition, diffusion of standards, preparation of union lists, generation of database services apart from setting up hardware, software and communication facilities. To meet this end, the NISSAT has initiated library/ information network development activities such as: ADINET in Ahmedabad, BONET in Mumbai, CALIBNET in Calcutta, DELNET in New Delhi, MYLIBNET in Mysore and PUNENET in Pune.

NISSAT strives to develop self-sustaining information systems. With this end in view, NISSAT only goes to the extent of setting up general infrastructural facilities like network service centres including hardware, software, manpower and other organizational requirements, communication facilities etc. With a change in the development and implementation strategy, the participating institutions in a network are to arrange their own terminal hardware, software, manpower and data conversion.

4.1.1 ADINET has 22 institutional members, five associate institutional members and five professional members. A centralised database has been created at ADINET which contains Institute Master, Journal Master and Book database. It has a Union List of Periodicals containing current information on over 3800 journals subscribed in 70 libraries in Ahmedabad. It also organised twelve workshop in areas

such as library automation, Email, Use of CCF & AACRII etc, and organised 17 local lectures of interest to ADINET participant institutions.

Other services provided by the net include Email, Internet, CDROMs and Photocopy. ADINET provided email connectivity to 30 libraries of Ahmedabad.

4.1.2 About 36 libraries have been networked under BONET through an IIP027 computer named SAKTI for providing access to members. BONET has 12 members. Services that are offered by BONET include : UNICAT - On-line catalogue of periodicals in member libraries, Access to on-line information on books in member libraries, Inter-library Lending Service for books and periodicals, Inter library Request service, On-line access to foreign library catalogues and commercial databases. BONET provides its members the hard copies of the catalogue of periodicals which can play a significant role in the rationalization of periodical acquisition.

4.1.3 CALIBNET has adopted a two way system for networking i.e. (i) the network route with a library automation and networking through its own application software "Maitrayee" and (ii) the e-mail route connecting member libraries with on-line access to various databases within network and Internet access.

The services provided by CALIBNET include Email access, Internet access, CDROM searches, On-line searches, Photocopy services, implementation, diffusion of standards, training and skill development. CALIBNET offers information on global markets, technologies, patents, business environments, industries etc. CALIBNET offers to convert on request existing card catalogue into machine-readable local databases by downloading of relevant records from LCMARC database. It also offers name and subject authority files of U.S. Library of Congress to help standardisation of library management functions.

4.1.4 MYLIBNET is the first library network established in a small city. The launching of MYLIBNET in association with Mysore City Library Consortium (MCLC) took place in 12th June 1995. Presently 16 institutions are actively involved in networking programme and all of them have been provided with email facility. The holding list of Mysore city libraries has been computerised and a software has been developed to enable the users to access the software on-line. MYLIBNET provided Email facilities to its members and organised 9 workshops and seminars on subjects like Multimedia applications in Library, Bar code applications, Networks, Internet etc.

4.1.5 Presently 36 libraries and 15 professionals from Pune city are accessing the PUNENET through modem. The users not only access PUNENET data, but also use the E-mail and Internet facilities. PUNENET provides links to Dialog,

Datastar home pages on internet. ISO 2709 format conversion routine was developed to enable PUNENET database adhere to the ISO standards. The routine can import or export records in the ISO 2709 format. PUNENET provides SDI and CAS services with help of various bibliographic databases on CDROM.

4.2 E-Mail Connectivity

NISSAT has established E - Mail connectivity with its information centres, library network societies, etc. through ERNET. This connectivity greatly enhances the resource sharing capabilities among these centres and also the provision of user services more efficiently. The ERNET group of the Department of Electronics, Government of India has provided the overall know how in this venture.

5. SDI/CUSTOM SEARCH : ONLINE AND CDROM BASED

5.1 NISSAT Online Access Centres to International Data Services.

In order to bring the information support services to the scientists and technologists in India on par with those available to their counterparts in the developed countries, NISSAT has established nine NISSAT Access Centres to International Database Services - NACIDS. The following centres listed in Table - VII - 2 have been providing services during the period of report.

TABLE - VII-2 : NISSAT Access Centres to International Database Services (NACIDS)

S.No.	Place	Host Institution
i)	Madras	Central Leather Research Institute
ii)	Pune	National Chemical Laboratory
iii)	Ahmedabad	Ahmedabad Textile Industry's Research Association
iv)	Bombay	Victoria Jubilee Technical Institute
v)	Hyderabad	Centre for Cellular & Molecular Biology
vi)	Thiruvananthapuram	Kerala State Industrial Development Corporation

NACIDS have trained intermediaries to assist or conduct online searches. The centres are gaining popularity considering that there is an increasing number of searches and the full search costs are recovered from the customers. Some of the centres have become self supporting.

5.2 CDROM Depository Centre

The NISSAT established a facility at Foundation for Innovations and Technology Transfer at Indian Institute of Technology at New Delhi in 1996, as a depository centre for acquiring all CDROM databases on India and about India.

Some of the collections of the centre include Business India Electronic Corporate Directory, Environment Asia, Gandhi Goa - The Pearl of Asia, Guru Nanak CDROM, Health Asia Hindi English Dictionary, India Mystica, Invitation India Information Interactive on Rajasthan, Innaware Educational CDs, Innovation India CD-ROM, Iyengar's Yoga for all Kompass India 96, Mythological collection on CDROM Suchak, Karishma, Taj Mahal, Wealth Asia, Yellow Page, etc.

6. INFORMATION TECHNOLOGY APPLICATION

The demand for use of computers ranges from automation of routine management functions in libraries to information retrieval or analysis of global databases. Since 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 from UNESCO. NISSAT subsequently obtained the official rights for distribution of the two packages in India.

As on date, there are about 1400 installations of CDS, ISIS and 47 installations of IDAMS in India. The implementation of CDS/ISIS is monitored regularly through exchange of information, user's group meetings and periodic surveys.

"SANJAY" is one of the major tools developed with the initiative of NISSAT to help the libraries and information centres in India to improve their housekeeping and service function through automation. The package is totally menu driven and can be used even by non-professionals.

NISSAT also developed another CDS/ISIS based package, known as TRISHNA. The TRISHNA supports the use of CDS/ISIS using a GIST CARD for materials in Devnagari and several other Indian scripts. This package was distributed to ASTINFO member countries like Nepal & Bangladesh.

7. DEVELOPMENT OF SKILLS IN INFORMATION TECHNOLOGIES

The education and training of information personnel in handling the modern information handling tools, techniques and information technologies was another area of thrust. Although, existing library and information science courses have been undergoing changes to incorporate modern developments in the information field, there is a need to supplement these with continuing education programmes at various levels.

In view of the situation, NISSAT encourages and supports a variety of manpower development programmes which cover topics such as application of computers in library and information centres, use of personal computers & CDS/

ISIS, TQM in library services, Science and technical communication, Scientometrics & Bibliometrics, Computer Cataloguing, CDROM/ Online search, Modern information access facilities to business and industry etc., in various parts of the country.

8. RESEARCH & DEVELOPMENT AND STUDIES.

NISSAT also promotes and supports studies, preparation of directories, databases, basic and applied research in information science etc., The list of such projects/ efforts is given below :

Table VII-3

S. NO.	ACTIVITY	INSTITUTE
i)	Development of databases on manufacturing of various kinds of Ferrous & Non-ferrous & Special Castings	IIF, New Delhi
ii)	Beyond Institutional Boundaries: A study of collaborative linkages of Indian science through Bibliometrics Indicators	NISTADS, New Delhi
iii)	Preparation of basic course materials for organising a series of workshops on patent information for R&D and business based on case studies.	NISTADS, New Delhi
iv)	Directory Database of Chemical and Pharmaceutical Industries	NCL, Pune
v)	Industrial Innovation Indicators A Pilot Study	NISTADS, Delhi
vi)	Establishment of Indian consultancy website	CDC, New Delhi

9. SCIENTOMETRICS COORDINATED PROGRAMME.

Plan of action for Scientometrics & Informetrics in India was prepared to identify the main areas in Scientometrics and informetrics with due regard to intellectual and economic gains, the investments necessary and the infrastructure already existing in the country. NISSAT has taken up the implementation of a programme of coordinated research in the area of Scientometrics/ Informetrics/ Bibliometrics. As a first step towards this, nine projects on "National Mapping of Science using CDROM databases" like Chemical Abstracts, Compendex, Inspec, Science Citation Index, Medline plus, EMBASE, Georef, MATHS Sci, CAB, AGRICOLA, ISA etc has been taken up.

10. INTERNATIONAL ACTIVITIES

The activities of ASTINFO/UNESCO (Regional Network for the Exchange of Information and Experiences

in Asia and the 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. The activities under ASTINFO are given below:

NISSAT secretariat has been awarded a UNESCO project for the establishment of the "Clearing House on CDS/ ISIS software and creation of Database on library network experts in ASTINFO region" under the Participation Programme. NISSAT also organised UNESCO Sub-Regional workshop on IDAMS.

NISSAT signed an MOU with SNTD Bombay, the MINISIS Resource centre in India for undertaking all activities relating to the promotion, installation and training courses on MINISIS, a relational database management system.

11. MONITORING AND COORDINATION

11.1 Promotion of NISSAT activities, products & services

In order to reduce the dependence on government investments for the development of scientific & technical information infrastructure in the country, the NISSAT products and services are to be marketed aggressively. In this regard several measures have been taken for market promotion. For example, operative level personnel from various NISSAT information centres have been given orientation courses on information marketing. NISSAT supported centres are being encouraged to generate revenue and to plough back this revenue for the development of the centre.

NISSAT entrusted the responsibility of marketing the products and services produced/generated by NISSAT to one of its information centres namely NICTAS at ATIRA, Ahmedabad. NISSAT signed an MOU with ATIRA for this purpose.

11.2 Information Today & Tomorrow (ITT)

NISSAT Newsletter namely ITT gives an overall view of developments in information products, services, systems and technology. This covers wide ranging issues relating to information and development of information centres and networks. News items like new concepts and services, events like seminars and training courses, new products like directories and information on status of information systems - at both national and international levels and trends in their development are covered.

Produced quarterly in cooperation with one of the centres of NISSAT at CLRI, Madras, it is distributed to 5000 individuals and institutions. The NISSAT Newsletter enjoys user appreciation and high professional esteem in India.

VIII. PUBLIC ENTERPRISES

VIII(A). NATIONAL RESEARCH DEVELOPMENT CORPORATION

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 year 1996-97 continued to be challenging for the Corporation. Nevertheless the overall performance of the Corporation has been quite satisfactory. In spite of setting up of separate In-house technology transfer organisations/cells by various R&D Organisations, Corporation with sustained marketing efforts has earned Lumpsum premia and Royalty of Rs.198.76 lakhs from the licensing of indigenous technologies in 1996-97 as compared to Rs.168.00 lakhs in 1995-96, an increase of 18.30%. The Corporation has earned a gross profit of Rs.26.28 lakhs.

2. PROFIT

Due to sustained hard and dedicated work of its executives and staff, Corporation continued to earn a profit. During the year the Corporation has earned a gross profit of Rs. 26.28 lakhs against Rs.35.67 lakhs in previous year. The fall in profit was due to the challenges posed by the highly liberalised industrial policy for the import of technology of the Government and slow down in the industrial growth in the country particularly for setting up projects based on indigenous technology.

The gross income of the Corporation from all sources, including premia and royalty, but excluding Grants-in-Aid, was Rs.291.72 lakhs as compared to Rs.278.22 lakhs in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

The Corporation continued its efforts to widen its technology resource base by tapping new sources of technologies. In this endeavour the Corporation signed MOU with the Central Manufacturing Tool Institute, Bangalore and Indian Renewable Energy Development Agency, New Delhi for the commercialisation of their technologies. During

the year, 24 new processes were assigned to the Corporation. Some of the commercially important processes assigned to the Corporation during the year were:

- Microprocessor Based Single Phase Energy Meter
- Biofertilizer
- A Biocatalyst for the Preparation of Invert Sugar Syrup from Aqueous Solution and a Method of Making the same
- Hydroxyapatite Coated Titanium Dental Implant for Single Tooth Replacement
- A process for Production of Biopesticide (Nimbecidine)

Due to intensive marketing efforts during the year 31 licence agreements were signed as compared to 34 in the previous year.

4. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during 1996-97 are:

- Gallium Metal
- Invert Sugar
- Glycol Based Antifreeze Coolant
- Spice Oleoresins
- Form-Fill- Seal Machine for Odd Shaped Components
- Special Blister Packaging Machine
- Air & Nitrogen Atomised Extra Fine Non-ferrous Metal Powders
- High Grade Pectin from Lime Peels
- Development of High Performance TMS 320 C 30 Based DSP Card for IBM PC- AT Computers with Relevant Softwares.
- Blood Bag

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 major technology development projects is given below:



VII.1 First Workshop on Patent Information in R&D and Industry



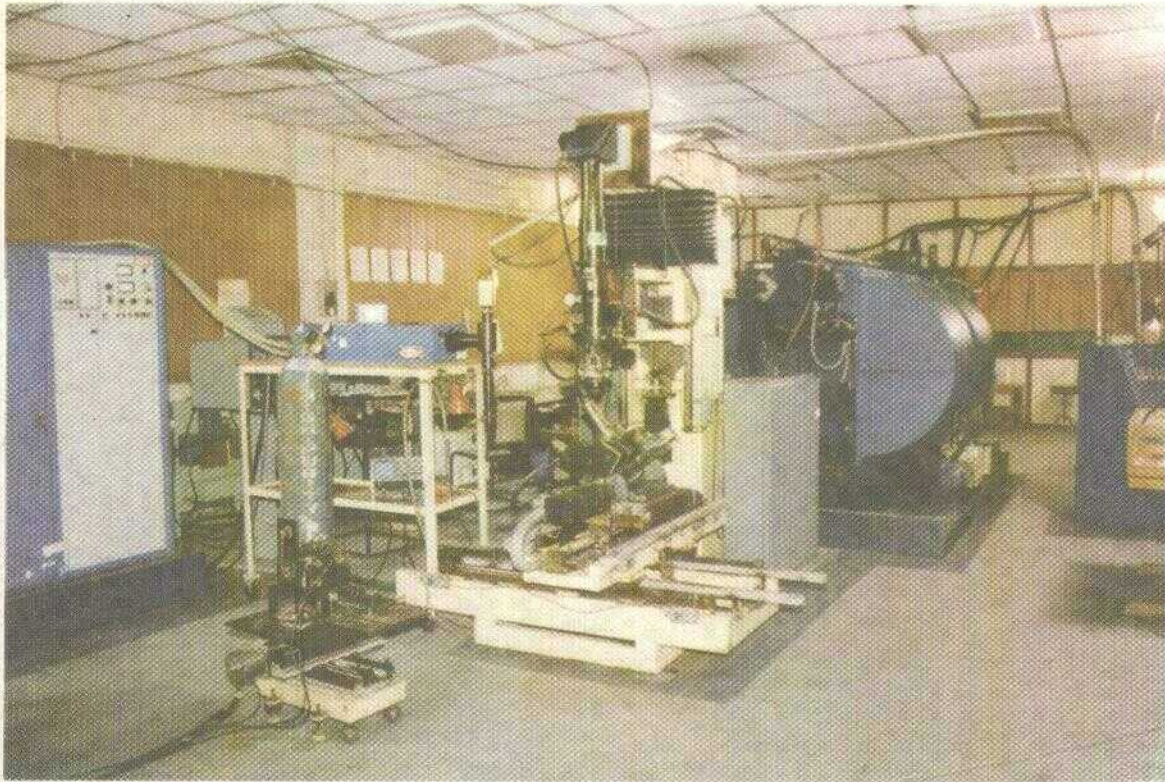
VIII.A.1 Sterilization and packing of Intra Ocular Lenses



VIII.A.2 Clinical Trials of Thrombinase at Malladi Research Centre



VIII.A.3 Novel Process and the Device for Reduction Roasting of Manganese Ore



VIII.A.4 Chemglaze process for improving fatigue crack growth resistance by laser beam



VIII.A.5 Rural Technology Awareness Programme in progress



VIII.A.6 Popularization of Mushroom Technology in Garhwal, UP



VIII.A.7 Samples of Doors of Rice Husk Particle Boards manufactured by M/s. RH Board SDN BHD, Malaysia under licence from NRDC.

5.1 Completed Projects

i) Sand Lime Bricks

Sand Lime Bricks are calcium silicate bricks and considered to be advanced building materials having a number of advantages over conventional bricks. The Central Building Research Institute, Roorkee of CSIR had carried out extensive research and development work to produce good quality Sand Lime Bricks. However, no party was interested in taking up the knowhow due to the low cost production of conventional bricks. With financial assistance in the form of Rs.10 lakhs as equity and Rs.340 lakhs by way of term loan from HUDCO and equity participation by the Corporation to the extent of Rs.30 lakhs the Corporation could licence the process to M/s Perival Bricks Pvt.Ltd., Sri Dungargarh (Raj.). A plant with the capacity of 30 million bricks per annum has since been commissioned and is in commercial production.

ii) Glucose Biosensors

The National Physical Laboratory in collaboration with the Centre for Biochemicals, Delhi and the Indian Association for the Cultivation of Science, Calcutta have designed and developed a Glucose Biosensor for the estimation of blood sugar in human beings. The Corporation provided a financial grant of Rs.1.5 lakhs to NPL for the fabrication of 50 prototypes of such Glucose Biosensors and 50,000 glucose biosensor strips in order to conduct field trials to generate confidence among entrepreneurs. NPL has already made prototypes of the Glucose Biosensors. The Corporation has licensed the knowhow to two parties which have commenced production.

iii) Single Piece Intra Ocular Lenses (IOLs)

The Venu Eye Centre, New Delhi has indigenously developed the process for the manufacture of single piece IOLs for the first time in the country. Keeping in view the increasing demand for single piece intra ocular lenses in the country, M/s Venu Eye Centre has formed a company Vision Surgicals Pvt.Ltd. to manufacture single piece IOL. NRDC has participated in the equity of the new company to the extent of Rs.12 lakhs (49% of total equity). The work has since been completed and the Company is marketing the product.

5.2 On going projects

Thrombinase - a blood clot dissolving agent

Thrombinase, a novel blood clots dissolving agent has been isolated, identified and purified for the first time from a Bacillus species at Vector Control Research Centre, Pondicherry. However, the new compound needs to be evaluated through basic toxicological studies followed by clinical trials. The Corporation in collaboration with Malladi

Research Centre, Madras is carrying out joint development work at a cost of Rs.80 lakhs which is to be shared equally. The work on the project started in June 1996. A sum of Rs.13.25 lakhs has already been released. The work is progressing satisfactorily.

The Corporation has filed patent applications for the process in India, USA, EPO (Germany, Switzerland, Belgium and UK). Patent in USA has already been awarded.

6. PROJECTS SUPPORTED BY DEPARTMENT OF SCIENTIFIC AND 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 Company concerned and third party licensing. A few of the major projects undertaken during the year under the PATSER are:

- Air Circuit Breakers (ACB) with enhanced short circuit current level by M/s JSL Industries Ltd.
- Upgradation of the Solar Cells by Central Electronics Ltd.
- Development of technology for new and/or modified polyimide resins, their precursors and modified phenolic resins & evaluation of their new applications by M/s.ABR Organics Ltd.,
- Development and process of manufacture of pyrazinamide through catalytic route by reacting ethylene diamine and propylene glycol to give methyl pyrazine followed by ammoxidation and hydrolysis to give pyrazinamide by M/s Southern Petro Chemical Industries Corporation Ltd.

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 get market surveys prepared on commercially important technologies by commissioning professional market survey agencies for the purpose. During the year, market survey reports on the following items were completed:

- Inhibitor for pickling of steel in HCl Solution
- Industrial Enzymes
- Concrete Block Making Machine
- Shrimp feed processing

- Miniclimbing crane
- Titanium tooth implant
- Bakery Margarine
- Near Net Shape Forging

8. INVENTION PROMOTION PROGRAMME

The Corporation continued to promote and encourage inventive talent amongst scientists, engineers, industrial workers and students by awarding prizes to meritorious inventions and providing financial assistance for fabricating prototypes setting up pilot plants to prove such inventions.

During the year, the Corporation received 43 proposals for prize awards and 16 proposals for providing financial assistance. The Corporation announced on Independence Day (1996) cash awards amounting to Rs.1.25 lakhs for 3 inventions. On Republic Day (1997) cash awards amounting to Rs.1.60 lakhs for 3 inventions were announced.

World Intellectual Property Organisation (WIPO) Gold and Silver Medals have also been awarded to 2 inventions that are suitable for developing countries.

Some of the meritorious inventions recognised through awards during the year were:

- * A Novel Process for Reduction Roasting of Manganese ore and device therefor.
- * Dual Polarized VSAT Antenna Feed
- * Wide L&C Band Antennas for Remote Controlled Aircraft.
- * Chemglaze: A Process for improving Fatigue Crack Growth Resistance by Laser Beam.

The Corporation also provided financial assistance to two inventors for fabricating prototypes/setting up pilot plants.

8.1 Patent Assistance

Keeping in view the globalisation of economy, the significance of Intellectual Property Rights is increasing. With this end in view 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 received 65 applications from individual inventors for such assistance. Assistance was granted to 35 inventors based on the patentability of the inventions involved and 30 patent applications were also filed on behalf of different R&D organisations.

9. DEVELOPMENT & PROMOTION OF RURAL TECHNOLOGY

The programme aims at the application of S&T for improving the standard of living of our rural people by

increasing employment potential through the development and application of appropriate rural technologies utilising local resources. With this end in view, the Corporation continued the programme of Development and Promotion of Rural Technology.

10. DEVELOPMENT PROJECTS

10.1 On Going Projects

i) Latex Based Products from Cactus

The Corporation funded a project at Shri Ram Institute for Industrial Research, Delhi for setting up a pilot plant for the production of products from the latex of the euphorbia plants abundantly available in our arid and semi-arid zones. The work on the project has been successfully completed and a pilot plant having a latex processing capacity of 50 litres/day has been set up at Sriram Research Institute for Industrial Research, Delhi. Using that pilot plant, some latex based products such as water emulsion paints were prepared for techno-economic evaluation. The Corporation is providing a sum of Rs.1.5 lakhs for setting up a production-cum-demonstration unit in a euphorbia growing area of Dehradun in collaboration with a voluntary agency Ashraya, Dehradun.

ii) Design and Development of Direction Finder to Locate Radio Distress Signals from Fishermen at sea

The Rural Electronics Group of the Electronic Research & Development Centre (ER&DC), Thiruvananthapuram of Department of Electronics has developed a sea-water proof, floatable, Radio Beacon for use of fishermen who go to sea in open boats without any form of safety equipment or means of communication. Keeping in view the usefulness of the device, the Corporation has provided a financial grant of Rs.2.30 lakhs to ER&DC for the design and development of a Direction Finder to work with the Beacon. ER&DC has already made one prototype of the device. The Monitoring Committee has suggested some modifications in the prototype which are underway.

11. RURAL TECHNOLOGY DEMONSTRATION CUM TRAINING CENTRES (RTDC)

The methodology adopted by the Corporation is to demonstrate the utility of its rural technologies and ensure their faster dissemination by setting up RTDC Centres in collaboration with voluntary agencies in various regions of the country. Pursuant to following this approach, besides strengthening 5 of the existing 52 RTDC Centres by providing additional items, the Corporation has also opened 2 new Centres at Hazaribagh (Bihar) & Pauri Garhwal (UP) during the year.

12. TECHNOLOGY AND PROJECT EXPORT

The Corporation continued its efforts to export Indian technologies and technical services to developing countries of South East Asia, Africa and Latin America. During the year the Corporation completed the preparation of 40 Project Profiles for Industrial Projects Services, Addisbaba, Etheopia on a fee of Rs. 1.14 lakhs.

The Corporation has also been able to generate interest in parties from Vietnam, Indonesia, Malaysia, China and Japan in some of the Corporation's technologies particularly for Rice Husk Particle Board and the blood clot removing pharmaceutical, Thrombinase.

13. FOREIGN EXCHANGE EARNINGS

The foreign exchange earnings of the Corporation amounted to Rs. 1.21 lakhs in 1996-97 as compared to Rs. 52.35 lakhs during the previous year.

14. 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 publications:

Awishkar - (Monthly in Hindi) Invention Intelligence (Monthly in English)

The following special publications were also brought out by the Corporation during the year:

- "NRDC at Your Service"
- "NRDC Technologies"
- Corporate Brochure - From Minds to Global Markets

15. SALE OF DSIR PUBLICATIONS

The Department of Scientific and Industrial Research has entrusted NRDC with the marketing and sale of their publications on Technology Status Studies/Technology Evaluation Studies/Project Profiles/Consultancy and other Studies and Handbook of Foreign Collaboration Approvals (1981-90). During the year, the Corporation sold 259 reports valued at Rs. 01 lakhs.

16. 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. With this end in view, the Corporation participated in exhibitions, seminars and get-togethers organised by various agencies as detailed below:

- (i) Chinese Technology Show, New Delhi (8-11 April, 1996)
- (ii) Lab. 96, Bangalore (7-10 June, 1996)
- (iii) Made in India Show at Nairobi, Kenya (15-18 August, 1996)
- (iv) Life-2000 '96, Bombay (2-5 October, 1996)
- (v) Vietnam-96 SME INTEREXPO-2, Vietnam (10-16 November, 1996)
- (vi) IITF '96, New Delhi (14-27 November, 1996)
- (vii) Science Fair, New Delhi (21-25 January, 1997)
- (viii) Osaka International Technology Exhibition (TECHNOMEFFE Kansai) AT OSAKA, JAPAN (24-26 February, 1997)
- (ix) India Intech Mart '97, Bangalore (19-22 March, 1997)

17. 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. The Corporation also publishes a popular science and technology monthly in Hindi, entitled Awishkar. To popularise the use of Hindi, the Corporation celebrated the "Hindi-Pakhwara" from Sept. 14-29, 1996. Two workshops on "Hindi-Grammer, Drafting & Noting" and "Official Language Policy & Implementation" in Hindi were conducted on 25th June 1996 and 18th March, 1997 respectively. The Hindi-English Glossary of Administrative Terminology was distributed during the workshops. Under the Hindi Incentive Scheme, certificates and cash awards were also given to selected staff members for their use of Hindi in official work. Two stenographers were sent for training in Hindi typing.

VIII(B). CENTRAL ELECTRONICS LIMITED

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 developments and from the country's National Laboratories, for its production programmes in diverse hi-technology areas of National Relevance. The activities of CEL are sharply focussed in three thrust areas:

- (i) Solar Photovoltaic Cells, Modules and Systems for a variety of both Rural and Industrial applications.
- (ii) Selected Electronic Systems - Equipment for Railway Signalling and Safety, Cathodic Protection Equipment for Oil Pipelines, Rural Automatic Exchanges (RAX) 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 an internationally recognised status of being among the top few producers of Single Crystalline Silicon Solar Cells in the world.

2. PERFORMANCE IN 1996-97.

2.1 Operating Results:

The production and sales achieved during the year as compared to the previous year are given below :

	(Rs.in crores)	
	1995-96 ACTUALS	1996-97 ACTUALS
PRODUCTION	37.96	61.38
SALES	50.12	60.57

2.2 Highlights of Operations :

2.2.1 Solar Photovoltaics (SPV)

In the Solar Photovoltaics Group, 1644.87 KWp of SPV Cells/ Modules were produced and 1741.99 KWp of SPV Modules were sold as against 996.03 KWp and 1452.29 KWp respectively in the previous year. A total of 13000 Nos. SPV Power Sources were supplied to DOT for its Rural Telecom Network as against 11310 SPV power sources supplied during the last year.

18 Nos. of Very Low Power TV Transmitters were supplied to Doordarshan during the year.

In the 3rd year of the National SPV Pump Programme of the Ministry of Non-conventional Energy Sources (MNES), the Company supplied 14 Nos. of SPV Pumps to various users through Indian Renewable Energy Development Agency (IREDA).

During the year, 1500 Nos. of SPV Lanterns as per the MNES specifications were supplied.

The Company has also supplied 550 KWp (approx.) of SPV Modules to various customers including nodal agencies and Govt. Departments/Public Sector Undertakings.

The Company also received a major order worth Rs. 10 crores (approx.) from the Ministry of Rural Development for supply and installation of 200 Nos. of the Deep Well Water Pumping Systems. The work of site survey was in progress during the year and the installation and commissioning of these systems is expected to be completed in 1997-98.

Exports

The Company has successfully executed export orders (directly and through Ministry of External Affairs) of 76 KWp of SPV Cells, Modules & Systems consisting of Domestic lights, Street Lights, Solar Water Pumping Systems, Solar Lanterns, etc., to various countries namely Italy, Egypt, Mali and Syria.

Company has for the first time set up a SPV Panel Manufacturing Plant in Syria for which complete technology and raw material support has been provided by the company. This is a first of a kind example of South - South Co-operation and export of technology from a developing Country in Solar Photovoltaics area.

2.2.2 Electronic Systems

The System Group produced 13449 Nos. of Charge Controllers for the SPV power systems for the DOT's Rural Telecom Network. 150 Nos. of Universal Axle Counters were sold during the year. 6 Nos. of PTV's were also sold during the year.

The Group produced and supplied 8 Nos. of VSATs using know-how from C-DOT to C-DOT/DST against orders received from them and obtained further order for 21 Nos. of VSATs which will be supplied during next year.



VIII.B.1 CEL's SPV Street Lights installed near Muscat in Oman (shown in inset) being inaugurated



VIII.B.2 Features of the SPV powered Traffic Signal System (inset) being explained to Secretary, DSIR

Against the Turnkey Order valued at Rs.2.73 Crores obtained from Indian Oil Corporation Limited, for supply of Cathodic Protection Systems in Chakshu-Panipat Pipeline, major part of the work on the mainline had been completed during the year and the balance is to be executed early in the next year.

The System Group has obtained a prestigious turnkey order of value Rs. 14.50 Crores from the Gas Authority of India Limited against Global Tender, for the supply of Captive Power Generation and Cathodic Protection System for the HBJ Pipeline Project. This Project funded by the Asian Development Bank is a deemed export project. The entire work on this project is likely to be completed before 1998.

For the execution of this Project the Company will be inducting the technology for Thermo Electric Generators (TEG) in Collaboration/Association with a Canadian Company, thus adding to its list of technologies held.

2.2.3 Components

In the Ferrites Plant, in addition to the normal mix of Ferrite Cores, 2000 Nos. of C-Band Microwave Ferrite Yokes and Rods were successfully completed and supplied for the Phase Shifter Assemblies.

The Company also supplied 7000 complete PZT Electric Systems to the Defence for their 84 mm Carl Gustaf ammunition. A further order for 12000 Nos. of the same was also received which will be supplied in the next year.

The Company supplied 2000 Nos. of C-Band Phase Shifters against the order received from Electronics Research & Development Establishment (LRDE), Bangalore of Defence Research and Development Organisation (DRDO). The Company had also supplied 59 Nos. of Frequency/Phase Correlators to Defence Electronic Research Laboratory (DLRL), Hyderabad.

The Microwave Division has also successfully productionised and supplied 2 Nos. of Direction Finding (DF) Systems during the year. The Division has also secured orders for 1000 Nos. of C-Band Phase Shifters, 25 Nos. of Phase Correlators for supply in the year 1997-98. In addition, orders for a number of new products for use in Electronic Warfare Systems namely Millimeter Wave Components, Detector Log Video Amplifier, Microwave Sub-systems, Spiral & Biconical Antennas, have been secured from the DRDO Labs, to be executed in the year 1997-98.

Exports

The Component Group exported 13900 Nos. of Piezo Ceramic Tubes for the third successive year with likely further recurring export orders for 20000 Nos. for this component.

3. OTHER HIGHLIGHTS OF 1996-97

3.1 Visits of Important Dignitaries:

The Company remained an attraction point for various important International/National dignitaries. As in the previous years, a number of VIPs visited the Company particularly the SPV Plant. These included foreign delegations from Muscat, Australia, South Africa, Cuba, Saudi Arabia, Bangladesh and Iran. The other notable visitors were:

Air Marshal S. Krishna Swamy, DCAS, Shri Jitendra Choudhary, Minister for Science and Technology & Environment Govt. of Tripura, Shri R.A. Mashelkar, Secretary DSIR and DG - CSIR, Dr. V. Bhaktavatsalam - MD, IREDA, Shri N.K.Sharma - MD NRDC, Mrs. Anita Soni, Prof.(A), NIFM and Shri P.C.Verma, DG - RDSO, Lucknow etc.

3.2 Voluntary Retirement Scheme :

During the year company re-introduced the Voluntary Retirement Scheme aiming at reducing the manpower and to bring down the fixed costs. The unspent balance of Rs.127.25 lakhs out of the grants received during 1995-96 was utilized to relieve 28 employees. A further grant of Rs. 100 lakhs was received to be utilised to relieve more employees in 1997-98 on the same terms and conditions.

3.3 Memorandum of Understanding (MOU) :

The Company has been a regular signatory of MOU with the Government, since 1992-93. Based on the actual performance for the year ending 31st March, 1997 the company has got 'Excellent' rating based on the MOU performance scoring for the year 1996-97.

3.4 Technology Transfer:

CEL team visited IMEC, Belgium for hands-on training on the cell processing towards the upgradation of its existing Screen Printing Technology to improve the Solar Cell Efficiency. All the necessary equipment have been ordered and few procured under this project which is funded by DSIR under its PATSER Programme. The actual upgradation will be carried out by the IMEC and CEL Scientists in our plant later in 1997-98.

Under the UHE Project funded by DSIR, the pilot production of High Efficiency Crystalline Silicon Solar Cells using the Buried Contact Technique has been started and good number of modules have already been fabricated. The average efficiency level of around 16.5% has been achieved. Several process steps are being further reoptimised for effecting cost reduction in the pilot processing line.

4. ROLE IN NATIONAL TECHNOLOGY MISSIONS

Company's SPV group supplied about 13000 SPV Power Sources for the DOT's VHF Rural Telecommunication Net-work.

5. DESIGN & DEVELOPMENT

5.1 Solar Photovoltaic Group

The Hybrid SPV Diesel Power Plant has been developed by the SPVG Team. During its demonstration to DOT Officials at CEL, they expressed that provision of linking the system with Grid-Power should also be made in the Hybrid System since at almost all their existing repeater stations Grid-Power is provided. SPVG design and development team added this feature to the Hybrid Power Plant and has installed it at Mancsar Repeater Station where it is undergoing extensive field trials. It has been operating satisfactorily.

The Solar Powered Traffic Signalling System has been developed and field tried successfully at one of the traffic intersections in Delhi. In this project, Delhi Traffic Police also contributed Rs. 2 lakhs. CEL and CMS Traffic Systems Limited jointly developed the system wherein CMS took care of the light fittings and controller while CEL designed and installed the PV System.

Both these projects were supported through funding under the PATSER Programme of DSIR.

The man-pack Solar Charger (Similar to Mark II module of HB Charger) for Armed forces was developed and supplied to Army. On the suggestions of the Army, Indicating Unit for the man pack charger was redesigned adding many features and significant Electronic Circuitry. 5 units of these chargers were manufactured, two of which were submitted to CQAL for evaluation. These units have almost met CQAL approval. The remaining 3 units have gone to Gangtok and Bikaner for field trials.

The Smart Solar Charger (Similar to Mark III model of H B Charger) for Ni-Cd., Batteries is being developed under funds support from DSIR. It will use foldable modules standardised for man-pack as further upgradation so as to include many more features. It will be Micro-processor based. The technology developed under this project will be useful for further extension of the Solar charger line of CEL's SPV products. The technology is being developed jointly by CEL & Electronic Research & Development Centre, Thiruvananthapuram.

5.2 Component Group

The Microwave Electronics Division has made significant achievement in taking up new products required for Electronic Warfare (EW) Systems like SAMYUKTA, and

SANGRAHA Programmes of DLRL - Hyderabad. The major sub-systems are Direction Finding (DF) System, up-down and down converter, Detector Log Video Amplifiers (DLVA). In addition few new types of Microwave Components, Spiral Antennas and Biconical Antennas have been taken up and developed. Two Nos of D.F. Systems have been supplied in 1996-97 which has been considered as a land mark achievement by DRDO.

The Development work in Phase Control Module (PCMS) have been continued for up-dating of technology. For this, DSIR has provided R&D grants support of Rs. 145 lakhs under the S&T Plan Schemes for the development of multi channel driving systems. The development work has already been started.

5.3 Electronics Systems

In view of the large emerging requirement by Indian Railways of Microprocessor based Solid State Interlocking Equipment in their network for signalling and interlocking applications to control the movement of railway traffic in a fail safe way through a station yard, CEL has taken up the development of the above equipment, jointly with C-DAC, N.Delhi under PATSER programme of DSIR. Development of the equipment is at an advanced stage of completion with hardware duly validated by RDSO and all software modules required for System control, interlocking, diagnostic and user friendly station specific data entry, have been developed. System integration with simultaneous testing of hardware with software developed is presently in progress. Site preparation work at a selected Railway Station on Delhi ring route, for conducting field trials after the clearance of the equipment by RDSO, is also being concurrently progressed.

6. INDUSTRIAL RELATIONS AND HUMAN RESOURCES DEVELOPMENT

6.1 Industrial Relations

The Company had fairly cordial industrial relations during the year as a result of the Management's continuous dialogue with the recognised Workers Union and with the Officers/ Executives Associations.

Employees participation in management continued through the forums of Shop Level and Plant Level Committees constituted for the purpose. 12 Meetings of the Shop Floor Committees and 4 of the Plant Level Committees of the different divisions of the Company were held during the year as against 9 and 3 respectively in the previous year.

6.2 Human Resources Development

In the face of global competition due to economic liberalisation programme of the Government, it has dawned that in order to survive, the organisation has to be made s

"Learning Organisation" and hence the knowledge and skill level of employees need to be continuously upgraded. With this in view, increased emphasis was laid on the Training & Development of employees. Towards this end a well defined training procedure has been prepared to impart need based quality training to employees as per requirements under ISO-9000 and other Technological upgradation.

530 Man-days Training was undertaken by organising in-house training programmes and 155 Man-days training by sponsoring employees to external training programme for specialised courses during the year 1996-97.

7. WELFARE OF WEAKER SECTIONS:

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. The total number of

employees, in these categories were 222 which represents about 25.43% of the total strength of Company as on 31st March, 1997.

8. USE OF HINDI:

With a view to ensure the proper implementation of official language policy of Government of India and the directives received from time to time in this regard, Official Language Implementation Committee/Sub-Committee and branch of Kendriya Sachivalaya Hindi Parishad have been emphasizing on progressive use of Hindi in the Company. The employees continued to be trained in Prabodh, Praveen, Pragya Hindi courses, Hindi type-writing and Hindi Computer. Hindi week was organised from 14.9.96 to 20.9.96. The employees are being encouraged and motivated to work in Hindi. The work for writing notes, reports and letters etc. in Hindi is in progress.

IX. ADMINISTRATION

1. 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 are being performed by the Department of Scientific and Industrial Research. Other house-keeping jobs are being performed by Department of Science & Technology. Activities related to promotions of scientific staff and officers (under the flexible complementing scheme) are also looked after by the Department.

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. Employees of the Department were also nominated for basic training on computer.

- (d) During 3-4 July, 1997, two days Hindi Workshop was organised by the Department for the employees who have working knowledge of Hindi.
- (e) From 1st to 15th September 1997 combined Hindi Pakhwara was observed by the Department of Science and Technology and Department of Scientific and Industrial Research 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 and officials of the Department were given prizes. Hindi versions of Orders, Notifications, Letters, Standard Drafts, Annual Report and Performance Budget were provided.

The staff strength in the different groups in the Department of Scientific & Industrial Research as on 1.1.1998 is given below:-

	Number of Employees			
	General	SC	ST	Total
Group A (Gazetted)	35	5	1	41
Group B (Gazetted)	5	3	-	8
Group B (Non-Gazetted)	13	4	-	17
Group C (Non-Gazetted)	24	3	2	29
Group D (Non-Gazetted)	12	2	-	14

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 and Aromatic Plants (CIMAP),
11. Central Leather Research Institute (CLRI), Madras
12. Central Mechanical Engineering Research Institute (CMERI), Durgapur
13. Central Mining Research Institute (CMRI), Dhanbad
14. Central Road Research Institute (CRRI), Delhi
15. Central Scientific Instruments Organization (CSIO), Chandigarh
16. CSIR Centre for Mathematical Modelling & Computer Simulation-(C-MMACS), Bangalore
17. Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar
18. Institute of Himalayan Bioresource Technology (IHBT),Palampur
19. Indian Institute of Chemical Biology (IICB), Calcutta
20. Indian Institute of Chemical Technology (IICT), Hyderabad
21. Indian Institute of Petroleum (IIP), Dehradun
22. Institute of Microbial Technology (IMT), Chandigarh
23. Indian National Scientific Documentation Centre (INSDOC), New Delhi
24. Industrial Toxicology Research Centre (ITRC), Lucknow
25. National Aerospace Laboratories (NAL) Bangalore
26. National Botanical Research Institute (NBRI), Lucknow
27. National Chemical Laboratory (NCL), Pune
28. National Environmental Engineering Research Institute (NEERI), Nagpur
29. National Geophysical Research Institute (NGRI), Hyderabad
30. National Institute of Oceanography (NIO), Goa
31. National Institute of Science Communication (NISCOM),New Delhi
32. National Institute of Science & Technology and Development Studies (NISTADS), New Delhi

33. National Metallurgical Laboratory (NML), Jamshedpur
34. National Physical Laboratory (NPL), New Delhi
35. Regional Research Laboratory (RRL-BHO), Bhopal
36. Regional Research Laboratory (RRL-BHU), Bhubaneswar
37. Regional Research Laboratory (RRL-JM), Jammu
38. Regional Research Laboratory (RRL-JT), Jorhat
39. Regional Research Laboratory (RRL-TVM), Thiruvanthapuram
40. Structural Engineering Research Centre (SERC-G), Ghaziabad
41. Structural Engineering Research Centre (SERC-M), Madras

STATEMENT ON RECOGNITION OF IN-HOUSE R&D UNITS

Month	Year	Receipts	Cumulative Receipts	Disposals	Cumulative Disposals	Cumulative Pendency at the end of the month
December	1996	22	-	-	-	22
January	1997	13	35	10	10	25
February	1997	13	48	10	20	28
March	1997	6	54	7	27	27
April	1997	9	63	9	36	27
May	1997	9	72	6	42	30
June	1997	8	80	8	50	30
July	1997	7	87	16	66	21
August	1997	5	92	6	72	20
September	1997	6	98	6	78	20
October	1997	8	106	9	87	19
November	1997	9	115	10	97	18
December	1997	8	123	3	100	23
January	1998	15	138	6	106	32
February	1998	3	141	6	112	29
March	1998	7	148	10	122	26

**STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS
WHOSE RECOGNITION EXPIRED ON 31.03.1997**

UNITS DUE FOR RENEWAL ON 1.4.1997

Month	Year	Receipts	Cumulative Receipts	Renewal applications processed	Cumulative Renewals processed	Cumulative Pendency at the end of the month
December	1996	196	196	-	-	196
January	1997	138	334	-	-	334
February	1997	31	365	-	-	365
March	1997	26	391	191	191	200
April	1997	18	409	78	269	142
May	1997	11	420	97	366	56
June	1997	20	440	30	396	44
July	1997	4	444	12	408	36
August	1997	11	455	47	455	-
September	1997	-	455	-	455	-
October	1997	-	455	-	455	-
November	1997	-	455	-	455	-
December	1997	-	455	-	455	-
Total		-	455	-	455	-

UNITS DUE FOR RENEWAL ON 1.4.1998

December	1997	50	50	-	-	50
January	1998	237	287	-	-	287
February	1998	51	338	-	-	338
March	1998	52	390	104	-	286

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL
EXPENDITURE MORE THAN Rs. 100 LAKHS**

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs in Lakhs)
1	ARM Limited	210
2	Adarsh Chemicals & Fertilisers Ltd.	267
3	Advani-Oerlikon Ltd	228
4	Alembic Chemical Works Co. Ltd.	221
5	Alfa Laval (India) Ltd.	600
6	Altos India Ltd.	187
7	Andhra Pradesh Paper Mills Ltd., The	111
8	Apollo Tyres Ltd.	262
9	Applied Electro Magnetics Pvt. Ltd.	118
10	Arvind Mills Ltd., The	101
11	Asea Brown Boveri Ltd.	2151
12	Ashok Leyland Ltd.	2168
13	Asian Paints (India) Ltd.	453
14	Associated Cement Companies Ltd.	769
15	Astra-IDL Limited	152
16	Atul Limited, The	396
17	BASF India Ltd.	140
18	BPL Limited	423
19	BPL Sanyo Utilities and Appliances Ltd.	288
20	BPL Telecom Ltd.	119
21	Bajaj Tempo Ltd.	1066
22	Ballarpur Industries Ltd.	111
23	Balmer Lawrie & Company Ltd.	203
24	Baroda Rayon Corporation Ltd., The	174
25	Bata-India Ltd.	190
26	Bergner Paints India Ltd.	158
27	Bharat Dynamics Ltd.	245
28	Bharat Earth Movers Ltd.	857
29	Bharat Electronics Ltd.	4858
30	Bharat Heavy Electricals Ltd.	5300
31	Bicycle & Sewing Machine Research & Development Centre	118
32	Biological E. Ltd.	304
33	Brakes India Ltd.	360
34	Bush Boake Allen (India) Ltd.	311
35	CMC Limited	552
36	Cadila Pharmaceuticals Ltd.	107
37	Camphor & Allied Products Ltd.	124
38	Carborundum Universal Ltd.	103
39	Castrol India Ltd.	128

Contd/-

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
40	Central Electronics Ltd.	509
41	Central Mine Planning & Design Inst. Ltd.	1166
42	Cheminor Drugs Ltd.	246
43	Chloride Industries Ltd.	163
44	Cipla Limited	1630
45	Clariant (India) Ltd.	318
46	Coates of India Ltd.	347
47	Cochin Refineries Ltd.	353
48	Colour-Chem Limited	317
49	Continental Device India Ltd.	205
50	Core Healthcare Ltd.	143
51	Crompton Greaves Ltd.	2174
52	Croslands Research Laboratories Ltd.	500
53	DCM Shriram Consolidated Ltd.	128
54	DCM Shriram Industries Ltd.	237
55	DE-NOCIL Crop Protection Ltd.	216
56	DGP Hinoday Industries Ltd.	190
57	DGP Windsor India Ltd.	142
58	Datapro Electronics Pvt. Ltd.	120
59	Dhampur Sugar Mills Ltd., The	175
60	Dharamsi Morarji Chemical Co. Ltd., The	138
61	Divi's Laboratories Ltd.	199
62	Dr. Reddy's Laboratories Ltd.	131
63	Dunlop India Ltd.	284
64	E.I.D. Parry (India) Ltd.	166
65	Eicher Limited	133
66	Eicher Ltd.	549
67	Eicher Motors Ltd.	192
68	Electronics Corporation of India Ltd.	760
69	Elin Electronics Ltd.	150
70	Engineers India Ltd.	356
71	Esvin Advanced Technologies Ltd.	148
72	Excel Industries Ltd.	247
73	FDC Limited	142
74	FGP Limited	142
75	Foseco India Ltd.	242
76	Fujitsu ICIM Ltd.	101
77	GEC Alstom India Ltd.	564
78	Gammon India Limited	128
79	Garware Polyester Ltd.	167
80	German Remedies Ltd.	106
81	Gharda Chemicals Ltd.	663
82	Glaxo India Ltd.	315

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
83	Godrej & Boyce Mfg. Company Ltd.	308
84	Godrej Soaps Ltd.	267
85	Goodlass Nerolac Paints Ltd.	260
86	Gujarat Communications & Electronics Ltd.	412
87	Gujarat State Fertilizers Company Ltd.	549
88	HCL Hewlett-Packard Ltd.	427
89	HMT Limited	541
90	Haryana State Electronics Development Corporation Ltd.	191
91	Hawkins Cookers Ltd.	100
92	Herdillia Chemicals Ltd.	101
93	Hindustan Aeronautics Ltd.	8160
94	Hindustan Antibiotics Ltd.	252
95	Hindustan Cables Ltd.	178
96	Hindustan Ciba-Geigy Ltd.	146
97	Hindustan Copper Ltd.	155
98	Hindustan Lever Ltd.	1732
99	Hindustan Motors Ltd.	327
100	Hindustan Petroleum Corporation Ltd.	286
101	Hindustan Photo Films Manufacturing Co. Ltd.	127
102	Hindustan Zinc Ltd.	138
103	Hoechst Marion Roussal Ltd.	1169
104	Hyderabad Industries Ltd.	235
105	ICI India Ltd.	316
106	IDL Industries Ltd.	202
107	IPCA Laboratories Ltd.	318
108	ITC Limited	786
109	ITI Equatorial Satcom Ltd.	111
110	India Glycols Ltd.	192
111	India Pistons Ltd.	103
112	Indian Aluminium Company Ltd.	566
113	Indian Drugs & Pharmaceuticals Ltd.	243
114	Indian Dyestuff Industries Ltd.	211
115	Indian Oil Corporation Ltd.	3253
116	Indian Petrochemicals Corporation Ltd.	1005
117	Indian Rare Earths Ltd.	113
118	Indian Telephone Industries Ltd.	4864
119	Ion Exchange (India) Ltd.	142
120	J.K. Industries Ltd.	299
121	J.K. Synthetics Ltd.	102
122	Jaysynth Dyechem Ltd.	129
123	Jenson & Nicholson (India) Ltd.	108
124	Johnson & Johnson Ltd.	165
125	Jyoti Limited	201
126	K.C.P. Limited	105
127	Keggfarms Pvt. Ltd.	138
128	Kelvinator of India Ltd.	359

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
129	Khandelwal Laboratories Ltd.	101
130	Kinetic Engineering Ltd.	506
131	Kirloskar Brothers Ltd.	383
132	Kirloskar Copeland Ltd.	203
133	Kirloskar Cummins Ltd.	1044
134	Kirloskar Electric Co. Ltd.	189
135	Kirloskar Oil Engines Ltd.	183
136	Kirloskar Pneumatic Co. Ltd.	108
137	Kopran Limited	424
138	Krishna Maruti Ltd.	247
139	L&T-McNeil Ltd.	117
140	LML Limited	366
141	Lakhanpal National Ltd.	181
142	Lakshmi Machine Works Ltd.	480
143	Larsen & Toubro Limited	1446
144	Lubrizol India Ltd.	388
145	Lucas-TVS Ltd.	381
146	Lupin Laboratories Ltd.	2840
147	Lyka Labs Limited	123
148	MAX-GB Limited	190
149	MRF Limited	1145
150	Madras Refineries Ltd.	232
151	Mafatlal Industries Ltd.	122
152	Mafatlal Industries Ltd., The	126
153	Maharashtra Hybrid Seeds Company Ltd.	240
154	Mahindra & Mahindra Ltd.	4135
155	Manali Petrochemical Ltd.	156
156	Maruti Udyog Ltd.	972
157	Maxworth Orchards (India) Ltd.	500
158	Merind Limited	327
159	Mirc Electronics Ltd.	406
160	Modi Rubber Ltd.	178
161	Modi Xerox Ltd.	232
162	Modipon Limited	274
163	Monica Electronics Ltd.	177
164	Motor Industries Co. Ltd.	1559
165	Mysore Kirloskar Ltd., The	263
166	NRC Ltd.	268
167	Natco Fine Pharmaceuticals Pvt. Ltd.	506
168	National Mineral Development Corporation Ltd.	594
169	National Organic Chemical Industries Ltd.	704
170	National Telecom of India Ltd.	641
171	National Thermal Power Corporation Ltd.	483
172	Ncore Technology Pvt. Ltd.	107
173	Neyveli Lignite Corporation Ltd.	362
174	Oil & Natural Gas Corporation Ltd.	2499
175	Oil India Limited	1043
176	Onward Technologies Ltd.	231
177	Optel Telecommunications Ltd.	451

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
178	Pace Elcot Automation Ltd.	180
179	Padmashri Dr. Vithalrao Vikhi Patel Sahakari Sakhar Karkhana Ltd.	310
180	Parke-Davis (India) Ltd.	153
181	Petrofils Co-operative Ltd.	188
182	Pfizer Limited	220
183	Pharmaceutical Products of India Ltd., The	504
184	Philips India Ltd.	495
185	Premier Automobiles Ltd.	476
186	Premier Instruments & Controls Ltd.	435
187	Proagro Seed Company Ltd.	185
188	Procter & Gamble India Ltd.	316
189	Projects & Development India Ltd.	388
190	Punjab Communications Ltd.	189
191	Punjab Tractors Ltd.	138
192	Rallis India Ltd.	777
193	Ramco Industries Ltd.	994
194	Ranbaxy Laboratories Ltd.	4149
195	Rane Brake Linings Ltd.	122
196	Rashtriya Chemicals & Fertilizers Ltd.	105
197	Recon Limited	228
198	Reliance Industries Ltd.	7509
199	Renewable Energy Systems Pvt. Ltd.	128
200	S.H. Kelkar & Company Ltd.	118
201	SOL Pharmaceuticals Ltd.	205
202	SOL Pharmaceuticals Ltd.	141
203	Samtel Color Ltd.	115
204	Sandvik Asia Ltd.	201
205	Saraswati Industrial Syndicate Ltd., The	263
206	Scooters India Ltd.	252
207	Sealol Hindustan Ltd.	115
208	Searle (India) Ltd.	260
209	Secure Meters Ltd.	163
210	Semiconductor Complex Ltd.	304
211	Shantha Biotechnics Pvt. Ltd.	148
212	Shasun Chemicals and Drugs Ltd.	124
213	Sieflex Robotics Co.	101
214	Simpson & Co. Ltd.	108
215	Smithkline Beecham Pharmaceuticals (India) Ltd.	134
216	Southern Petrochemical Industries Corporation Ltd.	712
217	Steel Authority of India Ltd.	4832
218	Sudarshan Chemical Industries Ltd.	190
219	Sun Pharmaceutical Industries Ltd.	390
220	Sundaram Brake Linings Ltd.	185
221	Sundaram Clayton Ltd.	166
222	TVS-Suzuki Limited	247
223	Tamil Nadu Dadha Pharmaceuticals Ltd.	115
224	Tamilnadu Petroproducts Ltd.	241
225	Tata Elxsi (India) Ltd.	145

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
226	Tata Engineering & Locomotive Co. Ltd.	7530
227	Tata Hydro-Electric Power Supply Co. Ltd., The	783
228	Tata Iron & Steel Co. Ltd.	1155
229	Tata Sons Ltd.	357
230	Tata Tea Ltd.	291
231	Technicom Systems (India) Pvt. Ltd.	125
232	Thermax Limited	338
233	Tide Water Oil Co. (India) Ltd.	130
234	Torrent Pharmaceuticals Ltd.	300
235	Tractors & Farm Equipment Ltd.	201
236	Travancore Chemical and Manufacturing Company Ltd.	204
237	Travancore-Cochin Chemicals Ltd., The	105
238	Unichem Laboratories Ltd.	170
239	United Catalysts India Ltd.	110
240	United Phosphorous Ltd.	650
241	United Telecoms Ltd.	207
242	Uptron India Ltd.	110
243	VIP Industries Ltd.	138
244	Venco Research & Breeding Farm Ltd.	329
245	Venkateshwara Hatcheries Ltd.	113
246	Venkateshwara Research & Breeding Farm Ltd.	343
247	Vera Laboratories Ltd.	118
248	Vitara Chemicals Ltd.	188
249	Voltas Limited	135
250	Webel Telecommunication Industries Ltd.	107
251	Wheels India Ltd.	212
252	Widia (India) Ltd.	530
253	Wipro GE Medical Systems Ltd.	100
254	Wipro Limited	297
255	Wipro Limited	693
256	Wockhardt Limited	1130

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL
EXPENDITURE IN THE RANGE OF Rs. 25 LAKHS TO Rs. 100 LAKHS**

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
1	ACE Laboratories Ltd.	79
2	AIMCO Pesticides Ltd.	36
3	ATCO Industries Ltd.	64
4	Ador Powertron Industries Ltd.	42
5	Ador-Samia Ltd.	36
6	Advanced Micronic Devices Ltd.	48
7	Aerospace Systems Pvt. Ltd.	80
8	Alembic Glass Industries Ltd.	46
9	Alkem Laboratories Ltd.	30
10	Alkyl Amines Chemicals Ltd.	35
11	Amar Dye Chem Ltd.	98
12	Ambalal Sarabhai Enterprises Ltd.	97
13	American Remedies Ltd.	45
14	Amphetronix Limited	59
15	Amrutanjan Limited	50
16	Andhra Pradesh Heavy Machinery and Engineering Ltd.	26
17	Andhra Sugars Ltd., The	60
18	Andrew Yule & Company Ltd.	35
19	Anil Starch Products Ltd., The	35
20	Ankur Seeds Pvt. Ltd.	46
21	Anupam Machine Tools Ltd.	25
22	Applied Electronics Ltd.	76
23	Armour Polymers Ltd.	57
24	Astra Microwave Products Ltd.	83
25	Audeo India Ltd.	62
26	Automatic Electric Ltd.	39
27	Autometers Limited	43
28	Avantel Communications Ltd.	39
29	Avery India Limited	35
30	BOC India Limited	69
31	BPL Sanyo Technologies Ltd.	37
32	Bajaj Electricals Ltd.	36
33	Bakelite Hylam Ltd.	78
34	Balsara Hygiene Products Ltd.	26
35	Bayer (India) Ltd.	49
36	Bells Controls Ltd.	44
37	Bharat Aluminium Company Ltd.	50
38	Bharat Forge Ltd.	42
39	Bharat Fritz Werner Ltd.	34
40	Bharat Heavy Plate & Vessels Ltd.	50

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
41	Bharat Petroleum Corporation Ltd.	66
42	Bharat Pumps & Compressors Ltd.	30
43	Bharat Starch Industries Ltd.	40
44	Bharti Telecom Ltd.	25
45	Bhoruka Gases Ltd.	33
46	Binani Industries Ltd.	38
47	Biochem Synergy Ltd.	86
48	Biocon India Ltd.	35
49	Birla VXL Ltd.	46
50	Blue Star Limited	53
51	Bombay Paints Ltd.	34
52	Britannia Industries Ltd.	96
53	Bry-Air (India) Pvt. Ltd.	26
54	Burroughs Wellcome (India) Ltd.	94
55	Cable Corporation of India Ltd.	39
56	Cadbury India Limited	85
57	Cadila Healthcare (P) Ltd.	78
58	Ceat Limited	60
59	Central Institute of Road Transport	78
60	Century Textiles & Industries Ltd., The	94
61	Chemplast Sanmar Ltd.	28
62	Cibatul Limited	79
63	Concept Pharmaceuticals Ltd.	37
64	Consolidated Coffee Ltd.	25
65	Controls & Switchgear Co. Ltd.	34
66	Cosmo Ferrites Ltd.	93
67	Cosmo Films Ltd.	41
68	Crown Television Ltd.	28
69	Cureworth (India) Ltd.	78
70	Cyanamid India Ltd.	80
71	Dai-ichi Karkaria Ltd.	29
72	Dave Paints Ltd.	32
73	Dee-Pharma Ltd.	38
74	Dey's Medical Stores (Mfg.) Ltd.	66
75	Dr. Beck & Company (India) Ltd.	68
76	Duphar-Interfran Ltd.	61
77	Dura Magnets Pvt. Ltd.	38
78	E.Merck (India) Ltd.	46
79	ESAB India Ltd.	71
80	EWAC Alloys Ltd.	84
81	East India Pharmaceutical Works Ltd.	81
82	Elcot Power Controls Ltd.	51
83	Electro Pneumatics & Hydraulics (I) Ltd.	60
84	Electronic Research Ltd.	45
85	Electronic Systems Punjab Ltd.	26

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
86	Electronica Machine Tools Ltd.	28
87	Electronica Mechatronic Systems (India) Pvt. Ltd.	85
88	Electrotherm (India) Ltd.	56
89	Elgi Equipments Ltd.	43
90	Elgi Tyre & Tread Ltd.	50
91	Ellora Steels Ltd.	74
92	Engineering Mechanics Research India Pvt. Ltd., (EMRC)	41
93	English Indian Clays Ltd.	25
94	Eternit Everest Ltd.	42
95	Eureka Forbes Ltd.	35
96	Fenner (India) Ltd.	53
97	Ferro Alloys Corporation Ltd.	40
98	Fertilizers & Chemicals Travancore Ltd.	54
99	Ficom Organics Ltd.	25
100	Firth (India) Steel Co. Ltd.	74
101	Fisher-Rosemount (India) Ltd.	31
102	Flex Chemicals Ltd.	26
103	Flex Industries Ltd.	93
104	Forbes Gokak Ltd.	36
105	Forbesons Tech Centre Pvt. Ltd.	31
106	Fort Gloster Industries Ltd.	78
107	Franco-Indian Pharmaceuticals Ltd.	42
108	GTC Industries Ltd.	34
109	Gajra Gears Ltd.	39
110	Galaxy Surfactants Ltd.	46
111	Ganga Agri Seeds Ltd.	54
112	Garware Wall Ropes Ltd.	46
113	Geep Industrial Syndicate Ltd.	32
114	Glenmark Pharmaceuticals Ltd.	54
115	Godfrey Phillips India Ltd.	39
116	Godrej Agrovet Ltd.	66
117	Gontermann-Peipers (India) Ltd.	74
118	Goodricke Group Ltd.	32
119	Graphite India Ltd.	49
120	Grauer & Weil (India) Ltd.	93
121	Grindwell Norton Ltd.	64
122	Guindy Machine Tools Ltd., The	43
123	Gujarat Alkalies & Chemicals Ltd.	62
124	Gujarat Ambuja Cements Ltd.	44
125	Gujarat Heavy Chemicals Ltd.	44
126	HTL Limited	85
127	Harbanslal Malhotra & Sons Ltd.	34
128	Hargovind Bajaj Research & Development Centre	40
129	Heavy Engineering Corporation Ltd.	96
130	Hero Cycles Ltd.	44

L. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
131	Hetero Drugs Pvt. Ltd.	45
132	High Energy Batteries (India) Ltd.	76
133	High Polymer Labs Limited	55
134	Himachal Futuristic Communications Ltd.	92
135	Himalaya Machinery Pvt. Ltd.	48
136	Hindalco Industries Ltd.	35
137	Hindoostan Spinning & Weaving Mills Ltd., The	47
138	Hindustan Composites Ltd.	54
139	Hindustan Insecticides Ltd.	76
140	Hindustan Latex Ltd.	45
141	Hindustan Organic Chemicals Ltd.	61
142	Hindusthan Development Corporation Ltd.	48
143	IBP Company Ltd.	94
144	IMI Software Ltd.	38
145	ITC Zeneca Ltd.	100
146	Imeco Ultrasonics	25
147	Incab Industries Ltd.	35
148	India Foils Ltd.	36
149	India Meters Ltd.	46
150	India Nippon Electricals Ltd.	43
151	Indian Farmers Fertilizers Co-operative Ltd.	29
152	Indian Herbs Research and Supply Co. Pvt. Ltd.	74
153	Indian Hume Pipe Company Ltd., The	45
154	Indo National Ltd.	32
155	Indofil Chemicals Company	41
156	Infar (India) Ltd.	49
157	Infocom Digital Systems (P) Ltd.	70
158	Infotech Enterprises Pvt. Ltd.	33
159	Instrumentation Ltd.	43
160	Intas Pharmaceuticals Ltd.	31
161	Intertec Communications Pvt. Ltd.	27
162	Intra Industries Pvt. Ltd.	49
163	Jagatjit Industries Ltd.	28
164	Jagsonpal Pharmaceuticals Ltd.	41
165	Jai Parabolic Springs Ltd.	75
166	Jain Irrigation Systems Ltd.	97
167	Jaya Hind Industries Ltd.	36
168	John Fowler (India) Ltd.	35
169	Jyoti Ceramic Industries Pvt. Ltd.	58
170	KCP Sugar & Industries Corporation Ltd.	84
171	KEC International Ltd.	54
172	Kasila Farms Pvt. Ltd.	46
173	Kaveri Telecoms Ltd.	27
174	Kerala Electrical & Allied Engineering Co. Ltd.	47
175	Kesar Enterprises Ltd.	30

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
176	Kilburn Engineering Ltd.	47
177	Knoll Pharmaceuticals Ltd.	99
178	L.G. Balakrishnan & Brothers Ltd.	25
179	Lamco Lightning Arrester Mfg. Co. Pvt. Ltd.	80
180	Laxmi Boilers (South) Pvt. Ltd.	31
181	Lectrotek Systems (Pune) Pvt. Ltd.	55
182	Lona Industries Ltd.	35
183	Lupin Chemicals Ltd.	80
184	M.J. Institute of Research	29
185	M.P. Electricity Board	43
186	MCE Products' Sales Service Ltd.	32
187	MIC Electronics Pvt. Ltd.	69
188	MTZ (India) Ltd.	29
189	Machine Tool Aids and Reconditioning	61
190	Macmet India Ltd.	26
191	Mafatlal Industries Limited	30
192	Maharashtra Electronics Corporation Ltd.	39
193	Mahendra Hybrid Seeds Company Ltd.	42
194	Mahindra UGINE Steel Co. Ltd.	27
195	Malhotra Shaving Products Ltd.	31
196	Max India Ltd.	35
197	McDowell & Co. Ltd.	72
198	Measurement Systems Pvt. Ltd.	28
199	Meltron Semiconductors Ltd.	49
200	Messung Systems	38
201	Metallizing Equipment Co. Pvt. Ltd.	26
202	Metallurgical & Engineering Consultants (India) Ltd.	54
203	Metroark Limited	30
204	Metrochem Industries Ltd.	45
205	Microland Limited	96
206	Minda Industries Ltd.	67
207	Minota Aquatech Ltd.	81
208	Mishra Dhatu Nigam Ltd.	55
209	Modistone Ltd.	44
210	Montari Industries Ltd.	86
211	Motorol (India) Ltd.	98
212	Mukand Limited	57
213	Mytimasters' Engineering Pvt. Ltd.	41
214	NGEF Limited	71
215	NICCO Corporation Ltd.	90
216	Nalco Chemicals India Ltd.	93
217	National Aluminium Company Ltd.	52
218	National Peroxide Ltd.	69
219	National Radio & Electronics Company Ltd., The	92
220	Nepa Limited	32

Sl. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
221	Neuland Laboratories Ltd.	26
222	Nirlon Limited	30
223	Nuchem Ltd.	94
224	O/E/N India Ltd.	28
225	OCL India Ltd.	40
226	Onida Savak Limited	36
227	Organic Coatings Ltd.	28
228	Orient Abrasives Ltd.	32
229	Orissa Industries Ltd.	61
230	Otis Elevator Co. (India) Ltd.	100
231	P.I. Industries Ltd.	73
232	Pacific Telecommunications & Instruments Ltd.	40
233	Paharpur Cooling Towers Ltd.	40
234	Panacea Biotec Limited	48
235	Paper Products Ltd. The	95
236	Parrys Confectionery Ltd.	59
237	Penam Laboratories Ltd.	49
238	Pennwalt India Ltd.	38
239	Pest Control (India) Ltd.	36
240	Phillips Carbon Black Ltd.	48
241	Pidilite Industries Ltd.	63
242	Polychem Limited	57
243	Porritts & Spencer (Asia) Ltd.	56
244	Pradeep Drug Company Ltd.	38
245	Praj Industries Ltd.	48
246	Precision Fastners Ltd.	32
247	Priyaraj Electronics Ltd.	46
248	Process & Product Development Centre	35
249	Processor Systems (India) Pvt. Ltd.	52
250	Pudumjee Pulp & Paper Mills Ltd.	33
251	Purolator India Ltd.	56
252	RES Photovoltaics Ltd.	84
253	Rainbow Ink & Varnish Manufacturing Co. Ltd.	31
254	Rajapalayam Mills Ltd.	34
255	Rajasthan Electronics & Instruments Ltd.	89
256	Ralliwolf Limited	32
257	Rane (Madras) Ltd.	77
258	Rapsri Engg Industries (P) Ltd.	41
259	Raptakos Brett & Co. Ltd.	50
260	Raymond Woollen Mills Ltd., The	70
261	Reckitt & Colman of India Ltd.	51
262	Resource Technologies Pvt. Ltd.	56
263	Rhone-Poulenc (India) Ltd.	28
264	Roots Industries Ltd.	54

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
265	Rubamin Ltd.	39
266	S.K.Dynamics Pvt. Ltd.	49
267	SAI Test Plant Pvt. Ltd.	50
268	SMZS Chemicals Ltd.	44
269	SPL Limited	30
270	SRF Limited	43
271	SSP (Pvt.) Ltd.	26
272	STP Limited	26
273	Sadhana Nitro Chem Ltd.	26
274	Sahyadri Dyestuffs & Chemicals	27
275	Samtel (India) Ltd.	39
276	San Engg & Locomotive Co. Ltd.	46
277	Scientific Instrument Co. Ltd., The	34
278	Secals Limited	75
279	Shalimar Paints Ltd.	58
280	Shaw Wallace & Company Ltd.	26
281	Shree Synthetics Ltd.	25
282	Shriram Honda Power Equipment Ltd.	39
283	Shyam Antenna Electronics Ltd.	63
284	Siel Compressor Ltd.	100
285	Simplex Castings Ltd.	40
286	Siris Limited	52
287	Solar Farmachem Ltd.	34
288	Solidaire India Ltd.	31
289	Sree Rayaleseema Alkalies & Allied Chemicals Ltd.	80
290	Sri Kannapiran Mills Ltd.	30
291	Standard Industries Ltd.	82
292	Stangen Immuno Diagnostics	42
293	Star Precision Electronics (India) Ltd.	74
294	Star Spin & Twist Machineries Ltd	43
295	Structwel Designers & Consultants Pvt. Ltd.	40
296	Sumitra Pharmaceuticals & Chemicals Ltd.	38
297	Sunbeam Castings	82
298	Sundaram Fastners Ltd.	50
299	Super Seals India Ltd.	29
300	Swadeshi Polytex Ltd.	31
301	THL Limited	51
302	TIPCO Industries Ltd.	59
303	TRF Limited	61
304	TTK Pharma Ltd.	30
305	TVS Electronics Ltd.	51
306	Tablets (India) Ltd.	25
307	Talbros Automotive Components Ltd.	52
308	Tamil Nadu Electricity Board	47
309	Tamil Nadu Newsprint and Papers Ltd.	42

SL. NO.	NAME OF THE FIRM	R&D Expenditure (Rs. in Lakhs)
310	Tata Chemicals Ltd	50
311	Tata Oil Mills Co. Ltd., The	42
312	Tata Refractories Ltd.	98
313	Tata Telecom Ltd.	94
314	Teletube Electronics Ltd.	44
315	Tetragon Chemie Ltd.	40
316	Textool Company Ltd.	89
317	Titagarh Industries Ltd.	34
318	Titan Industries Ltd.	66
319	Top Syringe Mfg. Co.	86
320	Tractor Engineers Ltd.	46
321	Transpek Industry Ltd.	32
322	Travancore Titanium Products Ltd.	52
323	Triveni Sheet Glass Works Ltd.	45
324	Tube Products of India	47
325	Turbotech Precision Engineering Pvt. Ltd.	36
326	UMW Industries Ltd.	33
327	USV Limited	80
328	Ucal Fuel Systems Ltd.	65
329	Unique Chemicals	39
330	Unique Pharmaceuticals Laboratories Ltd.	32
331	Universal Cables Ltd.	68
332	VXL Engineers Ltd.	26
333	VXL Instruments Ltd.	55
334	Vam Organic Chemicals Ltd.	73
335	Vedika International Pvt. Ltd.	48
336	Veejay Lakshmi Engineering Works Ltd.	31
337	Vidyut Metallics Ltd.	28
338	Vikram Cement	45
339	Vikrant Tyres Ltd.	56
340	Voltas Limited	29
341	Voltas Limited	40
342	W.S. Industries (India) Ltd.	40
343	WPIL Ltd.	26
344	Walchandnagar Industries Ltd.	84
345	Wander Limited	46
346	Wires and Fabriks (SA) Ltd.	26
347	Wolkem India Ltd.	85
348	Wyeth Laboratories Ltd.	97
349	Yamuna Gases & Chemicals Ltd.	45
350	Zandu Pharmaceutical Works Ltd., The	86

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS
APPROVED DURING 1997 AND UPTO 31.3.1998***

AGRICULTURAL, MEDICAL, NATURAL & APPLIED SCIENCES

Sl. No.	Name of the Institution	Approval Valid upto
1.	Varanashi Research Foundation, Adyanadka (Karnataka)	31.3.1999
2.	Tropical Botanic Garden and Research Institute, Thiruvananthapuram	31.3.1999
3.	Chittaranjan National Cancer Institute, Calcutta	31.3.1999
4.	Rajiv Gandhi Foundation, New Delhi	31.3.2000
5.	Bharti Vidyapeeth, Pune	31.3.2000
6.	Deccan College of Medical Sciences (of Dar-Us-Salam Educational Trust) Hyderabad	31.3.1999
7.	Shirke Engineering Research Centre, Pune	31.3.1999
8.	National Tea Research Foundation, Calcutta	31.3.1999
9.	Prof. G.M.Reddy Research Foundation, Hyderabad	31.3.1999
10.	Ramnarain Ruia College, Bombay	31.3.2000
11.	Kala Azar Research Centre of Balaji Utthan Sansthan, Patna	31.3.1999
12.	Marathwada Medical & Research Institute, Aurangabad.	31.3.2000
13.	South India Sugar Research Foundation, Madras	31.3.2000
14.	SPIC Mathematical Institute, Chennai	31.3.1999
15.	Indian Burns Research Society, Mumbai	31.3.2000
16.	Sushrut Medical Care and Research Society, Pune	31.3.2000

* Names of these organisations were also communicated to the Director General of Income Tax (Exemptions), Calcutta for issuance of Notification u/s 35 (1) (ii) of the I.T. Act, 1961.

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS
APPROVED DURING 1997 AND UPTO 31.3.1998***

SOCIAL SCIENCES

Sl. No.	Name of the Institution	Approval Valid upto
1.	Gujarat Vishvakosh Trust, Ahmedabad	31.3.1999
2.	Giri Institute of Development Studies, Lucknow	31.3.2000
3.	Indian Council of Basic Education, Mumbai	31.3.1999
4.	International Board of Yoga, Mumbai	31.3.1999
5.	Coimbatore Cancer Foundation, Coimbatore	31.3.1999
6.	CARITAS India, New Delhi	31.3.2000
7.	Entrepreneurship Development Institute of India, Gandhinagar	31.3.2000
8.	Natya Shodh Sansthan, Calcutta	31.3.2000
9.	Dharam Hinduja International Centre of Indic Research, Delhi	31.3.2000
10.	Indian Institute of Marwari Entrepreneurship, Jaipur	31.3.2000
11.	Institute of Development Studies, Jaipur	31.3.2000

* Names of these organisations were communicated to Director General of Income Tax (Exemptions), Calcutta for issuance of Notification w/s 35 (1) (iii) of the I.T.Act, 1961.

**CERTIFICATES FOR CLAIMING ACCELERATED DEPRICIATION ALLOWANCE ISSUED
BY DSIR UNDER RULE 5(2) OF IT 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.	Ficom Organics Ltd., Vadodara.	In-house	Quinalphos	245.53
2.	Ficom Organics Ltd., Vadodara.	Excle Industries Ltd.,	Malathion	165.98
3.	Sun Pharmaceutical (I) Ltd., Vadodara.	In-house	Bulk Drugs	286.77
4.	Herdillia Chemicals Ltd., Bombay	In-house	Di Phenyle Oxide(DPO)	237.23
5.	Herdillia Chemicals Ltd., Bombay	In-house	Iso-Butyl Benzene (IBB)	84.96
6.	Bharat Electronics Ltd., Bangalore	In-house	Electronic Equipment	1732.28
7.	Pesticides India Ltd., Udaipur.	In-house	Profenofos	594.71
8.	E.C.I.L., Hyderabad.	In-house	Electronic Equipment	285.38
9.	Veejay Lakshmi Engg. Works Ltd., Coimbatore	SITRA	Two for One Twister	419.00
10.	Jyoti Cermics Industries Ltd., Nasik	In-house	High Density High Alumina Ceramic Grinding Media	104.09
11.	Transmetal Ltd. Vadodara. Ltd., Vadodara	Transpek Industries	Tri Chloro Acetyl Chloride (TCAC)	125.63
12.	ISCO track Sleepers Pvt. Ltd., Bombay.	RDSO, Lucknow	Mono-block Concrete Sleepers	204.54
13.	Pidilite Industries Ltd., Bombay.	In-house	Violet pigment Plant	697.67
14.	Pidilite Industries Ltd., Bombay.	In-house	Organic pigment Plant	407.50
15.	Prestress(I) Pvt Ltd. Bombay	RDSO, Lucknow	Mono-block Concrete Sleepers	8.09
16.	Vaman Prestress Ltd. Bombay	RDSO, Lucknow	Mono-block Concrete Sleepers	35.28
17.	Punjab Tractors Ltd. SAS Nagar	CMERI, Durgapur, In-house	Tractor and Harvester	729.00
18.	Punjab Communications Ltd., SAS Nagar	TRC, New Delhi	Pulse Code Modulation Equipment	27.77
19.	Pidilite Industries Ltd., Bombay	In-house	Organic Pigment	126.54
20.	Pidilite Industries Ltd., Bombay	In-house	Violet Pigment	156.57

ABBREVIATIONS USED

<u>Sl. No.</u>	<u>Na</u>		
		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
1.	Gu	CBDT	Central Board of Direct Taxes
2.	Gir	CDC	Consultancy Development Centre
		CEL	Central Electronics Limited
3.	Ind	CMPDIL	Central Mine Planing & Design Institute Limited
4.	Inte	CSIR	Council of Scientific and Industrial Research
		DSIR	Department of Scientific and Industrial Research
5.	Coi	ECIL	Electronics Corporation of India Limited
6.	CA	ERDA	Electrical Research and Development Association
		ESCAP	Economic and Social Commission for Asia and the Pacific
7.	Ent Indi	GSI	Geological Survey of India
		HMT	Hindustan Machine Tools
8.	Nat	ICAR	Indian Council of Agricultural Research
		ICMR	Indian Council of Medical Research
9.	Dha of I	ICSSR	Indian Council of Social Science Research
		IIFT	Indian Institute of Foreign Trade
10.	Indi Jaip	IPCL	Indian Petrochemical Corporation Limited
		ISRO	Indian Space Research Organisation
11.	Insti	ITI	Indian Telephone Industries
		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
		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

* Names
of Noti