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NARC MAINTENANCE ORGANIZATIONS A REVIEW

by

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Idrees Anjum
Tahir Qureshi**

May, 1990

PARC • USAID • MART • WINROCK

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A

The MART (Management of Agricultural Research and Technology) Project is funded by the United States Agency for International Development (USAID). The MART Project's chief link to the Government of Pakistan is through the Pakistan Agricultural Research Council (PARC). A MART Project Coordination Committee composed of federal, provincial, and university representatives coordinates and guides project activities. Its purpose is to assist the Pakistani agricultural research system to strengthen its research management capabilities, and to improve communications, training, farming systems research, arid zone research, and research in the rural social sciences. Winrock International, through a contract with USAID, has responsibilities to assist with the first four of these tasks. Two international agricultural research centers, the international maize and wheat improvement center (CIMMYT) and the International Center for Agricultural Research in Dry Areas (ICARDA), are responsible for the other two tasks.

The mission of Winrock International Institute for Agricultural Development is to help reduce poverty and hunger in the world through sustainable agricultural and rural development. Winrock International assists people of developing areas - in Asia, Africa and the Middle East, Latin America and the Caribbean, and the United States - to strengthen their agricultural institutions, develop their human resources, design sustainable agricultural systems and strategies, and improve policies for agricultural and rural development. As an autonomous, nonprofit organization, Winrock International provides services independently as well as in partnership with other public and private organizations. The institute is recognized as a private voluntary organization.

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SUMMARY

Donor agencies have contributed millions of rupees and expertise for the construction of NARC building facilities and supporting infrastructure. The time, effort & money that went into planning, designing and constructing the specialized facilities are difficult to describe. The satisfaction of having invested such great capital & effort could soon give way to disappointment should the facilities not be properly operated and maintained.

Because of lack of interest and limited understanding of the importance of proper operation and maintenance, many good facilities have become non-functional. The blame is, in most cases, attributable to planners and managers who give little importance to O&M and provide insufficient funds for this purpose.

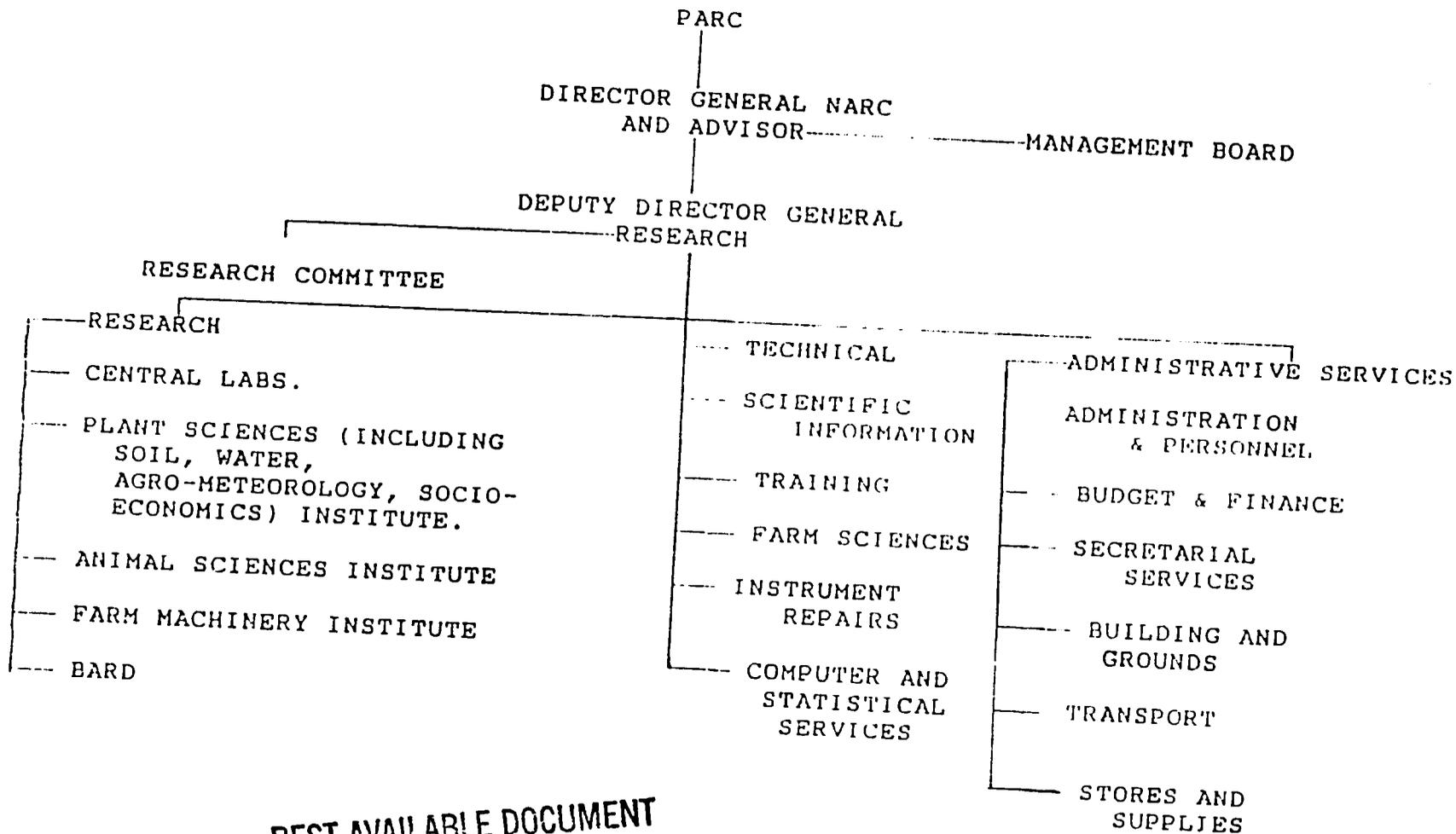
In this study, it was noticed that each NARC unit has separate maintenance personnel on its strength and there was all-round duplication of effort. It has, therefore, been recommended that for better management the repair and maintenance personnel be amalgamated into one unit under a director. This would result in better control, and fewer management problems and would be more economical. Centralized maintenance will reduce many bottle-necks and provide better results.

GENERAL

The three member Committee composed of persons listed below was assigned the task of reviewing the maintenance activities of the National Agricultural Research Centre, Islamabad. The Committee's Terms of Reference are at Annexure-A.

- a. Col. (Retd) M. Masood Khan - Chairman
 - b. Mr. Idrees Anjum,
Project Director (Works)
PARC - Member
 - c. Mr. Tahir Qureshi
Buildings Maintenance Services
USAID - Member
2. The committee met on 18 Feb. 1990 to chalk out its operational strategy. The committee had a meeting with the DG, NARC. He briefed the committee thoroughly about the mandate & organization of the various components of NARC. The organization chart of NARC is at Annexure B.
3. Following procedure was evolved to carryout the committee's mandate:
- a. Visit each unit and study its methods of maintenance.
 - b. Inspect buildings, vehicles and equipment.
 - c. Review documents related to each maintenance unit.
 - d. Review organizational frame-work of each unit.
 - e. Review functions assigned to each unit and job descriptions of its personnel.
 - f. Study budget allocations and any financial problems.
 - g. Identify major problems which need immediate attention.

NARC ORGANIZATION



BEST AVAILABLE DOCUMENT

OPERATIONS AND MAINTENANCE UNIT

1. The Operations and Maintenance Unit of the National Agricultural Research Centre is headed by an Executive Engineer. He is administratively responsible to the Director Administration but technical supervision over him is exercised by the Project Director (Works) PARC.
2. Organization chart of the Operations & Maintenance Unit is at Annexure-C.

The Executive Engineer's responsibilities are:

- a. To supervise ongoing civil works in NARC.
 - b. To monitor the progress of the construction projects in close liaison with the Dir.(Works) PARC, consultants and the donor agencies.
 - c. To maintain complete record of the service lines in the form of as-built drawings.
 - d. To plan, design, estimate and prepare documents for civil works upto a cost of rupees two millions.
 - e. To maintain the buildings in 1400 acres of the Centre.
 - f. To upkeep the water, gas and electric distribution systems of NARC.
 - g. To maintain metalled roads.
 - h. To liaise with WAPDA, CDA, SNGPL and PHED for uninterrupted supply of the services to the Centre.
 - i. To maintain the record of the allotment of accommodation and to supervise estate affairs of more than 100 officer and staff residences.
 - j. To maintain the telecommunications link between the NARC offices and residences through an internal 20+200 PABX.
3. The Committee visited various buildings & noticed following defects:

a. Brick Walls

Exterior brick masonry did not present neat appearance. At places, the growth of organic matter on the brick work under the spouts was visible. Removal of organic growth is essential to prevent disintegration of brick masonry.

b. Brick Floors

The floors laid in brick masonry also show disintegration at places.

c. Expansion Joints

The expansion joints in many buildings have started leaking. Repair may be carried out during dry spell of weather after the spring season.

d. Residential Accommodation

The residential buildings constructed by PWD are not in a good state of maintenance. Major defects are as under:

- i. Cracks have developed in the plastered surface.
- ii. Buildings require white washing/distempering.
- iii. Painting on timber & steel surfaces has worn out.
- iv. Decayed joinery requires replacement.

e. Laboratory

Artificial marble counter tops in the laboratories show their surface scratched with some metallic object. There are also indications of marks left by spillover of acids. The sinks fitted with the counter tops are filthy due to chemicals & solutions thrown into these and not diluted with water from the taps afterward.

f. Cafeteria

The cafeteria floor has numerous stains due to dumping of liquids or spillover of tea. The cold room is not being properly used.

g. Routine Maintenance

Due to paucity of funds, proper routine repair & maintenance is not being carried out. Inadequate budget is having adverse effect on the maintenance of buildings.

Budget

4. The Operations & Maintenance unit does not have separate budget. Inadequate funds are allocated for the repair and maintenance of the office & residential buildings in the Administration and General Services budget. These funds are not sufficient even for the purchase of consumable items.
5. The minimum requirement for maintenance of buildings, roads and services, according to the Executive Engineer, is rupees two million per annum. This estimate is within the premissible criteria as fixed by the government regulations. Budget allocations for repair and maintenance during the last five years are at Annexure D.

Organization of Operations & Maintenance Unit

6. The key to proper operation & maintenance is not only the organizational structure, but the number, qualifications & motivation of people who are employed in every organization. The staff employed in the NARC O&M Unit is not commensurate with the work load. The present sanctioned strength of maintenance personnel is listed in Annexure E.

Accommodation

7. Working facilities for an operations & maintenance unit have a direct influence on the morale of employees and the image of the institution they serve. A good working environment inspires a more professional attitude among maintenance personnel. At present, the NARC maintenance personnel are housed in a shabby temporary structure which is unsuitable for smooth and efficient working. The present available space is only 660 sft against the minimum requirement of 1700 sft.

AUTOMOBILE WORKSHOP

1. The NARC Automobile Workshop was established in 1986 under a Workshop Manager. The Workshop Manager is under the administrative control of Director Administration. The workshop consists of:
 - a. Auto Repair Shop
 - b. Fuel Station
 - c. Service & Maintenance Unit
 - d. Accounts Branch

Procedure:

2. The defective vehicle is brought to the workshop with a report by the parent department of the vehicle. It is technically examined by the Foreman of the Workshop and defects are noted on the report.
3. Defects which do not require replacement of parts are recorded on job-card and repairs are immediately carried out by the mechanic with the help of fitter/helper under the supervision of Foreman.
4. After the necessary repairs vehicles are road-tested by the Foreman and the vehicle's driver and after complete satisfaction, delivery of the vehicle is made over to the driver against his signature on the job-card.
5. If the nature of the defect involves the replacement of a part, or repairs such as radiator leak, broken leaf-spring, airconditioning, radio, cylinder-boring etc., which are to be carried out in the market due to non availability of the necessary facilities in the NARC Automobile Workshop, an estimate is prepared and sent to the concerned project for arrangement of funds in advance. Because the NARC Automobile Workshop does not have any funds at its disposal, the purchase of spare-parts and major repairs are carried out from the market at project expense.
6. The NARC Automobile Workshop has its own mini-store for keeping record of the purchase of spare-parts and repairs from the market.
7. The Transport Pool vehicles of the PARC/NARC which are used for staff conveyance and for VIP service, are mostly repaired on credit-basis by incurring expenditure from the labor charges account.

8. REPAIRS THAT CAN BE CARRIED OUT AT THE NARC AUTOMOBILE WORKSHOP

- 1). Engine overhauling of all types and models, both petrol and diesel, except machining work & repair of diesel pumps.
- 2). All Electrical systems of the vehicles except armature winding and radio/electronics works.
- 3). Wheel alignment except wheel balancing etc.
- 4). Tube punctures.
- 5). Complete painting of the vehicles.
- 6). Small scale denting etc. of all types.
- 7). Welding - both gas and electric.
- 8). Black-smith work on small scale.
- 9). Motor cycle and Vespa scooter repairs.
- 10). Oil changing and greasing etc.
- 11). Petrol supply of premium and regular grades, diesel-oil, mobil-oil, gear-oil, electrolyte for batteries, etc.

9 NUMBER OF TOTAL VEHICLES BEING REPAIRED:

The Pakistan Agricultural Research Council has 107 vehicles of different makes and models at Islamabad. These include heavy and light vehicles and motor cycles. These are being repaired and looked after at the NARC Automobile Workshop. The vehicles are listed in Annexure F.

10. Step by step procedure for repair of vehicles at the NARC Auto Workshop is as follows:
- a. Reporting of the defective vehicle in the Auto Workshop alongwith written details of the defects as noticed by the project/vehicle incharge.
 - b. IN/OUT timing recording by the time keeper at the workshop gate.
 - c. Defects diagnosis and analysis by the technical experts of the workshop.
 - d. Preparation of the job-card, if only minor repair is involved.
 - e. For minor repairs the requisite spare-parts demand indent.
 - f. For minor repairs the approval of the competent authority for purchase.
 - g. Market survey by the purchase-committee for quotations alongwith pre-receipted bills.

- h. Approval of the competent authority for the lowest quotation against the comparative statements and relevant expenditures for the preparation of the crossed-cheques.
- i. Actual purchase of the requisite spare-parts against the delivery of the crossed-cheque by the workshop procurement officer.
- j. Technical inspection of the purchased spare-parts by the workshop authorities.
- k. Store ledger-entry of the inspected spare-parts.
- l. Issuance of the requisite spare-parts against the respective job-cards.
- m. Fitting of the issued spare-parts on the defective vehicle and execution of repairs.
- n. Testing of the repaired vehicle performance by the workshop authorities.
- o. Entry of the labor charges on the job-card and preparation of the bill (invoice) in the Account Section of the workshop.
- p. Entry of repairs in the log-book of the vehicle.
- q. For heavy repairs and engine-overhauling, the approximate expenditure estimate prepared and sent to the project/vehicle incharge for necessary processing and providing advance amount in the form of crossed-cheque.
- r. The bulk stock for the petrol pump is purchased from M/s. Pakistan State Oil Ltd. (PSO) against the delivery of draft amount after prior approval by the competent authority.
- s. Coupons of different quantities for different petroleum products are printed by the Auto Workshop. These are issued to the project incharge against crossed cheques for the requisite amounts.
- t. Petroleum products are issued at the NARC petrol pump against the fuel coupons already issued for this purpose.

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11. EVALUATION AND MONITORING OF REPAIR WORK:

- a. In the prevalent evaluation system, when a defective vehicle reports in the NARC Autoworkshop, the defects diagnosing/analyzing is carried out by the workshop experts.
- b. Genuine spare-parts are purchased through a standing purchase committee of the workshop headed by the Workshop Manager.
- c. Fitting of the spare-parts and the execution of the repairs in the workshop is carried out under the supervision of the technical experts of the workshop.
- e. After the execution of the repairs, the performance testing of the vehicle is done by the technical experts of the workshop.
- f. Proper entry of the purchased spare-parts on the ledgers of the stores is being done and a proper record of the issuance of these spare-parts against the respective job is also kept.
- g. The store working is supervised by an officer and all the ledger entries are carefully checked and initialed by the officer.
- h. All purchases of genuine spare-parts are done on the lowest and competitive rates with prior approval of the competent authority.

12. BUDGET

Budget figures for the workshop for the last two years are given in Annexure G.

13. MAJOR PROBLEMS IN THE AUTO WORKSHOP:

- a. Scarcity of funds,
- b. Shortage of skilled manpower,
- c. Non availability of essential tools/equipments,
- d. Non-provision of liveries for workers,
- e. Lack of facilities like toilet and canteen,
- f. Non availability of bulk stock of fast moving items,
- g. Non-registration of spare-parts suppliers,
- h. Inadequate sheds for heavy vehicles,
- i. Ineffective service station and non-availability of service station staff,
- j. Inadequate civil works,
- k. Absence of weather protection for the petrol pump,
- l. Delayed receipt of payment against repairs bills

**FARM OPERATIONS
&
SERVICES**

1. GENERAL

Farm Operations & Services Unit is headed by a Director. The Unit has many pieces of farm machinery. A majority of is lying in the open. The Committee was informed that the F.O.&S. Tractor Workshop was occupying the full space but when the Automobile Workshop was established, it took over part of the accommodation from the Tractor Workshop, thereby causing parking problems for both the outfits.

2. FUNCTIONS

The functions of the Farm Operations and Services Directorate are:

- a. To allocate land for research programs and to prepare the land for researchers to carry out experiments, demonstration, seed production etc.;
- b. To provide labor to all research programs;
- c. To provide irrigation facilities for the research programs;
- d. To store and supply fertilizers, insecticides, weedicides and other inputs,
- e. To repair and maintain NARC agricultural machinery,
- f. To provide agricultural implements and repair service to various institutes of the Centre.
- g. To conduct farm machinery operations, seed bed preparation, moisture conservation, sowing and harvesting etc. etc.
- h. To maintain and level fields.
- i. To maintain civil structures i.e. fences, reservoirs & water courses etc.
- j. To establish an efficient surface and subsurface drainage system for the farms.

3. REPAIR AND MAINTENANCE PROCEDURE

The tractor/heavy machinery operators send defect reports about their machines to the Senior Engineer (Workshop). Defect is duly checked by mechanic and then repaired. If parts are needed to be replaced, new ones are issued from workshop store. When parts are not available in stock,

these are purchased from local market with the approval of competent authority.

4. Quarterly demand is placed on Purchase Officer NARC for the purchase of essential parts in bulk quantity.

ORGANIZATION

5. The organization chart of the F.O.&S. Unit is at Annexure H.

REPAIR FACILITY

6. Tools & equipment available in the F.O.&S. Workshop for repair of earth moving machinery is listed at Annex J.

TRACTORS AND IMPLEMENTS

7. These are listed at Annexures K&L.

ACCOMMODATION

8. Due to shortage of covered area, the equipment & implements are parked in the open. During rainy season, the whole area becomes muddy & it is difficult to operate the machines. An estimate of costs has been prepared for construction of a shed & parking place. It is placed at Annexure M. Another cost estimate has been prepared for construction of a tubewell, construction & maintenance of security posts, fences etc. The estimate is at Annexure N.

LANDSCAPE DIVISION

GENERAL

1. The Landscape Division is supervised by SSO (Horticulture). Its staff comprises of ASO and gardeners (malis). The functions of the Division are:
 - a. Maintenance of lawns
 - b. Beautification of NARC complex with flowers & plants.
 - c. Watering, hoeing and leveling of NARC complex open areas.
 - d. Maintenance of officers colony environment.
 - e. Improving the appearance of terraces, pools, lawns and workshop surroundings.

2. Budget

No funds are placed at the disposal of Landscape Division. The pay of staff is disbursed by Director Administration.

3. Maintenance Procedure

There is no hard & fast procedure for landscape work. Head Mali assigns the malis to various tasks on day to day basis. No nursery is being maintained to replenish old stock and work is done in an orthodox way. Mortality record of plants is not being maintained.

4. Problems: There are numerous factors which affect the smooth working of the Division. Some of these are:
 - a. No separate funds are available to carry out landscaping.
 - b. Shortage of implements e.g. mechanical lawn mowers.
 - c. Shortage of manpower to maintain approx 5 lac sq ft area.
 - d. Greenhouse facilities not available.
 - e. No office space allotted to the Division.
 - f. Irrigation system is not available.

5. PROCUREMENT OF STORES

NARC Procurement Unit provides stores to the Landscape Division and takes considerable time to do so.

**ANIMAL SCIENCES
INSTITUTE**

1. GENERAL

Animal Sciences Institute is located in the NARC Complex. It is under the direct control of the Director General NARC. The Institute has five tractors out of which four are off road, needing major repairs. The repair system is in a bad shape because it is manned by an unqualified mechanic and other artisans.

2. TOOLS AND PLANT

a.	Tractor Wheeled	Five
b.	Air Compressor	One
c.	Grinder	One
d.	Battery charger	One
e.	Drill machine	One
f.	Miscellaneous tools	
g.	Tractor Implements	

3. MANPOWER

Following person are employed for the running and repair of tractors in the Animal Sciences Institute.

a.	Tractor Operator	One
b.	Mechanic	One
c.	Fitter	One
d.	Helper	One

4. BUDGET

Rs. 15,000/- was made available for repair of the machinery for the financial year 1989-90.

5. COORDINATION

There is no coordination among the various NARC maintenance units. Like other units this one is functioning independently.

6. TRAINING

Animal Sciences Institute maintenance and repair staff is not trained.

**BARANI AGRICULTURAL
RESEARCH AND DEVELOPMENT
PROJECT**

GENERAL:

1. Barani Agricultural Research and Development (BARD) Project is primarily a Canadian aided project for carrying out research in Barani areas of Pakistan. Expatriate employees are available to help in the maintenance of agricultural equipment & plant. The standard of maintenance of vehicles & plant is comparatively better than in other NARC maintenance & repair units. During the Committee members' visit to the site, it was clear that BARD Project has no problem regarding availability of funds.
2. VEHICLES. See list attached at Annexure-0
3. FARM MACHINERY. List of tractors on BARD charge is at Annexure-P.
4. MANPOWER The list of manpower employed on maintenance & repair of vehicles & machinery is at Annexure-Q.
5. BUDGET for and Expenditure incurred under BARD Project during the last six years is at Annexure-R.

GREENHOUSES

GENERAL:

1. Greenhouses, a new technology, are controlled by Coordinator Plant Virology. Greenhouses were constructed at the National Agricultural Research Centre, Islamabad in September 1985 and space allocation was made in early 1986. The system consists of 2 greenhouses, 1 tunnel and 1 shadehouse with the following specifications:
2. Greenhouses: There are four compartments in each Greenhouse, each compartment measures 9.6 x 6 m (57.6 sq.m) and 2 m - 3.5 m high. Temperature control is related to humidity. It can be reduced by 8-10 degree centigrade to 50 degree centigrade. Minimum depends upon ambient temperatures. Usually a temperature of 23-25 degrees centigrade is maintained with 90% relative humidity.

The compartments are equipped with cooling and heating systems, humidifier pads, and exhaust fans. Heating system has never been used because it produces carbon monoxide for which a separate exhaust mechanism is not provided. No lighting provision was made.
3. Tunnel: The tunnel measures 8.5 x 41.5 m x 3 m (1058.25 cu.m). It is equipped with cooling and exhaust system. Heating system is provided but is defective as no separate exhaust was provided and due to accumulation of carbon monoxide many plants die. Temperature during summer is 40 degrees centigrade and winter 25 degrees centigrade. It is made of fibre glass, which has become brittle. It was damaged due to storms in 1987.
4. Shadehouse: A shadehouse measuring 28 x 36 x 2.5 m is equipped with sprinkle system of irrigation. The whole system was damaged twice by severe storms during 1987.
5. Installation: The greenhouses machinery was were installed at voltage of 440. With the fluctuation at voltage, magnetic switches get burnt very frequently. In general, the whole system is not very highly stable.

ALLOCATION OF GREENHOUSE COMPARTMENTS

6. 1A Tissue Culture
2A General purpose (Oilseed, Wheat, Cytogenetics, Legumes)
1B Plant Virology
2B Soil Science
7. Tunnel: Weed Science; Soil Science; Tissue Culture; Rice; Vegetable; Horticulture and Plant Introduction Programs.

8. Shadehouse: Vegetable and Horticulture Program.

EXISTING MAINTENANCE SET UP AND PROCEDURE

9. Greenhouses are maintained and controlled by:

- a. Incharge Greenhouse (P.S.O. Virology)
He operates the budget, corresponds, arranges material and meetings under the supervision of DG and DDG/NARC.
- b. Assistant Director (Agricultural Engineer)
He supervises, operates, maintains and keeps the system functional.
- c. Greenhouse Committee; comprises of Incharge, 5 members (Weed Science, Tissue Culture, Soil Science, Assistant Director and Electrician), headed by D.D.G. Its functions are to assist in the operation of greenhouses, allocate space, suggest improvements and make recommendations to D.G.
- d. Space Allocation

Subject to availability, space is allocated to different scientists and programs, and research work is approved by the Technical Committee on Research.

FUTURE NEEDS:

10. Physical facilities: Demand for greenhouses with compartments and controlled environment is increasing day by day. Present facilities are limited. Two more greenhouses are needed during the next five years. Soil mixer, soil sterilizer, implement shed, store house, and bins for soil, sand, farmyard manure, peat moss and mixing floor are essentially required. Humidifying pads in the existing green house and tunnel need to be replaced as they are torn up or blocked.
11. Tools and Plants: Only small sets of tools are available. One Generator is desirable to operate at times of load shedding. Provision of one autoswitch will protect the electric system of greenhouses.
12. Manpower: Presently, only one skilled laborer looks after greenhouse, does the cleaning work and many minor operations. One electrician and two skilled laborers are required on regular basis.

AC

FUNDING AND ACTUAL NEEDS:

13. Funds have been limited and are never provided as per demand. Actually provided funds during last four years are:

1986-87	Rs. 40,000
1987-88	Rs. 10,000
1988-89	Rs. 10,000
1989-90	Rs. 30,000

No funds are provided upto November in each year. Labor has to be paid from other sources. Similarly, greenhouses request different programs to meet their operational expenses.

14. Estimated annual budget needs are as follows:

Consumable stores	Rs. 25,000
Miscellaneous expenditure	Rs. 15,000
Repair of motors	Rs. 20,000
Diesel/Petrol/Lubricants	<u>Rs. 15,000</u>
Total	<u>Rs. 75,000</u>

USE OF PRIVATE BUSINESS FOR REPAIR AND MAINTENANCE

15. Minor repair is done locally. Major repairs such as rewinding of motors, fans etc. are done by private firms.

TRAINING OF STAFF

Greenhouse technology is a new field in Pakistan. It is necessary to provide 2 months training to the concerned engineer.

**LABORATORY EQUIPMENT
MAINTENANCE AND REPAIR
UNIT**

GENERAL:

1. The Lab. Equipment Maintenance and Repair Unit at NARC is meant for providing essential technical support services to agricultural/scientific research activities. It is responsible for installation, commissioning, maintenance and repair of all Laboratory equipments/instruments at NARC Complex, PARC, outstation labs. etc.
2. It is understood that maintenance and repair facilities and technical guidance might also be made available to other Federal/Provincial research organizations and Agricultural Universities in the country.

ASSIGNMENTS:

3. The Unit is required to take measures to ensure the efficient functioning of all research equipment. The electronics/electrical systems are handled by the Electro-nics Repair Cell while repairs and innovative jobs pertaining to glassware are carried out by the Glass Blowing Section.

LABORATORIES:

4. The LEM & R Unit has got one knuckle room each in the USAID and World Bank Lab. blocks respectively. The main test bench has been laid down in a room which is used for diagnosis/equipment testing/general repairs/electronics and electrical repairs etc. Spare parts are also stocked in the same room. The other room is occupied by ATO, Store Keeper and Typist. A third room is used as office of the P.I. of the LEM Unit.
5. In the other knuckle room there are glass lathe machine, optical strain detector, electrical annealing furnace, gas cylinders, glass blowing tools, grinding machine, glass cutting machine, glass repairing bench etc.

STAFF:

6. The staff in the Laboratory Equipment M&R Unit is listed at Annexure-S.

EQUIPMENT & TOOLS:

7. Major diagnostic equipment including tools for glass repair facility are listed at ANNEXURE-T.

ACHIEVEMENTS:

8. For normal repair/maintenance and general upkeep of the equipment, nine technicians of this unit have been trained

satisfactorily by an expatriate Consultant Engineer (Mr. Len Mattick) and this team is now quite helpful to the scientists for reducing the down-time of research equipment.

9. The necessary test tools used in diagnosis/repairs have been obtained and a very comprehensive Electronic Test Bench was designed, which is now operative in the present accommodation of Lab. Equipment Maintenance & Repair Unit.
10. For prompt diagnosis/rectification, these trained technicians have been divided into omission according to their qualifications, experience and specialized training for different sets of laboratory equipments.
11. The technical team is not only capable of carrying out necessary alterations/innovations in some major equipments like Plant Growth Chamber, Fume Hoods etc. but is also taking full care of large systems like Atomic Absorption Spectrophotometer, Plasma Emission Photometer, X-ray Diffractometer, and the recently installed Electron Microscope (Scanning + Transmission).

ORGANIZATIONS SERVED:

12. Repair and maintenance services are being provided to:
 - a. Central Labs at NARC
 - b. Other (Research) Departments within NARC Complex such as HBM, FMI, PGR etc.
 - c. Other (non-research) Departments in the NARC premises such as Training Centre, Accounts, Scientific Information etc.
 - d. PARC's outstation labs. such as CDRI (Murree) and AZRI (Quetta) etc.
 - e. Agricultural Research Institutes/Universities such as Animal Husbandry Deptt. Peshawar; AARI, Faisalabad; UAF Faisalabad, NWFP Agri. University, Peshawar; Rice Research Institute, Kala Shah Kaku; Soil Labs, Rawalpindi; Seed Certification, Islamabad; Seed Registration, Rawalpindi etc.

PERFORMANCE:

13. Performance of LEM&R Unit is described below:

- a. From NARC

Total No. of repair jobs received from 1.1.1986 to 31.12.1989.	- 784
Jobs completed	- 759
Jobs under repair	- 25
% Jobs completed	- 96.81%

82

b. From Outstation Labs		
No. of Jobs received		- 136
No. of Jobs completed		- 128
% of Jobs completed		- 94.11

As a result of consistent vigilance/efforts of this Unit, only eight lab. equipment pieces are down from a total of more than 500 present in the Labs. complex.

c. Year wise performance:

<u>Year</u>	<u>Jobs received</u>	<u>Completed</u>	<u>Percentage</u>
1985	115	108	94%
1986	127	119	94%
1987	308	298	96%
1988	185	176	95%
1989	96	90	94%

PLANS:

14. The goal of this unit is to be available to the National Agricultural Research System for maintenance and prompt repair of lab. equipment and allied instrumentation. For this purpose 10 more technicians are proposed to be recruited and trained for specific jobs. Small repair cells under the L.E.M.&R. Unit are proposed to be established at places like Quetta, Peshawar, Faisalabad, and Tandojam to cater to the needs of Agricultural Research Institutes locally.
15. It is planned also to train instrument technicians from various agricultural organizations at L.E.M. & R. Unit (NARC) Islamabad in general repairs, trouble shooting etc.

COORDINATION

16. The L.E.M. & R. Unit is providing regular service to all laboratories within NARC complex. The provincial research institutes are also getting technical help pertaining to laboratory equipments from this Unit.

BUDGET

17. Budget for the last five years is given below:

<u>Year</u>	<u>Amount</u>	
1984-85	3,20,000	
1985-86	8,00,000	
1986-87	9,00,000	
1987-88	6,00,000	
1988-89	58,000	(Operational side only)

FINDINGS AND SUGGESTIONS

FARM EQUIPMENT

The Committee went round all maintenance & repair units of NARC. The maintenance facilities are spread all over the complex. Coordination amongst various units is non-existent.

All units have their independent arrangements for repairs & maintenance. Effective management is essential for prompt & efficient functioning of each unit. Ineffective management has resulted in many cases of delay. Minor delays add up to significant totals. The principal delays are due to shortage of spare parts. From a study of the information provided by the maintenance units it appears that almost thirty per cent of the working time is lost because of delays in repairs.

Delays due to farm equipment breakdown can be materially reduced by strict adherence to the general maintenance principles outlined below. Delays due to ineffective management can be reduced by following efficient management procedures.

FARM EQUIPMENT MAINTENANCE - GENERAL PRINCIPLES.

Basic and continuous responsibility of supervisors and managers is to train farm equipment operators and to check that all equipment is properly maintained. Equipment operators must know their machine & must understand the machine's correct use and application. Thorough training, testing and supervision of operators increases production.

Each piece of equipment must be in good working condition and must be kept that way by proper maintenance. This requires that all drivers, operators, and supervisors be familiar with preventive maintenance and minor repair work at unit level. If the unit has more than 40 items of farm machinery, a trailer mounted lubricator must be provided to them.

Daily Maintenance: Most earth moving machinery requires lubrication after each 8 hours of use, or three times per day when working round the clock.

Inspections: Regular preventive maintenance, together with proper handling and use, will keep equipment off deadline and on the job. This regular preventive maintenance is the responsibility of the officer incharge of the unit. Periodic spot check and technical inspections by technically qualified personnel are also required.

Periodic maintenance: It should be carried out as detailed in the workshop manual. This should be ensured by the concerned units. Any violation may be seriously viewed.

PURCHASE OF SPARE PARTS:

In order to cut down time involved in drawing advances for repair of vehicles, it is recommended that at the beginning of each fiscal year, a reasonable amount calculated on the basis of the expenditure incurred in the previous years be credited as advance to the workshop account. Approval of repair estimates & sanction of expenditure may continue to be exercised by the concerned Program Leader. This account may be operated jointly by the Director/Workshop Manager and Assistant Accounts Officer.

PHYSICAL CONDITION:

It was noticed that the electrical wiring & fittings of sheds are in poor condition. The floors are broken and need repair. Hard stand should be provided for parking the vehicles & equipment.

BUILDINGS

There are two concepts of maintenance. One is corrective maintenance and other is preventive maintenance. The first concept emphasizes dealing with the problems after they occur. This is a necessary aspect of any adequate maintenance program. However, when the corrective approach comprises the institution's only program, as it often does when budgets are anaemic, it quickly leads to crises maintenance - the most expensive kind of program.

Preventive maintenance emphasizes finding and fixing potential problems before they disrupt operations. A good preventive maintenance program requires an initial outlay of time and money for proper organization and operation. It usually returns the cost many times by minimizing potential damage, reducing emergency overtime, and eliminating expensive rush purchasing and contracting. A preventive maintenance program can support but never be a substitute for a corrective program.

It is extremely important to keep on file or have access to a complete set of as-built drawings for all structures and abilities systems. These drawings are essential for understanding the systems, tracing faults, finding possible solutions, and planning for the execution of works.

Construction defects:

Professor H. James Miller visited Pakistan during 1986 and inspected the buildings located in NARC complex. He observed that several construction defects were causing damage to the brickwall surface due to water flowing over it. These defects were:

- a. Expansion joint construction was faulty & incomplete.
- b. Caulking of metal roof flashing was incomplete, and quality of workmanship of roof waterproofing faulty.
- c. Sheet metal lining for roof drain gargoyles to throw water away from buildings was not provided as intended.

Provision of gargoyles was a mistake as it is not in accordance with the local practice. It spreads water over wall surface and in case of winds, the splashes of water dampen the brick wall surface thereby causing effervescence effect in the dry season. In Pakistan down water pipes are used to dispose of rain water. Certain buildings in NARC Complex constructed with the assistance of World Bank were provided down water pipes and have been found working satisfactorily. The following treatment of the defects mentioned by Prof. Miller is suggested:

a. Expansion joints:

The present expansion joints may be treated with water sealant chemicals. The elastomeric rubber pad should be replaced between the joints and slightly rained cap should be placed over it.

b. Caulking of metal roof flashing:

Waterproofing of roofs needs immediate attention. Joints along the parapet roof require special attention. Alternate three layers of PB-4 and coarse cloth over the roof and along the parapets should be put in.

c. Sheet metal lining:

Use of sheetmetal lining on the brick surface is not an effective measure against rain water. The rain-face in Islamabad is of peculiar nature. It comes with the wind which makes the water from the gargoyles splash on the surface of brickwalls. Down water pipes should be considered as an alternative.

**RECOMMENDATIONS FOR
IMPROVEMENT OF
MAINTENANCE SYSTEM**

1. The maintenance units in NARC Complex are the following:
 - a. Automobile Workshop
 - b. Farm Operations and Services
 - c. Animal Sciences Institute
 - d. BARD
 - e. Buildings
 - f. Landscape
 - g. Laboratory Equipment
 - h. Greenhouses
2. Automobile Workshop and F. O. & S. Workshop should be merged and should operate as one unit to be called Combined Maintenance Unit (CMU). They should improve their physical facilities by installation of equipment procured under USAID and other development projects. After expiry of the BARD Project their workshop should merge with the proposed unit.
3. Vehicles having more than 5 years life be auctioned away and replaced because their repair becomes uneconomical.
4. The workshop staff salaries and benefits should be revised and related to their output and capabilities.
5. Training of CMU staff by the technical staff of tractor/automobile companies should be organized.
6. Suggested organization of the Combined Maintenance Unit, to be headed by a qualified mechanical engineer is at Annexure U. The Director of the CMU should be made responsible for:
 - (a). Efficient running of the CMU.
 - (b). Exercising financial and administrative powers in respect of non-development budget of all programs for repair and maintenance.
 - (c). Purchase of spare parts and other consumable stores as per procedure laid in PARC rules.
7. The Animal Sciences Institute has only a few pieces of earth-moving equipment which can be looked after by the above proposed Combined Maintenance Unit. The present maintenance staff available to the Institute is capable of only doing minor on the spot repairs. The staff lacks professional knowledge and needs further training. In addition, the proposed maintenance Unit should be made responsible to maintain mechanical/electrical equipment installed in Greenhouses. Funds allocated to Greenhouses for maintenance of equipment should be placed at the disposal of the proposed maintenance Unit in the interest of speedy & efficient maintenance of Greenhouses.

8. The physical facilities available at the automobile workshop are adequate in terms of space and area but are not properly designed and constructed. The workshop yard is full of loose gravel which poses great hazard to the moving vehicles. It is recommended that hard stand of concrete should be made for parking and movement of vehicles.
9. The workshop has received quite a comprehensive range of workshop tools and equipment but these are not being utilized properly for two obvious reasons:
 - Non-availability of proper workshop facilities.
 - Lack of trained staff.

The existing equipment should be segregated in separate rooms for unhindered repair and maintenance work. Proper training of the staff should be carried out at the NARC automobile workshop in addition to the training in the automobile companies.

10. Major repairs such as grinding/polishing of crankshafts, cylinder boring etc. should be carried out from the local market. It would be more economical than getting these done in NARC automobile workshop.
11. Building Maintenance Unit and Landscape Unit may be merged because both have related functions. Suggested organization for the merged unit is at Annexure V. Landscaping Unit does not require the services of a highly qualified senior person. Instead the unit should be headed by a supervisor having under his control foreman, nurserymen, malis & helpers.
12. The available office space is inadequate for the maintenance staff. Space requirements for the Operation & Maintenance Unit is 2000 sqft. The break down of this area is at Annexure W.
13. An adequate budget is fundamental to a good maintenance system. Establishing a realistic budget that is adequate, but not padded with unproductive staff costs, can be invaluable to the future of NARC. A major step in realistic budgeting is devising a cost accounting method that accurately reflects cost assignments. With accurate information at his disposal, an administrator can measure the state of efficiency of his organization, plan short range improvements & double check ways in which allocated funds are spent. The following heads of account may be adopted to work on the budget:
 - a. Establishment of maintenance unit
 - b. Building maintenance

- c. Utilities
- d. Custodial services
- e. Landscape & ground maintenance
- f. Major repairs & renovations
- g. Other services

14. Cost estimate of construction defects

To overcome the defects mentioned under Analysis & Findings, following cost estimate has been prepared:

(i) Hostel:

	<u>Estimated Cost in rupees</u>
a. Repair of expansion joints	22,000.00
b. Replacement of spouts	8,470.00
c. Relaying sewer-pipes from toilets	1,66,095.00
d. Caulking of flashing	11,190.00
e. Waterproofing	80,000.00
f. Repair of electrical system	30,000.00
Total:	<u>3,17,755.00</u>

(ii) Administration Block:

a. Repair of expansion joints	28,200.00
b. Replacement of spouts	33,000.00
c. Caulking of flashing	25,830.00
d. Water-proofing	1,62,000.00
e. Electrical work repairs	50,000.00
Total:	<u>2,99,030.00</u>

(iii) Library:

a. Replacement of spouts	10,120.00
b. Caulking of flashing	8,000.00
c. Water-proofing	55,040.00
d. Repair of electrical system	20,000.00
Total:	<u>93,560.00</u>

(iv) Auditorium:

a. Repair of expansion joints	21,150.00
b. Replacement of spouts	5,000.00
c. Waterproofing	39,000.00
d. Caulking of flashing	5,000.00
e. Repair of electrical system	10,000.00
Total:	<u>80,482.00</u>

(v) Laboratory:

a.	Repair of expansion joints	63,450.00
b.	Replacement of spouts	30,000.00
c.	Caulking of flashing	53,000.00
d.	Waterproofing	2,08,174.00
e.	Repair of electrical system	40,000.00
	Total:	<u>3,94,624.00</u>

Grand Total:	11,85,451.00
Add 5% contingencies:	59,272.00

Total:	<u>12,44,723.00</u>
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15. Following guidelines may be kept in view while preparing the annual budget for the maintenance of buildings:

a. Repair & maintenance cost of buildings
1.0% to 1.5% of the capital cost of the building

b. Maintenance of sewerage system
1. Sewer lines - 1.5% of the capital cost
2. Equipment - 3% of capital cost

c. Maintenance of water supply system
1. Pipe line - 1.5% of the capital cost
2. Equipment - 3% of the capital cost

16. Periodicity:

Guidelines for the frequency of repairs are at Annexure X.

SUMMARY OF RECOMMENDATIONS

1. Automobile Workshop:
 - a. Automobile and F. O. & S. Workshops should be merged under the technical & administrative control of a Director.
 - b. Vehicles having more than 5 years' life should be auctioned & replaced with new ones.
 - c. Salaries & benefits of workshop personnel should be revised commensurate with their qualifications & experience.
 - d. All funds allocated to different units for maintenance purposes should be placed at the disposal of Director Combined Workshop.
 - e. Major repairs should be carried out by private repair shops in the local market.
 - f. Proposed organization of the Combined Workshop is at Annexure U. It should be adopted.
 - g. Permanent floors should be made for repair & parking of vehicles.
 - h. Training of technical staff should be organized in a systematic manner.
2. Operation & Maintenance Unit:
 - a. Landscape division may be merged with Operation & Maintenance Unit.
 - b. A building with a covered area of 2000 sq.ft. should be constructed to house the staff.
 - c. Funds for removal of construction defects in existing buildings amounting to Rs. 1.25 millions should be provided at the earliest.
 - d. Operation & Maintenance Unit should be provided with the latest equipment for the maintenance of buildings.
3. General:
 - a. There is a paramount need for a standby generator in the Greenhouse.

- b. Relay switches should be installed to save the Greenhouse equipment from fluctuation of current.
- c. Creation of a vacancy to be filled by a graduate electronics engineer in Laboratory Equipment & Maintenance Unit is recommended.

Terms of Reference for a Review of
NARC Maintenance Organizations

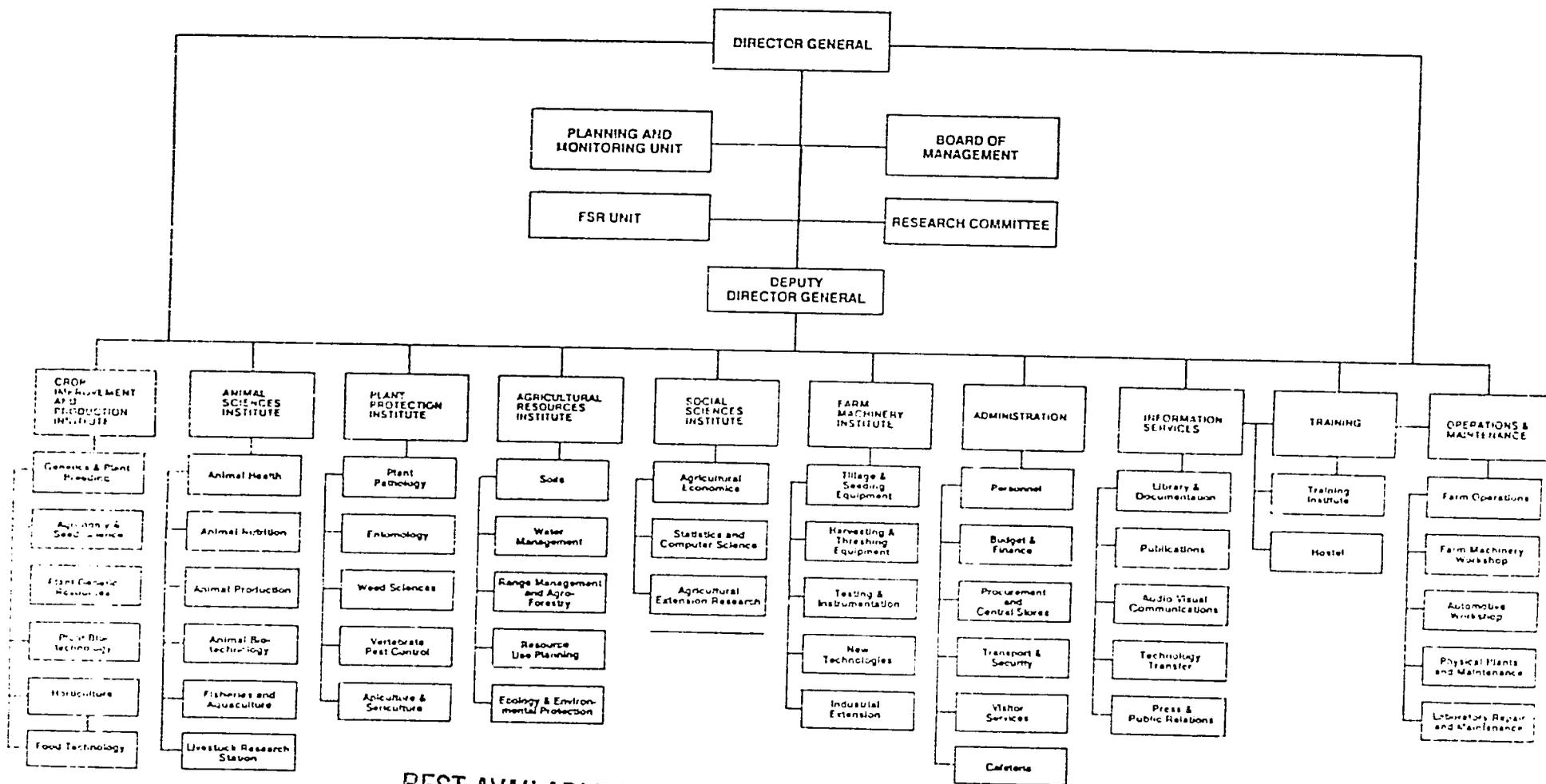
The purpose of this review is to examine the existing maintenance organizations and procedures at NARC, to describe their current status, especially how they coordinate with one another, and to recommend ways to improve the operation and coordination of the maintenance units.

A three or four-person task force will be formed to carry out this review. Possible members are: Director (Works), a senior officer from the Farm Machinery Institute, the chief of USAID's Building Management Services, and a respected agriculturist, either Pakistani or foreign, who is unassociated with NARC. This team will visit each unit of NARC that has maintenance responsibilities (buildings and grounds maintenance; vehicle repair shop; Farm Operations and Services; the BARD maintenance facility; the Laboratory Equipment Repair Unit; and any other) to discuss their operations with their staff and to obtain first-hand knowledge of their activities, staffing, physical facilities, funding capabilities, and limitations. The task force should be careful to learn of any duplication among the units or any gaps that exist in repair and maintenance services at NARC. The task force should also consider the usefulness of utilizing local commercial businesses for NARC repair and maintenance, rather than this being done by NARC staff.

The Task Force will prepare a report which details, but is not limited to the following information: Description of the unit's activities, physical facilities, staff and their training, budget, relationship to other NARC maintenance units and the unit's hierarchical place in NARC's organizational chart. The report should also give recommendations for strengthening the over-all maintenance organization and recommendations to improve individual units.

This review and the preparation of the report would require about 10 working days and should be accomplished in a period of no more than four calendar weeks.

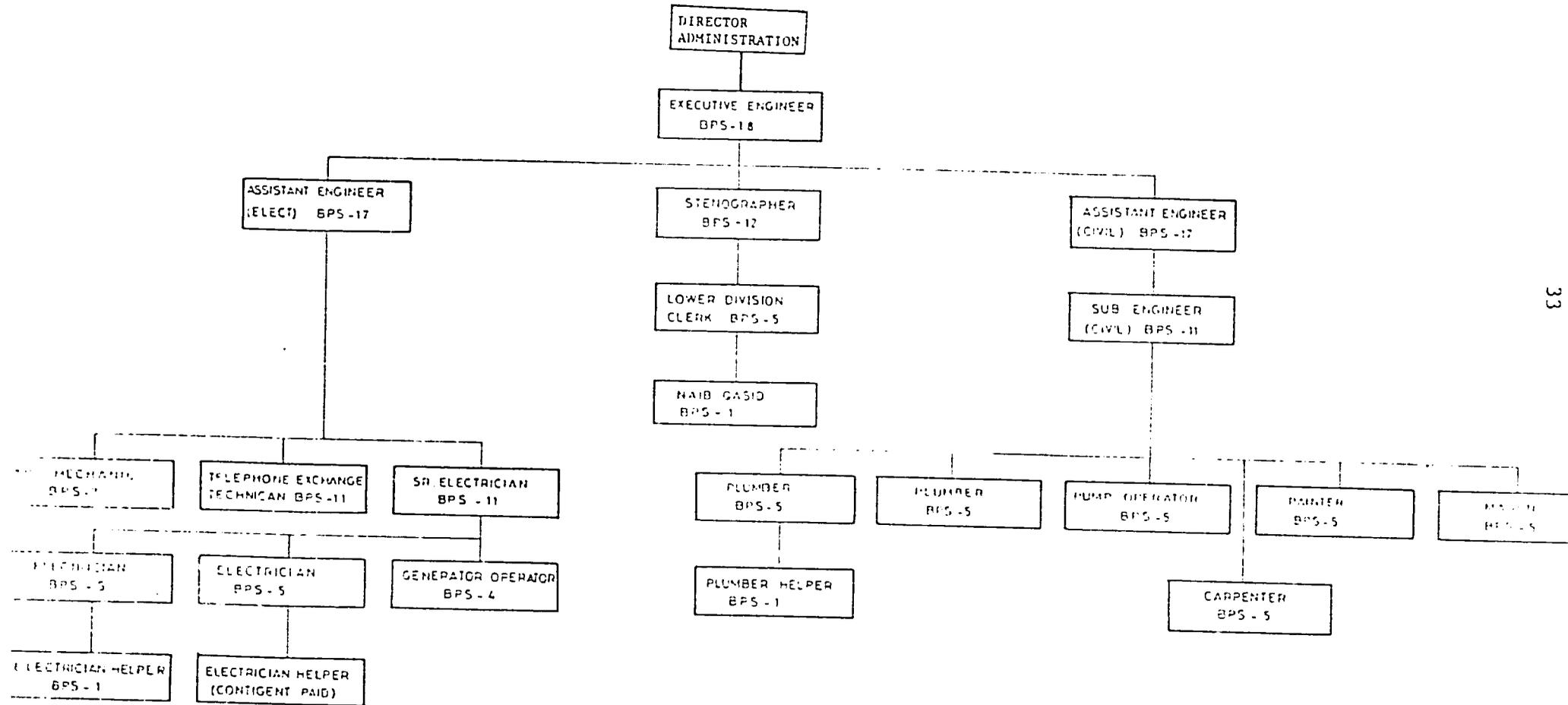
organizational chart for NARC



BEST AVAILABLE DOCUMENT

ORGANISATION CHART

OPERATIONS/MAINTENANCE/WORKS AND SERVICES UNIT NARC.



33

BEST AVAILABLE DOCUMENT

ANNEXURE D

BUDGET ALLOCATIONS FOR THE REPAIR AND MAINTENANCE
OF NARC BUILDINGS

	1985-86	1986-87 (Million Rupees)	1987-88	1988-89	1989-90	1989-90 (Revised)
1. Repair & Maintenance of Office Buildings.	0.1000	0.280	0.200	0.120	0.240	0.460
2. Repair & Maintenance of Residential Buildings	0.001	0.225	0.090	0.071	0.075	0.375
3. Repair & Maintenance of Furniture and Fixture		0.015	0.015	0.010	0.005	0.005
Total:	0.101	0.520	0.305	0.201	0.310	0.840

MANPOWER FOR MAINTENANCE

	Post/Designation	BPS	Authorized	Held	Required	Deficiency
1.	Executive Engineer	18	1	1		-
2.	Assistant Engineer (Elect)	17	1	1		-
3.	Assistant Engineer (Civil)	17	1	1		-
4.	Sub Engineer (Civil)	11	1	1	2	1
5.	Sr. Electrician	11	1	1		-
6.	Sub Engineer (HVAV)	11	-	-	1	1
7.	Draftsman	11	-	-	1	1
8.	Telephone Exchange (Tech.)	11	-	-	1	1
9.	Telephone Exchange Operator	4	-	-	1	1
10.	A/C Mechanic	7	1	1		-
11.	Electrician	5	2	2	3	1
12.	Generator Operator	4	1	1		-
13.	Plumber	5	2	2	3	-
14.	Pump Operator	5	1	1		-
15.	Painter	5	1	1		-
16.	Mason	5	1	1		-
17.	Carpenter	5	1	1		-
18.	Electrician Helper	1	2	2	3	1
19.	Plumber Helper	1	1	1	2	1
20.	General Helper	1	1	1	2	1
21.	Office Assistant	11	-	-	1	1
22.	Stenotypist	12	1	1		-
23.	Clerk	5	1	1		-
24.	Storekeeper	5	-	-	1	1
25.	Naib Qasid	1	1	1	2	1

VEHICLE MAINTENANCE LOAD

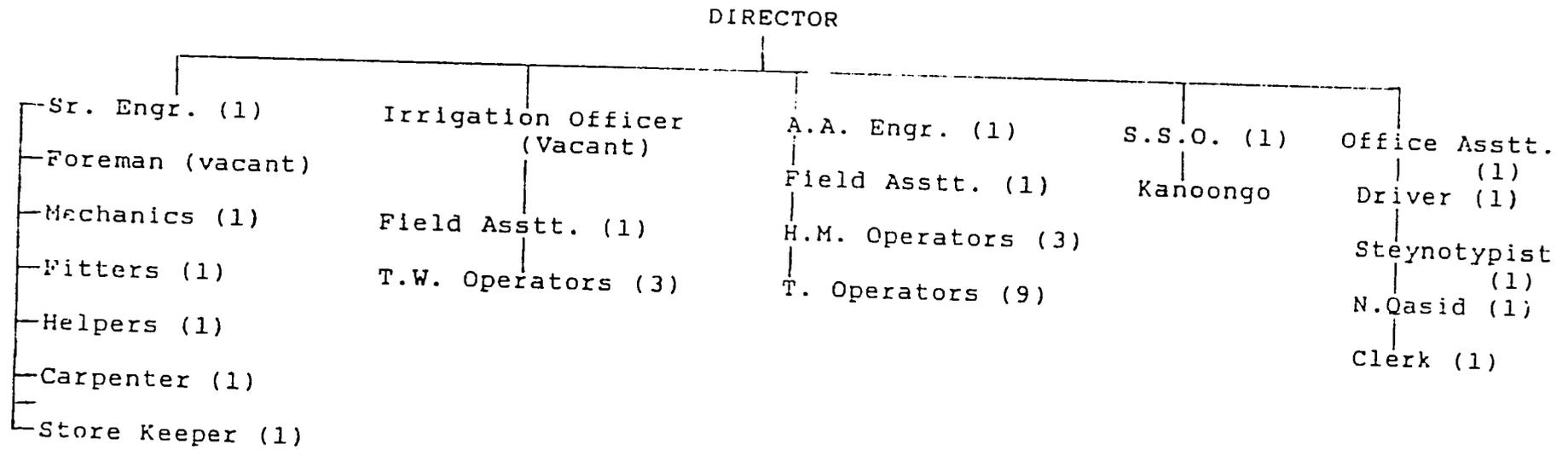
	<u>VEHICLE REGN. NO.</u>	<u>MAKE/TYPE</u>	<u>MODEL YEAR</u>
1.	IDB-7614	BEDFORD BUS	1987
2.	ID- 8481	-DO-	1983
3.	IDA-4205	TOYOTA COASTER	1976
4.	IDA-4206	-DO-	1976
5.	IDB-739	-DO-	1985
6.	IDB-4231	LAND CRUISER	1985
7.	IDB-4232	-DO-	1985
8.	IDA-9612	-DO-	1985
9.	IDB-3257	-DO-	1976
10.	ID- 6371	TOYOTA HIACE	1983
11.	ID- 8017	-DO-	1983
12.	IDA-8267	-DO-	1985
13.	IDB-4716	MITSUBISHI	1986
14.	IDA-7376	TOYOTA COROLLA	1985
15.	IDB-5469	SUZUKI CAR	1987
16.	IDB-2383	FORD LASER	1983
17.	ID- 6628	TOYOTA COROLLA	1983
18.	ID- 6629	-DO-	1983
19.	IDA-7028	-DO-	1985
20.	IDA-9759	-DO-	1985
21.	IDA-6943	-DO-	1985
22.	IDA-6942	-DO-	1985
23.	IDA-9844	TOYOTA CORONA	1985
24.	IDB-2761	-DO-	1985
25.	IDB-3718	-DO-	1985
26.	IDB-3719	-DO-	1985
27.	IDB-6653	-DO-	1985
28.	IDB-3258	TOYOTA CROWN	1974
29.	IDB-7522	SUZUKI CAR	1987
30.	IDB-7523	-DO-	1987
31.	IDB-7524	-DO-	1987
32.	IDB-7525	-DO-	1987
33.	IDB-7858	-DO-	1982
34.	ID- 4702	SUZUKI JEEP	1987
35.	IDB-4258	-DO-	1987
36.	IDB-4147	-DO-	1987
37.	ID- 3081	SUZUKI VAN	1982
38.	ID- 3083	-DO-	1982
39.	ID- 4709	-DO-	1982
40.	ID- 4708	-DO-	1982
41.	ID- 5815	-DO-	1983
42.	ID- 8016	-DO-	1983
43.	IDA-4202	SUZUKI PICK UP	1980
44.	IDA-4204	-DO-	1980
45.	IDA-4218	-DO-	1980
46.	ID- 5193	-DO-	1980
47.	IDB-4309	-DO-	1986

48.	RIH-6201	-DO-	1980
49.	IDB-1840	VESPA SCOOTER	1986
50.	IDB-1841	-DO-	1986
51.	ID- 3712	MOTOR CYCLE	1983
52.	ID- 5483	-DO-	1982
53.	IDB-6143	-DO-	1980
54.	ID- 3084	-DO-	1983
55.	ID- 3085	-DO-	1983
56.	IDA-9841	TOYOTA CORONA	1985
57.	IDA-9843	-DO-	1985
58.	IDA-1329	FIAT CAR	1984
59.	IDA-1423	-DO-	1984
60.	IDA-1462	-DO-	1984
61.	IDA-7614	BEDFORD BUS	1987
62.	X-68-1809	TOYOTA JEEP	1982
63.	X-68-1578	-DO-	1982
64.	ID- 7159	BEDFORD BUS	1982
65.	ID- 9475	-DO-	1982
66.	IDB-7438	-DO-	1987
67.	IDB-9270	-DO-	1987
68.	IDA-3648	TOYOTA HIACE	1985
69.	IDA-3150	-DO-	1982
70.	ID- 6359	-DO-	1982
71.	ID- 3992	-DO-	1982
72.	IDA-9752	TOYOTA COASTER	1985
73.	IDA-9753	-DO-	1985
74.	IDB-2710	-DO-	1985
75.	IDB-5302	MAZDA BUS	1979
76.	IDA-5304	-DO-	1985
77.	IDA-9710	TOYOTA PICK UP	1985
78.	IDA-6089	-DO-	1983
79.	IDA-8268	-DO-	1985
80.	IDB-2801	TOYOTA DELUX	1985
81.	IDB-2802	SUZUKI JEEP	1985
82.	IDB-2803	-DO-	1985
83.	IDB-4528	-DO-	1985
84.	IDB-4529	-DO-	1985
85.	IDB-4534	SUZUKI PICK UP	1985
86.	IDB-4275	-DO-	1985
87.	IDA-5472	TIST TRUCK	1985
88.	IDA-7692	T.LAND CRUISER JEEP	1982
89.	ID- 6852	-DO-	1982
90.	IDB-2819	LAND CRUISER	1985
91.	IDA.9751	TOYOTA COASTER	1985
92.	IDA-9801	TOYOTA CORONA CAR	1985
93.	IDB-2166	-DO-	1985
94.	IDB-6629	TOYOTA COROLLA CAR	1982
95.	IDB-5469	SUZUKI CAR	1982
96.	IDB-5962	-DO-	1987
97.	IDB-1328	TIST CAR	1985
98.	IDB-1368	-DO-	1985
99.	ID- 7195	HONDA M/CYCLE	1982

100.	ID- 7196	-DO-	1982
101.	ID- 5529	-DO-	1983
102.	IDA-2862	-DO-	1983
103.	IDA-1529	TOYOTA JEEP	1982
104.	ID- 6855	COROLLA CAR	1982
105.	ID- 9942	TOYOTA JEEP	1982
106.	ID- 6851	-DO-	1982
107.	IDB-2152	TOYOTA	1985

AUTO WORKSHOP BUDGET

	<u>Total allocation</u>	<u>Salaries & Allowances</u>	<u>Net</u>
1988-89	5,55,000.00	5,00,000.00	55,000.00
1989-90	7,41,000.00	5,73,000.00	1,68,000.00
1990-91 (Demanded)	9,48,000.00	6,17,000.00	3,31,000.00

ORGANIZATION OF FO&S UNIT

EQUIPMENT IN FO&S WORKSHOP

1.	Battery Charger	1
2.	Welding Plant (Three Phase)	1
3.	Welding Plant (Single Phase)	1
4.	Press Drill	1
5.	Lathe Machine	1
6.	Air Compressor (Heavy Duty)	1
7.	Air Compressor Small (for field duty)	1
8.	Testing Bench	1
9.	Drill Machine	1
10.	Saw Machine	1
11.	Hand Tools Complete Set	1
12.	Generator 5 KV	1
13.	Grinder	2
14.	Gas Welding Set	1

LIST OF TRACTORS IN
FO&S. UNIT

	<u>MAKE</u>	<u>YEAR OF PURCHASE</u>	<u>QTY.</u>	<u>REMARKS</u>
1.	FIAT 640	1976	8	
2.	FIAT 480	1976	1	
3.	MF 265	1983	3	
4.	J.D. 4040	1982	2	USAID
5.	Road Grader CIP	1964	1	do
6.	Buldozer CIP	1964	1	do
7.	Sope Loader (Case)	1962	1	do
8.	Forklift 7 tons	1962	1	do
9.	Forklift 2 tons			

LIST OF FIELD EQUIPMENT WITH
FO&S UNIT

	<u>DESCRIPTION</u>	<u>QTY.</u>	<u>REMARKS</u>
1.	Bed Shaper.	2 No.	
2.	Boarder Disc.	1	
3.	Chisel Plough.	2	
4.	Cultivator.	7	
5.	Disc Harrow.	9	
6.	Disc Plow.	1	
7.	Ditcher.	3	
8.	Front Loader.	1	
9.	Fertilizer Broadcaster	3	
10.	Front Blade.	2	
11.	Cutter Cleaner.	1	USAID
12.	Ittifaq Wheat Thresher.	1	
13.	Scraper (Eversman).	1	USAID
14.	Land Plainer (Eversman).	2	do
15.	J.D. R.M.B.P.	2	do
16.	Maize Planter.	1	do
17.	J.D. Disc Harrow.	1	do
18.	J.D. Field Cultivator.	1	do
19.	J.D. Subsoller	2	do
20.	J.D. Seed Drill	2	do
21.	J.D. Spiketooth Harrow	2	do & Oilseed
22.	J.D. Rotary Hoe	1	USAID
23.	J.D. Toolbar Carrier	1	do
24.	J.D. Movers Conditioner	6	do
25.	J.D. Pull Type	1	do
	Forage Harvester M. 3760		
26.	J.D. Finishing Harrow	1	do
27.	Land Levellor	2	
28.	M.B. Plough	2	
29.	Maize Sheller	2	
30.	M.F. Scari Fire	2	
31.	Post Hole Digger	6	
32.	Rotary Slasher	4	
33.	Rotavator	5	
34.	RMB Plough	6	
35.	Rotary Slasher	4	
36.	Rear Blade	1	
37.	Road Roller	1	USAID
38.	Reaper	1	
39.	Sub Soiler	3	
40.	Seed Drill	4	
41.	Trolley	6	

ESTIMATED COST FOR
CONSTRUCTION OF PARKING SHED FOR TRACTORS

	Rs.
1. Shed 10,000 sft. approx.	10,00,000/-
2. Soling 36,000 sft.	3,60,000/-
3. Loading & Unloading Ramp.	1,00,000/-
4. High Water Pressure Tractor Washing Ramp	1,00,000/-
	<u>15,60,000/-</u>

ESTIMATED COST FOR
TUBEWELL, SECURITY POSTS, FENCES ETC.

FUTURE IMPLEMENTS

	Rs.
1. Land development work.	2,00,000/-
2. Construction of wire crae spurs.	4,00,000/-
3. Construction of fence line.	6,00,000/-
4. Installation of new tubewell.	5,00,000/-
5. Development of drainage channels.	30,000/-
6. Construction of security guard posts/huts.	30,000/-
Total:	<u>17,60,000/-</u>

LIST OF BARD VEHICLES

	<u>VEHICLE NO.</u>	<u>TYPE</u>	<u>MODEL</u>
1.	8467	Jeep	1982
2.	6856	Pickup	1982
3.	2154	Surf	1985
4.	2086	Surf	1985
5.	8013	Dyna Truck	1985
6.	8532	Suzuki	1985
7.	2153	Surf	1985
8.	8468	Dyna Truck	1985
9.	2155	Surf	1985
10.	1142	Pajero	1988
11.	1141	Pajero	1988
12.	4549	Pickup	1988
13.	4562	Pickup	1988
14.	4558	Pickup	1988
15.	4563	Pickup	1988
16.	5548	Pickup	1988
17.	5529	Pickup	1988
18.	5528	Pickup	1989
19.	5488	Pickup	1989
20.	5547	Pickup	1989
21.	5549	Pickup	1989
22.	5546	Pickup	1989
23.	5526	Pickup	1989
24.	5659	S/Wagon	1989
25.	5527	Pickup	1989

LIST OF HARD TRACTORS

	<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>MANUFACTURER</u>	<u>YEAR</u>
1.	0811	TRACTOR 42 HP	MASSEY FERGUSON	09/83
2.	0812	TRACTOR 42 HP	MASSEY FERGUSON	09/83
3.	0813	TRACTOR 42 HP	MASSEY FERGUSON	09/83
4.	0910	TRACTOR 25 HP	MASSEY FERGUSON	09/83
5.	0912	TRACTOR 70 HP	MASSEY FERGUSON	09/83
6.	0911	TRACTOR 25 HP	MASSEY FERGUSON	09/83
7.	0932	TRACTOR	MASSEY FERGUSON	05/85
8.	0987	TRACTOR 50 HP	MASSEY FERGUSON	09/85
9.	0979	TRACTOR 50 HP	MASSEY FERGUSON	03/86
10.	0981	TRACTOR 50 HP	MASSEY FERGUSON	03/86
11.	1002	TRACTOR	MASSEY FERGUSON	03/86
12.	1074	TRACTOR	MASSEY FERGUSON	07/86
13.	1072	TRACTOR	MASSEY FERGUSON	06/88
14.	1073	TRACTOR	MASSEY FERGUSON	07/88
15.	1076	TRACTOR	MASSEY FERGUSON	07/88
16.	1077	TRACTOR	MASSEY FERGUSON	07/88
17.	0250	TRACTOR	MASSEY FERGUSON	12/89

BARD MANPOWER EMPLOYED ON MAINTENANCE AND REPAIRS.

	<u>Designation</u>	<u>No. of Posts</u>
1.	Assitt. Engineer	2
2.	Senior Mechanic	1
3.	Junior Mechanic	2
4.	Tractor Driver	3
5.	Vehicle Driver	1
6.	Fieldman	1
	Total:	<u>10</u>

ANNEXURE R

BUDGET AND EXPENDITURE INCURRED BY BARD PROJECT ON REPAIR AND MAINTENANCE

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	<u>Years</u>	<u>Budget</u>	<u>Expenditure</u>
1.	1984-85	0.048	0.179
2.	1985-86	0.070	0.198
3.	1986-87	0.135	0.132
4.	1987-88	0.160	0.124
5.	1988-89	0.160	0.120
6.	1989-90	0.155	0.038 (Upto Jan.1990)

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Staff in the Laboratory Equipment
M&R Unit

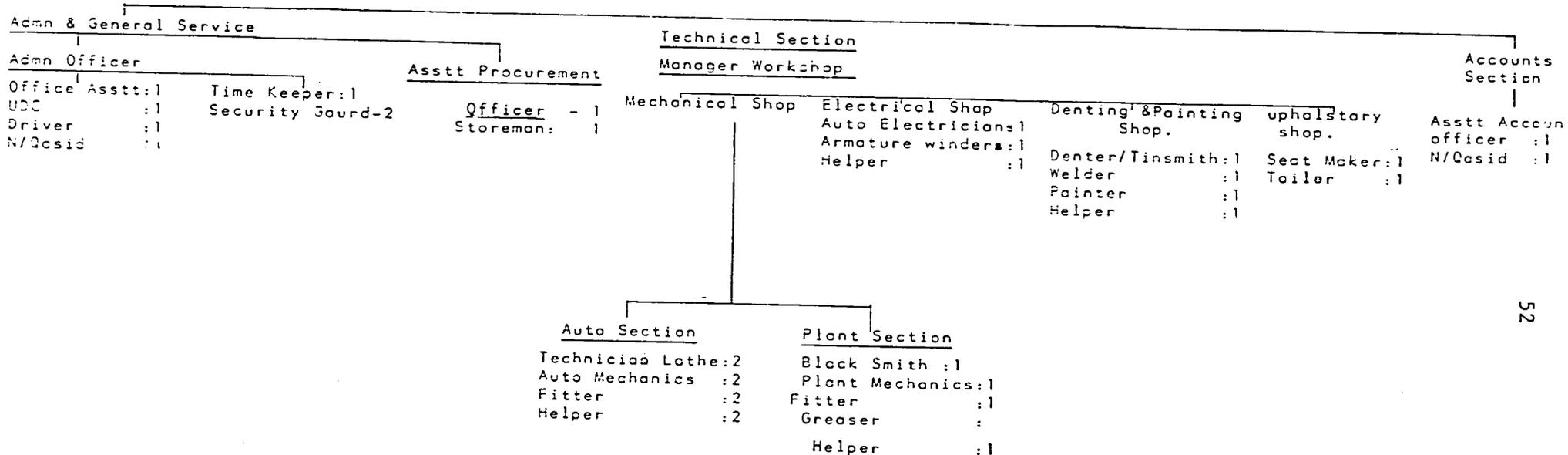
	<u>NAME</u>	<u>DESIGNATION</u>	<u>BPS</u>
1.	Mr. Zafar Hameed Hashmi	D.D(Labs & Equip)	18
2.	Mr. Mohammad Rashid	A.T.O	16
3.	Mr. Mohammad Amin Saleemi	A.T.O	16
4.	Mr. Asif Mahmood	A.T.O	16
5.	Mr. Nawaz Jamil	A.T.O	16
6.	Mr. Mohammad Ilyas	A.T.O	16
7.	Mr. Anser Mahmood	Sr.Tech	14
8.	Mr. Mukhtar Ahmad	Sr.Tech	14
9.	Mr. Saeed Akhtar	Tech. I	11
10.	Mr. Muzhar Iqbal	Glass Blower	11
11.	Mr. Zafar Iqbal	Store keeper	10
12.	Mr. Riaz Ahmad	Tech. II	8
13.	Mr. Musharraf Ali Khan	Jr. Assistant	7
14.	Mr. Abdul Waheed	Naib Qasid	1

MAJOR DIAGNOSTIC EQUIPMENT/TOOLS AVAILABLE
IN LAB EQUIPMENT M&R UNIT

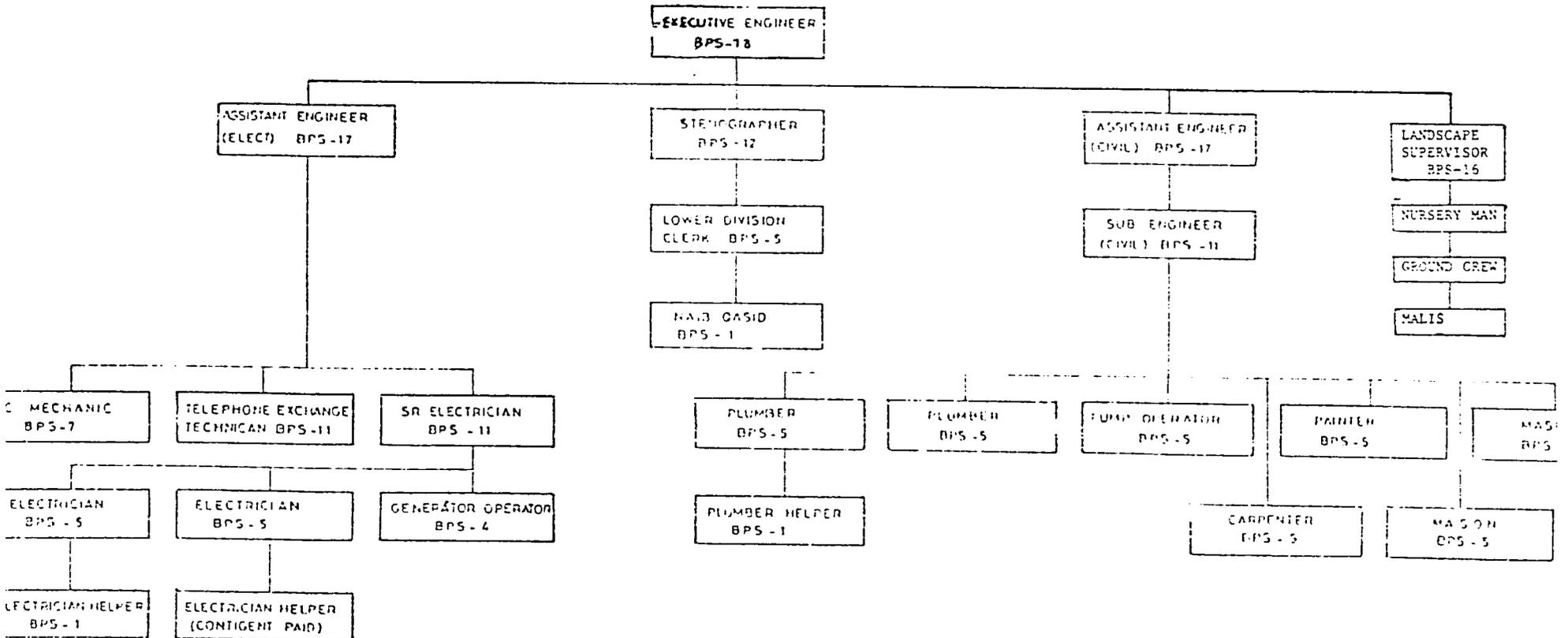
<u>S.NO.</u>	<u>EQUIPMENT</u>	<u>BRAND</u>	<u>ORIGIN</u>
1.	Analog Multimeter (3004)	HIOKI	Japan
2.	Analog Multimeter VF5		Japan
3.	Audio Generator LAG 26	Leader	Japan
4.	Circuit Checker (Bt 20008)	National	Japan
5.	Clamp-on power Hi Tester	Hioki	Japan
6.	Clamp Tester (Analog)SK 7200	Kaise	Japan
7.	Dual power Supply (PR 630)	TRIO	Japan
8.	DVM Meter (3200)	HIOKI	Japan
9.	Digital clamp Tester (3261)	HIOKI	Japan
10.	Digital LCR Meter ELC 120	ESCORT	Taiwan
11.	Digital Multimeter TMR 451	Thander	Japan
12.	Frequency Counter FC 754 A	TRIO	Japan
13.	I.C Tester (AC 1)	Sanwa	Japan
14.	L.C.R.Meter (LCR 745)	Leader	Japan
15.	LUX Hi Tester 3421	HIOKI	Japan
16.	Oscilloscope (20 MZ)	TRI O CS 1040	Japan
17.	Oscilloscope 40 MZ	TRI O CS 1040	Japan
18.	Oscilloscope 5 MZ	Thandar To 315	Japan
19.	Pulse Generator (TG 105)	Thandar	Japan
20.	Power Supply (PR 602A)	TRIO	Japan
21.	Sweep/Function Generator (FG 271)	TRIO	Japan
22.	Screw Driver Set 7710	Draper	Japan
23.	Transistor Checker(LTC 906 A)	Leader	Japan
24.	Tool Kit (Electronics)		
25.	Variable Voltage Transformer SB 2	Yokohama	Japan
26.	Drill Machine 220/240 V	Meddings	U.K
27.	Electrical Annealing Furnace 57/6 (900 c)	Herbert	Germany
28.	Electrial Annealing furnace 58/6 III (900 c)	Herbert Arnold	Germany
29.	Glass Cutting Machine Model "C"	Pistorius	USA
30.	Glass Grinding machine	Somaca	USA
31.	Glass Working Lathe Model 65 35	Woodland	USA
32.	Glass Coil Winding machine Automatic	Herbert Arnold	Germany
33.	Glass Tubing Cracking off Automatic Machine	Herbert Arnold	Germany
34.	Glass Blowing Kit 32002 002	VWR	USA
35.	Panthograph with Accessories	Herbert Arnold	Germany
36.	Vibro Engraver 32882001	VWR	USA

PROPOSED COMBINED WORKSHOP UNIT ORGANISATION CHART

DIRECTOR



SUGGESTED ORGANISATION CHART



SPACE REQUIREMENTS FOR THE O&M UNIT OF NARC

Description	Available Space	Required Space
1. Office for Executive Engineer	150 sft	150 sft
2. Office for Assistant Engineers	150 sft	200 sft
3. Office for clerical staff and Record Room.	---	200 sft
4. Office for Technical Staff (Sub Engineers, Draftsman) etc.	---	200 sft
5. Transit Store	130 sft	150 sft
6. Workshops	---	400 sft
7. Toilets	50 sft	100 sft
8. Circulation Area/Corridors	180 sft	300 sft
9. Office for Landscape set up	---	300 sft
Total:	660 sft	2000 sft

MAINTENANCE OF BUILDINGS
RECOMMENDED MAINTENANCE SCHEDULE

1. White washing or colour washing walls	1 year
2. Cobri looping roof	1 year
3. White washing ceiling	2 years
4. Distempering	2 "
5. Scrubbing and cleaning mosaic floor with datergents	2 "
6. Emulson painting	3 "
7. Mud plastering	
a. Exterior walls and roof	3 "
b. Interior walls	5 "
8. Painting (Wood works)	3 "
9. Polishing (Wood works)	3 "
10. Thatching	3 "
11. Coal tarring/bitumen painting	4 "
12. Approach road tarring	6 "
13. Lime or cement plastering	
a. Exterior	10 "
b. Interior	20 "
14. Glass panes	10 "
15. Brick pavement replacing	15 "
16. Conglomerate flooring	20 "
17. Lims (cement painting)	20 "

PETTY REPAIRS (INCLUSIVE OF ALL JOB ITEMS):

i. Main buildings	Rs. 10% sft. of P.A.
ii. Out Houses	Rs. 5% sft. of P.A.