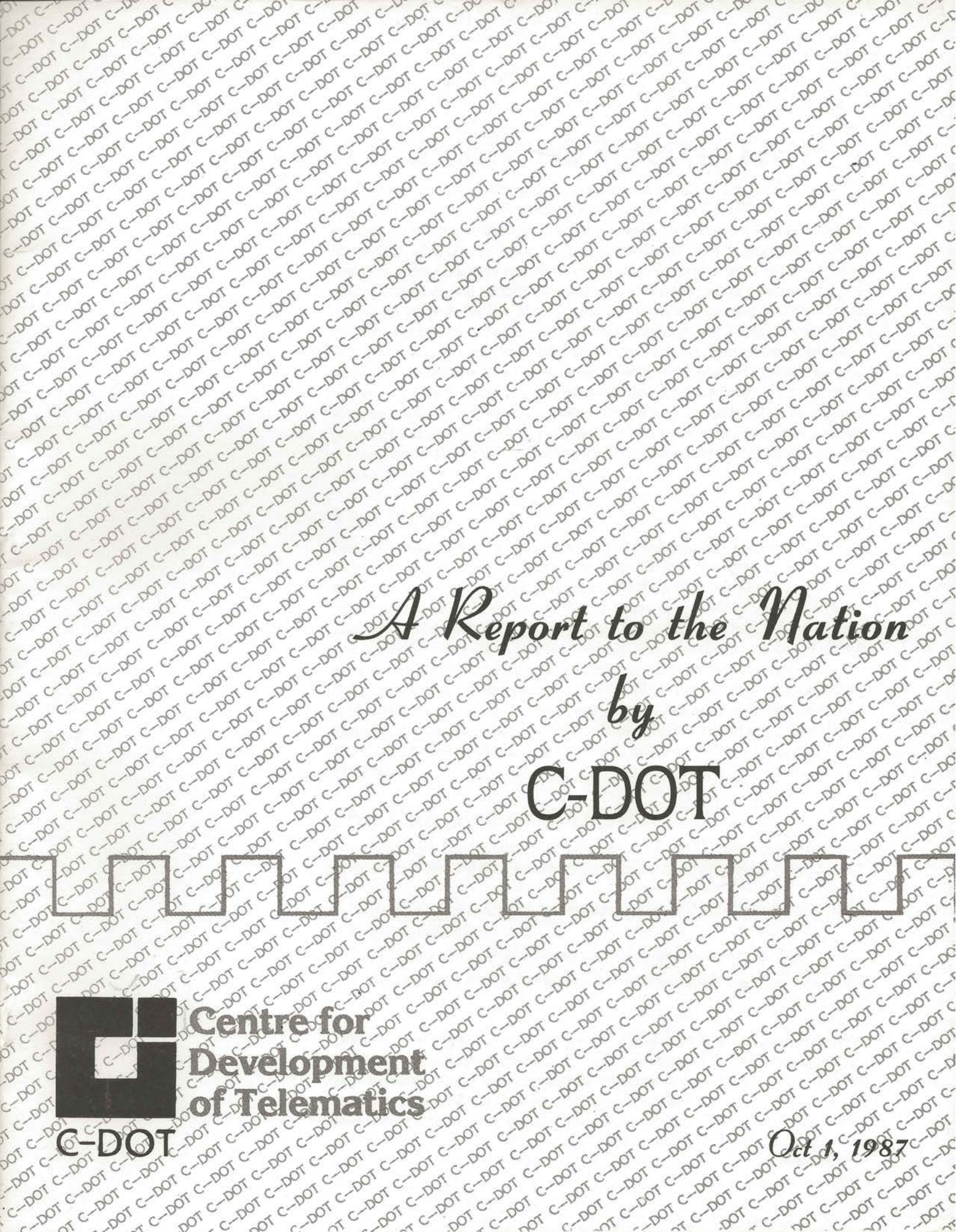
A Report to the Nation by C-DOT



Centre for Development of Telematics

C-DOT

Oct 1, 1987

A REPORT TO THE NATION

Mr. Prime Minister, distinguished guests and friends from C-DOT.
It is a pleasure to present a report to the nation on C-DOT's accomplishments in the last 3 years. Perhaps, someone may be curious to know why, when C-DOT has been an open book right through. Answer is that this great nation of ours had reposed in us 'super trust' of developing sophisticated digital telephone switching technology and products on our own from scratch for Rs. 35 crores in 36 months. Now the question is how far have we been able to come up to her expectations ? Did we size up to it ? The questions posed are as difficult as the answers themselves. But our endeavour would be to answer these queries frankly and honestly, for you to judge. According to us, the task was not, and has not been a simple one by any yardstick. In fact, for quite some time, it was considered to be a great gamble by many. However, we believe, it has proven to be a great initiative on the part of the Indian system to challenge the genius and the drive of our young people.

The Need

Telecommunications is fundamental to overall human, social and economic development in the modern world. It is changing at an incredible rate from the present telephone service to the future convergence of communication and computers into the emerging field of TELEMATICS, paving the way for the Information Age. India, with a strong industrial base and scientific manpower, impressive in quality, numbers and range of skills, must move forward to bring the benefits of telematics to the people, industry, agriculture and commerce through improved mobility, education, productivity and efficiency. For a vast country like ours, with diverse regional languages, traditions and culture, efficient communication and future telematics services are essential to achieve national unity and integration.

The Concept — C-DOT

The Centre for Development of Telematics (C-DOT) was established on August 25, 1984 by the Government with the following objectives :

* To develop sophisticated telematics technology and products indigenously.
* To digitise India's telephone network to improve overall service.
* To be prepared for the Integrated Services Digital Network (ISDN) for the future.

C-DOT is a scientific society funded jointly by the Dept. of Electronics and the Dept. of Telecommunications. The main goal of C-DOT has been to help increase telephone accessibility, improve overall reliability and develop rural communications. The basic strategy has been to focus on self-reliance, labour intensive and capital sensitive programmes. The emphasis on self-reliance is essential to meet the high traffic conditions and the predominant hot climate in India. Self-reliance is also needed to build local industrial infrastructure and train manpower to effectively maintain and manage the complex networks on our own.

The Accomplishments

In the last 36 months, C-DOT has accomplished a great deal in many areas such as Infrastructure, Products (PBX, RAX, MAX), Productionisation, Vendor Development, Documentation, Training, Technology Transfer, Human Resource Development etc. A great deal still needs to be accomplished in the near future.

The Infrastructure

At present C-DOT has a total of 425 people with an average age of 25 years. In Delhi, there are 215 people working on Software, Systems, Documentation, Training, Administration and Finance. In Bangalore, there are 210 people working on Hardware, Vendor Development and Productionisation. We have a large computer network facility established in Delhi with appropriate tools and techniques for about 150 engineers to develop the software. System integration and final evaluation facilities are also set up in Delhi. In Bangalore, we have hardware laboratories, a pilot production plant and a technology transfer cell. Besides this, C-DOT has on-going interactions with IITs, universities, quality/testing laboratories, software consultants, DOT, DOE, ET & T and other R&D institutions and industries.

In an effort to optimize human productivity, we have developed new work environment, new work culture and new work standards which reflect an egalitarian approach as opposed to the traditional hierarchical management. New procedures, policies, training, tools and methods are evolved and computerised to improve internal communication, interpersonal relationships, team work and individual commitment to the overall programme. The project is monitored through annual plans, computerised PERT with clarity on responsibility, authority and meaningful deliverable milestones and periodic reviews. At C-DOT, administration and support staff plays an important role in providing proper infrastructure for engineers to function.

We believe that the key to the successful programme implementation lies in our administrative approach to mobilise and motivate dedicated young engineers with DRIVE — Dedication, Responsibility, Initiative, Vision and Enthusiasm.

C-DOT's Technology

The technology used to develop the C-DOT DSS family can be classified into atleast four different areas, i.e.,

* Systems
* Hardware
* Software
* Production

In each of the above areas, technological choices were very complex. On one hand, we needed the most advanced state-of-the-art technical solutions and on the other, we had to develop the basic infrastructure locally for professional grade components, ancillary industries and productionisation. Similarly, in the beginning, we needed only basic Plain Old Telephone Services, but for the future, we have to migrate our product line to Integrated Services Digital Network. However, the key technological challenge was to develop a product family using Indian talent which could be produced in India, with as much local content as possible, but never losing sight of international price and standards.

Simultaneously, it was essential to develop infrastructure to make sure that we remain in tune with the frontier technologies in switching systems' hardware and software through necessary value engineering, upgrading, retrofit and product migration into the 1990s.

The C-DOT DSS technology includes state-of-the-art digital PCM (32 channels) — CCITT compatible, non-blocking switching, distributed (multi-microprocessor based) control, modular and functional hardware, high level language programming in 'C', feature flexibility and redundancy for high reliability.

Family of Products

Based on these technologies, a family of Digital Switching Systems consisting of four major products — Private Automatic Branch Exchange (PABX), Rural Automatic Exchange (RAX), Main Automatic Exchange (MAX) & the Trunk Automatic Exchange (TAX) with non-blocking capabilities, sizes ranging from 128 ports to 16000 ports, have been designed, which can be expanded to 40000 ports with concentration.

The family concept provides commonality in hardware, software, packaging, maintenance, spares, reliability, administration, training, documentation etc. This commonality benefits in component availability, production, testing, installation, maintenance and overall operations. The entire C-DOT family of products is designed with around 30 different printed circuit card types with 5 basic building blocks. Similarly, in software, around 4000 modules have been developed with over 350,000 lines of source and 10 megabytes of object code/data. The entire family has been designed with complete redundancy beyond 8 ports to ensure fail-safe mechanism with automatic switching-over of faulty modules. It is hoped that the family concept will benefit more in the long run through standardisation for all major switching applications in the country.

PBX

* 128 port PBX for business applications has been developed and productionised.
* 48 manufacturers from Private/Public and Joint sectors have been licenced for C-DOT PBX technology. Out of these, 20 have made prototypes with complete production infrastructure.
* 15 are already in production. Over 2000 lines are already working in the field.
* PBX feature enhancements and expansion are being designed to address larger market needs.
* PBX was introduced first in 1985 to get early feedback on vendor development and productionisation concepts for MAX.

RAX

* 128 port RAX suitable for rural application which does not require air-conditioning was developed and has been working at Kittur, Karnataka since July, 1986. Subsequently, one more RAX was installed in Madhya Pradesh.
* And, now seven manufacturers have been licenced to produce C-DOT RAX.
* A factory has been set-up at Bangalore in collaboration with ITI to manufacture C-DOT products commencing with RAX.
* RAX was introduced after the PBX to verify various network/signalling interfaces for MAX.

MAX (512 port)

The 512 port main exchange which consists of four 128 port modules with additional processing and switching network capabilities contains approximately 90% of the hardware and software required for the large 16000 port system. At present, 10 prototypes of 512 port MAX with complete hardware and software are working in the laboratories. These are used to test various call processing, administration and maintenance software features and functions. One 512 port MAX was installed in Delhi Cantt. in June, 1987 and is undergoing final field evaluation. This system will be offered to Dept. of Telecommunication during this month for cut-over into commercial service. This exchange is suitable for a majority of small towns, suburban and distributed switching applications in urban areas.

MAX (16000 ports)

Contrary to the general belief, detailed design for the 16000 port main exchange started in January, 1985. It essentially consists of multiple 512 port MAX modules (upto 32) connected through a simple Central Switch Module. This exchange is suitable for high traffic needs for urban and metropolitan areas. The skeletonised version of two 16000 port systems with complete hardware and software are in operation today in Delhi and Bangalore. A prototype of this, with 2000 ports equipped, was installed in Ulsoor, Bangalore in August, 1987. We are currently performing field tests and plan to cut-over with 7000 ports in service around December, 1987.

Other Products

Besides these products, we have also developed two telephone instruments, basic and feature phones, to be used with C-DOT PBX. These are designed in cooperation with IIT, Bombay. CCITT No. 7 Signalling System is also designed and is currently working in our laboratory. We have also started work towards the future ISDN capabilities and prototype version of digital telephones are already working in the labs. Once the MAX is fully evaluated, it will be field tried as TAX/ILT for tandem applications with minor modifications.

Productionisation

It was decided from the beginning that C-DOT will also be responsible for productionisation of all its products. As a result, a great deal of emphasis has been placed right from day one on documentation, training, packaging, installation, maintenance, testing, quality control, component specifications, assembly methods, system integration, software production etc.

C-DOT production philosophy focuses on simplicity in manufacturing, based on assembly approach, which is labour intensive and capital sensitive. For example, all components are purchased from outside vendors, tested, assembled and integrated to provide complete system solution.

All our manufacturing plants are designed to include computerised production planning, material management and marketing/financial systems. We have a separate team for technology transfer to assure technology transfer as opposed to technology transplant.

Today, we have 20 manufacturing units for PBXs with full infrastructure, a pilot production plant at ITI and one at C-DOT, Bangalore. The emphasis was quality during system design, circuit design, software design, before and during manufacturing, during installation, and during operation and maintenance.

Vendor Development

In order to assure early indigenisation of C-DOT DSS design, we had our first vendor conference in January, 1985 where 400 potential vendors came to Bangalore, 400 to Bombay and 400 to Delhi. Because of this overwhelming enthusiasm on the part of Indian entrepreneurs, today we have over 100 vendors, providing various components for C-DOT products. At present, almost everything except integrated circuits (50% of the cost of our products) are manufactured locally. We plan to indigenise, majority of the integrated circuits also by 1990 through joint efforts with SCL, Chandigarh and BEL, Bangalore.

Finance

Of Rs. 35 crores which was allocated to C-DOT for the first technology mission, Rs. 30 crores has been spent in 36 months. Of this, 20% has been spent on over 1000 man years of engineering effort, 40% on equipment and 20% on infrastructure. Financial systems at C-DOT are designed to provide support as opposed to controls. As a result finance has been a help as opposed to hindrance.

It is believed that the Rs. 30 crores we have invested will be paid atleast 20 times over in the next 10 years in the form of foreign exchange savings. Not to mention the overall growth in the local economy resulting from new jobs created and the new infrastructure built for components, circuits, systems and services. For example, just the introduction of C-DOT RAX is going to save over Rs. 50 crores in the next 5 years by not importing the rural exchanges.

Human Resources Development

Human Resources Development has been the key to our progress. However, this is also one area where we have been weak. Inspite of several in-house training programmes, university interfaces, consultants, NRI experts, conferences, seminars, workshops etc., a great deal needs to be accomplished to build technical leaders for tomorrow's need in this vital technology.

Our human resource capital in the brain banks abroad with non-resident Indians has been effectively used by C-DOT. This was useful to bridge the grey areas of technology through frequent individual visits to India for interaction with our young engineers.

Future Horizon

Inspite of all these accomplishments, we still have miles and miles to go. We are conscious of the fact that designing a family of Digital Switching Systems will not solve the telecom problems of India. Now the new C-DOT systems will have to be field tried and manufactured in large quantities. Although, we may find some problems during the field trial, we are confident that our qualified and dedicated engineers will solve these as they appear.

Once manufactured, it will have to be installed and maintained nationwide. Alongwith switching, transmission systems will also have to be updated. Simultaneously, our people will have to learn to manage this new technology through new training and new tools, necessary to provide improved services to the ultimate customer.

While this activity is going on, we have a major task of institution building ahead of us. We now want to convert C-DOT from the project oriented organisation to a viable institution which can preserve its unique character and environment and continue to flourish at the present pace.

The second technology mission to be accomplished by 1990 includes, besides field trials, clean-ups, bulk productionisation of MAX, feature enhancements, software modifications, product migration, value engineering, various other exchange applications, CCITT No. 7 Signalling Systems and Integrated Services Digital Network capabilities.

We also have a great deal of work ahead of us to explore export potential for our technology and products in developing countries worldwide. We are confident that with the seeds we have planted, we can change the face of telecommunications in India, only if we think anew to re-train, re-tool, and re-organise our entire sector.

It is hoped that our effort in initiating indigenous development aimed at self-reliance in this technology of tomorrow, will give us courage to focus on self-reliance with C-DOT models and methodology, necessary to harness energies and intellect of our own people, not only for modernising the telecom sector but also for various other vital developmental activities, essential to meet the basic needs of our people at large. We would like to end this report with a comment that "qualified and dedicated people coupled with management skills to mobilise and motivate their capabilities are the ultimate limitations of development, and **not capital or technology.**

Finally we would like to thank :

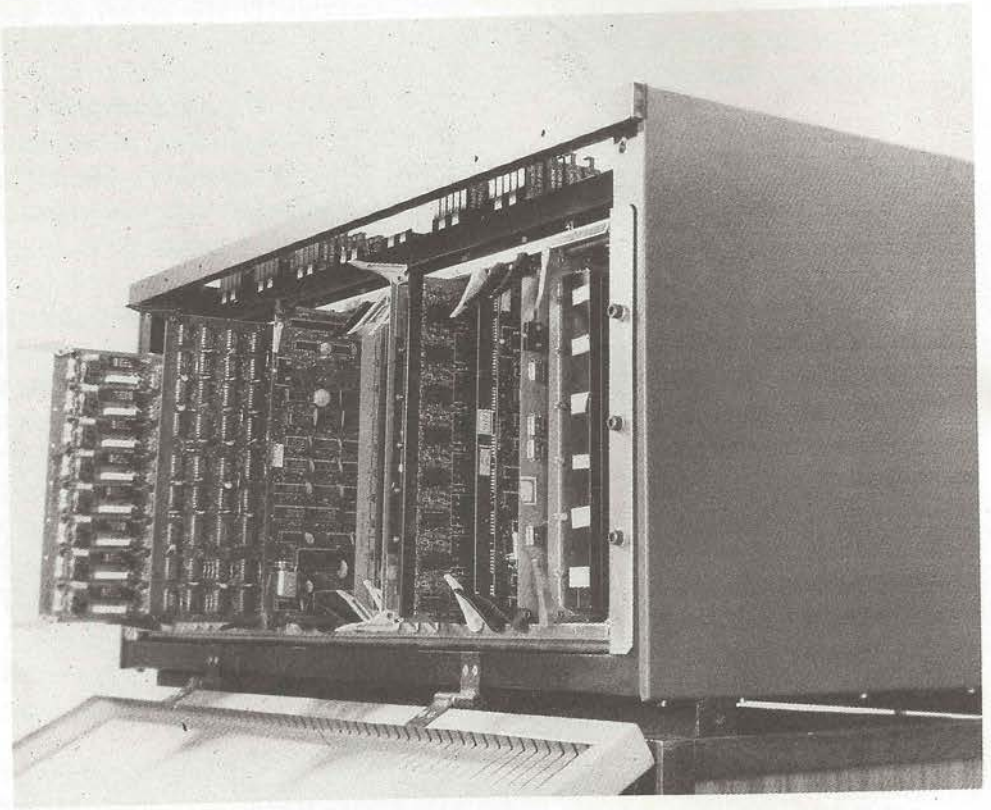
* Our families for allowing each one of us to spend long hours at C-DOT
* Media for fair coverage of ongoing C-DOT activities and
* All those individuals, organizations and Government agencies who have supported us in various activities.

Mr. Prime Minister, please allow us to say publicly that without your personal involvement from 1981, our dream to build self-reliance in this vital technology of tomorrow as part of the ultimate goal outlined by our founding fathers of independent India would have remained only a cherished reverie never to be achieved — but only to be deferred, delayed, distracted and dead. Through your concern, commitment and continuing encouragement, it has been possible to deliver this development to the nation.

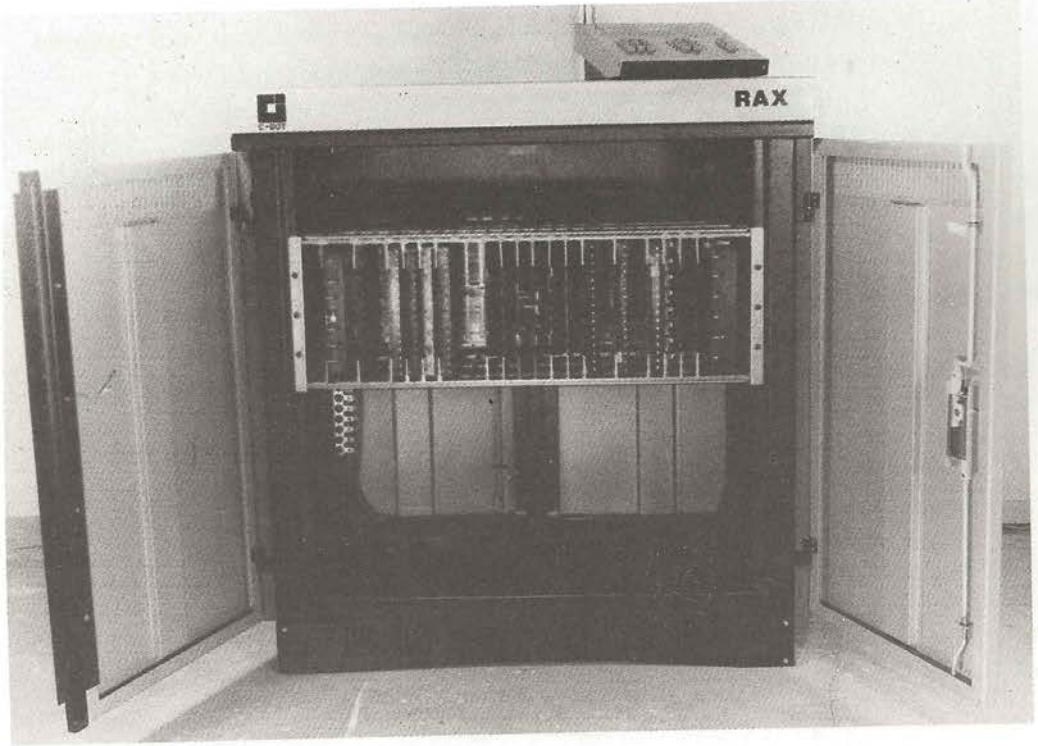
Thank you for your vision, support and presence.

PEOPLE AT C-DOT.

C-DOT Products

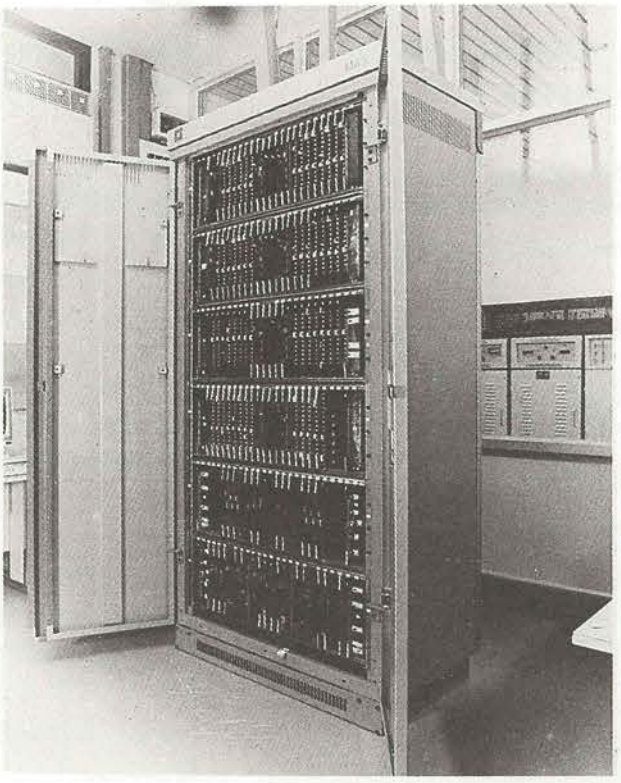


128 port PBX

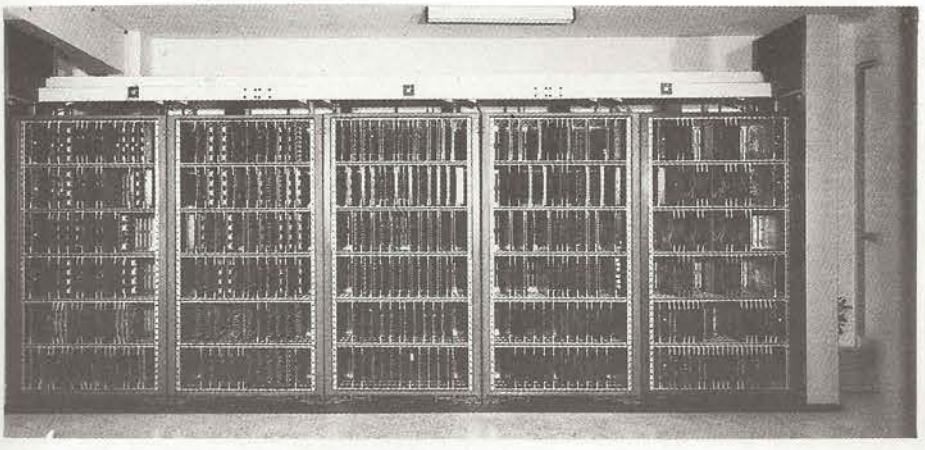


128 port RAX

C-DOT Products



512 port MAX



16000 port MAX

C-Dot technology for EPABX developed

Modern electronic exchange know-how

Major Events

Aug 1984 — July 1985

Aug
- C-DOT comes into being with a team of 30 engineers.

Sep
- Draft of bye-laws referred for clearance.
- First meeting to work out the details of budget.

Oct
- Brainstorming by C-DOT engineers on General Technical Specifications of the Digital Switching Systems.

Nov
- Orders placed for the purchase of Main Frame Computer.

Dec
- First set of C-DOT bye-laws for administration and management cleared by the Government of India.

Jan
- Vendor Conferences at Delhi, Bangalore and Bombay to assess the status and to work out development plans for ancillary industries for components and parts required for assembly oriented manufacture of C-DOT products.
- General Technical Specifications of C-DOT DSS finalised in consultation with Ministry of Communications.

Feb
- Accommodation rented for offices at Delhi and Bangalore.
- System Architecture of C-DOT DSS finalised.
- Recruitment of project team begins.

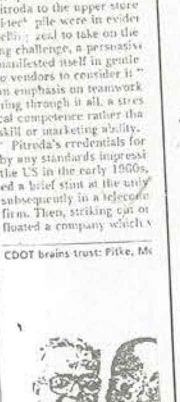
Mar
- Functional Specifications of C-DOT DSS released.

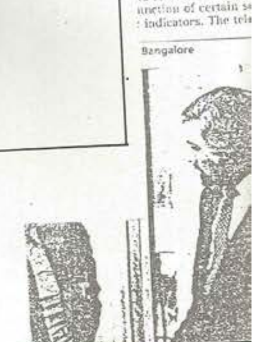
Apr
- Appointment of Project Board Members approved.
- C-DOT team strength reaches 100.
- Policy on administration and financial delegation of powers, facilities and other benefits to C-DOT team members, in line with C-DOT philosophy of creation of a new work culture finalised.

May
- VAX-11/730 computers installed at Delhi for Software Development.
- NRIs hired as Technical Consultants to help C-DOT in specialised fields.
- Hardware and Software Architecture finalised.
- DSS Features and Facilities finalised.

Jun
- Detailed Hardware and Software Design work started.

Jul
- C-DOT Team strength reaches 200.
- Purchase and procurement procedures simplified/streamlined.
- Library set up in Delhi and Bangalore.





GANDHI 26 NEW DELHI

MR GANDHI SAID INDIA WAS ON THE VERGE OF DEVELOPING ITS

THE WORLD, IF NOT NOT BETTER.

SERIOUS THOUGHT HAD BEEN GIVEN TO IMPROVING TELECOMMUNICATIONS

... BUT RESOURCE CONSTRAINTS ALSO HAD TO BE TAKEN INTO

Big rush for C-Dot knowhow

Ready buyers for C-DOT technology

Electronic exchange for Karnataka village

Rural exchange technology: C-DOT claims an edge

Major Events Aug 1985 — July 1986

Aug

* First C-DOT Anniversary Celebrations at Delhi and Bangalore. First C-DOT News Letter released.
* Inauguration of 128 port PBX by Shri Ram Niwas Mirdha, Minister of State for Communications at Bangalore.
* First PBX manufacturers conference at Bangalore.

Sep

* PBX features and capabilities demonstrated to the Prime Minister at his office.

Oct

* Meeting with potential manufacturers to set up a platform for the Technology Transfer of 128 port PBX.

Nov

* Workshop on Team Building and Communication for C-DOT team at Delhi.
* C-DOT team strength reaches 300.

Dec

* PBX features and capabilities demonstrated in the Parliament House.

Jan

* First PBX prototype developed by C-DOT manufacturers.
* Work on CCITT No. 7 starts.

Feb

* Preliminary integration of DSS hardware and software begins.
* First House Journal released.
* More office/laboratory accommodation hired at Bangalore.
* Pilot Production Plant set up.

Mar

* First prototype of 512 port MAX released. RAX moved to Kittur for testing in the field.
* Agreement signed with 48 manufacturers for transfer of 128 port PBX technology.

Apr

* Vendors Conference at Bangalore.
* Computer Centre set up at Bangalore.

May

* C-DOT participates in 'India on the Move' Exhibition in the Parliament Annexe.
* Hotline (internal news magazine) started.
* First Training Programme at Bangalore for PBX manufacturers.

Jun

* C-DOT team strength reaches 400.
* Micro VAX-II computers installed at Delhi.
* Line to line calls on simulated hardware of C-DOT DSS established.

Jul

* 128 port RAX cut-over into service at Kittur, Karnataka.

C-Dot to pilot pro...

Can this dreamer's revolution ... Third W... telecom...

Indian engineers develop digital electronic PABX in record time

CENTRE FOR DEVELOPMENT OF TELEMATICS announces MANUFACTURERS' CONFERENCE

C-Dot keen to provide rural exchange knowhow

(20) THE HINDUSTAN TIMES WEDNESDAY JANUARY 28 1987

C-DOT has an eye on future

By A. Thothathri Raman

-DoT and ESS-II

Pact on using C-DoT switching knowhow

Eight companies opt for C-DOT

India to make digital switching system

Major Events

Aug 1986 — July 1987

Aug

* Major project progress review held.
* II Annual Day Celebrations at Delhi and Bangalore.

Sep

* C-DOT participates in the "Africa Telecom '86" at Kenya — RAX makes impact.
* Card Test Facility set up at Bangalore.
* Prototypes of Feature & Simple phones ready.

Oct

* Line to Line call with C-DOT DSS established in the Lab.
* Diagnostic programme developed for the validation of 512 port MAX.

Nov

* Cuban and SAARC delegations visit C-DOT.

Dec

* Mr. R.E. Butler, President, ITU visits C-DOT.
* Joint conferences of PBX Licencees, manufacturers and vendors at Delhi.

Dec

* First Outgoing and Incoming calls established with C-DOT DSS in the Lab.
* MOU with ITI signed for ITI-C-DOT factory establishment.

Jan

* System Feature Tester Developed.
* Training of DOT Engineers on C-DOT DSS Architecture, Technology, Features and Facilities, Operations and Maintenance.
* C-DOT participates in "India Comm '87".
* Agreement with 8 State Electronic Development Corporations and ITI signed for transfer of 128 port RAX technology.

Feb

* First Central Module released.

Mar

* Management Training Programme for Group Leaders and Managers.

Apr

* Major Project Progress Review held.

May

* 128 port MAX installed at Churhat, M.P.

Jun

* 512 port MAX installed at Delhi Cantt.
* Fabrication of Multimodule MAX for Ulsoor field trial starts.
* Installation of equipment at ITI-C-DOT factory, Bangalore begins.

Jul

* First Marketing Managers Conference to formulate the strategy for Marketing of PBX.

C-DoT aids Kittur's growth

-DOT p… AX line

DoT, Meltron … vanced PA…

AFTER a telling time of two-and-half years, the Centre for Development of Telematics (C-DOT) came into being in August 1984.