

ESTIMATES COMMITTEE
(1965-66)

NINETY-FIFTH REPORT
(THIRD LOK SABHA)
MINISTRY OF DEFENCE

**(DEFENCE RESEARCH AND DEVELOPMENT
ORGANISATION)**

**Electronics and Radar Development Establishment,
Bangalore and Defence Electronics Research
Laboratory, Hyderabad**



LOK SABHA
NEW DELHI

March, 1966
Phalgun, 1887 (Saka)

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CONTENTS

	PAGE
COMPOSITION OF THE COMMITTEE	(iii)
INTRODUCTION	(v)

PART I

Electronics and Radar Development Establishment, Bangalore.

CHAPTER I—Introductory

A. General	1
B. Defence Electronics Group	6
C. Electronics and Radar Development Establishment	6

CHAPTER II—ORGANISATION AND FUNCTION

A. Functions	8
B. Organisation	8
C. Administration	12
D. Budget and Accounts	16

CHAPTER III—RESEARCH AND DEVELOPMENT PROJECTS

A. Planning and Formulation of Electronics requirements	17
B. Procedure for development and production of Electronic Equipment	17
C. Five Year Plans of R & D Establishments/Laboratories	19
(a) General	19
(b) Five Year Plan of Electronics Group	20
(c) Five Year plan of Electronics Group	21
D. R & D Projects during Third Plan	21
E. Review of R & D Work	24

CHAPTER IV—MISCELLANEOUS

A. Liaison with Industry	26
B. Liaison with Academic and Research Institutes	28
C. Research and Training Facilities	29
D. Information Services	30
E. Foreign Exchange	32

	PAGE
F. Fabrication of Test Equipment	33
G. Patenting of Developed Products	34
H. Assistance to less developed countries	34

PART II

Defence Electronics Research Laboratory, Hyderabad

CHAPTER V—ORGANISATION AND FUNCTIONS

A. Introductory	35
B. Functions.	36
C. Organisation	37
D. Budget Estimates and Accounts	40

CHAPTER VI—RESEARCH AND DEVELOPMENT PROJECTS

A. Planning and Formulation of requirements	42
B. Five Year Plan of D.L.R.L.	42
C. Current Projects	42
D. Major Achievements	43

CHAPTER VII—MISCELLANEOUS

A. Collaboration with Academic Institutions and Civil Research Units	46
B. Foreign Exchange	46
C. Equipment and Accommodation	49

CHAPTER VIII—CONCLUSION	53
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APPENDICES

I. Organisational chart of Electronics and Radar Development Establishment	54
II. Statement showing authorised and actual strength of staff of L.D.R.E.	
III. Organisational chart of D.L.R.L.	57
IV. Statement showing the authorised and actual strength of staff of D.L.R.L.	58
V. Summary of Recommendations/conclusions contained in the Report	67
VI. Analysis of recommendations in the Report	76

ESTIMATES COMMITTEE

(1965-66)

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INTRODUCTION

1. the Chairman, Estimates Committee having been authorised by the Committee to submit the report on their behalf, present this Ninety-fifth Report on the Ministry of Defence—Defence Research and Development Organisation in respect of Electronics and Radar Development Establishment, Bangalore and Defence Electronics Research Laboratory, Hyderabad.

2. The Sub-Committee on Defence of the Estimates Committee took evidence of the representatives of the Ministry of Defence on the 31st January and 1st February 1966. The Committee wish to express their thanks to the Scientific Adviser to the Minister of Defence, Joint Secretary, Ministry of Defence (Department of Defence Production) and Directors of Electronics and Radar Development Establishment, Bangalore and Defence Electronics Research Laboratory, Hyderabad, and other Officers of the Ministry for placing before them the material and information they wanted in connection with the examination of the estimates.

3. The Committee wish to extend their thanks to Dr. D. S. Kothari, Chairman, University Grants Commission, Dr. S. Husain Zaheer, Director General, Council of Scientific and Industrial Research, Dr. R. S. Varma of Delhi University, Dr. B. D. Nagchaudhuri, Director, Saha Institute of Nuclear Physics, Calcutta, Shri J. C. Kapoor, President and Chief Executive Officer, Air Conditioning Corporation Ltd., Calcutta, and Dr. Y. A. Fazalbhoy, Managing Director, General Radio and Appliances Ltd., Bombay for giving evidence and making suggestions to the Committee.

4. The Committee also wish to thank Dr. J. S. Chatterjee of Jadavpur University for making useful suggestions to the Defence Sub-Committee of the Estimates Committee during their visit to Calcutta. The Committee also wish to thank Dr. S. Dhawan, Director, Indian Institute of Science, Bangalore, Dr. Amarjit Singh, Director, Central Electronics Engineering Research Institute, Pilani, and Major General B. D. Kapur (Retired) for furnishing memoranda to the Committee.

5. The Report was considered and adopted by the Sub-Committee on the 16th March, 1966 and finally approved by the whole Committee on the 21st March, 1966.

6. A statement showing the analysis of recommendations contained in the Report is also appended to the Report (Appendix VI).

NEW DELHI;

March 21, 1966.

Phalguna 30, 1887 (Saka).

ARUN CHANDRA GUHA,

Chairman.

Estimates Committee.

PART I

ELECTRONICS AND RADAR DEVELOPMENT ESTABLISHMENT

I. INTRODUCTORY

A. General

Electronics is the nervous system of modern technology and has assumed an important role in the monitoring and control of the production process in the engineering, chemical and metallurgical industries. It is vital for atomic energy, communications and defence.

Present Production Base

2. In India, the electronics industry has just made a beginning with the establishment of the manufacture of radio receivers, radio and line communication equipment, nuclear electronic instruments and in a very small way, radar equipment. Most of the sophisticated developments in electronics have yet to be established in the country. Similarly, the production of components for electronic equipment in India can also be said to be merely in its infancy, for components of the high specifications required for sophisticated electronic equipment, with one or two notable exceptions, are yet to be produced. By and large, there is no production of microwave systems, radio navigational aids, sophisticated communication equipment and advanced computers.

Appointment of Bhabha Committee

3. In view of the urgent need to develop the electronics industry in the country to meet the multifarious needs of modern technology, the Government of India appointed in August 1963 an Electronics Committee under the chairmanship of late Dr. H. J. Bhabha with the following terms of reference:

- (a) to assess the total requirements of the country in respect of various items of electronic components and equipment;
- (b) to survey the existing and potential sources of supply and to recommend how best these sources can be tapped and capacity expanded; and

- (c) to recommend measures for planned development of electronics so that the country as a whole may become self-sufficient in this field in the shortest possible time and in the most economical manner.

Estimated Requirements

4. The Electronics Committee submitted its report to the Government in February, 1966. That Committee has stated that its report may be considered to cover the ten-year period 1966—75 or the periods of the Fourth and the Fifth Five-Year Plans.

The Electronics Committee has assessed the value of the electronic equipment required over the next ten years as Rs. 1650 crores at existing prices. The Defence requirements have been assessed as about Rs. 730 crores. The value of the electronic equipment produced by the existing electronics industry in India is approximately Rs. 26 crores per annum. Table I indicates the estimated need during the next ten years of various categories of electronic equipment and the extent to which this need can be supplied by the existing industry.

TABLE I

Item	Requirements over ten years	Extent of available supply from the existing industry.
(In crores of Rs.)		
1. Radio Receivers and other consumer products	450	170
2. Low power radio communication equipment	310	37
3. Microwave systems and associated equipment including radar and radio navigational aids	290	17
4. High power radio transmitters, industrial heating equipment, railway signalling and process control installations and other major industrial equipment	250	3
5. Electronic equipment for line communication systems	150	34
6. Computing, data processing and nuclear, medical and industrial equipment	165	4
7. Test instruments	35	..
TOTAL	1,650	265

The Electronics Committee has tentatively estimated that roughly Rs. 50 crores worth of equipment may have to be imported immediately for defence purposes leaving the rest to be produced in the country. It has stated that if the annual output of electronics industry is increased every year by Rs. 30 crores over a ten-year period starting from the second year, the industry will have a capacity to produce approximately Rs. 300 crores worth of electronic equipment per annum at the end of the ten-year period and the total amount of the equipment produced during this ten year period will be approximately Rs. 1600 crores.

Estimated Investment and Annual turnover

5. The Electronics Committee has estimated that the total capital investment in the industry at the end of ten years will be approximately Rs. 170 crores, which is expected to give finished equipment of all types valued at Rs. 305 crores per annum starting from primary materials. Table 2 gives the estimated investment in different sectors of the industry at the end of ten years and the value of the annual product.

Electronics Committee

TABLE 2

Item	Estimated annual turnover in 1975		Maximum estimated capital investment upto and including 1975		
	1	2	3	4	5
1. Primary materials		28.0*	12.0
2. Components					
2.1 Resistors		7.5	..	3.5	..
2.2 Capacitors.		7.5	..	3.5	..
2.3 Connectors, relays and switches		9.0	..	4.0	..
2.4 Transistors and semiconductor bodies		17.0	..	8.5	..
2.5 Electron tubes		13.0	..	6.5	..
2.6 Panel instruments, hardware and other components		30.0	..	15.0	..
TOTAL COMPONENTS		84.0*	41.0

1	2	3	4	5
3. Radio receivers and other consumer products	73·0	..	20·0
4. Low Power radio communication equipment	59·0	..	24·0
5. Microwave systems and associated equipment including radar and radio navigational aids	57·0	..	24·0
6. High power radio transmitters, industrial heating equipment, railway signalling and process control installations and other major industrial equipment	50·0	..	20·0
7. Electronic equipment for line communication systems	26·0	..	12·0
8. Computing, data processing and nuclear medical and industrial equipment	33·0	..	15·0
9. Test instruments	7·0	..	3·0
TOTAL	305·0	..	171·0
	Say :	300·00	..	170·0

*The value of primary materials and components (Items 1 and 2) has been taken into account in the final cost of equipment in Items 3 to 9.

The annual production of Rs. 300 crores envisaged would represent less than 10 per cent of the estimated gross national product in 1975. At present electronics production barely accounts for a mere 0·15 per cent of the gross national product. As against this, present production of electronic equipment in Japan, where electronics is used exclusively for non-defence purpose is 3·5 per cent of the gross national product. In USA and France, this figure is higher.

The total investment of Rs. 170 crores envisaged in the electronics industry during the ten-year period would be less than 1 per cent of the proposed total outlay in the Fourth Five Year Plan.

Manpower requirements

6. It has been estimated that in 1975 for producing Rs. 300 crores worth of electronic equipment the total number of persons employed

will be 3,30,000 of which 2,50,000 will be skilled workers, technical staff and engineers. It has also been estimated that for research and development activities in laboratories and research institutes outside the production plants, an additional force of some 15,000 scientists and engineers will be required, with approximately 30,000 supporting staff. Thus the total number of persons who will be employed directly or indirectly in an electronics industry of the size envisaged in 1975 will be about 400,000 in round figures of which over 300,000 will be engineers, scientists and skilled workers.

Research and Development

7. Along with the establishment of a requisite production base, there is also a vital need of substantially increasing research and development capacity so as to develop expertise and resources in the country for indigenous development and production of new generation of communication-electronic equipments, to Indianise foreign equipments and to optimise on performance of existing range of equipments. There is for instance a need for research and development in the micro-miniaturisation field to reduce size and weight of the equipments for use in mountain regions, as well as development of equipments for electronic warfare for which technical know-how will have to be entirely developed within the country.

As against this, the present facilities are in an embryonic stage and require considerable re-inforcement and augmentation. The Electronics Committee has recommended immediate build up of resources and facilities in this field and has estimated that the total cost of research, design and development is likely to be of the order of Rs. 85 crores per annum by 1975. This expenditure will amount to between 25 and 30 per cent of the value of Rs. 300 crores of equipment produced. The ratio tallies with the corresponding figures for the U.S., where the expenditure on research, design and development is approximately 30 per cent of the annual turnover of the industry.

8. The Committee hope that in view of the vital importance of electronics in modern life, industry and defence, Government would make an immediate examination of the recommendations made by the Electronics Committee and initiate energetic measures to implement them. This is essential if the country is to have by the end of the next ten years a self-sufficient and self-reliant electronics industry capable of keeping pace with developments in the other technologically advanced countries of the world.

B. Defence Electronics Group

9. The Committee have been informed that an Electronics Group has been formed in the Defence Research and Development Organisation to meet the equipment needs of the Armed Forces with indigenous production to the maximum extent possible. Until recently, the Electronics Group comprised the Directorate of Electronics at R & D Headquarters at Delhi and the Electronics and Radar Development Establishment (LRDE) at Bangalore. In 1961, two laboratories, the Solid State Physics Laboratory (SSPL) at Delhi and the Defence Electronics Research Laboratory (DLRL) at Hyderabad were added to the Group.

10. To maximise the effectiveness of the group, LRDE has been built up as an equipment-oriented establishment responsible for the development of prototypes, which are production worthy to meet the operational requirements of services. The DLRL is a technique-oriented establishment concentrating on new techniques and other applications in futuristic range of equipments. The SSPL is responsible for research and development in the area of semi-conductors and solid state devices and circuitry so that ultimately by the use of these devices and circuitry, the size, weight and power consumption of equipments would be significantly reduced.

11. It has been explained by the Scientific Adviser during evidence that electronics is distinct and different from other areas of defence research, *viz.* engineering, armaments, general stores etc. dealt with by the Defence R & D Organisation. Electronics is something which has seeped today extensively into all the defence gadgets and, in fact, practically into every aspect of our lives and it is a subject which is increasing in sophistication and developing extremely rapidly. The subject of Electronics stands on a different footing and has so much of basic and applied research injected into it in recent years that it necessitates dealing with research and development in electronics in a big way and separately. It is for this reason that research and development have not been combined in one institution.

C. Electronics and Radar Development Establishment

12. Though in its present form, the Electronics and Radar Development Establishment came into being in 1958, it traces its inception much further back to the Technical Development Establishment (TDE), created during World War II. Technical Development Establishment was mainly concerned with the location of

sources of supply of such defence stores as could be produced in the country and the inspection of manufactured items. However, realising the necessity for increasing the tempo of research and development work in the rapidly expanding field of electronics and in the context of the increasing requirements of electronic equipment by the Services, Technical Development Establishment was reorganised in 1958 to form the present establishment.

II. ORGANISATION AND FUNCTIONS:

A. Functions

13. As stated earlier, the Electronics and Radar Development Establishment is an equipment-oriented establishment responsible for the development of prototypes which are production worthy to meet the operational requirements of the Services.

The functions of this Establishment are:—

- (a) to conduct design and development work in accordance with the service requirement and ensure availability of prototypes according to agreed time schedule;
- (b) to educate and assist industries in the fabrication of reliable prototype equipment;
- (c) to assist through expert advice, selection of new electronic equipment required by the Services;
- (d) to render such other technical advice as may be required in the field of its specialisation;
- (e) to undertake design modification for extending the capabilities of existing Service equipment; and
- (f) to endeavour to complete all development action as required by the current procedures in sufficient time.

The Committee have been informed during evidence that the Electronics and Radar Development Establishment does not undertake any basic research. However, sometimes, applied research which may be necessary in connection with specific developmental projects undertaken by the establishment is carried out.

B. Organisation

14. The Electronics and Radar Development Establishment is organised to function on the basis of three areas as shown below:—

- (a) Task area of functional groups;
- (b) Support area; and
- (c) Direction and Control area.

In the Task area, there are technical or functional divisions organised to undertake developmental projects to meet Service requirements as stipulated in Qualitative Requirements and as

indicated in Policy Statements. Each of these divisions has further specialised groups which concentrate on tasks having narrower fields of specialization.

The primary role of support services is to provide centralized and specialized technical services required commonly by the functional divisions. Centralisation ensures economic utilisation of available resources.

The Direction and Control area is organised to ensure continuous check and control of the progress of work in accordance with plans.

An organisational chart of the Electronics and Radar Development Establishment is given at Appendix I.

Electronics Development Panel

15. There is an Electronics Development Panel which is a recommendatory body to the Scientific Adviser to the Minister of Defence and functions under his overall direction. The composition and functions of this Panel are as under:—

Composition

Chairman—Director of Electronics, R & D Headquarters.

Members—

Defence R & D Organisation

Director, Technical Development and Production (Air).

Director, Defence Electronics Research Laboratory.

Director, Electronics and Radar Development Establishment.

Director, Solid State Physics, Laboratory.

Officer I/C, Indian Naval Physical Laboratory.

Defence Inspection Organisation

Director, Production and Inspection (Electronics).

Chief Inspector (Electronics)

Army Headquarters:

Director of Signals

Director of Artillery

Director of Weapons & Equipment

Director of Electrical and Mechanical Engineering.

Commander, EME Technical Services Group

Naval Headquarters:

Director, Naval Signals Division
 Director of Electrical Engineering

Air Headquarters:

Director of Signals
 Deputy Chief Scientific Officer (Air)

Other Organisations:

Managing Director, Bharat Electronics Ltd.
 Director, Central Electronics Engineering Research
 Institute.

Functions

- (1) To consider the scientific and technical requirements of the Services as referred to them and advise with regard to the formulation of research and development programmes in the concerned fields.
- (2) To review periodically progress of research and development projects and to make recommendations; also to recommend allocation of *inter se* priorities to projects wherever required.
- (3) To make recommendations concerning 'farming out' of suitable research tasks to the Universities/National Laboratories/other research institutions outside defence.

16. The Committee have been told that the membership of the Electronics Development Panel does not include any representatives of the private sector industry or scientists from the universities. The Scientific Advisor has explained during his evidence that as classified projects are discussed at the meetings of the Electronics Development Panel, they have no outsiders on it except the Director of Central Electronics Engineering Research Institute, Pilani, where some of their problems are being handled.

The Committee feel that it would be useful to have on the Electronics Development Panel eminent scientists and experts from the universities, technological institutes and the private sector industry in order that fresh mind and expert knowledge of the outside scientists and technologists may be brought to bear on the defence electronics research and development projects.

Frequency of Electronics Development Panel Meetings

17. The Committee note that it has been laid down that the R & D Panels will normally meet twice a year but they may meet more often if required. The Committee however understand that in actual practice the number of meetings of the Electronics Development Panel held since 1958 is as under:—

	<i>No. of meetings held</i>
1958	4
1959	3
1960	1
1961	1
1962	1
1963	2
	(including truncated meeting)
1964	1
1965	1

The normal duration of the meetings of the Electronics Development Panel is stated to be one full working day.

The Committee note that out of 8 years since the inception of the Electronics Development Panel in 1958, in as many as 5 years only one meeting of the Panel has been held each year.

The Committee further note with regret that out of 11 items on the agenda for the meeting of the Electronics Development Panel held on the 2nd April, 1965 as many as 5 items were not considered at all.

The Committee feel that if only one meeting of the Panel is held in a year and more than 45% of the items on the agenda are not considered at any of the meetings, this is bound to affect adversely research and development work of the Electronics and Radar Development Establishment.

The Committee cannot but regard this position as very unsatisfactory. They consider that the Electronics Development Panel should meet at least twice a year and complete consideration of all the items on the agenda even if a meeting has to be held for more than one day at a time.

C. Administration**Staff Strength**

18. The actual strength of the officers and staff of the Electronics and Radar Development Establishment as on 1st January, 1966 is

50 Gazetted Officers and 416 non-gazetted staff as against the authorised strength of 57 gazetted officers and 447 non-gazetted staff which does not include the staff sanctioned in December, 1965 under the radar augmentation proposal. A statement showing the authorised and actual strength of the staff of the Establishment as on 1-1-1966 is given in Appendix II.

The staff sanctioned in December, 1965 for radar reinforcement comprises 37 gazetted officers and 130 non-gazetted staff.

The Committee have been informed that action has been initiated to recruit staff to fill the vacancies.

The Committee cannot over-emphasise the importance of developing radar technology in the country rapidly and suggest that vigorous efforts should be made to recruit suitable manpower for the purpose.

Administrative staff

19. The Committee find that out of a total of 466 staff in the establishment, there are 88 ministerial staff and 109 other miscellaneous staff comprising class IV staff, M. T. Drivers, Gate keepers etc. An eminent scientist has stated in evidence before the Committee that the Defence R. & D. Establishments are doing a lot of administrative work, and that the administrative staff should be reduced to the minimum, otherwise they tend to multiply the administrative work and get more and more administrative staff, thus making a laboratory into an administrative office.

The Committee would like to stress that the presence of too much administrative staff in a R. & D. Laboratory/Establishment is undesirable as it spoils the atmosphere for research and development. They would therefore recommend that the position of administrative staff in the Electronics and Radar Development Establishment may be urgently reviewed.

Administrative work done by the Director

20. On enquiry as to what proportion of the effort of the Directors of Electronics and Radar Development Establishment and Defence Electronics Research Laboratory is generally devoted to administrative or non-scientific work, and whether they have adequate time left to them to devote to the direction and co-ordination of research and development programme and activities, the Committee are informed that while the Director, Electronics and Radar Development Establishment spends about 20 per cent of his time on administrative work, the Director, Defence Electronics Research Laboratory has to spend about 30 to 40 per cent of his time on it as the Defence Electronics Research Laboratory is a relatively new establishment.

The Scientific Adviser has stated that depending upon the stage of steadiness which these Establishments have reached, the Directors should be able to devote more and more of their time to technical work.

The Committee note that the Electronics and Radar Development Establishment has been provided with one Senior Administrative Officer and one Assistant Administrative Officer and the Defence Electronics Research Laboratory with one Administrative Officer Class I junior grade.

It has been stated in evidence by the Directors of Electronics and Radar Development Establishment and Defence Electronics Research Laboratory that they have not delegated any financial power to the Administrative Officers.

The Committee feel that if the Director of an establishment is provided with an administrative Officer to assist him in administrative duties, it is only desirable and appropriate that the Administrative Officer is delegated powers to enable him to be really useful to the Director and to relieve him of the administrative work, otherwise the Administrative Officer will be practically of little use to the Director.

Provision of medical facilities

21. The Committee understand that under the Central Services Medical Attendance Rules 1944, the employees of the Electronics and Radar Development Establishment (including industrial employees with not less than one year's continuous service) and their families are entitled to receive medical treatment from civil hospitals and the cost of the treatment is reimbursable to them. They have been informed that the medical facilities are also available at the premises of the Establishment and the following is the authorised complement.

Assistant Surgeon	..	1
Compounder Grade I	..	1
Nursing Orderly	..	2

The Committee have been informed that the post of Assistant Surgeon for the Establishment which was initially released to the U.P.S.C. in early January, 1961 has not been filled up. The history of the case as intimated by the Ministry of Defence has been summarised as under:—

“The post of Civilian Assistant Surgeon was released to the UPSC in early January, 1961. A candidate was selected but he declined to accept the appointment when it was offered to him. The Commission was requested in October 1961 to nominate another candidate. The second candidate recommended by the Commission was offered the appointment in March, 1962 but the offer of appointment was return-

ed undelivered with the remarks "Left not known". The position was explained to the Commission and as advised by them the Directorate General Armed Forces Medical Services were requested to provide a Medical Officer from their resources. The Directorate General Armed Forces Medical Services were reminded periodically and they advised in December 1962 that it was not possible to go in for recruitment for 5 or 6 posts including that for the Electronics and Radar Development Establishment. At the instance of the Directorate General, Armed Forces Medical Services, the Electronics and Radar Development Establishment was asked in January, 1963 to forward the names of suitable local candidates.

The Electronics and Radar Development Establishment forwarded a list of 36 candidates for consideration. They also suggested the name of one lady doctor and requested that she might be considered for appointment in that Establishment. The applications received from the candidates were forwarded in April 1963 by Directorate General, Armed Forces Medical Services to the Ministry of Defence (D/Appts) for consideration.

The question of appointing the lady doctor suggested by the Electronics and Radar Development Establishment was examined in consultation with the Ministry of Health as she was serving under them. The Ministry of Health did not agree to her transfer as she was involved in a disciplinary case. Since 1963, the question of appointment of an Assistant Surgeon to Electronics and Radar Development Establishment has been under consideration of Directorate General, Armed Forces Medical Services, who had been reminded in the matter periodically.

The Directorate General, Armed Forces Medical Services intimated in June, 1965 that the post of Assistant Surgeon in Defence Installations had been released to the U.P.S.C.

A candidate has now been selected and he has been asked to appear before a Medical Board."

It has been stated in evidence that usually the UPSC suggests two or three names for a post but of late the Commission has been suggesting only one name.

The Committee are surprised to learn the history of the case as revealed above. There are several disquieting features in this case:

(i) The Committee cannot understand how the candidate who was selected by the UPSC could not be traced.

(ii) When on the advice of the UPSC, the case was referred to the Directorate General, Armed Forces Medical Services, for selection of candidates in 1961, the Committee cannot understand why while sending 36 names in April 1963, the LRDE made a specific recommendation about the case of a lady doctor thereby practically imposing its own selection over the DGAFMS.

(iii) That lady doctor being a local doctor engaged in Government service the Committee expect that the LRDE ought to have enquired about her antecedents from the office where she was engaged. Ultimately, when that lady doctor could not be selected as the Health Ministry did not agree to release her on account of some disciplinary action pending against her, it seems no action was taken by the Establishment to forward further names to the DGAFMS.*

(iv) The Committee fail also to understand why out of 36 names, the DGAFMS who was free to make his own selection, could not select any other candidate besides the lady doctor.

(v) The Committee have not been able to ascertain what further action since 1963 has been taken in this direction.

The whole thing appears to the Committee to be irregular and improper. They cannot but deplore the manner in which a particular lady doctor was sought to be appointed in the Electronics and Radar Development Establishment. They deprecate the inordinate delay in filling the post of Assistant Surgeon in that Establishment.

The Committee consider that for the posts to be filled through the UPSC, the Commission should invariably be requested to approve a panel of at least three candidates for one vacancy as against one candidate as is the practice at present, so that if the first person on the approved panel declines the offer, the appointment can be offered to the second person and so on.

This would obviate the need for going through the entire process of selecting a candidate all over again and consequently reduce the delay to large extent.

*At the time of factual verification, the Ministry of Defence have furnished the following facts which were not made available to the Committee earlier:

- (i) The Lady Doctor was not a local doctor engaged in Government service at Bangalore. She has been and still is a Doctor employed in a Hospital in Port Blair (Andaman Island). She was keen to join a post in Bangalore as her husband is employed in LRDE Bangalore.
- (ii) UPSC did not agree to any *ad hoc* selection being made out of the 36 candidates mentioned above. The Lady Doctor in Question not only satisfied the requirements of qualifications and experience prescribed for the post, but she was also holding a similar post in a substantive capacity under the Health Ministry and as such concurrence of the UPSC was not necessary for her appointment as it would mean a case of transfer only. Further, her willingness to join LRDE also weighed a good deal because two candidates selected through UPSC earlier did not ultimately join LRDE."

D. Budget & Accounts

Procedure for formulating and approving budget proposals:

22. The Committee has been informed that the procedure for formulating and approving budget proposals relating to the Electronics and Radar Development Establishment is that the draft budget to cover the following year's work is prepared by the Establishment and forwarded to the R. & D. Headquarters by September-October of the current year. Subsequently, a meeting is held by the Chief Controller, R&D/Scientific Adviser where the Headquarters Technical Director concerned and the Director of the Establishment are present to make any final adjustments. After this, the overall budget is considered by the R. & D. Executive Committee and the R. & D. Council. Based on allocations made by the Government, corresponding adjustments are made in the allotment to the Groups, these are sub-divided to the Establishments.

Budget Estimates and Actual Expenditure:

23. The actual expenditure of the Electronics and Radar Development Establishment during 1964-65 and its budget estimates for 1965-66 are Rs. 57.19 lakhs and Rs. 63.70 lakhs respectively as per details below:

Item	Actual Expenditure 1964-65	Budget Estimates 1965-66
(Rs. in thousand)		
1. Military Officers	120·0	188·0
2. Other Ranks	28·0	47·0
3. Civilian Officers	471·0	514·0
4. Civilian others	1363·0	1575·0
5. Industrial staff	767·0	815·0
6. Miscellaneous Charges	114·0	135·0
7. Movement of Personnel	140·0	115·0
8. Movement of Stores	14·0	20·0
9. Local Purchase of Materials and stores	855·0	
10. Central Purchases of Materials and stores including purchases abroad except in U.K.	1704·0	2589·0
11. Purchase of materials and stores in the U.K.	159·0	372·0
TOTAL	5719·0	6370·0

III. RESEARCH AND DEVELOPMENT PROJECTS

A. Planning and Formulation of Electronics requirements:

24. The Committee have been informed that there are detailed arrangements for formulating immediate as well as long-term requirements of the Defence Services for electronics equipment as far as other fields. The Services draw up what are called long term policy statements, which constitute the basis for formulating the immediate as well as long term requirements. The Services' requirements are formulated for a period of ten years and the R&D Organisation plans its work accordingly. The requirements which are required to be met immediately and which can be met immediately with the resources available constitute the basis on which the R & D Establishment draws up its programme of work for the first five years. The subsequent five years constitute the basis for the long-term requirements.

The Scientific Adviser has stated in evidence that the research and development staff of the R. & D. Establishments and Technical Directors at the R. & D. Headquarters are very closely associated with and play an important part in the formulation of the ten-year plans or long term plans by the Services.

B. Procedure for development and production of Electronic Equipment

Procedure for development, production and inspection:

25. The Committee understand that a procedure has been drawn up for the development, production and inspection of electronic equipment. This procedure lays down, in great detail, the system of processing electronic projects from the stage of their conception to the stage of mass production of the electronic equipment.

Phases in the Procedure:

26. The process of development and production may be divided into six phases, which are as follows:—

- (i) *Study Phase.*—The aim of the study phase is to make it quite clear, what the Service Headquarters want in the light of what can be developed and how the equipment

- can be designed to meet Service Headquarters' requirement. In the case of a major project, the study period may well occupy a year or more and may involve the production of 'A' models, i.e., laboratory models of the equipment.
- (ii) *Development Phase*.—The aim of this phase is to provide 'B' Models (i.e., industrially engineered prototypes) for Users Trials. This phase may take a period of one to two years depending upon the equipment.
 - (iii) *Users Trials Phase*.—This phase covers the User Trials and any modifications which may be required, the preparation of 'C' Models (which would incorporate all the modifications brought out as a result of technical and user trials on Model 'B') for the approval of all concerned, procurement of drawings and the issue of a Development Completion Certificate.
 - (iv) *Engineering for Production Phase*.—This phase covers the completion of engineering development, the revision of procurement drawings and the provision of inspection test equipment. A limited number of 'D' Models made to prove tools and procurement drawings may be made during this phase.
 - (v) *Early Production Phase*.—This phase covers the production of a limited number of equipments for tests by Electronics and Radar Development Establishment and Chief Inspector of Electronics, leading to the initiation of the Production Release Certificate by Electronics and Radar Development Establishment and its endorsement by the Chief Inspector of Electronics.
 - (vi) *Main Production Phase*.—Full scale production takes place under the supervision of the Director of Production and Inspection (Electronics) and Chief Inspector of Electronics. The Technical completion certificate is issued by the Chief Inspector of Electronics.

Time-lag between development and production:

27. The Committee have been informed that the average time-lag between the development of a prototype of electronic equipment and its production in the country generally varies between 2½ years and 3½ years. The Scientific Adviser has stated during evidence that the time-lag is too long and should be compressed. He has

stated that in U.K. and other advanced countries, a time-lag of 18 months would be regarded to be reasonable. He has stated that in a country like India perhaps one year to 18 months would be accepted as a reasonable time-lag.

He has informed the Committee that an analysis of the factors that go to make this time-lag more in this country than in a developed country like U.K. has been made and it has been found that part of the delays is due to cumbersome procedures. Apart from the procedural delays, there are other factors contributing to this time-lag e.g., the components have to be imported in respect of electronics. He has emphasised that with regard to production of the items developed in the country, advance action must be taken to import components, to tool up these things and to short-cut considerations which the sanctioning authority may have.

The Scientific Adviser has expressed the view that once a prototype is made in science and technology, it is very necessary that immediately or as soon as possible, it should go into production, because any delay may mean that more sophisticated or better items may, in the meantime, be produced by others and the item developed by the R. & D. Organisation may not be needed by the Defence Services. In his opinion, if the products developed by indigenous talents are to be utilised, the moment a product is developed, the machinery must be so geared that it should be possible to produce it even on a small scale, to start with.

The Committee are greatly concerned at the cumbersome and dilatory procedures which impede the progress of defence research and development projects and the production of the developed prototypes. They suggest that the procedures, which do not correspond to the needs of the present situation, should be comprehensively reviewed and modified as necessary without delay so that the time-lag in the various stages between the assignment of a project to a scientist and the establishment of mass production of the item developed, is reduced to the barest minimum.

C. Five Year Plans of R. & D. Establishments/Laboratories

(a) General

28. The Scientific Adviser has stated in evidence that each R. & D. Establishment/Laboratory and each area is required to prepare its five years plan of work and development. The five year plans of the different laboratories and different fields come to the R. & D. Headquarters and are pooled together. They are then considered in the context of the resources available and the priorities which may

be allotted for the various fields of activity. The plans are pruned as necessary and fitted into the total plan of the R. & D. Organisation. The overall R. & D. plan then goes before the Ministry of Defence and is fitted into the five year Defence plan. The Ministry does a certain amount of pruning and then the various parts of the Defence five year plan emerge. The Committee understand that the present five year plan of the R. & D. Establishments/Laboratories covers the period 1964-65 to 1968-69.

The Committee consider that it would be desirable if the five-year plans of R. & D. Establishments/Laboratories synchronise with the National Five Year Plans so that the resources for the R. & D. Establishments/Laboratories could be planned in a realistic manner. They hope that necessary adjustment of years will be made to facilitate better allocation of funds on the basis of Plan period.

(b) *Five Year Plan of Electronics Group*

29. The Committee have been informed that the Electronics Group of R. & D. Establishments/Laboratories have drawn up their own five year plan. In drawing up the five-year plan, consideration has been given to such important factors as the Services' requirements, important problems and future trends, the present and planned growth of the production base, present organisation and the inadequacy of R. & D./Establishments. It is in this context that the firm and potentially rewarding areas of applied research and development work, which are clearly dictated by Services' requirements of the likely future communication-electronics equipments have been finalised.

The Committee note that the five year plan of the Electronics Group *inter alia* contains a specific programme of work of each establishment, and priorities of tasks with the facilities required and the financial effect of the plan.

The overall financial effect of the five year plan of the Electronics Group is Rs. 1,183 lakhs of which Rs. 412 lakhs are in foreign exchange and Rs. 771 lakhs in rupee element.

The Committee note that the Electronics Committee has recommended that an investment of Rs. 170 crores in the electronics industry over the next ten year period should be made and given a high priority.

The Committee have been informed by the Scientific Adviser during evidence that the report of the Electronics Committee constitutes the basis on which the future plans of the Defence Electronics Establishments would have to be worked out.

The Committee suggest that the five-year plan of the Defence Electronics Group of Establishments may be reviewed urgently in the light of the report of the Electronics Committee.

(c) *Five Year Plan of Electronics and Radar Development Establishment*

30. The five year plan of the Electronics and Radar Development Establishment as prepared by the Establishment is of the order of Rs. 604.33 lakhs of which Rs. 184.79 lakhs are in foreign exchange and Rs. 419.59 lakhs are in rupee element.

The specific programme of work of the Electronics and Radar Development Establishment during the five year plan gives the existing and proposed projects, along with time schedules and financial estimates.

The total outlay on the development projects as proposed in the plan is Rs. 167.55 lakhs of which Rs. 60.55 are in foreign exchange and Rs. 107.00 in rupee element.

D. R. & D. Projects during Third Plan

R. and D. Projects finalised during Third Plan

31. The Committee have been informed that 30 development projects were finalised by the Electronics and Radar Development Establishment during the Third Plan period.

It has been stated that the approximate estimate of the foreign exchange saved as a result of the items developed is Rs. 3.5 crores. The estimate is based on the cost of equipment as indicated by the Indian manufacturers.

The progress made in the execution of these projects is indicated below:

(i) Items developed and production launched	7
(ii) Items developed and cleared for bulk production	9
(iii) Equipment for which User Trials have been completed and 'C' Models are under fabrication before production clearance	4
(iv) Equipment in advanced stage of development (under User Trials/ Demonstration)	10
TOTAL	30

Current Projects

32. The Committee have been informed that the total number of projects, provision for which was made in the budget of the Electronics and Radar Development Establishment for 1965-66, is 41. Subsequently during the financial year, 5 more projects were allotted to the Establishment. The break-up of the 41 projects under different categories is as under:

Major	10	New	5	User sponsored	32
Minor	31	Carry-over	36	R & D investigational projects	9
TOTAL	<u>41</u>		<u>41</u>		<u>41</u>

Radar Development:

33. Radar is a modern and sophisticated area of vital importance to the Army, Navy and the Air Force.

It has been stated by the Scientific Adviser in evidence that with the limited facilities available so far, the progress made by the Electronics and Radar Development Establishment in developing three kinds of radars is fairly satisfactory. However, in view of the vital importance of radar, much greater facilities are needed. A plan for the augmentation of facilities for development of radar activity has been sanctioned by Government in December, 1965. It has been stated that even to make a modest beginning in radar work, the initial requirement of financial support was of about Rs. 1.62 crores in foreign exchange, of which Rs. 60 lakhs was in free foreign exchange and the rest to be materialised under U.S. Aid. However, in view of the changed situation, only Rs. 60 lakhs in free foreign exchange are now available. The Scientific Adviser has stated that if the requisite finance is made available for the radar activity, it would be possible in the course of about two or three years to have a very substantial base for radar work and the Electronics and Radar Development Establishment and Defence Electronics Research Laboratory would have the potentiality to do work in radar as modern standards would require them to do.

The Committee consider that in view of the special importance of radar to the Defence Services, every step should be taken to sustain and encourage the confidence of the two units, viz. LRDE and DLRL.

NOTE:—If the estimated cost of a project is over Rs. 1 lakh, it is termed as a major project. If a project is estimated to cost less than Rs. 1 lakh, it is called a minor project.

in the development of radar according to modern standard and for that, all procedural delays should be scrupulously avoided and administrative machinery properly geared up. The Electronics and Radar Development Establishment and the Defence Electronics Research Laboratory should on their part, take urgent and concerned steps to implement the plan for reinforcement of radar development activity, according to upto date standard of effectiveness.

Wireless Set 'P' MK I

34. The Committee have been informed that in October 1954, General Staff had initiated a Qualitative Requirement for the development of Wireless Set 'P' which was required in Infantry and Tank versions. The development of this Set was undertaken by M/s CSF in France who had then signed an agreement for the establishment of production facilities of communication equipments at the Bharat Electronics Ltd.

During the period 1955 to 1960, a number of prototypes were presented by the CSF through BEL for technical and user trials. However, a number of short-comings were observed on these Sets and, in order to expedite the development work, improvements to the latter models were examined in India by BEL and Electronics and Radar Development Establishment and modified prototypes of the equipment were accepted and cleared for production by the Services in December, 1961 with certain relaxations.

The BEL entrusted manufacture of a limited quantity of Sets to the CSF in France and during the manufacture of the Sets, CSF carried out some circuitry changes from the accepted versions of the prototypes. In the course of inspection of the product in France and subsequent assembly in India from imported kits certain teething troubles came to light, including the need to improve the stability of the set below -20°C . Further tests/trials in India also revealed that adequate interference-free frequencies spread throughout the band (47 to 55 Mcs) and in a pattern were not obtainable. Further production of the equipment was suspended in BEL, pending investigations, modifications and acceptance of the Set before giving clearance for bulk production. A special team was ordered by Government to steer the progress of this project. The technical problems were satisfactorily resolved and the bulk production was established in 1965.

The Committee note that the Wireless Set 'P' MK-1 which is an important communication set, has taken as long as 10 years for deve-

lopment and to go into bulk production. The Scientific Adviser has admitted that the delay in the development of this Set has been unduly long.

The Committee consider the delay in the development of the Wireless Set 'P' MK1 as unfortunate. They feel that with proper planning and sustained action, it should have been possible to reduce the time taken in development.

Apparatus Carrier Telephone (1+4) 2A.

35. The Committee note that the time taken in the development of Apparatus Carrier Telephone (1+4) 2A which was carried out by the Electronics and Radar Development Establishment in collaboration with Messrs. Indian Telephone Industries, Bangalore has been about seven years.

The Committee consider this time too long and feel that it should have been possible to reduce it by special efforts. The Committee further hope that in future, there should be energetic efforts to reduce the time taken in the development of weapons of strategic importance.

E. Review of Research & Development Work

36. The research and development work of the Electronics and Research Development Establishment is reviewed. The review is two-fold, that is review by R. & D. Headquarters as the executive agency and review by the concerned R. & D. Panel and Committees. The review by the R. & D. Headquarters is carried out by the Director of the Establishment itself and also by officers from the R. & D. Headquarters, viz., Director of Electronics, Chief Controller, R. & D. and Scientific Adviser. All projects which are product-oriented are reviewed by the Electronics Development Panel. Major and important projects are also reviewed by the R. & D. Executive Committee and the R. & D. Council.

It has been stated in evidence that the evaluation of the work of the Electronics and Radar Development Establishment has not yet been undertaken by an independent expert committee. The Scientific Adviser has expressed the view that it is too early to undertake such an independent evaluation but in another three or four years it is proposed to have an independent evaluation of the whole R. & D. establishment.

The Committee consider that it would be useful to have a periodical evaluation conducted of the research and development work of

the various R. & D. Establishments every five years by a Committee consisting of eminent scientists drawn both from the Defence Research and Development Organisation and from outside. They hope that the first evaluation will be undertaken at an early date.

IV. MISCELLANEOUS

A. Liaison with Industry

37. The Committee understand that the principle governing the allocation of development projects to Government R. & D. Establishments, public sector industry and private sector industry is that if the R. & D. Establishment has the capability and resources to do it, it is given to it. If the project cannot be executed within the Government R. & D. Establishment, it is given to a public sector industry provided the latter has the facilities for developing the project. If the R. & D. Establishment and the public sector industry are unable to undertake the project, then it is contracted out to a private sector industry.

Pattern of collaboration arrangements

38. The Committee have been informed by the Ministry that the general pattern of collaboration arrangements with the industries in public and private sectors for the development of electronic equipment is briefly as follows:—

“In early development stage itself, the likely industries are induced to take an interest in the project so that at the appropriate time, they are able to participate effectively in development collaboration. Although the endeavour is to get more than one industry interested in order to introduce an element of competition even at the pre-development stage, so far, because of the very narrow industrial base, it has not been found easy to secure this multi-industry interest. In fact, quite often, it becomes difficult to find even one suitable industry with sufficient interest for collaborative development. This is unavoidable phenomenon at this stage of our industrial evolution as generally all industries both public and private, have sufficient orders in hand of less complex and more remunerative product lines. In advanced development phases, collaboration is secured on the basis of industrial capability for undertaking the project. Estimate is prepared of the likely cost of the project at this stage and payment made subsequent to the prototypes being made available by the concerned industry and after its engineering evaluation and re-work, if necessary.

The Committee cannot too strongly emphasise the urgent and vital need for making concerted efforts by all concerned to meet the country's defence needs of electronic equipment in the overall national interest. They hope that the industry will rise equal to the task. In this context, the Committee would like to stress that there is an absolute necessity of urgent establishment of powerful design and development groups both in Government organisations like Atomic Energy Establishment, the Council of Scientific and Industrial Research and the Defence Research and Development Organisation and in large undertakings in the electronics industry in the private and public sectors as recommended by the Bhabha Committee. They would urge that effective and concrete measures should be initiated in this direction without delay.

Development contracts:

39. The Committee have been informed that the cost of development of electronics equipments, which were placed with the private and public sector industries during the years 1963-64, 1964-65 and 1965-66 is as per details given below:—

Year	Orders on Private Sector Industries	Orders on Public Sector Industries	Total cost
	Rs.	Rs.	Rs.
1963-64	45,466	79,532	1,24,998
1964-65	3,40,202	..	3,40,202
1965-66	45,956	5,70,000	6,15,956

The Committee have also been informed that the contract includes clear-cut arrangements about costs, a time scale for the various phases and a list of major technical problems assembled in order of priority. The contractors are required to submit regular reports of progress. They are also required to contact the officers of the Electronics and Radar Development Establishment for adequate monitoring and supervision of their activity.

Assistance to industry:

40. One of the functions of the Electronics and Radar Development Establishment is to educate and assist industries in the fabrication of reliable prototype equipment. The Committee have been informed by the Ministry that the process of enthusing and educating the industry starts early in the design phase. The

'design guidance' booklets prepared by the R. & D. Establishment, are issued to the industries for their study and when appropriate, engineers from the industries are invited to visit the Establishment and hold on-the-spot discussion regarding the technical details of the project. Technical and management personnel of industries are also encouraged to visit the Establishment and acquaint themselves with the complexities of military design and development work, and, in particular, the requirements of reliability and the maintenance angles. During the Development stage, close association is maintained with the industry by Electronics and Radar Development Establishment project teams and other specialists in the Establishment, such as environmental and design engineers, connected with the projects. Whenever technical difficulties are encountered by the industry, which are beyond their capability, a solution is provided to the industry by the specialists of the R.&D. Establishment.

Also, the industries are helped in the project work by making available specialised facilities such as environmental engineering equipment in the Establishment to appraise their product at various phases of development. Assistance is rendered by component development staff on reliability aspects and type approval of components.

It has been stated by the Scientific Adviser in evidence that the Electronics and Radar Development Establishment has done good work in educating and assisting the industries in fabrication of defence electronic equipment. He has further stated that a great deal of work, however, remains to be done in the country. The private industries have to be educated to do the defence work because they are not used to the exacting type of defence work.

The Committee suggest that greater efforts should be made by the Electronics and Radar Development Establishment to educate and assist the industry in the fabrication of reliable prototype equipment in view of the stringent requirements and strict specifications for defence.

B. Liaison with Academic and Research Institutes

41. The Committee have been informed that the collaboration between the Electronics and Radar Development Establishment and Institutions and Laboratories outside Defence R. & D. Organisation is primarily on the working levels for different projects. All programmes with such outside agencies are formally channelised through the Directorate of Electronics, after consultation with the

Heads of Establishments/Laboratories. After a project has been "framed out", the Establishment concerned keeps a close touch with the institution concerned at the project level.

Director, Electronics and Radar Development Establishment is a member of the Executive Council of the Central Electronics Engineering Research Institute, Pilani. He is also a member of the Electronics Development Panel and the Defence Electronics Research Committee who are represented amongst others by Director, C.E.E.R.I., Pilani and eminent scientists from civil research units/Institutes of Technology. Director of Electronics at the R.&D. Headquarters is a member of the Committees constituted in electronics by the Atomic Energy Commission and the Scientific Advisory Committee to the Cabinet.

42. The Committee understand that a total of 33 electronics projects have so far been farmed out by the Defence R. & D. Organisation to academic and other civil research institutions. Of these 33 projects, 8 have been farmed out to academic institutions, 10 to Department of Atomic Energy including Tata Institute of Fundamental Research Bombay, 9 to Central Electronic Engineering Research Institute, Pilani, 5 to Central Electro-Chemical Research Institute and one to Regional Research Laboratory, Hyderabad.

The Committee have been assured by the Scientific Adviser that the liaison between the L.R.D.E. and other civil research laboratories engaged in the field of electronics is very good.

The Committee would like to stress the importance of maintaining the closest possible links between the different agencies concerned with research and development work in the field of electronics so that there may be no scope for any unnecessary duplication of effort and wasteful expenditure.

The Committee have also referred to the question of liaison between the Defence Electronics Laboratories with universities and other civil research institutions in Chapter VII of the report.

C. Research and Training Facilities

Training of newly recruited Engineers and Scientists:

43. There is a scheme of training of newly recruited engineers and scientists in the Electronics and Radar Development Establishment with a view to converting them into purposeful and competent development technologists. The new entrant is initially exposed to short

formal course of training for 'orientation'. After the orientation the trainee is attached for an "on-the-spot" training with project officers for a period of six months. In addition to this, there is scheme in the R. & D. Organisation called the apprenticeship training scheme. Newly recruited engineering graduates or Master's degree holders are selected for this training and after successful completion are appointed as J.S.O./S.S.O.I.I.

The Committee have been informed that a scheme has also been drawn up for advanced training of Defence Scientific/Technical personnel with special reference to long range defence requirements. It has, however, been the experience of the Ministry that foreign nations are reluctant to admit for training equipment-oriented technologists in their laboratories.

The Committee feel that there is urgent need for augmenting the facilities for training in electronics and suggest that special and sustained efforts should be made at appropriate level to secure training facilities in the field of electronics for defence scientists and technologists working in the Electronics and Radar Development Establishment and Defence Electronics Research Laboratory.

Provision of training facilities to Post-graduate students:

44. The Committee note that at present facilities are provided in the Establishment for practical training for Engineering/Science students from various institutions/universities. Post-graduate trainees are entertained every year for a period of two to three months on unclassified projects.

The Committee consider that provision of such facilities is of great advantage to the progress of scientific research in the country and will result in fruitful co-ordination and co-operation between the two sectors—University and non-University. The Committee feel that since our resources in finance and technical personnel are limited, unless they are utilised most advantageously, it will be impossible to obtain the best results.

D. Information Services

45. The science of electronics is a subject which is in the vanguard of technological progress and consequently in a state of extremely rapid development. It is therefore essential that Electronics and Radar Development Establishment as also other electronic research laboratories/institutes and the electronics industry in the country should keep themselves abreast of the progress in the rest of the world.

46. The Committee have been informed that the LRDE keeps itself abreast of the latest researches and developments in the field of electronics in other countries by the following process:—

- (i) Through the medium of the Services organised by its Technical Information Centre.
- (ii) Through study of latest prototypes available in the country or procured specially for this purpose.
- (iii) Through participation in scientific and technical discussions and symposia.
- (iv) Through technical staff deputed abroad.

47. Regarding the means employed for exchange of information between the LRDE and the electronics research laboratories on the civil side in the country, the Committee have been informed that the interest of LRDE is more intense on the engineering capabilities of the industrial sector, though it is very interested also in the scientific activities of other civil R & D establishments. The LRDE therefore concentrates heavily to survey and collate information of production capacity in the country with relation to the projects handled by the Establishment. It also concerns itself with classification and storage of information relating to components production potential of the country. It has specialised means to survey, collect and collate information relating to engineering product and processes. Information regarding scientific activities of other institutes is gathered in the conventional manner by exchange of publications and study of reports.

48. A view has been expressed before the Committee by an eminent scientist that there is lack of communication of results of research and development carried out in the Defence R & D Establishments/Laboratories and various Civil Laboratories, universities and Indian Institutes of Technology. In foreign countries e.g., USSR, UK, France, and USA, scientists talk about their ideas before they do something. In India, however, nothing is talked about until everything is in printed form or published in a paper. He has suggested that a Central Clearing house of information may be set up where full information should be available of the various activities and developments that have taken place in the universities and the various electronics laboratories/institutes e.g. Atomic Energy Department Laboratory, National Physical Laboratory, Delhi, Institute of Radio Physics and Electronics, Calcutta, Saha Institute of Nuclear Physics, Calcutta, Central Scientific Instruments Organisation, Chandigarh and Indian Institute of Science, Bangalore, This would enable Defence R & D Organisation to sponsor schemes and developmental

activities in various organisations to supplement their own efforts. The Central Clearing House should keep a complete modern card index and filing information system, so that various developments right from the inception could be known.

The scientific adviser has stated in evidence that there is no systematic way of collecting the information but the Electronics Research Committee is expected to have knowledge of the facilities available in various institutions.

In view of the vital importance of electronics in defence, atomic energy, communication and industrial production, the Committee feel that there is urgent need for devising a systematic way of collecting information about the researches and developments in electronics and would therefore suggest that the desirability of setting up a suitable machinery for this purpose may be examined by the Defence Organisation in consultation with the Council of Scientific and Industrial Research and the Atomic Energy Establishment.

The Committee need hardly stress that there should be free communication of results of research and development between the R & D Establishments under the Defence R & D Organisation and the Civil Laboratories, Universities, Institutes of Technology etc., consistent with considerations of security so that there is close co-ordination of national effort and resources, and all unnecessary duplication is avoided.

E. Foreign Exchange

49. The Committee have been informed that the details of foreign exchange asked for, allotted to, and utilised by Electronics and Radar Development Establishment during the years 1961-62 to 1965-66 are as follows:—

Year	Asked for by the Estt.	Allotted to the Estt.	Utilised by Establishment
1961-62	No estimates prepared.	3,34,218	3,34,218
1962-63	..	2,55,000	2,55,144
1963-64	13,00,000	7,20,000	7,22,949
1964-65	11,00,000	4,66,000	4,66,315
1965-66*	14,00,000	6,00,000	5,42,051@

@ Upto January 1966.

*This does not include requirement of Foreign Exchange reflected in the Radar augmentation proposals. These proposals have, however, been sanctioned only recently by the Government but with limited Foreign Exchange.

50. It has been stated that the requirements of foreign exchange projected by the Establishment were not met fully during the years 1963-64, 1964-65 and 1965-66 on account of foreign exchange position. The requirement of components for development projects was given the first priority and as such no major projects were allowed to suffer. However, of necessity adjustments had to be made in the pace of build-up of facilities and competence of the Establishment.

51. The Committee have been informed that a tentative assessment for the foreign exchange requirements during the Fourth Five Year Plan period is about Rs. 2 crores. This includes build up of radar facilities and undertaking of projects arising from long term policy statement of the Services. This estimate does not however include requirements of funds for "farmed out" projects to agencies outside Defence R & D Organisation.

In view of vital importance and urgency of the development projects of the Electronics and Radar Development Establishment, the Committee hope that the foreign exchange requirements of the Establishment would be met to the maximum extent possible.

F. Fabrication of test equipment

52. The Committee have been informed that fabrication of test equipment to meet its own needs is carried out by an R & D Establishment as far as possible. In the case of Electronics and Radar Development Establishment, however, the Scientific Adviser has stated that the test equipment is mostly standard electronic testing equipment and by and large would have been imported except for the engineering plant which would have been procured through local sources. However, some test equipment which would not be very expensive or which would not be very sophisticated has been fabricated by the Electronics and Radar Development Establishment itself. This is worth about Rs. 2.5 lakhs. It has been stated that electronic testing equipment is also made in Atomic Energy Department, Indian Telephone Industries, Central Electronics Engineering Research Institute and some other places in the country.

The Committee suggest that sustained and concerted efforts may be made by the Electronics and Radar Development Establishment in conjunction with the Atomic Energy Department, Indian Telephone Industries, Central Electronics Engineering Research Institute and other organisations concerned to develop and produce electronic test equipment as expeditiously as possible so that valuable foreign exchange could be saved and dependence on foreign assistance eliminated.

G. Patenting of Developed Products

53. It has been stated in evidence that no royalty is charged from a private sector unit when any know-how developed by the Defence Establishment is passed on to it unless a patent is taken. It has further been stated that by and large military products being very expensive because of their high quality, will not be needed by the civil trade and there would be no market for them.

The Scientific Adviser has stated that the point about taking patent for the know-how developed by the Defence R & D Establishments/Laboratories will have great significance on an international scale. In his view, the LRDE has done very good work which will be of military value on an international scale and they were trying to get a patent on that scale.

The Committee suggest that whenever any new technique and know-how is developed by the LRDE or by any other Laboratory/Establishment of the Defence R. & D. Organisation the question of taking patents on national and international scale for such new technical processes or products should be considered comprehensively.

H. Assistance to less developed countries

54. India has been importing know-how from developed countries. It has been stated by the Scientific Adviser in evidence that the Defence R & D Organisation has done some very good work in certain fields and many foreign countries are anxious to know how high altitude jungle and special climatic problems are being tackled by this Organisation.

The Committee consider that the Ministries of Defence and Education should examine the desirability of helping the less developed countries, particularly in Asia and Africa with whatever know-how and trained personnel they can afford to give them as this will improve the image of India in those countries as also in international scientific world.

PART II

DEFENCE ELECTRONICS RESEARCH LABORATORY

V. ORGANISATION AND FUNCTIONS

A. Introductory

55. The Committee have been informed that while one can look to universities and other scientific institutions in the country for progress in fundamental scientific research, applied research for developing specific technologies and equipment for military purposes has to be largely undertaken by the Defence R & D Establishments to ensure concentration of effort and speed and to satisfy security considerations.

56. It has been stated that to meet the needs of development research in the rapidly expanding field of electronics, the Defence Electronics Research Laboratory was established at Hyderabad in 1961 by combining and suitably reinforcing the two sections engaged on electronics and radar research in Defence Science Laboratory at Delhi and in Electronics and Radar Development Establishment at Bangalore.

57. The Scientific Adviser has stated in evidence that it was necessary to set up the Defence Electronics Research Laboratory to meet the Defence needs of electronics and it is by no means a surplus laboratory. In this context, he has pointed out that at present there are three major scientific organisations in the country, namely, the Atomic Energy Commission, Council of Scientific and Industrial Research and the Defence R & D Organisation. These three have electronics laboratories. Atomic Energy Commission has an Electronics Division, Council of Scientific and Industrial Research has Central Electronics Engineering Research Institute, and the Defence R. & D. Organisation have Electronics and Radar Development Establishment at Bangalore and Defence Electronics and Research Laboratory at Hyderabad. On the Production side, there is only one big agency viz., Bharat Electronics Ltd., which has been functioning for the last few years. The MIG Electronics at Hyderabad has only now come into existence. It has been stated that the exhaustive investigation by the Electronics Committee has revealed that so far as the field of electronics is concerned considering the demands of the

country, these institutions are far from few, either viewed at laboratories or viewed as establishments. In fact many more electronics establishments would have to come in to cope with the growing requirements of the country in the field of electronics.

58. It has further been stated that in comparison with the advanced countries like the UK and USA, the research and development effort in electronics in India is relatively negligible.

In UK. and USA. there are several major government electronics research and development laboratories and in size, probably, each of these major laboratories is five to ten times of size of the existing laboratories in India.

In this context, it is relevant to mention that the Electronics Committee has emphasised that in order to develop a self-reliant and largely self-sufficient electronics industry capable of meeting Indian needs, and of competing in world market, the establishment of powerful design and development groups is of absolute necessity.

B. Functions

59. The Defence Electronics Research Laboratory has been charged with the responsibility for the initiation and conduct of technique-oriented research and for the application of such research to futuristic equipment. Its functions are as follows:—

- (a) To acquaint itself with the long-term policy statements of the Services with a view to evolving techniques and circuitries for use by other equipment-oriented R & D Laboratories/Establishments.
- (b) To undertake applied research on techniques which are likely to be incorporated in the futuristic range of equipment for the Services.
- (c) To undertake investigational work related to improvement in the performance of equipment, components and materials.
- (d) To conduct propagation studies in the frequency spectrum utilised by the Services, to be able to advise/assist the preparation of frequency prediction charts, setting up of radio relay links and siting of radar stations.
- (e) To undertake applied research work to evolve jamming, counter measures and counter-counter measures/techniques in radar and other electronics equipment.

- (f) To closely liaise with universities/other institutions in the national echelon and suggest tasks for farming out to these establishments.

It has been stated by the Scientific Adviser in evidence that the Defence Electronics Research Laboratory undertakes a very small amount of basic research for sustaining applied research.

C. Organisation

60. The Defence Electronics Research Laboratory is headed by a Director Grade I. Functionally, the laboratory has been organised into the following Divisions:—

- (a) Radar and Microwaves
- (b) ECM and ECCM
- (c) Propagation
- (d) Radio Systems
- (e) Communication
- (f) Rocket Instrumentation
- (g) Devices.

Besides the above functional Divisions, a Nucleus Standards and Measurements Laboratory and a Materials Laboratory have also been set up. The Laboratory has a Radar Field Research Station at Jamnagar and small Ionospheric Field Research units at Gauhati, Jammu and Hyderabad.

In order to coordinate the technical activities of the various divisions within the Laboratory as well as the Field Research Station a Technical Coordination Group has been formed in the Laboratory.

The Laboratory has also Support Services which include Administrative and Store Division, Technical Information Centre, Photographic Section, Design Drawing and Workshop Sections.

A chart showing the organisational set-up of the Laboratory is given in Appendix III.

Defence Electronics Research Committee

61. There is a Defence Electronics Research Committee. It was originally constituted in 1959. It was reconstituted in August

1964. The present composition and functions of this Committee are as follows:—

Composition

Dr. K. R. Ramanathan, Director,
Physical Research Laboratory, Ahmed-
dabad,

Chairman

Director of Electronics R &D.

Director, Electronics and Radar
Development Establishment, Banga-
lore.

Members ex-officio

Director, Solid State Physics Labo-
ratory, Delhi.

Rep. Institute of Armament Techno-
logy, Kirkee.

Rep. CSIR (Dr. Amarjit Singh Dir-
ector, CEERI, Pilani.

Three Members from universities.

(a) Prof. H. Rakshit, IIT Kharag-
pur

Other Members

(b) Prof. S. Sampath, IIT Madras

(c) Dr. U. D. Desai, Physical Re-
search Laboratory, Hyderabad.

Dr. V. Narayanarao Director, DELRL,
Hyderabad.

Member Secretary

The representatives of the three Services are coopted as members.

Functions:

- (i) To assess national research potential in relation to the needs of defence electronics.
- (ii) To recommend allocation of research tasks to various institutions including allocation of work under the grants-in-aid scheme.
- (iii) To consider ideas, suggestions and requirements as may be placed before the Committee by the users, Electronics Development Panel and interested institutions/individuals.
- (iv) To advise on Defence research and development and facilities therefor, keeping in view the research tasks in the electronics field.

The Defence Electronics Research Committee functions as an advisory committee to the Scientific Adviser.

The Scientific Adviser has stated in evidence that coordination of activities of the Defence Electronics Research Committee with those of the Electronics Research Committees on the civil side is secured through some common membership of these committees. **The Committee think that coordination between the defence and civilian electronic research merely through common membership of the Committees is not adequate and that some more effective liaison should be established.**

Frequency of Meetings of Defence Electronics Research Committee

62. The Defence Electronics Research Committee meets once a year. The normal duration of a meeting of this committee is stated to be one full working day.

The Committee feel that the Defence Electronics Research Committee should meet more often than once a year as at present and should also consider and review the progress of the electronics research and development programmes and the facilities available and required therefor.

Staff Strength

63. The actual strength of officers and staff of the Defence Electronics Research Laboratory as on 1.1.1966 is 52 gazetted officers and 144 non-gazetted staff as against the authorised strength of 68 gazetted officers and 187 non-gazetted staff, which does not include the staff sanctioned in December, 1965 under the radar augmentation proposal. A statement showing the authorised and actual strength of staff in the various categories as on 1.1.1966 is given in Appendix IV. The staff sanctioned in December, 1965 under radar re-inforcement proposal consists of 15 gazetted officers and 51 non-gazetted staff.

The Committee have been informed that action has been initiated to recruit staff to fill the vacancies.

Incentives for Scientific staff

64. Research and Development personal both civilian and service, are eligible for cash awards and commendation certificates for original ideas, inventiveness and suggestions leading to better utilisation of existing stores and improvement in working procedure resulting in economy in men, materials and time. The Committee have been informed that in DLRL during 1965-66 four officers have been given cash awards of Rs. 1,000 each and three non-gazetted officers have been given cash awards of Rs. 200 each. This group of officers and staff was given these awards because they worked with dedication on a vital defence equipment.

The Committee are glad to note that as many as seven members of this Laboratory won cash awards for meritorious work during 1965-66. They hope that this will encourage others also to put in greater efforts.

D. Budget and Accounts

65. The actual expenditure of the Defence Electronics Research Laboratory during 1964-65 and its Budget Estimates for 1965-66 are Rs. 19.34 lakhs and Rs. 26.89 lakhs respectively as per details given below:—

(Figures in lakhs of Rs.)

	1964-65 Actuals	1965-66 Budget Estimates
<i>Pay and Allowances</i>		
Civilian Officers	3.75	5.25
Civilian Others	4.95	7.12
Industrial staff	1.87	3.55
<i>Stores & Project Activity</i>		
Misc. charges	0.59	1.25
Move of personnel	0.35	0.60
Move of Stores	0.11	0.12
LP/CP of materials and stores including purchase from abroad except UK.	7.72	9.00
TOTAL	19.34	26.89

The budget estimates for 1965-66 are based on the fact that Defence Electronics Research Laboratory is a growing establishment.

The miscellaneous expenditure estimated at Rs. 1.25 lakhs during 1965-66 relate to mainly provision of books, technical journals, service stamps, telephone rentals, liveries, special steel furniture typewriters/duplicators and other miscellaneous contingencies.

VI. RESEARCH AND DEVELOPMENT PROJECTS

A. Planning and formulation of requirements

66. The arrangements for formulating immediate as well as long-term requirements for defence electronics research are the same as outlined in the case of Electronics and Radar Development Establishment. A ten-year programme is formulated based on long term Policy Statements drawn up by the Services. Out of that such things as need long range attention are picked out. The Defence Electronics Research Laboratory assesses them and finds out what are the new and modern techniques that are coming into vogue and how it can undertake them for the Service's requirements. All future long range plans are looked at from the point of view of study of art in electronics technology. All immediate tasks are separated out and handled by the Electronics & Radar Development Establishment by using known techniques and known engineering methods. Long range tasks requiring studies of special phenomena like miniaturisation, electronic warfare, special antennas etc. come to Defence Electronics Research Laboratory and it tackles them as long range problems.

B. Five Year Plan of DLRL

67. The five year plan of the Defence Electronics Research Laboratory for the period 1964-65 to 1968-69 as prepared by the Laboratory is of the order of Rs. 341.14 lakhs, of which Rs. 128.55 lakhs are in foreign exchange and Rs. 212.59 are in rupee element.

The specific programme of work of the Defence Electronics Research Laboratory during the five year plan gives the existing and proposed research and development projects, along with time schedules and financial estimates.

The total outlay on the development projects as provided for in the plan is Rs. 94.50 lakhs of which Rs. 69.05 lakhs are in foreign exchange and Rs. 25.45 lakhs are in rupee element.

C. Current Projects

68. The Committee have been informed that 15 projects have been provided for in the budget estimates of the Defence Electronics

Research Laboratory for 1965-66. The break-up of these 15 projects under different categories is as under:—

Major	10	New	12	User sponsored	6
Minor	5	Carry over	3	R&D investigational projects	9
TOTAL	15		15		15

In addition to these 15 projects, a number of small supporting minor projects are undertaken which are within the financial powers of the Director of the Laboratory. It has been stated in evidence that of the 15 projects provided for in the budget estimates, 2 projects are practically completed and the remaining will be carried forward to the next year. It has also been stated that normally, it takes 3 to 4 years to complete a major project and 1 to 2 years to complete a minor project.

D. Major Achievements

69. The Committee have been informed that since its inception in 1961, the Defence Electronics Research Laboratory has made significant progress in various areas of its activity. A brief review is given in the subsequent paragraphs.

Development of vital Communication Equipment

70. In the case of secrecy equipments, know-how has of necessity to be indigenous. Based on the techniques evolved by it, the Defence Electronics Research Laboratory has developed a vital defence equipment urgently required by the Services. The users have recommended the introduction of this equipment in its present form, into the Service. It is proposed to establish pilot plan production of the same at the Laboratory shortly on placement of orders.

The Committee hope that in view of the vital importance of this equipment to the defence services, energetic steps would be taken by the Defence Electronics Research Laboratory to establish production of the equipment on a pilot plant scale without any avoidable delay.

Development of Ionospheric Recording Equipment

71. The Defence Electronics Research Laboratory has developed and fabricated an automatic Ionospheric recorder which records the height of the ionosphere. The Laboratory prepares frequency prediction charts for the Defence Services with the help of this equipment. This has resulted in considerable saving in foreign exchange.

It has been stated that other scientific institutions in the country like INSCOPAR have evinced keen interest in the recorder developed by Defence Electronics Research Laboratory and made enquiries for the supply of these to them.

The Committee suggest that steps should be taken to encourage indigenous manufacture of the ionospheric equipment developed by the Defence Electronics Research Laboratory. They also suggest that the desirability of taking a patent for this equipment may be considered.

Development of techniques of non-metallic mines detection

72. There is an urgent requirement by the Services of a mine detector capable of detecting non-metallic anti-tank and anti-personnel mines. For this purpose, the techniques involved are very sophisticated and even in more advanced countries this problem has not been fully solved. The known techniques suffer from serious drawbacks such as false alarms and low sensitivity of the system. The Defence Electronics Research Laboratory has succeeded in evolving a technique, based on which experimental models have been made. These are being technically evaluated.

The Committee suggest that the development work with regard to the techniques evolved by the Defence Electronics Research Laboratory for detecting non-metallic mines should be completed as early as possible.

Development of Log-periodic Antenna VHF Bands

73. A broad VHF vehicular log periodic antenna covering a frequency range of 50 to 100 mcs. has been developed by the Defence Electronics Research Laboratory. It has been technically evaluated in association with the users and the performance has been found satisfactory. A new model covering frequency range of 70 to 100 mcs. as suggested by the users has been developed and fabricated. Preliminary examination carried out by the users has shown its performance to be satisfactory and further trials are being carried out to assess its suitability for introduction into Service.

Development of telemetry transmitter

74. The Defence Electronics Research Laboratory is engaged in development of electronic payload instrumentation and telemetry as a support activity to the rocketry programme of Defence R & D Laboratory, Hyderabad. It has developed a four channel telemetry transmitter for use in the 3 stage high altitude sounding rockets.

Evolution of techniques for incorporation in the futuristic range of equipment

75. The Committee understand that the Defence Electronics Research Laboratory is working on a number of techniques for possible incorporation in the futuristic range of equipments. These include techniques for the development of Electronic Counter Measures (ECM) and Electronic Counter/Counter Measures (ECCM) devices such as radar search receivers, high power jammers, false echo jammers etc. In the field of radar and communication equipment, work/study is being carried out on the techniques of pulse compression, electronic scanning, broad-band antennas, frequency synthesis and digital speech systems.

The Committee suggest that in all these researches, a priority should be fixed and that research may be intensified on the basis of priority fixed so that investigation may become effective and purposeful in a short time.

Development of techniques of Battle-field Surveillance Radar

76. One of the Investigations undertaken by the Defence Electronics Research Laboratory is the development of techniques for Battlefield Surveillance Radar for locating moving objects. This is a technique in which considerable amount of work is needed before the techniques could be perfected. Some progress has been made in this project and an experimental model of an equipment has been fabricated for essential studies. Development of an improved model aiming at improved range and reduced weight and size is continuing.

The Committee suggest that efforts may be intensified to develop techniques for Battlefield Surveillance Radars to meet future Services requirements.

VII. MISCELLANEOUS

A. Collaboration with Academic Institutions and Civil Research Units

77. The field of electronics is one where there is a considerable amount of basic research and applied research and the universities and the higher institutes of technology have a very important part to play. The Committee are informed that two professors at the Indian Institute of Technology, Kharagpur and the Indian Institute of Technology, Madras are members of the Defence Electronics Research Committee. Besides, the Defence R. & D. Organisation have a mechanism by which the Director of Electronics at the R & D Headquarters also visits the electronics department of universities and farms out projects which deal with either basic or applied research.

78. The Committee note that in all 33 electronics research and development projects have so far been farmed out by the Defence R. & D. Organisation to academic and other civil research institutions. Of these 33 projects, 8 projects have been farmed out to academic institutions, 10 to Department of Atomic Energy including the Tata Institute of Fundamental Research, 9 to Central Electronic Engineering Research Institute, 5 to Central Electro-chemical Research Institute, Karaikudi and one to Regional Research Laboratory Hyderabad.

The particulars of the 8 projects farmed out to academic institutions under Grants-in-aid scheme for defence research are as follows:—

Particulars of Projects	Name of the Institutions:
1	2
(i) Studies on Tectron and liquid/solution transistors	College of Technology, Bhopal.
(ii) Studies on attenuation of 3cm waves by rain and other meteorological conditions.	BHU, Varanasi.
(iii) Speech Band Compression	I.I.T. Kharagpur
(iv) Sub-surface Communication	Do.

1	2
(v) Development of mm wave techniques and their application.	Andhra University
(vi) Study of Parametric amplifiers and mixers using semi-conductor diodes.	Allahabad University, Allahabad.
(vii) Study of Electronic and crystalline structure of metals, alloys and intermetallic compounds in relation to their physical and mechanical properties.	University of Poona.
(viii) Basic studies on Jamming of Speech	Osmania University, Hyderabad.

79. The Committee have been informed by an eminent scientist that there is a practice in many countries that specific assignments are given to academic and technical laboratories and institutions for which they are particularly equipped. This often involves breaking up a problem into smaller components so that they are no longer highly sensitive or confidential and then contracting out these components and assignments to various laboratories best fitted to to carry out such work. The Scientific Adviser has stated that this concept was introduced in the Defence Organisation in India about two years ago and only a small number of projects are being handled that way.

The Scientific Adviser has informed the Committee that it was not only his experience but the experience reflected by the visits which the Defence Officers who deal with the electronics now make to universities that in this field, where increasing sophistication and new and modern equipment becomes necessary, the universities are being gradually depleted because they have no money, no foreign exchange, and, with a few exceptions, their laboratories are poorly equipped and they want to utilise the money given by the Defence R. & D. Organisation, under the Defence Grants-in-aid Scheme for defence research to equip themselves.

The Scientific Adviser has stated that except the five Institutes of Technology, Banaras Hindu University, Calcutta University, and the Indian Institute of Science, Bangalore which are well-equipped, practically all the universities are somewhat poor in regard to facilities for carrying out research in electronics.

The Scientific Adviser has stated: "Whether it is defence science, industrial science or atomic science, we must have a strong base at the university level because the utilisation of it for national

purposes rests on them. The money being spent on university science departments is ridiculously low now in proportion to what is spent on other spheres. Unless we strengthen the university science departments, there is a very little scope of building up the applied science departments in the proper manner."

Regarding the results achieved by farming out the projects to the universities, the Scientific Adviser has stated that "in some universities dividend is being paid and in some, dividend is not being paid because they do not have the equipment. I would say, it is fifty-fifty."

In view of the great potentialities of electronics in defence and industry, the Committee cannot over-emphasise the importance of associating universities, higher institutes of technology and other academic institutions in the country with defence electronics research.

According to the assessment made by the Electronics Committee, the electronics industry of the size envisaged in 1975 would need 3,00,000 engineers, scientists and skilled workers. Considering the urgent need for trained manpower for the electronics industry, it is essential that the universities and other academic institutions are adequately equipped to enable them to supply properly qualified personnel. The Committee therefore suggest that Government and the University Grants Commission should give this matter their most careful and urgent consideration and provide the necessary facilities to the universities and other academic institutions to train up adequate number of efficient scientists who will be able to undertake the necessary research schemes and projects in electronics.

The Committee feel that there is enough of unnecessary secretiveness in defence research units and a general tendency of avoiding close collaboration with civil scientific research units. They suggest that, as in the U.K. and the U.S.A., the Defence Research and Development Organisation should maintain maximum contact and collaboration with the Universities, National Laboratories and other academic and scientific research institutions in the country and make a wider use of these institutions for undertaking research projects.

The Committee recommend that the Defence Research and Development Organisation should adopt the method of breaking up a problem into components so that they no longer remain highly sensitive and confidential. Sub-problems may then be farmed out to various laboratories in the country, both defence and non-defence.

B. Foreign Exchange

80. The Committee have been informed that the details of foreign exchange asked for, allotted to and utilised by Defence Electronics Research Laboratory during the years 1962-63 to 1965-66 are as follows:—

(Figure in Lakhs of Rs.)

Year	Asked for by Lab.	Allotted to Laboratory	Utilised by Laboratory
1962-63	8.60	3.0	3.05
1963-64	5.49	2.50	2.52
1964-65	8.03	7.00	7.07
1965-66	7.40	6.00	5.00 (This is upto Jan. 1966 only).

The Committee have been informed that the requirements of foreign exchange projected by the Defence Electronics Research Laboratory were not fully met on account of difficult foreign exchange position. However, priority was allotted to test equipments and components required to progress priority projects. The figures given above do not include requirement of foreign exchange reflected in radar augmentation proposals.

The assessment of foreign exchange requirement of the Defence Electronics Research Laboratory for the Fourth Plan is estimated to be about Rs. 1 crore.

The Committee feel that in view of the very difficult foreign exchange position at present, the Defence Electronics Research Laboratory and other units under the Defence R. & D. Organisation should make an earnest effort to avoid imports, by finding or developing local substitutes; and at the same time Government should not make any delay in sanctioning the required and assessed foreign exchange after being satisfied that there cannot be any further reduction in the foreign exchange requirement in the interest of useful and necessary research.

C. Equipment and Accommodation

Electronic Test Equipment

81. The Committee have been informed that at a rough estimate the proportion of test equipment, plant and other accessories obtain-

ed by the Defence Electronics Research Laboratory from various sources would be as follows:—

(i) Manufactured in Laboratory	15 per cent.
(ii) Obtained from indigenous sources	20 per cent.
(iii) Imported	65 per cent.

It has been stated that very few of the test equipments required for the type of research and project activity, being of specialised and sophisticated nature, are manufactured in the country. Wherever indigenous test equipment meeting requirements is available, the same is only procured. For items to be imported, a certificate of clearance from Director General, Technical Development is obtained.

Special equipment/accessories particularly required for specific projects, wherever possible are manufactured in the Laboratory. In certain cases, constituent items/assemblies not available in India have only been imported and equipments fabricated in the Laboratory. Notably the laboratory has fabricated three manual recorders one automatic Ionospheric recorder and a riometer, resulting in approximate saving of Rs. 3 lakhs in foreign exchange. Locally certain items have been fabricated for instance, antenna masts, equipment casings and mechanical assemblies.

82. The Committee have been informed that broadly, imported equipment include sophisticated electronic test equipments like special type signal generators, microwave signal generators, Esternal Angus recorders, output power meter, Pulse generator, varactor diodes, Special wave guide material, GR impedance bridge, GR Microwave source, FM and AM Signal generators, Noise Generators and components to military grade specifications.

83. The Committee have been informed that the Emergency Sub-Committee of the Scientific Advisory Committee to the Cabinet constituted a Working Group on Electronic Measuring and Test Instruments in December, 1962 with Director, Electronics Group in Atomic Energy Establishment, as the Chairman and membership from the Department of Defence Production (Director of Electronics and the Director, Production and Inspection (Electronics), Posts and Telegraphs, Council of Scientific and Industrial Research, Tata Institute of Fundamental Research and Ministry of Transport and Communications to standardise on the specifications of electronic measuring and testing instruments and draw out individual specifications for a rationalised range of test equipments to promote indigenous development and production in the country.

As the Electronics Committee had since been formed by the Cabinet, the Working Group made its draft Report to that Committee. The Electronics Committee approved the individual specifications and issued them in the form of a report. The report covers a range of 37 electronic test instruments.

84. It has been stated that considerable progress has already been made by the Department of Defence Production (DGI Organisation) in establishing indigenous manufacture of test equipment in the country. In the case of 15 types of instruments, orders have been placed on industry for their manufacture. In the case of 10 types of instruments, prototypes are under fabrication.

In the case of additional 10 types of instruments, preliminary investigational work has now been undertaken. These instruments being of sophisticated nature and their requirements being comparatively small, lower priority was assigned to development work in this case.

The All India Instruments' Manufacturers Association has been contacted and provided with minimal specifications for circulation to their members in an attempt to establish indigenous source of development and production of these instruments. In addition to the range of instruments, covered in the report of the Electronics Committee, investigation work has been undertaken in respect of the following instruments for which there is a specific requirement for the Defence:—

- (a) HM Deviation Meter
- (b) EM|AM Portable Signal Generator, and
- (c) Decible Meter portable.

The Committee have already pointed out the desirability of developing and manufacturing all the electronic test equipment indigenously so that dependence on foreign assistance may be eliminated (See para 52). They hope that concerted efforts will be made by the scientific organisations and the industry in this direction with a sense of urgency.

Accommodation

85. During their visit to the Defence Electronics Research Laboratory, the sub-Committee on Defence were informed that the laboratory and workshop were not adequately equipped to carry out research and development work satisfactorily and a good deal of facilities like land, accommodation, equipment etc. were still required.

It has been stated by the Scientific Adviser in evidence that a workshop worth about Rs. 1 lakh was sanctioned and completed in 1964. A communication building at an estimated cost of Rs. 5 lakhs has also been sanctioned and the construction which has already commenced is expected to be completed by November, 1966. Administrative sanction for providing additional accommodation of 18000 sq. ft. at a cost of Rs. 16 lakhs has also been issued. As regards equipments, these were being given to the Laboratory to the extent the resources permit. The Scientific Adviser has stated that by and large, the requirements of the Laboratory for accommodation and equipment would be met.

The Committee suggest that it should be ensured that the target dates for the completion of the construction of buildings required by the Defence Electronics Research Laboratory are adhered to.

VIII. CONCLUSION

86. In view of the importance of electronics in modern life, industry and defence, and the dynamic nature of the subject, it is imperative that the country should have a self-reliant and self-sufficient electronics industry with built-in capacity for growth and development, capable of keeping abreast of the latest techniques and developments in electronics in the rest of the world.

Intensive research and development is essential for the growth of the electronics industry in the country. The Committee cannot over-emphasise the importance of establishing powerful design and development groups both in Government Scientific Organisations and in large undertakings in the electronics industry both in public and private sectors. The Committee consider that the Electronics and Radar Development Establishment and the Defence Electronics Research Laboratory which have been set up to meet the needs of the Defence Services in the expanding field of electronics should be adequately equipped and suitably manned. It is important that the research and development work of the scientists and technologists is not held up due to procedural delays. The Committee consider that an urgent and comprehensive review of the procedures for the development and production of the electronic equipment may be made with a view to effecting improvements and reducing to the barest minimum the time-lag involved in the various stages.

NEW DELHI;

March 21, 1966.

Phalguna 30, 1887 (Saka).

ARUN CHANDRA GUHA

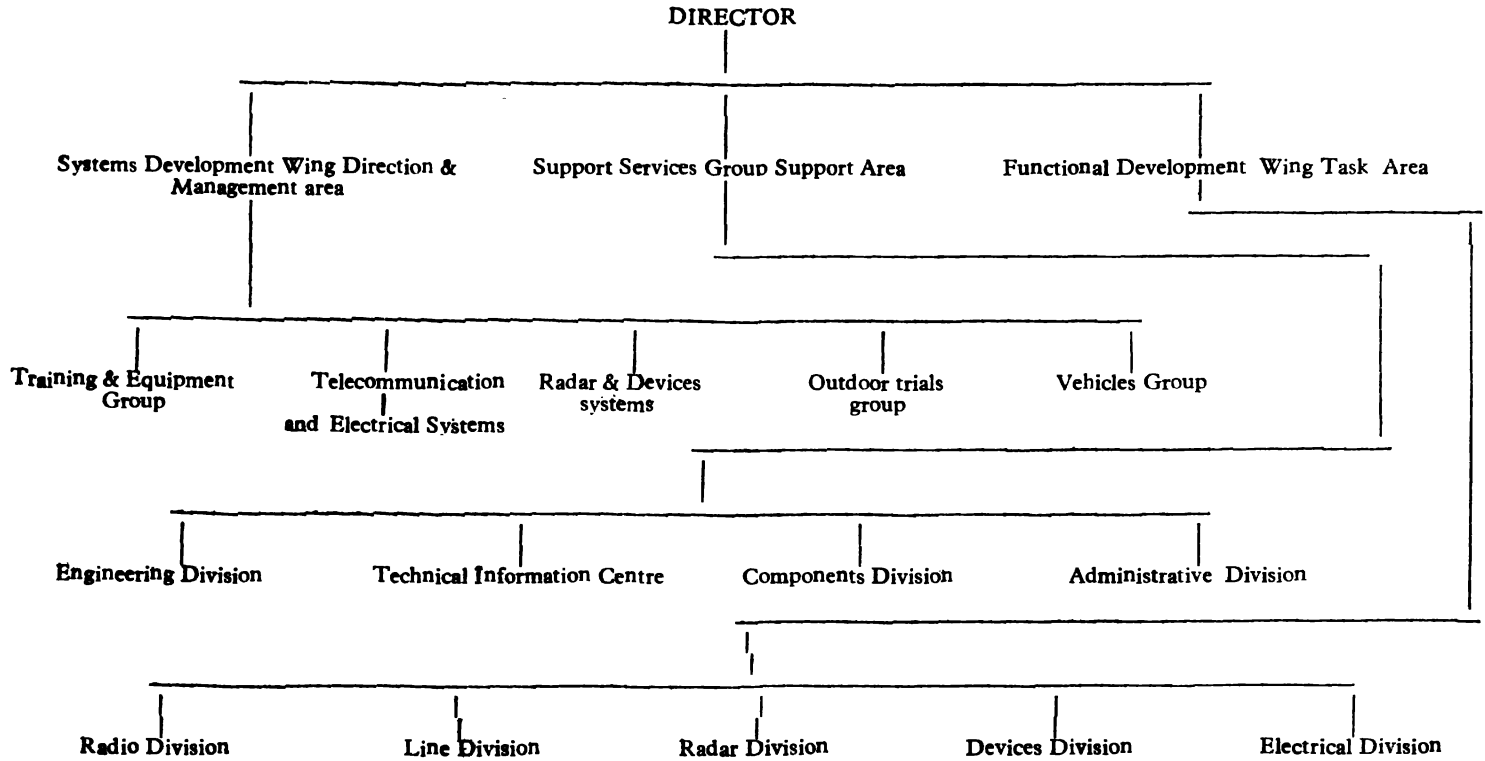
Chairman,

Estimates Committee.

APPENDIX I

(Vide para 14)

Organisation Chart of Electronics and Radar Development Establishment, Bangalore



APPENDIX II

(Vide para 18)

Statement showing authorised and actual strength of staff of Electronics and Radar Development Establishment, Bangalore as on 1-1-66 (less Radar Augmentation Proposals)

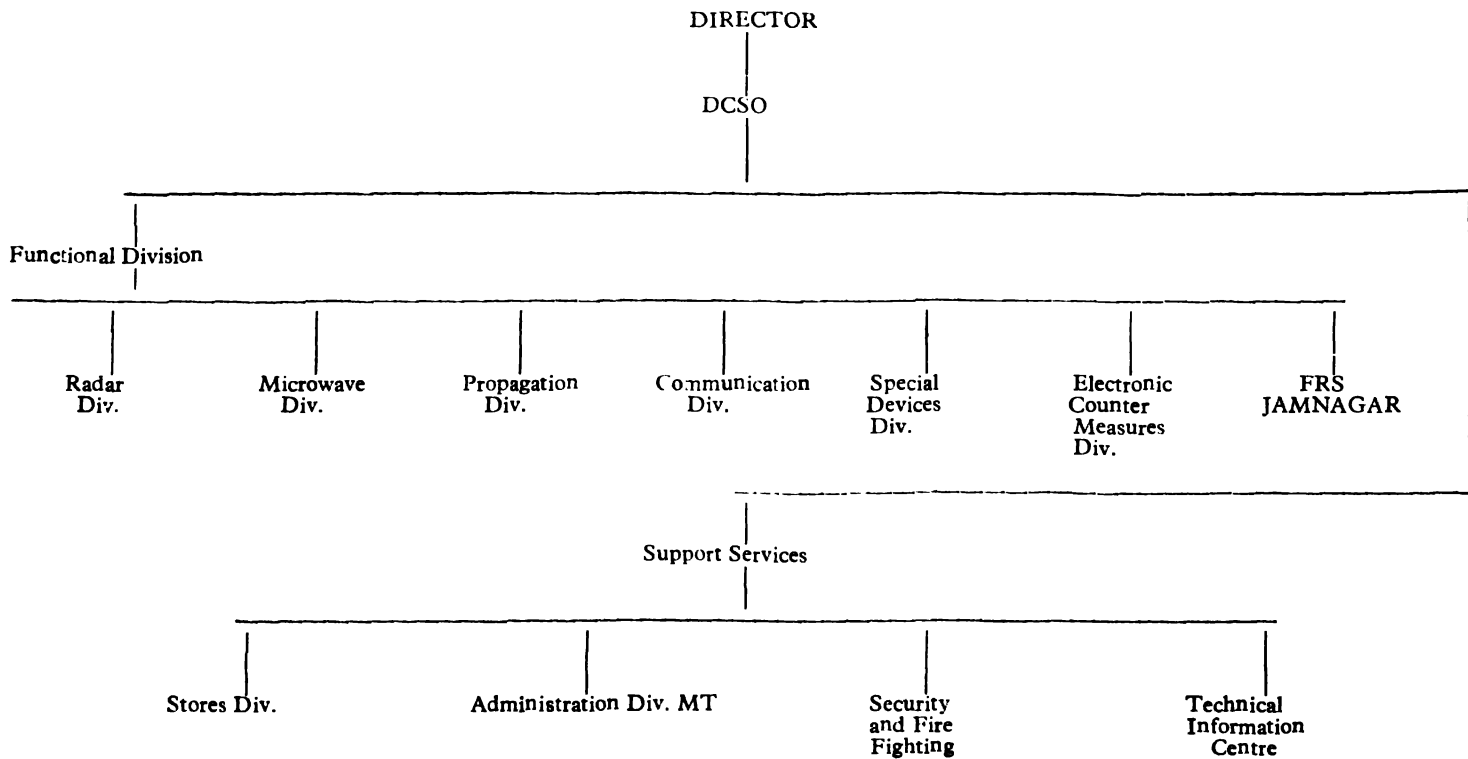
Category	Authorised	Actual
Brigadier	1	1
LT Col.	2	2
P ScO	3	3
Maior	7	6
SSO I	14	13
SSO II	7	7
JSO	17	13
Senior Admin. Officer	1	1
Assistant Admin. Officer	1	1
Stores Officers	1	1
Civilian Asstt. Security Officer	1	1
Welfare Officer	1	1
Civilian Assistant Surgeon	1	..
NON-GAZETTED		
Foremen	48	30
Assistant Foremen	35	31
Chargemen	23	31
JCOs	8	8
Supervisors	53	55
PA's	1	1
Chief Draughtsmen	3	3
Draughtsmen	29	27
CSKs	10	9
Stenographers	12	9
Headclerks	4	4

Category	Authorised	Actual
Cashier	1	1
Assistant Cashier	1	1
Tracers	8	4
Clerks	75	72
Storemen	25	21
Miscellaneous	111	109

APPENDIX III

(Vide para 60)

Organisational Chart of Defence Electronics Research Laboratory, Hyderabad



APPENDIX IV

(Vide para 63)

Statement showing authorised and actual strength of staff of Defence Electronics Research Laboratory, Hyderabad as on 1-1-66 (less Radar Augmentation proposal).

Category	Authorised	Actual
Director Grade I	1	1
DCSO	1	1
Lt. Col.	1	..
P Sc O	1	2
Major	4	..
SSO I	16	16
SSO II	14	16
JSO	28	15
Admin. Officer	1	1
Civilian Security Officer	1	..
NON-GAZETTED		
SSA	27	25
JSA	18	16
Lab. Asstt.	30	8
Foremen	1	1
Chargeman	1	..
Head Clerks	1	..
PA	1	..
Stenographer	1	1
Cashier	1	..
Chief Draughtsmen	1	..
Draughtsmen	4	4
CSKs	2	1
Clerks	8	8

Category	Authorised	Actual
Librarian]	1	1
Photographer Gde II	1	1
Steno-typist	1	1
Fire Supervisor	1	..
Fire Engine Driver	4	..
Leading hand fire	4	1
MT Drivers	6	6
Gatekeepers	8	8
Class IV	65	62

APPENDIX V

Summary of Recommendations/Conclusions

Serial No.	Reference to Para No. of Report	Summary of Recommendations/Conclusions
1	2	3
1	8	<p>The Committee hope that in view of the vital importance of electronics in modern life, industry and defence, Government would make an immediate examination of the recommendations made by the Electronics Committee and initiate energetic measures to implement them. This is essential if the country is to have by the end of the next ten years a self-sufficient and self-reliant electronics industry capable of keeping pace with developments in the other technologically advanced countries of the world.</p>
2	16	<p>The Committee feel that it would be useful to have on the Electronics Development Panel eminent scientists and experts from the Universities, technological institutes and the private sector industry in order that fresh mind and expert knowledge of the outside scientists and technologists may be brought to bear on the defence electronics research and development projects.</p>
3	17	<p>The Committee note that out of 8 years since the inception of the Electronics Development Panel in 1958 in as many as 5 years only one meeting of the Panel has been held each year.</p> <p>The Committee further note with regret that out of 11 items on the agenda for the meeting of the Electronics Development Panel held on the 2nd April, 1965 as many as 5 items were not considered at all.</p> <p>The Committee feel that if only one meeting of the Panel is held in a year and more than 45</p>

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per cent of the items on the agenda are not considered at any of the meetings, this is bound to affect adversely research and development work of the Electronics and Radar Development Establishment.

The Committee cannot but regard this position as very unsatisfactory. They consider that the Electronics Development Panel should meet at least twice a year and complete consideration of all the items on the agenda even if a meeting has to be held for more than one day at a time.

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The Committee cannot over-emphasise the importance of developing radar technology in the country rapidly and suggest that vigorous efforts should be made to recruit suitable manpower for the purpose.

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The Committee would like to stress that the presence of too much administrative staff in a R & D Laboratory/Establishment is undesirable as it spoils the atmosphere for research and development. They would, therefore, recommend that the position of administrative staff in the Electronics and Radar Development Establishment may be urgently reviewed.

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The Committee feel that if the Director of an Establishment is provided with an Administrative Officer to assist him in administrative duties, it is only desirable and appropriate that the Administrative Officer is delegated powers to enable him to be really useful to the Director and to relieve him of the administrative work; otherwise the Administrative Officer will be practically of little use to the Director.

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The Committee have noted several disquieting features in the case relating to the appointment of Assistant Surgeon in Electronics and Radar Development Establishment. They cannot but deplore the manner in which a particular lady doctor was sought to be appointed in the Electronics and Radar Development Establishment. They deprecate the inordinate delay in filling the post of Assistant Surgeon in that Establishment.

The Committee consider that for the posts to be filled through the UPSC, the Commission

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		<p>should invariably be requested to approve a panel of at least three candidates for one vacancy as against one candidate as is the practice at present so that if the first person on the approved panel declines the offer, the appointment can be offered to the second person and so on.</p> <p>This would obviate the need for going through the entire process of selecting a candidate all over again and consequently reduce the delay to a large extent.</p>
8	27	<p>The Committee are greatly concerned at the cumbersome and dilatory procedures which impede the progress of defence research and development projects and the production of the developed prototypes. They suggest that the procedures, which do not correspond to the needs of the present situation, should be comprehensively reviewed and modified as necessary without delay so that the timelag in the various stages between the assignment of a project to a scientist and the establishment of mass production of the item developed, is reduced to the barest minimum.</p>
9	28	<p>The Committee consider that it would be desirable if the five-year plans of R & D Establishments/Laboratories synchronise with the National Five Year Plans so that the resources for the R & D Establishments/Laboratories could be planned in a realistic manner. They hope that necessary adjustment of years will be made to facilitate better allocation of funds on the basis of Plan period.</p>
10	29	<p>The Committee suggest that the five-year plan of the Defence Electronics Group of Establishments may be reviewed urgently in the light of the report of the Electronics Committee.</p>
11	33	<p>The Committee consider that in view of the special importance of radar to the Defence Services, every step should be taken to sustain and encourage the confidence of the two units, viz. LRDE and DLRL in the development of radar according to modern standard and for that, all procedural delays should be scrupulously avoided and administrative machinery properly geared up. The Electronics and Radar Development</p>

1	2	3
		<p>Establishment and the Defence Electronics Research Laboratory should, on their part, take urgent and concerted steps to implement the plan for reinforcement of radar development activity, according to up-to-date standard of effectiveness.</p>
12	34	<p>The Committee note that the Wireless Set 'P' MK1, which is an important communication set, has taken as long as 10 years for development and to go into bulk production. The Committee consider the delay in the development of this Set as unfortunate. They feel that with proper planning and sustained action, it should have been possible to reduce the time taken in development.</p>
13	35	<p>The Committee consider the time of seven years taken in the development of Apparatus Carrier Telephone (1+4)2A as too long and feel that it should have been possible to reduce it by special efforts. The Committee hope that in future, there should be energetic efforts to reduce the time taken in the development of weapons of strategic importance.</p>
14	36	<p>The Committee consider that it would be useful to have a periodical evaluation conducted of the research and development work of the various R & D Establishments every five years by a Committee consisting of eminent scientists drawn both from the Defence Research and Development Organisation and from outside. They hope that the first evaluation will be undertaken at an early date.</p>
15	38	<p>The Committee cannot too strongly emphasise the urgent and vital need for making concerted efforts by all concerned to meet the country's defence needs of electronic equipment in the overall national interest. They hope that the industry will rise equal to the task. In this context, the Committee would like to stress that there is an absolute necessity of urgent establishment of powerful design and development groups both in Government organisations like Atomic Energy Establishment, the Council of Scientific and Industrial Research and the Defence Research and Development Organisation and in large undertakings in the electronics industry in the private and public sectors as recommended by the Bhabha Committee. They would urge that effec-</p>

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		tive and concrete measures should be initiated in this direction without delay.
16	40	The Committee suggest that greater efforts should be made by the Electronics and Radar Development Establishment to educate and assist the industry in the fabrication of reliable prototype equipment in view of the stringent requirements and strict specifications for defence.
17	42	The Committee would like to stress the importance of maintaining the closest possible links between the different agencies concerned with research and development work in the field of electronics so that there may be no scope for any unnecessary duplication of effort and wasteful expenditure.
18	43	The Committee feel that there is urgent need for augmenting the facilities for training in electronics and suggest that special and sustained efforts should be made at appropriate level to secure training facilities in the field of electronics for defence scientists and technologists working in the Electronics and Radar Development Establishment and Defence Electronics Research Laboratory.
19	44	The Committee consider that provision of facilities in the Electronics and Radar Development Establishment for practical training for Engineering/Science students from various institutions/universities is of great advantage to the progress of scientific research in the country and will result in fruitful co-ordination and co-operation between the two sectors—University and non-University. The Committee feel that since our sources in finance and technical personnel are limited, unless they are utilised most advantageously, it will be impossible to obtain the best results.
20	48	In view of the vital importance of electronics in defence, atomic energy, communication and industrial production, the Committee feel that there is urgent need for devising a systematic way of collecting information about the researches and developments in electronics and would therefore suggest that the desirability of setting up a suitable machinery for this purpose may

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be examined by the Defence Organisation in consultation with the Council of Scientific and Industrial Research and the Atomic Energy Establishment.

The Committee need hardly stress that there should be free communication of results of research and development between the R & D Establishments under the Defence R & D Organisation and the Civil Laboratories, Universities, Institutes of Technology etc., consistent with considerations of security so that there is close co-ordination of national effort and resources, and all unnecessary duplication is avoided.

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In view of the vital importance and urgency of the development projects of the Electronics and Radar Development Establishment, the Committee hope that the foreign exchange requirements of the Establishment would be met to the maximum extent possible.

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The Committee suggest that sustained and concerted efforts may be made by the Electronics and Radar Development Establishment in conjunction with the Atomic Energy Department, Indian Telephone Industries, Central Electronics Engineering Research Institute and other organisations concerned to develop and produce electronic test equipment as expeditiously as possible so that valuable foreign exchange could be saved and dependence on foreign assistance eliminated.

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The Committee suggest that whenever any new technique and know-how is developed by the Electronics and Radar Development Establishment or by any other Laboratory/Establishment of the Defence R & D Organisation, the question of taking patents on national and international scale for such new technical processes or products should be considered comprehensively.

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The Committee consider that the Ministries of Defence and Education should examine the desirability of helping the less developed countries, particularly in Asia and Africa with whatever know-how and trained personnel they can afford to give them, as this will improve the image

1	2	3
		of India in those countries as also in international scientific world.
25	61	The Committee think that co-ordination between the defence and civilian electronic research merely through common membership of the Committee is not adequate and that some more effective liaison should be established.
26	62	The Committee feel that the Defence Electronics Research Committee should meet more often than once a year as at present and should also consider and review the progress of the electronics research and development programmes and the facilities available and required therefor.
27	64	The Committee are glad to note that as many as seven members of Defence Electronics Research Laboratory won cash awards for meritorious work during 1965-66. They hope that this will encourage others also to put in greater efforts.
28	70	The Committee hope that in view of the vital importance of the equipment referred to in para 70, to the defence services, energetic steps would be taken by the Defence Electronics Research Laboratory to establish production of the equipment on a pilot plant scale without any avoidable delay.
29	71	The Committee suggest that steps should be taken to encourage indigenous manufacture of the ionospheric equipment developed by the Defence Electronics Research Laboratory. They also suggest that the desirability of taking a patent for this equipment may be considered.
30	72	The Committee suggest that the development work with regard to the techniques evolved by the Defence Electronics Research Laboratory for detecting non-metallic mines should be completed as early as possible.
31	75	The Committee suggest that in all the researches referred to in para 75, a priority should be fixed and that research may be intensified on the basis of priority fixed so that investigation may become effective and purposeful in a short time.
32	76	The Committee suggest that efforts may be intensified to develop techniques for Battlefield

Surveillance Radar to meet future Services requirements.

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In view of the great potentialities of electronics in defence and industry, the Committee cannot over-emphasise the importance of associating universities, higher institutes of technology and other academic institutions in the country with defence electronics research.

According to the assessment made by the Electronics Committee, the electronics industry of the size envisaged in 1975 would need 3,00,000 engineers, scientists and skilled workers. Considering the urgent need for trained manpower for the electronics industry, it is essential that the universities and other academic institutions are adequately equipped to enable them to supply properly qualified personnel. The Committee therefore suggest that Government and the University Grants Commission should give this matter, their most careful and urgent consideration and provide the necessary facilities to the universities and other academic institutions to train up adequate number of efficient scientists who will be able to undertake the necessary research schemes and projects in electronics.

The Committee feel that there is enough of unnecessary secretiveness in defence research units and a general tendency of avoiding close collaboration with civil scientific research units. They suggest that, as in the U.K. and the U.S.A., the Defence Research and Development Organisation should maintain maximum contact and collaboration with the Universities, National Laboratories and other academic and scientific research institutions in the country and make a wider use of these institutions for undertaking research projects.

The Committee recommend that the Defence Research and Development Organisation should adopt the method of breaking up a problem into components so that they no longer remain highly sensitive and confidential. Sub-problems may then be farmed out to various laboratories in the country, both defence and non-defence.

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34	80	<p>The Committee feel that in view of the very difficult foreign exchange position at present, the Defence Electronics Research Laboratory and other units under the Defence R & D Organisation should make an earnest effort to avoid imports, by finding or developing local substitutes; and at the same time, Government should not make any delay in sanctioning the required and assessed foreign exchange after being satisfied that there cannot be any further reduction in the foreign exchange requirement in the interest of useful and necessary research.</p>
35	84	<p>The Committee have already pointed out in para 52, the desirability of developing and manufacturing all electronic test equipment indigenously so that dependence on foreign assistance may be eliminated. They hope that concerted efforts will be made by the scientific organisations and the industry in this direction with a sense of urgency.</p>
36	85	<p>The Committee suggest that it should be ensured that the target dates for the completion of the construction of buildings required by Defence Electronics Research Laboratory adhered to.</p>

APPENDIX VI

Analysis of recommendations in the Report

I. CLASSIFICATION OF RECOMMENDATIONS:

A. Recommendations for improving organisation and working:

Serial Nos. 5, 22 and 34.

B. Recommendations for effecting economy:

Serial Nos. 5, 22 and 34.

ANALYSIS OF MORE IMPORTANT RECOMMENDATIONS DIRECTED TOWARDS ECONOMY:

Sl. No.	Sl. No. as per Summary of Recommendations Appendix V	Particulars
1	2	3
1	5	The presence of too much administrative staff in R & D Laboratory/Establishment is undesirable as it spoils the atmosphere for research. The position of administrative staff in Electronics and Radar Development Establishment needs to be urgently reviewed.
2	22	Sustained and concerted efforts may be made by the Electronics and Radar Development Establishment in conjunction with the Atomic Energy Department, Indian Telephone Industries, Central Electronics Engineering Research Institute and other organisations concerned to develop and produce electronic test equipment as expeditiously as possible so that valueable foreign exchange could be saved and dependence on foreign assistance eliminated.
3	34	In view of the very difficult foreign exchange position at present, the Defence Electronics Research Laboratory and other units under the Defence R & D Organisation should make an earnest effort to avoid imports, by finding or developing local substitutes.

Sl. No.	Name of Agent	Agency No.	Sl. No.	Name of Agent	Agency No.
27.	Bahree Brothers, 188, Lajpatrai Market, Delhi-6.	27	33.	Bookwell, 4, Sant Narakari Colony, Kingsway Camp, Delhi-9	96
	Jayana Book Depot, Chapparwala Kuan, Karol Bagh, New Delhi.	66		MANIPUR	
29.	Oxford Book & Stationery Company, Scindia House, Connaught Place, New Delhi.	69	34.	Shri N. Chaoba Singh, News Agent, Ramlal Paul High School annex Imphal	77
30.	People's Publishing House, Rani Jhansi Road, New Delhi.	76		AGENTS IN FOREIGN COUNTRIES	
31.	The United Book Agency, 48, Amrit Kaur Market, Pahar Ganj, New Delhi.	88	[35.	The Secretary, Establishment Department, The High Commission of India, India House, Aldwych, London, W C. 2.	
32.	Hind Book House, 82, Janpath, New Delhi.	95			

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**PUBLISHED UNDER RULE 382 OF THE RULES OF PROCEDURE AND CONDUCT OF
BUSINESS IN LOK SABHA (FIFTH EDITION) AND PRINTED BY THE GENERAL
MANAGER, GOVERNMENT OF INDIA PRESS, MINTO ROAD, NEW DELHI.**
