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## 資料リスト

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資料1：パキスタン電信電話総局作成「研究計画線表」に対する日本側見解

COMMENTS FROM JAPANESE SIDE ON "PROJECTS TO  
BE UNDERTAKEN IN C.T.R.L. ISLAMABAD" PROPOSED  
BY T&T OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Comments from Japanese Side on "Projects to Be Undertaken  
in C.T.R.L. Islamabad" proposed by T&T of Pakistan

I. Basic Concept

The research projects proposed by T & T for the respective sections can be classified, through our examination, into the following two categories.

- (1) Research projects that can be estimated to allow development for practical use to be completed and production to be started in near future in Pakistan.
- (2) Research projects which involve extremely high research levels and for which efforts should be made, for the time being, to the acquisition of fundamental knowledge.

Let us now consider each of these two categories in more detail. Research projects belonging to the former category will allow expansion of coverage in service, introduction of new services, or automatization of the existing service by the addition of equipment to be developed through the development at the laboratory to the existing electrical communication facilities in Pakistan.

Most of these research projects are those of which identical techniques have been already completed in developed countries and of which development can be completed in Pakistan with comparatively small numbers of research personnel and engineers in comparatively short periods of time but by giving a stress on the introduction of modification in consideration of the climate, environment, technical circumstances, facilities of existing manufacturing factories, etc., of Pakistan.

Research projects belonging to the latter category are mostly on those systems which, like electronic exchange systems, have been

completed by employing great numbers of research workers and engineers over long periods of time on the accumulation of advanced technology in developed countries. These developed countries are continuing everlasting efforts with great numbers of staff and large amounts of money for further improvements and development of new types to come in future generation not to become behind their competitors in the fields of these research projects.

Accordingly, it may be suitable to progress research in the laboratory as follows.

- i) To study and examine the system configuration, circuit configuration, and components of equipment belonging to this category which have been and will be developed with latest technology.
- ii) To establish a research scheme in which problems encountered in operating facilities or systems introduced into Pakistan will be solved and modification will be made as required for these facilities or systems to meet the circumstances of Pakistan. By growing and accumulating these capabilities, the laboratory will be able to play a pivotal role for operating facilities or systems by its own efforts even when there is no help nor cooperation from the manufacturing countries after introduction of latest technology into Pakistan, which may often happen to developing countries.
- iii) To aim at gradual progress so as to become capable to manufacturing some equipment and facilities with the substantiation in the quality and quantity of research workers and engineers and the development in general technical level in Pakistan.

It may also be necessary to assign responsible persons to the respective research projects and since it is not suitable for each res-

possible person to be in charge of two or more items, the number of research projects should be made smaller than the number of AE's in the respective sections.

## II. Research Projects for Respective Sections

### 1. Telephone Equipment Section

#### (1) Development of telephone for high loss subscriber line

Pakistan has many thinly populated areas and it may often happen that telephones must be set at places distant from the telephone exchange. Since a similar technique has been already developed for practical use in Japan, this research project may see its goal by expanding the research schedule to three year or so.

#### (2) Development of pushbutton dial telephone

This type of telephone has been already introduced for practical use in several countries and it may be a matter of course in a sense for Pakistan to plan the development of pushbutton telephone suitable for its manufacturing technology. However, it is to be noted that although this type of telephone will allow reduction in required connection time and abbreviated dialling when connected with crossbar or electronic exchange, it is rather difficult to provide these advantageous features of this type of telephone by connection to EMD exchange widely used in Pakistan.

If Pakistan has the plan to introduce electronic exchange widely, the production of pushbutton dial telephone will be important. Then, this research project will be adequate and probably more important than the research project of (1) above.

#### (3) Development of small-type telephone

This project of developing small-type telephone on the basis of the pushbutton dial telephone set out to be developed in the project mentioned in (2) above should naturally be given lower priority than the project of (2) above.



(4) Development of electronic telephone

In Japan, the development of this type of telephone which employs electronic parts as telephone circuit elements has been completed in combination with the development of small-type telephone corresponding to the project mentioned in (3) above. Similar course of development should recommendably be followed in Pakistan as well.

(5) Development of picture phone

Many developed countries were attracted by the development of this type of telephone called television telephone but since it has been found that this telephone will be rather costly for its expected worth in service, all of these countries are now very negative for its introduction. Accordingly, attention to this project should be limited to the examination of the world's trend in this field.

(6) Development of cord dial telephone

The number of associate parties to be called up from one telephone is generally 20 - 30. The development of such equipment that will dispense with dialling their telephone numbers by memorizing these numbers on card. In particular, this type of telephone is extremely useful when the trunk circuits often become busy and repeated dialling is required upon dialling the telephone for toll calls.

Technically, this telephone does not involve so many difficulties and can be developed comparatively easily by studying products already manufactured in many countries.

(7) Development of button telephone

Since this telephone is a type of small PBX where plural telephone lines can be used common to a larger number of telephone sets and is useful for the development of communication efficiency

at offices and others, similar types of telephone have been commercialized in varieties of types.

This project seems to be practical if the demand to this kind of telephone is strong.

## 2. Switching System Section

### (1) Study and development of small-type electronic exchange

This research project will be progressed in the following course.

- i) Through the study of the function system structure, circuits, software and circuit components, the technical level on the operation and maintenance of the electronic switching system will be built up.
- ii) To operate the D20 Electronic Exchange in combination with other exchange such as PBX installed in the laboratory and examine and study its functions.
- iii) To operate the D20 Electronic Exchange in combination with a telephone exchange located in the neighborhood of the laboratory and examine and study its functions.
- iv) To modify the software system of D20 to adopt the national network of Pakistan along with the studies of ii) & iii).
- v) By advancing these technical accumulation efforts, the laboratory will play a leading role in all fields of electronic exchanges in Pakistan.
- vi) To advance research and development for domestically producing some equipment and software of the electronic switching system.

This research project is regarded as "giant" system research and will range over a long period of time and a particularly large number of distinguished research workers and engineers should be provided in the Switching System Section.

(2) Study and development of subscriber identification equipment

The development of this type of equipment will be required when such requirement is set out by T&T as to be able to issue detailed bill for STD or SITD rather than periodic pulse metering system and when the automatic detection of the calling party is required without asking the telephone number of the calling party by the introduction of new manual switching boards. Similar techniques have been already developed in USA, Japan, etc., and this project will not be an impossible theme.

(3) Development of mobile automatic exchange

Automobile is not of typical examples to which mobile telephone may be introduced. Automatic exchange of mobile telephone in narrow areas such as in intra-city or municipality areas is comparatively easy to establish and this type of technology has been already put into practical use in Japan. However, this does not give sufficient advantage in use and the development of such a system that will automatically discriminate the location of automobiles running over long distance on highways, etc., and will establish telephone connections automatically, will require a high technical level involving the use of electronic exchange. In addition, such a system will require a number of radio transmitter-receiver stations to be installed in Pakistan and requires the investment of a large amount of money. Accordingly, the research in the laboratory should be limited to the study of mobile telephone systems rather than the development thereof.

(4) Development of remote control electronic switching system

The central processor of electronic exchange may usually have a margin in capacity and the number of subscribers is comparatively small at the initial stage when the electronic exchange is

installed for the first time. This switching system in which call processing of subscribers located several kilometers from the telephone office will be performed by the margin in capacity may be on an extension line of, or closely related to, the research project mentioned in (1) above. Accordingly, the development of this type of switching need not be picked up as a research project for the time being.

(5) Development of auto-routine tester for electronic exchange

Although concrete contents of this research project are rather vague, this research project in which the development of such a system that will automatically test junction and trunk lines by utilizing various functions of electronic exchange is aimed by the modification of the software of the electronic exchange and the development of adapters should be carried into execution in a final stage of the research project of (1) above.

(6) Development of autoline routiner for external line testing of EMD exchange

The concrete contents of this research project are not known for sure. If this research project is intended for the development of such a system that will automatically test a great number of subscriber lines one after another by a test equipment installed at the telephone exchange, this will play an important role for grade-up of the service and rationalization of maintenance.

3. Telegraph Section

(1) Study and development of VFT terminal equipment

VFT terminal equipment (FS carrier telegraph terminal equipment) is capable of multiplex transmission of 22 - 24 telegraph channels on one telephone channel.

This research program is intended for effective utilization of expensive wideband transmission lines such as cables, satellites, and microwave. This type of terminal equipment is one of the most fundamental, important ones and it is very important from the standpoint of the communication policy of Pakistan also to study the terminal equipment, master related basic techniques, and initiate domestic production as much as possible.

(2) Study and development of multiplex telegraph equipment

This research project is an application of the VFT terminal equipment research project mentioned in (1) above. At present, various types of multiplex telegraph terminal equipment are used for multiplex transmission of various telegraph signals such as message, telex, and data on one telephone channel. Although it may be very important to acquire development capabilities by studying the multiplex techniques of these terminal equipment which provide various transmission functions, modulation methods (such as FDM, TDM, and PDM) and degrees of multiplex, yet it may be better to start the study and development after mastering VFT terminal equipment to some extent.

(3) Study and development of electronic teleprinter

Terminal equipment of telex and data communication systems tend to be designed more compact, lightweight, and higher in performance. In particular, microprocessor technique will be introduced to the full in developing high-performance equipment. Future development is anticipated in this field. Since this research project will require high technical levels, it should desirably be initiated with study.

(4) Study and development of VF/carrier facsimile equipment

Facsimile as a means for picture transmission may play a major role in future data communication. Being capable of transmitting data on telephone lines, facsimile may be greatly developed in the range of application by studying its applications in parallel with the expansion of telephone networks and spread of telephone.

This research project is important but requires high technical levels and should recommendably be initiated with study.

(5) Study and development of S+6 DX equipment

S+6 DX terminal equipment is such a duplicate communication equipment capable of transmitting one telephone channel and six telegraph channels on one telephone channel. This equipment is a sort of VFT terminal equipment. A couple of this equipment (2 sets) are listed for research purpose. This research program should be executed in parallel with the research project on VFT terminal mentioned in (1) above.

(6) Study and development of auto code sender to observe the quality of VFT channel load and Telex/Gentex equipment in Pakistan

At present auto code senders are employed for the performance test of terminal facilities and transmission lines of VFT and Telex/Gentex systems in Pakistan. These auto code senders are indispensable in maintenance and can be comparatively easily developed.

#### 4. Data Communication Section

(1) Study and development of modems with different speeds

In order to connect various terminal equipment such as typewriters and printers to data communication lines of which demand has been rapidly increasing, modems are necessary for converting

d-c signals to a-c signals or converting a-c signals having been sent to d-c signals for operating terminal equipment. Since these modems are comparatively simple in construction and circuitry if they are intended for low-speed data, the study and development of these modems is suitable as a research project.

- (2) Study and development of keyboard printer, paper tape reader and paper tape puncher

These items of equipment are popular as terminals in data communication and also used in the computer installed in the laboratory, so that it is very significant to study their functions, mechanical construction, circuit configuration, etc. However, this research project should be limited to study for the time being, since these items of terminal equipment require complicated, high-precision construction and will become expensive unless mass produced.

- (3) Study and development of error correction equipment

Various methods can be considered for automatically correcting signal error caused in a data communication line through detection at the receiving terminal. It is recommendable to study error correction and start the development of some simple error correction equipment in order to cope with the increasing demand in data communication. However, since this section is expected to study computer, this research project should be executed only when the study of computer still leaves a margin.

## 5. Power Plant Section

- (1) Study and development of power supply units of different ratings

The research project transferred from TRC (research on rectifiers) should be progressed and completed before everything.

(2) Study and development of automatic voltage regulator (AVR)

Study and development of AVR as part of the research project of (1) above may be necessary.

(3) Study and development of equipment for charge/discharge display of battery

This research should be executed in parallel with the research on rectifiers in (1) above.

6. Microwave Section

This section has a comparatively large number of research projects for the number of research personnel and various priorities are given to its research projects as shown in Table 1. Since many projects will be started in the first year, difficulties may be involved from the beginning.

Table 1 Research Projects

Priority	I	II	III	Total
No. of Projects	8	3	1	12

Table 2 Year of starting research

Starting year	1979	1980	Total
No. of projects	6	6	12

From these tables, it can be determined that the year of beginning research projects should be greatly changed in consideration of



the number of research personnel and research periods.

Consideration should be taken so that new research should be executed after completion of some research.

Table 3 - Expected Schedule of Research

Year Research Project No.	'79	'80	'81	'82	'83	Remarks
1	-----					
2	-----					
3		-----				Start in '84
4		-----				Start in '85 or later
5	-----					
6	-----					
7	-----					
8		-----				Start in '84
9	-----		-----			
10		-----				Start in '85 or later
11		-----				do
12		-----				do

----- Initial  
 \_\_\_\_\_ Revised

## 6. Microwave Section

- (1) Study of 2700Hz system FM transmitter and receiver and relevant sub-units

This system is intended for multiplex communication of 2700 telephone lines in the case of telephone for long-distance calls. Since the equipment introduced to CTRU will form a 1800-channel system, it is recommended to start with the basic research of the transmitter-receiver of 1800-channel system, accumulate high knowledge related with this system, and play a leader's role in solving problems which may be encountered in actually operating this type of microwave system in Pakistan.

- (2) Development of FM telephone modulator and demodulator
- (3) Development of FM TV modulator and demodulator

These items of equipment are intended for modulating or demodulating telephone and television signals in telephone and television transmission and are formed with extremely complicated combination of circuits for obtaining the required transmission characteristics. Accordingly, a stress should be given to the study of circuit configuration for the time being and development for practical use should be planned in future.

- (4) Study and development of compensatory equipment of differential gain

This equipment is intended for effecting compensation for reducing the influence of the transmission system to amplitude variation against the amplitude variation of the received signal.

This equipment is as important for differential phase (DP) compensation. It is recommended that this research project should be started with the accumulation of basic study and should in future be

advanced to development in parallel with the development of (3) above.

(5) Study and development of attenuator for use of M/W frequency

(6) Development of waveguide

These items of equipment compose waveguide circuits of microwave transmitter-receivers and are very important for wideband, high-performance transmission. Domestic manufacturing of these items of equipment should be started if a proper production system is available after understanding the high manufacturing technique, connecting technique, and electric characteristics of surface conductors.

(7) Study and development of IF amplifier

IF amplifier is used for conversion of the received microwave signal to an IF signal, AGC (automatic gain control) and SQ (squelch point) setting, and other functions. This component unit of the receiver provides the bulk of the receiver gain and incorporates a comparatively large number of component parts. This unit may be replaced upon occurrence of failure in the receiver, and it is recommendable to acquire repair/manufacture technique of this unit, which should be started with the replacement technique of component parts.

(8) Study and development of UHF 12 channel set

Use of UHF transmitter-receiver and terminal equipment is effective for small-capacity transmission.

It is desirable to accumulate technical capacities by conducting fundamental study of 400MHz transmitter-receiver and related terminal equipment. Requiring the technical examination of items including propagation, this research project will range five years or so.

(9) Study and development of selfsupporting and guide structure

Since architectural technology on the structure is already established in Pakistan, its application to this project is recommendable.

(10) Study of application of laser in telecommunication

Laser is one of such fields that are studied most emphatically at many laboratories in the world. It may be extremely important for the laboratory to grasp what is going on in this rapidly progressing field of technology. Participation in international conferences which are often held at some corners in the world should be considered in future in addition to study by literature.

(11) Study and development of parametric amplifier

Parametric amplifier is used to obtain a signal to be transmitted by amplifying an extremely weak input signal with a frequency higher than the input signal frequency. The signal thus obtained is used on the receiving side in satellite communication and tropo-scattering microwave systems. In this research project, a stress should be given to the accumulation of basic knowledge for the time being and development should be considered in future.

(12) Study and development of servo-mechanism models and their applications in telecommunication

Servo mechanisms in radio engineering are utilized in antenna systems satellite communication terrestrial stations, space diversity waveguide system in microwave communication, and rotating antenna systems in UHF systems. Servo control is being substituted with electronic control by the development of electronic components and circuits except in satellite communication terrestrial stations where various systems in use are not of no large type.

## 7. VHF Section

- (1) Study and development of transmitter and receivers for use in VHF frequency range

VHF transmitter-receivers are used for various purposes and can be classified into two categories: those handling a single input and output signals and those handling multiplex input and output signals. Since the ultimate purpose is mainly domestic production, it is recommendable to select a transmitter-receiver suitable for the intended purpose, start basic study of the electric characteristics and performance of the transmitter-receiver thus selected for the accumulation of technical experience, and enter into production but only after the necessary production system is established. VHF equipment is available in various types depending on the purpose and the determination of the type of equipment to be manufactured is very important. This research point of equipment should better be executed together with the research project of (8) in the microwave section.

It is recommendable to start with the study of transmitter and receiver for use in VHF and UHF frequency ranges before everything.

- (2) Study and development of automobile radio telephone system including transmitter & receiver for base station and transmitter station and transmitter and receiver for mobile station

Different telephone systems are employed in different countries, which is advantageous for the study of mobile communication. Radio equipment to be installed at fixed and mobile stations should cover rather narrow calling service zones. Study should be started with the accumulation of technical fundamentals for automatic con-

nection in a given small area. Communication available between automatic running on highways or over wide areas require extremely a high technical level and should be engaged in the considerable remote future.

This research project should be started with the study of propagation techniques applicable to narrow service areas and examination of various technical problems to be encountered in automobile telephone. The development of equipment should recommendably be planned separately in future.

(3) Study and development of duplex filter

Although, in principle, antennas are necessary separately for the transmitter and receiver, use of a duplexer in the feeder system allows the number of antennas to be reduced to one.

In the VHF band, high output power and narrow frequency spacing are required and the development of duplexer for practical use will require a considerable period of time. This research project should be started with the accumulation of basic knowledge.

(4) Study and development of 150MHz walkie-talkie set

Walkie-talkie is widely used in the world as a simple means of communication. The service area can be expanded by establishing a fixed repeater station. Walkie-talkie sets may be among those products that will be manufactured domestically in Pakistan.

(5) Study and development of high-gain antenna

A high-gain antenna may be used for obtaining signal output and input at high gain in the VHF band. Various types of antennas, which may be used for different purposes, may be picked up for study. This research project should be started with fundamental study and trial manufacture should be entered but after sufficient

accumulation of technical knowledge and experience.

(6) Study and development of VHF power amplifiers up to 50 watts

A power amplifier is employed in the final stage in VHF transmitters. Development of high-output power amplifiers not with vacuum tubes but with semiconductors requires latest technology. So, research for these high-output power amplifiers should be started with study after completion of research project (1) above.

8. HF Section

(1) Study and development of transmitter up to 10KW and associated communication receiver (ISB type)

The ISB type is used as a standard type of shortwave communication as well as the SSB type. Being applicable to both telegraph and telephone, the ISB type has wide applications for use at fixed and mobile (marine) stations and thus may suitably be picked up as an object of research and development. In particular, the technique of terminal equipment and receiver is versatile and should be acquired.

(2) Development of Lincompex

Lincompex is immune from disturbance such as noise and fading and provides better performance characteristics than VODAS equipment, so that it is used for mobile radio for ships and automobiles. With its specifications being recommended by CCIR, it is rather easy to challenge.

(3) Study and development of transistorized radio terminal

Since all latest radio terminal equipment are transistorized, this research project is faced upon execution of the research projects of (1) and (2) above. For developing and domestically manu-



facturing the transistorized radio terminal, it is necessary to study, develop, and acquire basic circuit and manufacturing techniques.

(4) Study and development of long periodic aerial

Long periodic aerial is a comparatively new type of shortwave antenna and is expected to increase in number in future. The development, domestic production, and installation of this antenna can rather easily be accomplished.

9. Carrier Section

(1) Study and development of sub-units for use with coaxial cable

These sub-units are used for carrier frequency signal transmission systems using coaxial cable. In the C-12M System, 2700 channels are multiplexed per system to be sent through a long-distance transmission line. For this system, study should range from the fundamentals of wired transmission to the advanced knowledge of transmission characteristics. It may be recommended that those sections not requiring advanced techniques should be manufactured domestically and other sections shall be limited to fundamental research and accumulation of technical knowledge.

(2) Study and development of remote supervision equipment

This equipment allows sending failure alarm information from an unattended repeater station to an applicable attended station for the purpose of supervision and prearrangement for test. With the development in quality, transmission lines tend to introduce higher multiplexing and the number of unattended stations is increasing. Accordingly, various remote supervisory systems should be compared with each other so as to pick up the most suitable system for the requirements of Pakistan.

(3) Study and development of power feeding equipment

This equipment is intended for feeding power to the repeating equipment by receiving power from the power supply section.

Power supply to a coaxial cable is made by using the outer and core conductors of the coaxial cable, so that it is necessary to separate the transmission circuit from the power circuit. This technique is not so difficult. However, since not so many systems require this equipment, the advantage of its development may be rather small.

(4) Study and development of line repeater equipment (underground type), etc.

When, in multiplex transmission using coaxial cable, the distance of transmission is large, attenuation appears. In order to compensate for this attenuation and provide the required transmission quality, line repeater equipment should be installed at given intervals. In particular, line repeater equipment installed under the ground should be water- and moisture-proofed. The development should be entered after finishing the accumulation of fundamental knowledge and executed step by step.

## 10. PCM Section

(1) Study and development of sub-units of PCM system

This research project is intended for the study and development of various equipment for use in PCM transmission systems.

Some of the major equipment included are channel unit, coder, decoder, pulse generator, etc., and power supply and supervisory equipment are required as the auxiliary equipment for functioning this system.

It is recommendable to make fundamental study and accumulate technical knowledge to allow the preparation of the specifications and the acceptance test for these equipment so as to establish a national system standardization in Pakistan.

## 11. Outside Plant Section

### (1) Study and development of accessories for use with outside plant

Some of outside facilities or materials for use with outside plant may not require so high accuracy. Although it is recommendable to study and be engaged in the development of these facilities, the kinds of accessories for the outside plant are numerous and various kinds of materials, manufacturing facilities and test equipment are indispensable. Therefore, the selection of the accessories to be developed is important. For the time being, it should be limited to one kind or two realizable in Pakistan. As a long test period is required after development, the cooperation of the operating department is also indispensable.

### (2) Study and application of equipment for line faults localization and detection

To localize the fault if encountered in a telephone cable with test equipment is very important for smooth troubleshooting and repair. It is useful to introduce these test equipment for use with the existing lines in Pakistan and establish their standard usage.

### (3) Study and standardization of jointing methods

It is very important to study the jointing and splicing methods of cables and other line facilities and establish most suitable standard methods in Pakistan. However, the start of this project should be limited to one or two kinds of cables, as jointing materials and tools differ with the type of cable.

- (4) Study and standardization of materials for use in the Department and Installation Procedure

The standardization of materials for use in the Department of outside plant is very important for effecting efficient installation and maintenance and for the development in the reliability of communication system. Therefore, this research project is very suitable.

## 12. Standard Section

- (1) To establish and maintain primary and secondary standards to calibrate test equipment for use in the CTRL

The laboratory will be furnished with a great volume of test equipment and others, some of which must be calibrated by skilled engineers. Although the repair of test equipment and others should usually be executed by their manufacturers, this will be sometimes difficult in the circumstances of Pakistan. Therefore, some simple troubles should be repaired in this section.

## 13. Semiconductor Section

- (1) To produce IC according to the designed specifications

This project seems to intend to construct IC manufacturing facilities and manufacture IC for use in the field of electrical communication. The fundamental research should be made by using IC manufacturing facilities and, after sufficient accumulation of technical knowledge and experience, components for use in the laboratory should be produced.

#### 14. Circuit Component Section

- (1) To produce circuit components according to designed specifications

Such circuit components as resistors and capacitors are indispensable for electrical circuits. It is recommended to start manufacturing, on a trial basis, simple circuit components by using manufacturing facilities and acquire sufficient technical knowledge and experience so as to be able to supply products for use in the laboratory in future. It is recommendable to study the standardization of these types of components in Pakistan.

#### 15. Computer Section

- (1) Study and application of electronic computer

It is recommendable to execute the following items in this project.

- i) To study hardware and acquire sufficient technical knowledge and experience so as to become capable of repairing in the event of failure.
- ii) To study software, make simple software, and operate the computer by the staff.
- iii) To prepare software for scientific and technical calculation necessary for research activities in the laboratory.
- iv) To prepare software necessary for the administration and management of the laboratory, such as software for the control of materials and equipment in the laboratory, and utilize the computer for work in the laboratory.

16. Workshop Section

(1) Application of workshop facilities for prototype and trial production

This section plays the roll of manufacturing those prototype items as requested from various sections in the laboratory by using machine tools and others and play a role as a servicing section for supporting the progress of research in these sections.

17. Chemical Lab./Testing Lab. Section

(1) Study and application of testing facilities

It is suitable for this section to be engaged in the measurement of the electric and temperature characteristics of various component parts manufactured on trial basis in the Semiconductor and Circuit Component Sections.

資料 2 : 個別プロジェクトの線表

SEC	NO.	PROJECT	PRIORITY		SCHEDULE					1	2	3	4	5	6	7	8	9	10	Comment
			I	II	III	79:80	81:82	83:84	85											
	1	High loss Tel Set	O							3.5	Y	10,000	Y	Y	NIL	30\$	Y	1981	10,000	
	2	Push Button Tel Set	O							3.5	Y	50,000	Y	Y	NIL	50\$	Y	1982	50,000	
TEL	3	Small Tel Set	O																	
EQP	4	Electronic Tel Set	O																	
	5	Picture Phone	O																	
(1)	6	Card Dial Phone	O																	
	7	Button Tel Set	O																	
	8	Small Type ESS	O							4.5	Y									
SW	9	Sub Id Equip	O																	
SYS	10	Mobile Ex	O																	
(2)	11	Remote Control ESS	O																	
	12	Auto Line Tester	O							3.5	Y	50	Y	N	NIL	240\$	Y	1981	50	
	13	Auto Line Router (EMD)	O																	
	14	VF Telegraph	O							7	Y	50 VFT 15 S+	Y	Y	45,000\$ 18,000	40,000\$ 15,000	N	1982		
TGF	15	Multi Tqf Equip	O																	
(3)	16	Electronic Teleprinter	O																	
	17	VF/Carrier FAX	O																	
	19	Auto Card Sender	O																	

Since this project deals in study and experiment - only in earlier - 1/5 phase covering 3 to 4 years from the starting year, hence the information under these col (3-10) can not be given at this stage.

{ Also included S+6 DX

※ 1. NP - Number of Personnel      6. IMP - Import Value (Present Time)  
 2. PD - Intention of Domestic Production      7. COST - Expected Cost  
 3. QY - Expected Quantity per Year      8. NS - New Service ?  
 4. FCT - Factory Equipment      9. YNS - Year of New Service  
 5. PART - Necessity of Parts Import      10. DS - Demand of New Service







SEC NO.	PROJECT	PRIORITY I II III	SCHEDULE					1	2	3	4	5	6	7	8	9	10	Comment
			79	80	81	82	83											
53 1	Accessories	O																
54 2	Line Faults Loc Equip	O					3.5	N				10,000\$			N			..... This is not a production project.
55 3	Jointing	O					6.5	N							N			..... -do -
56 4	Material/	O																
57	Standard	O					4	N							Y			..... This is not a production project.
58	I.C.	O					16	Y	1,000	N	Y				Y	1979	1,000	..... Production only for CTRL needs.
59	C.R.	O					13	Y	5,000	N	Y				Y	1979	5,000	..... -do -
60	Computer	O					2	N										..... Study project only.
61	Workshop	O					17	N							N			..... For C.I.R.L. needs only.
62	Test Facilities	O					2.5	N							Y			..... -do -

## Enquiry Card

December 1978

Section & Item No.	1/1	Research Project	High loss telephone set		
Details	This project deals with the development and manufacture of such telephone which can compensate for the additional transmission loss on account of long lines for remote situated subscribers. This will thus help in meeting the national and international transmission plan and also will afford efficient service to the telephone users. This telephone will be manufactured locally for which facilities already exist.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1/2 A.D.E. 1 E.S. 2				
Additional Research Equipment	1) Side tone attenuator measuring set 2) Capacitor variable 3) Resistance variable				

Enquiry Card

December 1978

Section & Item No.	1/2	Research Project	Push button telephone set		
Details	<p>This project provides for the development of push button telephone sets and there after its manufacture in Pakistan. Not only that this telephone is necessary for electronic exchange which are now gradually finding its way in the country but also it is important from the subscriber point of view who desires a change in the existing and particularly after introduction of such new sets in the areas served by newly installed telephone. This can be manufactured locally either in the present factories or after establishing new factory.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D. E.        0.5 A. D. E.    1 E. S.        2				
Additional Research Equipment	1) Circuit testers 2) Frequency counter				

Enquiry Card

December 1978

Section & Item No.	2/1	Research Project	Small type ess		
Details	<p>This project envisages the study of the soft ware and Hard ware of the ESS as a first stage and to modify and design interface equipment to provide inter-exchange working between ESS and other exchanges like electronic PAK and EMD/F1 exchanges (already working in Pakistan/as a second stage and finally after having acquired proper level of technical knowledge to develop some equipment of both soft ware and Hard ware stage by stage for domestic production.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 5 A.D.E. 2 E.S. 1				
Additional Research Equipment	1) Electromagnetic Oscillograph 2) Impulse recorder 3) Syncroscope (dual) 4) Mili second meter 5) Capacitor variable				

Enquiry Card

December 1978

Section & Item No.	2/5	Research Project	Auto line tester		
Details	<p>This project provides for the development and thereafter manufacture of a semi automatic equipment for testing the subscriber lines automatically from inside the exchange. It will afford testing of all the sub-lines in one night line and will accordingly play a great role in raising the efficiency which is not possible in the present set up of manual testing. production facilities are available in T.I.P. EMD 1000 1/hr.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 5 A.D.E. 1 E.S. 1				
Additional Research Equipment	1) Selective level meter 2) Relay tester 3) Artificial cable of different gauges 4) Resistance variable				

Enquiry Card

December 1978

Section & Item No.	3/1	Research Project	Study and development of VFT equipment		
Details	<p style="text-align: center;">It is proposed to study and development of VFT manufacturing technology in the country.</p> <p><u>NOTE:</u> Project for study and development of S+6D equipment has also been merged in this project.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E.        1 A.D.E.    2 E.S.        4				
Additional Research Equipment					

Enquiry Card

December 1978

Section & Item No.	3/2	Research Project	Study and development of time division Multiplexing equipment (TDM)		
Details	First two years will be devoted to study only then development work will be started.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1/2 A.D.E. 1 E.S.				
Additional Research Equipment	1) Spare unit of T.D.M. (1 set) 2) Common unit for DATAX TDM-12 1 set 3) TDM-A32 (Stcut-Stop channel card, 4 <sup>CH</sup> /card 1 set				



Enquiry Card

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Section & Item No.	4/1	Research Project	Study and Development of MODEMS with different speeds		
Details	<p>For introduction of data communication facilities in Pakistan, for which sufficient demand exists, it is important to manufacture the modems locally. Initially low speed modems (200, 1200, 2400 bands) may be taken up.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E.	1			
	A.D.E.	3			
	E.S.	4			
Additional Research Equipment					

Enquiry Card

December 1978

Section & Item No.	5/1	Research Project	Study and Development of Power Supply units of Different Ratings		
Details	All power supplies for telecommunication-systems are being imported from abroad. It is proposed to develop for local manufacture power-supplies of the most widely used ratings.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D. E.            1 A. D. E.       2 E. S.            4				
Additional Research Equipment	List of additional equipment required is attached.				

ADDITIONAL TEST EQUIPMENT FOR POWER PLANT SECTION CTRL.

- (1) AC Precision 13 Range Volt/Ammeter.
- (2) DC " 17 " Volt/Ammeter.
- (3) Divert Acting Electrical AC Recording Voltmeter.
- (4) Divert " Electrical DC Recording Voltmeter.
- (5) Noise meter.
- (6) Divert Acting DC Current Recorder.
- (7) Syncroscope.
- (8) Gauss Meter.
- (9) Electronic Flux meter.
- (10) Portable Power factor meter YEW 2039
- (11) Line current Tester YEW 2063
- (12) Phase Rotation meter.
- (13) Sliding AC Voltage Regulators (Slidec)  
Input AC 230 50-60 C/s  
O/P 0-260 Volts  
Max. current 20Amp.
- (14) Surface temperature Indicator.

Enquiry Card

December 1978

Section & Item No.	6/1	Research Project	Study and Development of 1800 channel M/W F.M. Transmitter and receiver		
Details	The purpose of the project is to study and develop F.M. transmitters and receivers of 1800 channel M/W system for local production. A factory for the production of 960 channel M/W systems is provided in the five year development plan 1978-1983. However, in near future it is planned to introduce 1800 channel M/W system to connect the main cities of the National network. It has therefore been considered necessary to develop the 1800 channel M/W system in the laboratories for local production. The FM transmitter and receiver is intended for transmission and reception of telephone and television signals on M/W frequencies.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. 1 E.S.				
Additional Research Equipment	1) Signal generator 2, 4, 6, 7, 11GHZ 2) Antenna Pattern Measuring Unit 3) Microwave Power Meter 4) Barretor Mount 5) Spectrum Analyser				



Enquiry Card

December 1978

Section & Item No.	6/4	Research Project	Study and Development of Waveguide and Attenuator for 1800 channel Microwave system		
Details	<p>The purpose of the Project is to study and develop Waveguide and attenuator of 1800 channel. M/W system for local production. A factory for the production of 960 channel Microwave system is provided in the five year development plan 100 1978-1983. However, in near future it is planned to introduce 1800 channel Microwave system to connect the main cities of the National network. It has therefore been considered necessary to develop the 1800 channel Microwave system in the laboratories for local production. The waveguide and attenuator is intended for transmission of microwave signals between the antenna system and the transmitter receiver.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D. E. A. D. E. 1 E. S.				
Additional Research Equipment	<ol style="list-style-type: none"> <li>1) Waveguide Attenuator</li> <li>2) Mic</li> <li>3) Directional coupler</li> <li>4) Phase shifter</li> <li>5) Isolator</li> <li>6) Magic Tee</li> <li>7) Resonant Cavity wave length Meter</li> <li>8) Slotted lines</li> </ol>				

Enquiry Card

December 1978

Section & Item No.	6/5	Research Project	Study and Development of I. F. amplifier for 1800 channel Microwave system		
Details	<p>The purpose of the project is to study and develop I. F. amplifier of 1800 channel Microwave system for local production. A factory for the production of 960 channel Microwave system is provided in the five year development P 100 1978-1983. However, in near future it is planned to introduce 1800 channel microwave system to connect the main cities of the National network. It has been considered necessary to develop the 1800 channel Microwave system in the laboratories for local production. The I. F. amplifier is used for convention of the received microwave signal to an IF signal, AGC, sqelch setting etc.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. A.D.E. 0.5 E.S.				
Additional Research Equipment	1) Transister curve tracer 1 2) Level test set 1 3) Digital voltmeter 1 4) Analog Voltmeter 1 5) Square law and linear Detector 1 6) Crystal Detector 1				

Enquiry Card

December 1978

Section & Item No.	6/6	Research Project	Study and Development of 12 channel UHF system		
Details	The purpose of this project is to study and develop multi-channel UHF system in the laboratories for local production. There is a substantial requirement of low capacity UHF systems for providing adequate trunk lines to small exchanges in the towns. Multichannel UHF systems are being assembled in carrier telephone Industries Islamabad and local production of UHF system developed in the laboratories can be realised without and difficulty.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. A.D.E. 1 E.S.				
Additional Research Equipment	1) 12 channel UHF complete with Transceiver antenna coaxial cable, 12 channel mux and accessories including literature. 2) Complete set of test equipment comprising of signal generator, frequency counter, selective, level meter, return loss, Measuring set Field strength Meter, Transmission Measuring set, Oscilloscope, Powermeter Psophometer distortion meter, throughline walmeter, spectrum analyser, attenuator, power supplies cords, connectors and accessories.				2 sets  2 sets



Enquiry Card

December 1978

Section & Item No.	6/7	Research Project	Study and Development of self supporting and guyed structure		
Details	<p>The purpose of this project is to study and develop self supporting and guyed structures on the laboratories for local production. These structures are used for mounting antennas of Microwave UHF VHF and HF communication systems. Architectural technology on the structures is already established and quite a few factories are also manufacturing guyed and self supporting structures. It has therefore been considered necessary to include this project.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. A.D.E.     0.5 E.S.				
Additional Research Equipment	Complete set of test gear for measurement of tensile strength dimensions, breaking stress, fatigue and aging etc.				



Enquiry Card

December 1978

Section & Item No.	7/2	Research Project	Study and development of automile radio telephone system including T/R for base station T/R for mobile station and inter-face equipment																						
Details	<p>The purpose of this project is to study and develop automobile Radio telephone systems for local production. There is a substantial demand for provision of telephones in the cars by high officials of the Government and private parties. It is therefore essential to introduce radio telephone system. The equipment can be locally produced in CTI Islamabad. The mobile radio telephone system will be introduced in the main cities in the initial stage for local coverage. After considerable experience is gained, the system can be developed for providing communication on highways.</p>																								
Classification	A. New Technology B. Production		C. Field Technology D. Standardization																						
Priority	I																								
Schedule	'79	'80	'81	'82	'83																				
Research Personnel	D.E. A.D.E.     1 E.S.																								
Additional Research Equipment	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 80%;">1) Mobile Radio Test Set</td> <td style="width: 20%; text-align: right;">1</td> </tr> <tr> <td>2) Termination Power meter</td> <td style="text-align: right;">1</td> </tr> <tr> <td>3) Through line Power meter</td> <td style="text-align: right;">1</td> </tr> <tr> <td>4) Frequency counter</td> <td style="text-align: right;">1</td> </tr> <tr> <td>5) Synchroscope</td> <td style="text-align: right;">1</td> </tr> <tr> <td>6) Field strength meter</td> <td style="text-align: right;">1</td> </tr> <tr> <td>7) Circuit Tester</td> <td style="text-align: right;">1</td> </tr> <tr> <td>8) Power supply</td> <td style="text-align: right;">1</td> </tr> <tr> <td>9) Cords and accessories</td> <td style="text-align: right;">1</td> </tr> <tr> <td>10) Dual Pin in Recorders</td> <td style="text-align: right;">1</td> </tr> </table>					1) Mobile Radio Test Set	1	2) Termination Power meter	1	3) Through line Power meter	1	4) Frequency counter	1	5) Synchroscope	1	6) Field strength meter	1	7) Circuit Tester	1	8) Power supply	1	9) Cords and accessories	1	10) Dual Pin in Recorders	1
1) Mobile Radio Test Set	1																								
2) Termination Power meter	1																								
3) Through line Power meter	1																								
4) Frequency counter	1																								
5) Synchroscope	1																								
6) Field strength meter	1																								
7) Circuit Tester	1																								
8) Power supply	1																								
9) Cords and accessories	1																								
10) Dual Pin in Recorders	1																								

Enquiry Card

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Section & Item No.	7/4	Research Project	Study and development of High gain antennas for VHF & UHF		
Details	The purpose of this Project is to study and develop in the research laboratories high gain antennas in 150 Mhz and 400 Mhz band for local production. The antennas will be required for use with the VHF and UHF systems being developed in the CTRL for local production. Local production can be arranged at carrier Telephone Industries Islamabad.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. A.D.E. E.S. 1				
Additional Research Equipment	1) High Gain Antennas i) Yagi type 2 ii) Corner reflector type 2 iii) Parabolic dish type 2 2) Signal Generator 1 3) Level meter 1 4) Frequency counter 1 5) Vs WR Meter 1 6) Antenna Pattern Measuring Unit 1 7) Vector Impedance Bridge 1				

Enquiry Card

December 1978

Section & Item No.	8/1	Research Project	Study and development of transmitter upto 10KW and associated ISB receiver		
Details	The purpose of this project is to study and develop of 10KW HF ISB transmitter and associated HF ISB communication receiver for local production. The transmitter and receiver will be used for providing telecommunication facilities to for flug and remote areas where the topography is not suitable for open wire or VHF communication. Local production can be arranged at NRTC Haripur.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. E.S.				
Additional Research Equipment	1) 10KW ISB transmitter 1 2) ISB communication receiver 1 3) RF power meter 1 4) Dumy load 1 5) Spectrum analyser 1 6) Noise figure meter 1 7) Oscilloscope 1 8) Signal Generator 1 9) Frequency counter 1 10) VS WR meter 1 11) RF spurious power meter 1 12) Megger 4KV (Insulation tester) 1				

Enquiry Card

December 1978

Section & Item No.	8/42	Research Project	Study and development of transisterized Radio terminal for HF system		
Details	<p>The purpose of this project is study and develop a transistorsed radio control terminal for local production. This system will work alongwith 10KW transmitter and I.S.B. receiver in order to link them with existing telephone exchanges. This system can be produced locally in C.T.I. This system is very essential to provide communication in remote areas.</p>				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. A.D.E.     0.5 E.S.				
Additional Research Equipment	1) Synchroscope                     1 2) Circuit tester                     2 3) Selective level meter             1 4) Audio Signal Generator         1				

Enquiry Card

December 1978

Section & Item No.	CARR (9) 48 & 51	Research Project	Study and development of sub-units and Line repeaters (underground) of 12 MHZ Coaxial carrier system		
Details	(i) Purpose: The ultimate aim of developing this carrier system is to have a complete working unit of 2700 channel using indigenous materials and components as far as possible. (ii) Justification: With the adoption of NWD and to cope with the rising demand for more audio channels, 12MHZ system, having a capacity of 2700 channels would help ease the situation. (iii) Manufacturing: Facilities: Considerable manufacturing facilities are available at CTI, Islamabad. (iv) Introduction: The system will be introduced in national network after successful field trial.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. 3 E.S. 3				
Additional Research Equipment	1) Noise figure measuring facilities 2) Distortion meter 3) Frequency counter (precision) 4) White noise generator 5) Variable attenuators 6) Variable low pass filter 7) Variable high pass filter 8) Group delay measure set 9) Automatic in-circuit transistor checker 10) White noise detector 11) Refecto Mat 12) Components of terminal and line amplifier				

Enquiry Card

December 1978

Section & Item No.	PCM (10) 52	Research Project	Study and development of Sub-Units of PCM-30 System		
Details	(i) Purpose: PCM technology being not very common in the country, this project is aimed at acquiring this technology by developing a PCM-30 system, in its sub-units using indigenous materials and components as far as possible. (ii) Justification: To help ease the demand for more junction cables in large cities economically and quickly. (iii) Manufacturing facilities: Considerable manufacturing facilities are available at CTI, Islamabad. (iv) Introduction: It is aimed to introduce the system in the department after its success-ful/field trial.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. 3 E.S. 3				
Additional Research Equipment	1) PCM-30 terminal and Repeaters 2) PCM Signal Generator 3) 2048M Bits/Sec 4) Level Digital Oscillator (with noise generator) 5) Level Meter with psophometer 6) Measurement of total distortion including quantizing distortion PCM level tester set 7) Error detection meter 8) Error Rate Generator 9) Amplitude Delay Distortion Analyses 10) Wave analyses				



Enquiry Card

December 1978

Section & Item No.	11/1	Research Project	Study and application of test equipment for line fault detection and localization		
Details	Test equipment of various manufacturers for cable fault detection and localization is being used in Pakistan T&T. The maintenance staff is not properly trained in the use of this test equipment. It is proposed to study and standerize for use in the department such test equipment which is most suitable for this purpose, keeping in view the specific conditions of this country.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1/2 A.D.E. 1 E.S. 2				
Additional Research Equipment	List of additional equipment required is attached.				

## SECTION NO. 11

11.2.1	No. 2 BW Tester	1
11.2.2	Search Signal Oscillator Type 20F	1
11.2.3	Search Signal Amplifier type-3	1
11.2.4	Cable Faulty Detector Pick-up Coil and Holder	1 set
11.2.5	Search Coil Measuring the Depth of Underground Cable	1
11.2.7	Model 3 Portable Line Fault Locator	1
11.2.8	Capacity Bridge 1-E	1
11.2.9	SD Wire Trouble Searcher Antena	1
11.3	Cable Fault Locator MW 32B	1
11.6.8	Cross Talk Measuring Set 50-B	1
11.6.12	Return Loss Measuring Set UM-11B	1
11.6.16	Level Meter TLM-23	1
11.6.17	Direct Reading Impedance Bridge DRZ-3	1
11.6.20	Cross Talk Measuring Set MXT-25A	1
11.7.2	Ultra Megohm Meter Model SM-10E	1
11.8	Pinhole Detector	1
11.10	Electrolytic Condenser Tester	1
11.12	DC Super Imposed Inductance Bridge	1

### Enquiry Card

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Section & Item No.	11/3	Research Project	Study and Standardization of Plastic Cable splicing and Jointing Technique		
Details	Plastic cables are now being widely used in Pakistan. Different cable manufacturers have introduced different jointing techniques. It is proposed to mechanize the splicing of cables and to standardize the most suitable jointing technique in this country.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E.            1/2 A.D.E.        2 E.S.            4				
Additional Research Equipment	Materials and Tools Required for plastic cable Jointing.				

Enquiry Card

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Section & Item No.	12	Research Project	Establish and Maintain primary and Secondary Standards to calibrati test equipment for use in C.T.R.L.		
Details	High accuracy is demanded of the instruments which are used for measuring parameters of digital models and equipments being used in the research projects. To achieve the above purpose, calibration and standardization of the measuring instruments and components to be used is a must.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. 2 E.S. 1				
Additional Research Equipment					

Enquiry Card

December 1978

Section & Item No.	13	Research Project	To produce IC's according to the designed specifications		
Details	Manufacturing facilities for IC's are not available in this country. To fulfill the requirement of research on "logical circuit designing and development" local facilities only for CTRL are provided. After successful completion of development projects the manufacturing of equipment using IC's on commercial basis may be taken up.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1	Chemist 1	Lab Assistant 4		
	A.D.E. 2	Metalurgist 1	Lab Technician 4		
	E.S. 2	Photographer 1			
Additional Research Equipment	<ol style="list-style-type: none"> <li>1) Thickness measuring instrument</li> <li>2) Network Analyzer</li> <li>3) Platinum resistance thermometer</li> <li>4) Four point measuring set</li> <li>5) Inspection Machine</li> <li>6) Curve Tracer</li> <li>7) Gaugematic sectioning system</li> </ol>				

## Enquiry Card

December 1978

Section & Item No.	14	Research Project	To provide circuit components according to designed specifications		
Details	The purpose of the project is to manufacture components according to the specifications and requirements of the other research projects. The existing factories in the country working on commercial basis are not in a position to provide special items of specifications without ensuring the possibility of mass supply/production. The components manufactured shall be used for research purposes only.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E.            1 A.D.E.        3 E.S.            3		Photographer        1 Lab. Technician    5		
Additional Research Equipment	<ol style="list-style-type: none"> <li>1) Manufacturing facilities of all type of filters including mechanical crystals etc.</li> <li>2) Facilities for crystal cutting grinding, Tapping etc &amp; polarization determining equipment</li> <li>3) Magnet making machine</li> <li>4) Coil winding machine (Big size)</li> <li>5) Coil winding machine (Small size)</li> <li>6) Transformer turn-Ratio measuring device</li> <li>7) Wiring wrapping and unwrapping</li> </ol>				

Enquiry Card

December 1978

Section & Item No.	15	Research Project	Study and application of electronic Computer		
Details	The plans are underway for data communication network in the country by T&T. The need for data information center and the telephone building network design, necessitates the use of digital computers in near future. In order to make available trained staff for the purpose, this project has been introduced.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E. 1 A.D.E. 1 E.S.				
Additional Research Equipment	1) Digital memory oscilloscope 2) K-Y plotter				

Enquiry Card

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Section & Item No.	16	Research Project	Application of workshop facilities for prototype and trila production		
Details	The workshop acts as a service facility for the successful completion of other research projects. Mechanical parts required for equipment being developed shall be produced in this shop.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D. E. A. D. E. 1 E. S. 1	Fireman Asstt. Fireman Machine Operator	1 4 6	Fitter Turner Carpenter Mechanic	2 2 2 1
Additional Research Equipment	<ol style="list-style-type: none"> <li>1) Arrangement for making pot cores</li> <li>2) Thermosetting machine</li> <li>3) Injection moulding machine</li> <li>4) Die sinking machine with facilities to Invert</li> <li>5) Pipe making machines (seamless)</li> <li>6) Filing Machines</li> <li>7) Extrusion press</li> </ol>				



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Section & Item No.	18	Research Project	Study and application of testing Facilities		
Details	The purpose of the project is to test the materials to be used in the T&T department in general and testing of materials to be used for research projects in particular. C.T.R.L. shall also act as an authentic standardizing agency for the department in case some conflict is developed.				
Classification	A. New Technology B. Production		C. Field Technology D. Standardization		
Priority	I				
Schedule	'79	'80	'81	'82	'83
Research Personnel	D.E.            0.5 A.D.E.        1 E.S.            1				
Additional Research Equipment	List of additional equipment required is attached.				

## CHEMICAL LAB/TESTING LAB SECTION

- 1) Electronic Microscope with High Resolution Powers
- 2) Photo Colorimeter and Dark Room
- 3) Spectrometer for Determining Impurities in Different Alloys
- 4) PH Meter for Plastics and Liquids
- 5) Automatic Recorder for Temperature and Humidity (Hodo Graph)
- 6) Material Analysis and Plastic (Used in Telecommunication Field).  
Testing Facilities
- 7) Micro Meter and Vernier Callioer
- 8) Tensile Testing Machine with Elongation Measuring Tape Capacity  
Capacity 100 Kgs.
- 9) Keisistance Measuring Bridge upto 1m Ohm
- 10) Apparatus for Detecting Defects in Copper Enamelled Wires with a  
D.C. Voltage Scuree Supply (100 volts)
- 11) Terra Ohm Meter for Measuring High Resistances Measuring Range  
Measuring Range upto  $10^{12}$
- 12) Die Electric Loss Factor Meter  
Measuring Frequency 800 Hz and Voltage Source 100 Volts A.C.  
with a Range from 0-.06
- 13) Apparatus for Determining the Softening Temperature of Enamel  
Insulation
- 14) High Voltage Tester 0 - 5KV and 0 - 10KV (G.C.)
- 15) Different Grades of Pencils for Determining the Bardness of Enamel  
Insulation
- 16) Different Type of Mandrels and Winding Machine with Adjustable Speed
- 17) Oven upto 400°C
- 18) Apparatus for Measuring Capacitance with A.C.
- 19) Apparatus for Measuring Capacitance Unbalances at Frequencies  
Form 800 - 1000Hz
- 20) Analytical Balance
- 21) Refrigerator upto -10°C
- 22) Low Temperature Impact Apparatus  
Temperature Range upto - 40°C
- 23) Apparatus for Testing Rubber and Plastics  
(Behavious Towards Liquids Vapours, Ozone Gas etc.)

- 24) Different Types of Bending Devices for Plastics at Low Temperature
- 25) Hardness Testing Meter for Rubber
- 26) Desicater, Vacuum Desicator and Vacuum Pump
- 27) Electric Furnace Temperature upto 1,200°C
- 28) Vacuum Oven
- 29) U V Cabinet for Testing Stability of Polymers Against UV
- 30) Cooreivity Meter
- 31) Flux Meter
- 32) Hardness Testing Machine for Plastics
- 33) Thermostat with Automatic Control of Temperature
- 34) Apparatus for Testing the Solderability of Copper Enamelled Wires and Tin Coated Wires
- 35) Bending Testing Machine
- 36) Abrasion Testing Machine for Rubber and Plastics
- 37) Commercially Available Apparatus for Testing the Melt Index of Thermo-Plastic Materials
- 38) Capillary Viscometer for Testing the Relative Viscosity and Determining the Meclular Weight of Polymers
- 39) Vicats Testing Apparatus for the Thermal Stability of Plastics
- 40) Fatigue Testing Machine for Springs
- 41) Fatigue Testing Machine for Hand-Set Coils
- 42) Aneroid Barometer
- 43) Apparatus for Measuring Electroplastic Limit Charging and Half Value Time of Discharge
- 44) Apparatus for Determining the Properaties of Farromagnetic Materials
- 45) Steam Oven, Automatic Control of Temperature and Humidity
- 46) Apparatus for Determining Amount of X-Linking Among Polymer
- 47) Flaw Detection in Castings X-Rays & Ultrasonics

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資料 4 : Organization of C.T.R.L. (Dec. 1978)



GM 1

DR 6

DE 12

ADE 34

ES 21

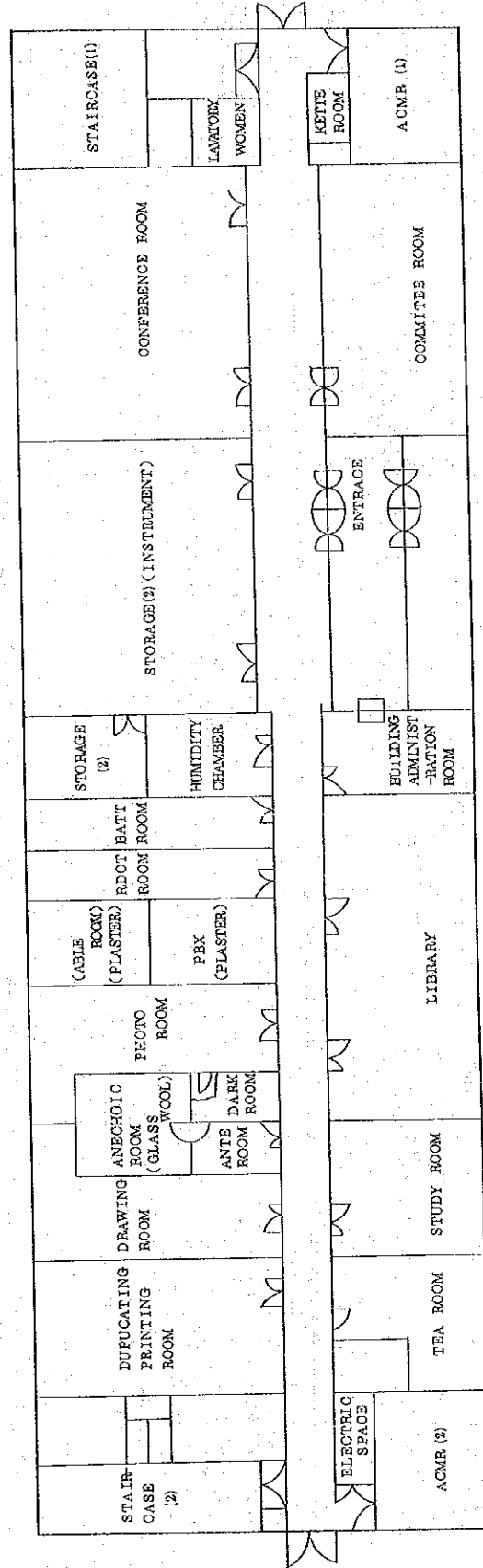
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資料 5 : CTRL フロアプラン (略図)

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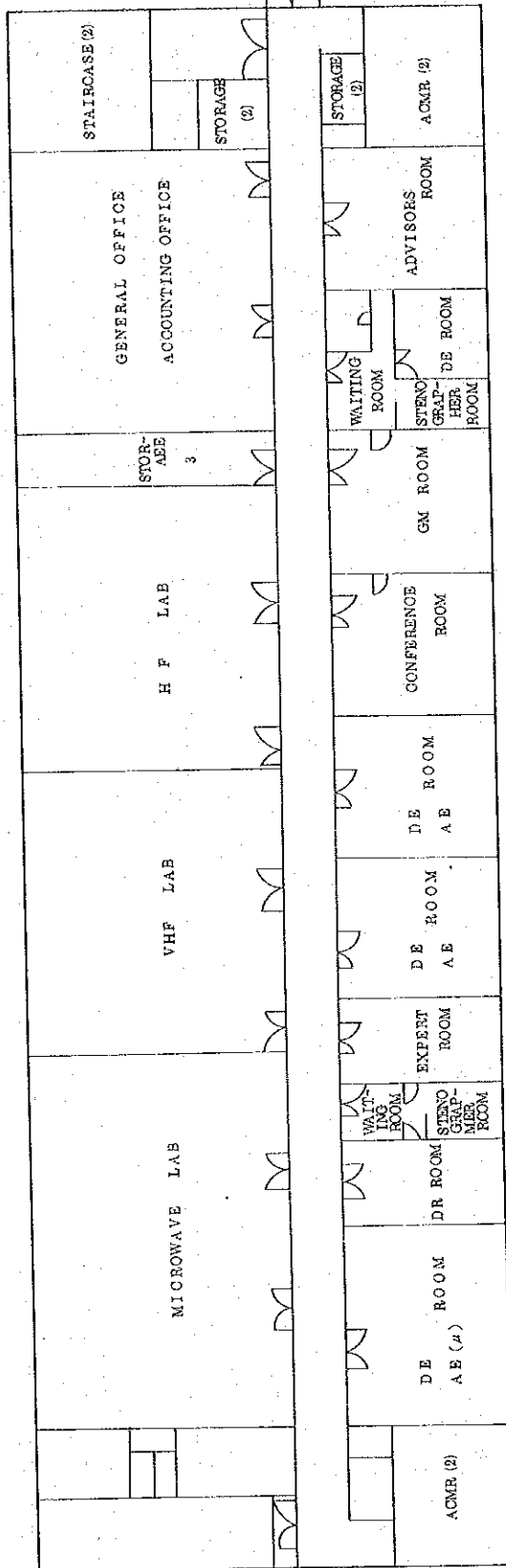




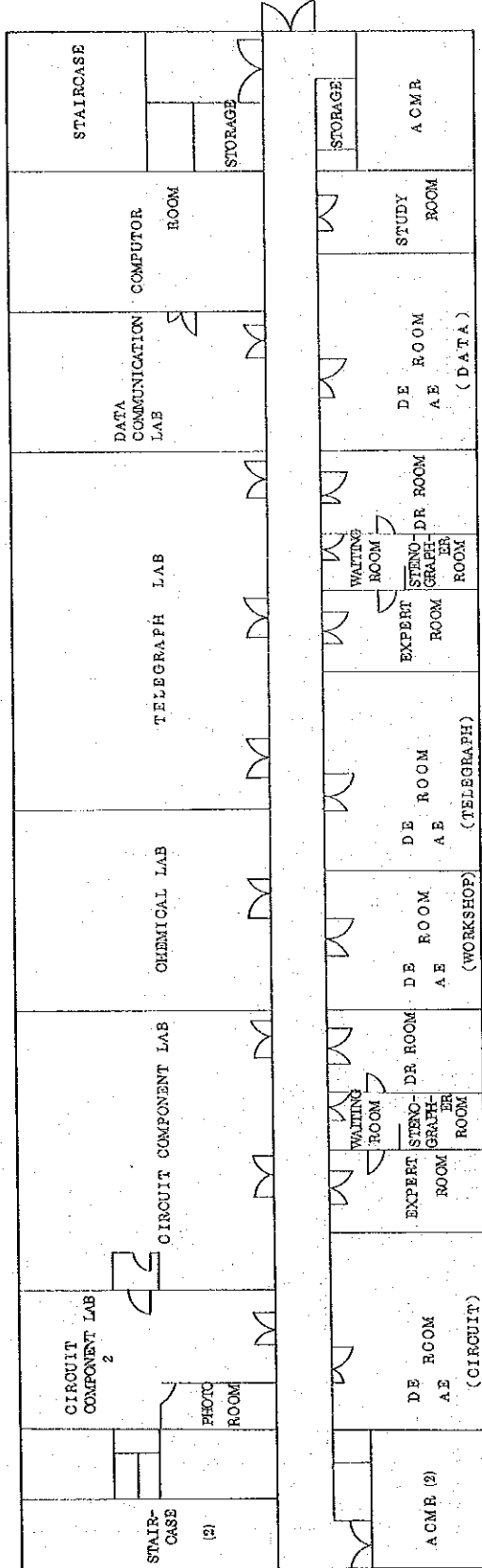


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