

## **BHARAT ELECTRONICS LIMITED**

Bharat Electronics Limited (BEL) was established at Bangalore, India, by the Government of India under the Ministry of Defence in 1954 to meet the specialised electronic needs of the Indian defence services. Over the years, it has grown into a multi-product, multi-technology, multi-unit company serving the needs of customers in diverse fields in India and abroad.

BEL offers products and services in a wide spectrum of technology like Radars, Military Communications, Naval Systems, Electronic Warfare Systems, Telecommunications, Sound and Vision Broadcasting, Opto-Electronics, Tank Electronics, Solar Photovoltaic Systems, Embedded Software and Electronic Components. With its expertise developed over the years, the company also provides turnkey systems solutions.

Defence continues to be BEL's prime focus but the Company has also diversified into civilian areas. Some of the successful civilian products include the Electronic Voting Machines, Solar Powered LED-Based Traffic Signal Lights, Simputers and Set Top Boxes.

BEL offers contract-manufacturing services for both domestic and international customers. It has automated assembly, inspection and testing facilities as also precision machining capabilities. It adheres to strict process and manufacturing standards, producing world-class products.

BEL has its Registered Office at Bangalore and manufacturing units at nine locations in India. A network of marketing and customer support centers across India and two overseas offices at New York and Singapore supplement the operations of the manufacturing units.

### **HISTORY**

The growth and diversification of BEL over the years mirrors the advances in the electronics technology, with which BEL has kept pace. Starting with the manufacture of a few communication equipment in 1956, BEL went on to produce Receiving Valves in 1961, Germanium Semiconductors in 1962 and Radio Transmitters for AIR in 1964.

In 1966, BEL set up a Radar manufacturing facility for the Army and in-house R&D, which has been nurtured over the years. Manufacture of Transmitting Tubes, Silicon Devices and Integrated Circuits started in 1967. The PCB manufacturing facility was established in 1968.

In 1970, manufacture of Black & White TV Picture Tube, X-ray Tube and Microwave Tubes started. The following year, facilities for manufacture of Integrated Circuits and Hybrid Micro Circuits were set up. 1972 saw BEL manufacturing TV Transmitters for Doordarshan. The following year, manufacture of Frigate Radars for the Navy began.

Under the government's policy of decentralization and due to strategic reasons, BEL ventured to set up new Units at various places. The second Unit of BEL was set up at Ghaziabad in 1974 to manufacture Radars and Tropo communication equipment for the Indian Air Force. The third Unit was established at Pune in 1979 to manufacture Image Converter and Image Intensifier Tubes.

In 1980, BEL's first overseas office was set up at New York for procurement of components and materials. In 1981, a manufacturing facility for Magnesium Manganese Dioxide batteries was set up at the Pune Unit. The Space Electronic Division was set up at Bangalore to support the satellite programme in 1982. The same year saw BEL achieve a turnover of Rs.100 crores.

In 1983, an ailing Andhra Scientific Company (ASCO) was taken over by BEL as the fourth manufacturing Unit at Machilipatnam. In 1985, the fifth Unit was set up in Chennai for supply of Tank Electronics, with proximity to HVF, Avadi. The sixth Unit was set up at Panchkula the same year to manufacture Military Communication equipment. 1985 also saw BEL manufacturing on a large scale Low Power TV Transmitters and TVROs for the expansion of Doordarshan's coverage.

1986 witnessed the setting up of the seventh Unit at Kotdwara to manufacture Switching Equipment, the eighth Unit to manufacture TV Glass Shell at Taloja (Navi Mumbai) and the ninth Unit at Hyderabad to manufacture Electronic Warfare Equipment.

In 1987, a separate Naval Equipment Division was set up at Bangalore to give greater focus to Naval projects. The first Central Research Laboratory was established at Bangalore in 1988 to focus on futuristic R&D.

1989 saw the manufacture of Telecom Switching and Transmission Systems as also the setting up of the Mass Manufacturing Facility in Bangalore and the manufacture of the first batch of 75,000 Electronic Voting Machines.

The agreement for setting up BEL's first Joint Venture Company, BE DELFT, with M/s Delft of Holland was signed in 1990. Recently this became a subsidiary

of BEL with the exit of the foreign partner and has been renamed BEL Optronics Devices Limited.

The second Central Research Laboratory was established at Ghaziabad in 1992. The first disinvestment (20%) and listing of the Company's shares in Bangalore and Mumbai Stock Exchanges took place the same year.

BEL Units obtained ISO 9000 certification in 1993-94. The second disinvestment (4.14%) took place in 1994. In 1996, BEL achieved Rs.1,000 crores turnover. In 1997, GE BEL, the second Joint Venture Company with M/s GE, USA, was formed as also the third JVC with M/s Multitone, UK, BEL Multitone. The same year, USA imposed supply restrictions on BEL.

In 1998, BEL set up its second overseas office at Singapore to source components from South East Asia. The same year, US and European sanctions were imposed on BEL. The Company was able to overcome the effects of the sanctions and insulate Indian defence forces from the fall-out of denial regimes by finding technical solutions to circumvent the denials and by keeping up the promised deliveries to customers. The year 2000 saw the Bangalore Unit, which had grown very large, being reorganized into six Strategic Business Units (SBUs). The R&D groups in Bangalore were also restructured into Specific Core Groups and Product Development Groups. The same year, BEL shares were listed in the National Stock Exchange.

In 2002, BEL became the first defence PSU to get operational Mini Ratna Category I status. In 2003, the Company's turnover crossed the Rs.2,500 mark.

In 2005, BEL achieved a turnover of Rs.3223.6 crores. BEL achieved a turnover of Rs.3,561 crores (provisional) in 2005-06.

## **CORPORATE VISION, MISSION, VALUES & OBJECTIVES**

### **Vision**

To be a world-class enterprise in professional electronics.

### **Mission**

To be a customer focussed, globally competitive company in defence electronics and in other chosen areas of professional electronics, through quality, technology and innovation.

### **Values**

- We put our customer first.
- We are proud of being a part of the organization.
- We work with transparency, honesty & integrity.
- We trust and respect individuals.
- We foster team work.
- We strive to achieve high employee satisfaction.
- We encourage flexibility & innovation.
- We endeavour to fulfil our social responsibility.

## **Objectives**

- To be a customer focussed company providing state-of-the-art products & solutions at competitive prices, meeting the demands of quality, delivery & service.
- To generate internal resources for profitable growth.
- To strive for self-reliance through indigenisation.
- To attain technological leadership in defence electronics through inhouse R&D, partnership with defence/research laboratories & academic institutions.
- To give thrust to exports.
- To create a facilitating environment for people to realise their full potential through continuous learning & team work.
- To give value for money to customers & create wealth for shareholders.
- To constantly benchmark company's performance with best-in-class internationally.
- To raise marketing abilities to global standards.

## PRODUCT RANGE

### RADARS

- Fire Control Radars
- Weapon Locating Radars
- Battle Field Surveillance Radars (Short and Medium Range)
- Weapon Control Radars
- Tactical Control Radars
- High Power 3D Radars - Static and Mobile (Long Range)
- Low Flying Detection Radars
- Naval Radars (Tracking/Surveillance/Fire Control/Navigational)
- Low Probability of Intercept Radars
- Precision Instrumentation Radar (PCMC)
- Airport Surveillance Radars
- Doppler Weather Radars
- Maritime Patrol Radar (SV 2000)
- Central Acquisition Radars
- IFF Equipment/Secondary Surveillance Radars
- Radar Displays and Multi Function Consoles
- Automatic Data Handling System for Radars
- Radar Simulators
- Upgradation Services for the existing Radars

### SONAR & UNDERWATER EQUIPMENT

- Sonars and Transducers
- Towed Torpedo Decoy
- ASW Fire Control Systems
- Homing Sonars
- Sonar Simulators
- Sonobuoys

### NAVAL FIRE CONTROL SYSTEMS

- Gun Fire Control Systems for Naval Platforms
- Optical Director Systems for Naval Guns
- Electro Optical Fire Control Systems

### COMMAND & CONTROL SYSTEMS

- Battle Management System (BMS)
- Shakti (Artillery Combat Command & Control System)
- Sanjay (Battlefield Surveillance System)
- Samvahak (Command Information & Decision Support System)
- Combat Management System for Naval Platforms
- Integrated Air Command & Control System (IACCS)

### COMMUNICATION EQUIPMENT

- Receivers (VLF, HF, VHF)
- Transmitters (HF, VHF)
- Transreceivers (HF, VHF, V/UHF, UHF, Digital Microwave)
- Frequency Hopping Radios
- Radio Relays
- Stand Alone Communication Unit (SACU)
- Emergency Communication System for Trains
- Ground to Air Communication Equipment (VHF, V/UHF, UHF)
- Asynchronous Transfer Mode Switch

- Shelterised Communication Vehicles
- Wireless Message Transfer Unit (WMTU)
- Intelligent Message Terminal (IMT)
- Modulators
- Base Stations
- Alphanumeric Messaging Terminals for Radios (BEST, SMART, HART, RDT)
- Military Switches (Digital Switching Systems, Automatic Electronic Switches, Digital Trunk Unit, Data Concentrator, Unit Level Switch Board)
- Semi Ruggedised Automatic Exchange
- Multiplexers
- CDMA Networks

## COMMUNICATION SYSTEMS

- Composite Communication Systems
- ATM based Integrated Shipborne Data Network
- Link-II systems
- Troposcatter Communication Systems
- Point to Multipoint Communication System

## ENCRYPTORS

- Voice/ Data/Fax, Bulk Encryptors
- Encryptors (n\*64 Kbps, 2/8/34 Mbps, IP, STM 1/16 BEU)

## EQUIPMENT / SYSTEM CONFIGURATIONS

- Handheld, Manpack, Static, Mobile, Shelterised

## SATCOM SYSTEMS

- Satellite Communication Equipment in extended C,S & Ku Bands
- Fly Away Terminals
- TV uplink earth stations/TRACT – Transportable Uplinks
- Intelsat F3 earth stations
- S-Band Satellite Communication Terminal
- Digital Satellite News Gathering (DSNG) Vans
- Mobile Communication Terminal (MCT)
- Sub-systems: Modems, Amplifiers, Up/Down Converters, LNAs, SSPAs
- System integration and total solutions for Radio & Satellite Network (APNET, Network for other State Govt Offices, Police Network (Polnet), Telemedicine Systems, BEL & OFB Net etc.)

## TELECOM EQUIPMENT / SYSTEMS

- 2/8/34Mbps Intermediate Data Rate (IDR) Modem Equipments for Cellular backhaul Full range of ADSL2+ CPEs
- Digital Loop Carrier (DLC) based Broadband Networks
- DSL based Broadband Networks
- FITH based GPON Solutions
- Wi-Fi / Wi-Max based Broadband Networks
- Digital Electronic Exchange of Capacity 40 - 40,000 lines (256P RAX, 512P SBM RAX, MAX-L, MAX-XL)
- Digital Access Cross Connect (DACC)
- Multiplexing Equipment at 2, 8, 34 & 2/34 MB Level
- Synchronous Terminal Multiplexers
- Wireless in Local Loop (WLL) System

## SOUND & VISION BROADCASTING

- Sound Broadcast Transmitters and Studio Equipment for Prasar Bharathi (AIR)
- (1KW, 100 KW )
- MW Transmitters and FM Transmitters – 100W, 200W, 500W, 1KW, 5KW, 10KW
- 10KW MW Mobile Broadcast Station
- Television Broadcast Transmitters (100W Band I & III, 100W UHF, 300W UHF, 500W / UHF & Class AB), 1 KW, 10 KW
- Remote Unmanned TV Station
- TV Receive Only (TVRO) Terminals (S Band/C Band)
- Digital Colour TV Outside Broadcast Van
- Television Studio Equipment
- Cable TV Head End System, TV Demodulators
- Set Top Box (DTH, Cable)
- Commercial IRDs
- Disaster Warning Set Top Box (STB)

## **TANK ELECTRONICS AND CONTROL SYSTEMS**

- Gun Control & Drive Systems for Armoured Fighting Vehicles & Air Defence Artillery
- Gun Systems
- Fire Control Systems for Armoured Fighting Vehicles
- Fire Control Systems for Air Defence Artillery Gun Systems
- Electro Optical Fire Control & Tracking System for Land, Sea and Airborne Applications
- Servo Pedestal Platforms for Land, Sea and Airborne Applications
- Analog & Digital Tank Intercom System for Armoured Fighting Vehicles
- Electronic subsystems and harnesses for Armoured Fighting Vehicles
- Advanced Land Navigation Systems (ALNS)
- Nag Missile Carrier (NAMICA)
- NBC Protection System for Armoured Fighting Vehicles
- Integrated Fire Detection & Suppression System (IFDSS)
- Integration of Electronic Reconnaissance Equipment on Combat Vehicle
- Hydraulics for T-72 Tank Stabilisers

## **OPTICS & ELECTRO-OPTICS**

- Optical Sub-Assemblies
- Monocular Night Scope with 35mm Still Camera Attachment
- Passive Night Vision Devices: Goggles, Binoculars, Periscopes, etc
- Night Vision Weapon Sights for 5.56 INSAS, 7.62mm Rifle, LMG, AK-47, 84mm RL, etc
- Light Weight Night Weapon Sight, Night Vision Monocular
- Night Vision Device for Mortar Fire Control, Day & Night Sight for T72, T55 & BMP Tanks
- Thermal Imaging Systems – Hand Held Thermal Imager, Integrated Observation Equipment etc.
- Passive Night Observation Device
- Laser Range Finders
- Gap Measurement Device, Angular Measuring Devices
- Head Up Display (HUD) for fighter aircrafts
- Head Lights & Search Lights for Armored Vehicles, Tank Sight
- Holographic Weapon Sight, Zoom Stereoscope
- Forward Observers Video Communication System
- Un-cooled Thermal Imager
- Surgical Microscopes for Ophthalmic, ENT & other Applications
- Day/Night Sights and Sub-Systems for Tank Fire Control Systems
- Spotting Scope

## **ELECTRONIC WARFARE SYSTEMS**

- Electronic Warfare Equipment (Airborne, Shipborne, Land-Based)

## AVIONICS

- Cockpit Display Systems
- Digital Flight Control Computer
- Acoustic Miss Distance Indicator
- Radio altitude Switch
- Pylon Interface Boxes for LCA
- Ground Control Systems for UAV
- Data Links for Helicopters & UAV

## ANTENNAE

- Shaped Reflector Radar Antenna
- Multi Beam and Scanning Beam Antenna
- Phased Array Antenna System
- IFF Array Antenna (Linear & Planner)
- Composite (Moulded) Antennae for Radar & Communication Equipment
- Microwave Line of Sight (LOS) Antenna
- Television Receive Only (TVRO) Antenna
- Very Small Aperture Terminal (VSAT) Antenna
- Satellite Earth Station Antenna System
- Cellular Antenna, GSM Antenna
- Telescopic Masts/Mobile Elevated Hydraulic Mast

## OTHER PRODUCTS AND SYSTEMS

- Electronic Voting Machines
- Simputers
- Satellite Radio Receivers
- Simulators & Trainers (Forward Observer Simulator, Vehicle Driving Simulator, Mortar Simulator, Tank Driving and Gunnery Simulator for T-72, T-90 & BMP II, Anti Tank Guided Missile Simulator)
- Space Electronic items
- Armoured Engineer Reconnaissance Vehicle
- Ruggedised PC
- Automatic Test Equipment
- High Voltage Power Supplies & Modulators
- Alarm systems for Railway unmanned level crossings
- Display Systems
- Data Handling Systems
- Versatile Console System
- Modular Data Bus (MDB)
- GPS Receivers and Applications
- Shelters for Electronic Systems
- Software Modules
- Signal Conditioners for PSLV & GSLV
- RPL Dosimeter
- Hydraulics for T-72 Tank Stabilizers
- Power Steering electronics for 4 wheelers
- Lawful Interception and Monitoring Solutions
- (GSM/CDMA, E-mail, Wi-Fi/Wi-Max, V-Sat, Thuraya)

## COMPONENTS

### MICROWAVE

- Active/Passive Components up to 18 GHz
- Ku/C Band Receiver for Satellite Payloads
- 100W Continuous Wave Amplifier of 'C' and Extended 'C' band Satellite



## **SEMICONDUCTORS**

- Silicon Devices (Power & RF Transistors, Small Signal Devices, Detectors)
- Integrated Circuits & ASIC Design Services
- Hybrid Microcircuits
- Liquid Crystal Displays & Devices
- Micro Electro Mechanical Systems (MEMS)

## **PROFESSIONAL TUBES & PASSIVE COMPONENTS**

- Transmitting Tubes (Triodes & Tetrodes)
- Microwave Tubes (Magnetrons, Klystrons & TWTs)
- Vacuum Interrupter Tubes
- Space-grade Band Pass Filters
- Waveguide Rotary Joints
- Quartz Crystals, Quartz Crystal Oscillators and Filters
- Ceramic Feed Throughs, EMI Filters & RFI Filters
- Stationary and Rotating Diagnostic X-Ray Tubes and Tube Heads

## **SMART SOLUTIONS / e - SOLUTIONS**

- e-Governance Projects/Solutions
- Smart Cards & Smart Card based Systems / Solutions
- Security Solutions
- Internet Enabled Turnkey Solutions

## **SOLAR PRODUCTS**

- Cells & Modules (Monocrystalline & Multicrystalline)
- Solar Battery Chargers & Solar Power Plants
- Solar Lighting Systems

## **BATTERIES**

- Magnesium Manganese Dioxide Batteries
- Lithium Sulphur Dioxide Batteries
- Ni-Cadmium Rechargeable Battery Packs
- Ni-MH/Li-ion Batteries

## **PROJECTS & CONSULTANCY**

- Turn-key Projects/Systems/Solutions
- State-of-the-art Traffic Signals & allied Products (Intelligent Area Traffic Control & Management Systems)
- Display Boards and Systems, X-Ray Baggage / Container Inspection systems
- Special Purpose and Custom built Machines/Systems/Solutions
- Smart Card Access Control / CCTV system
- Composite Data Recorder System for storage & retrieval of data for defence customers.

## **DESIGN SERVICES**

- Project & Consultancy Services
- Design Services of Core Subsystems like Power Amplifiers, Power Supplies, RF & Synthesizers, Encryptions, DSP, Signal Processing, Software
- State-of-the-art advanced design services offered by Central Research Laboratory of BEL in the following areas:

- Microwave, Millimeterwave, antennas and subsystems
- RF and Microwave Components and Devices
- Systems/Subsystems of Radar/Sonar Equipment
- Signal processing
- Advanced Switching, Transmission, Access subsystems
- Cryptography
- VLSI, SOC
- Embedded Systems & Software
- Application Software Solutions for large systems
- Image Processing Solutions etc.

## **CONTRACT MANUFACTURING SERVICES**

- 'Build to Spec' and 'Build to Print'
- Assembly of PCBs (SMT, THROUGH HOLE, MICRO BGA), Modules and
- Testing
- Precision machining and Fabrication
- Optical and Opto Electronic Components and Assemblies
- Microwave Super Components Assemblies
- Antennae Manufacturing
- Cable Assemblies and Wiring Harness
- Stator Coils & Rotors for CT Scan equipments
- Fabricated & Machined sub-assemblies for MRI equipments
- Aluminium alloy Housings for Medical equipments
- Copper-Nickel & Stainless Steel Housings for X-Ray equipments