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MAINTENANCE AND SERVICING OF EQUIPMENT
IN THE PUBLIC SECTOR

DP/MAT/83/001

MALTA

Terminal report*

Prepared for the Government of Malta
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Siegmund W. Chochoiek,
expert in electronics

Backstopping officer: V. Smirnov, Engineering Industries Branch

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ABSTRACT

This Terminal Report on the UNDP-Project "Maintenance and Servicing of Equipment in the Public Sector", Number MAT/83/001/A/01/37 describes all progress made and activities involved during its life-time of 3 years.

Background will be given on the difficulties met in setting-up the Advanced Electronics Maintenance Unit according to the objectives given in the respective project document, as well as on the necessity of separating certain tasks from the services covered by this Unit directly.

A brief summary of all lectures and training courses delivered by the two Experts Mr. E. Stoehr and myself, will be mentioned too.

This report covers the total period of the project from 1st March 1983 to 31st August 1986.

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1. Introduction/Background

The project "Maintenance and Servicing of Equipment in the Public Sector" of the Government of Malta has been started in March 1983, and been advised by one expatriate UNDP Expert in electronics engineering up to August 1985. From September 1985 to August 1986, this project has been extended with the same objectives and under the same title as its predecessor but with the appointment of a second expert in electronics engineering. During the period of 2 years of building up the Advanced Electronics Maintenance Unit, it became obvious that to provide additional training and for further development of this Unit, another expatriate help would be required.

In the past, servicing and maintenance of mechanical and electronic equipment in the Public Sector was carried out by individual units in the various Government departments and Parastatal organizations concerned. In the case of the more sophisticated area of electronic equipment, the local knowhow was and is still limited. The need for some central authority which would be able to co-ordinate, perform and supervise servicing and maintenance on such advanced electronic equipment has long been felt.

Therefore, it has been decided to set up for this purpose a Unit directly responsible to the Office of the Prime Minister.

The main functions of this Advanced Electronics Maintenance Unit should include:

- the co-ordination of the activities of the various maintenance sections;
- tendering of advice;
- practical assistance in the actual running;

- servicing and maintenance of all electronical equipment currently in use in the Public Sector;
- responsibility for the professional/technical staff of the various Departments and Corporations;
- responsibility for their conditions of service including appointments, promotions, transfers and the organization of shift work whenever the provision of round-the-clock services are called for;
- permanent and close relationship with the relevant Faculties of the University;
- appropriate placement of worker students during their work-phase;
- taking account of the needs of pupil-workers and extended skill workers (E.S.T.S. students).

Furthermore, it has not been possible to identify locally anyone with the right blend of knowledge and experience in the wider field of electronics, who can be entrusted with the responsibility of organizing the services of the Advanced Electronics Maintenance Unit and deals with the day-to-day running thereof.

Accordingly, it was expected that this Project will:

- (a) assist in the consolidation and organization of, and advise the Government on the servicing unit being set up specifically to coordinate all activities relating to the servicing and maintenance of machinery and equipment in Government Departments and Parastatal organizations;

- (b) assume direct responsibility for, and participate actively in the day-to-day running of that part of the Unit dealing with Electronic equipment; until such time as a local counterpart can be trained to take over as Head of the Advanced Electronic Maintenance Unit;
- (c) advise the University and other Educational authorities on the planning and curricula of courses concerning the study of electronic engineering;
- (d) help organize and run practical on-the-job training courses at technician level for the staff of the Maintenance Unit dealing with the electronic equipment;
- (e) advise Government organizations including Government-controlled companies on production and/or operational techniques in the field of electronics.

The main outputs of the Project were defined as follows:

- A functioning section fully manned by Maltese nationals for servicing electronic equipment.
- Trained local technicians, at least 5, including the future head of the section.
- Focal point services for the planning and development of curricula for electronic engineering studies at Maltese educational institutes, and for the development by Government-owned companies of appropriate techniques in the field of electronics.

2. State of the Advanced Electronics Maintenance Unit (A.E.M.U.) in September 1985

A line is to be cut between the development within this Project up to September 1985 and the time after, up to its termination in August 1986.

In the first place, during the initial phase of setting-up the Unit, only one expert has been recruited, but from September 1985 onwards, a second UNDP Expert has been sharing the duties together with him.

Secondly, being directly involved in this project as the second expert only during the second phase, I have to base all aspects of this report describing the period before my assignment on second-hand information and previous reports. This might perhaps in some cases exclude facts and outputs referred to the past, because of being beyond my knowledge.

2.1 Activities/Outputs

With the help of an expatriate UNDP Expert, namely Mr. Edgar Stoehr, the A.E.M.U. has been set-up within the premises of the Technical Institute in Paola, Corradino Hill, consisting of one workshop and one small office. The area has been furnished with adequate furniture and test-equipment (as per Annex 7.3) to provide working facilities for up to 12 technicians apart from 2 desks for the Expert and one for a local understudy in the said office. This office comprises a store area for consumable electronic components as well as a personal computer system and book shelves. Both rooms are fully air-conditioned. These facilities, already available early in 1985, and initial management, put the A.E.M.U. into a position to perform the following tasks:

- (a) The Unit can be approached by Departemental and Parastatal bodies (as per Annex 7.5) to utilize its skills and facilities for maintenance, repairs or other technical support.
- (b) The Unit offers on request, test-equipment and knowhow to train selected technicians from different Government Departments in the wide field of advanced electronics.

Administratively-wise, the A.E.M.U. is responsible to the Mechanical and Electrical Division at the Office of the Prime Minister directly.

In particular, the Unit has been found in the following state:

I) Premises

One workshop and one small office situated on the first floor of the so-called "Telecom-building" at the Technical Institute, Paola, provides space for 12 technicians and 2 additional staff. Considering the future work-load expected, the space is not sufficient at all.

II) Equipment

The test-equipment and tools available are of a basic nature to carry out works on electronic apparatus in general.

Special test-equipment or special tools, e.g. to repair and calibrate video-recorders, are not available.

Each workbench contains a set of basic tools as well as a digital multimeter. (see Annex 7.3)

The quality of the tools and equipment purchased for the Unit is of a high standard and can technically be considered fully satisfactorily.

III) Staff

The A.E.M.U. was found operative with one technical officer, already employed on a full-time basis. No further technical staff or maltese engineering staff was employed or attached to the Unit at that time.

Mr. Stoehr, U.N. Expert, performed the duties of the Head of the A.E.M.U. including all day-to-day activities.

No maltese understudy was identified.

Some E.S.T.S. students were seconded to the Unit from other Departments for training purposes.

IV) Workload

With the help of E.S.T.S. trainees, student-workers and the above mentioned Technical Officer under the supervision of the U.N. Expert, certain repairs and calibrations on different equipment could be carried out.

The U.N. Expert, Mr. Stoehr, has been called several times to different Government Departments, seeking his advice on technical aspects and policies in conjunction with upgrading the maltese standard in the field of electronics.

2.2 Utilization of results

Since the initial period of this Project had mainly to deal with the setting-up, furnishing and staffing of the A.E.M.U., the utilization of this was to continue on the chosen line.

- (a) It was obvious that the workload involved in the activities actually envisaged in the Project Document became too big for it to be fully carried out by one expatriate Electronics Engineer. Therefore, a second expert had to come into the

Project to share duties with the other one in order to lead all activities to a successful end.

One Expert should concentrate on the analog aspects of the Unit's activities; the second Expert on the digital problems and organisation of the Unit in general.

- (b) At that point in time, the Unit was still a non-established and unsettled organisation which required further improvements and strengthening.
- (c) The abilities and facilities were limited compared to the performance expected by the Unit and described in the respective Project Document.
- (d) Only a limited number of jobs could have been accepted due to the limited technical background and number of staff available.

3. State of the A.E.M.U. in August 1986

3.1 Activities throughout one year

By termination of this project in August 1986, the Unit was operative to perform servicing, repairs and maintenance on a limited number of electronic equipment.

The staff present and employed with the Unit was as indicated below:

1 Engineer (B.Sc.) Grade P.O. IIA From April 1986

1 Engineer (B.Sc.) Grade P.O. I From August 1986
(Specialised on Telecom-equipment)

1 Technical Officer Grade T.O. III From January 1985
(in charge of spare-parts and all inventory)

8 Technicians Group D From August 1986
(All ex-trainees in industrial electronics from the Fellenberg Training Centre)

1 Messenger Group D From August 1986

A committee consisting of Mr. Ciantar L. (Office of the Prime Minister), Mr. Chochoiek S.W. (U.N. Expert), Mr. Zammit (Headmaster, Fellenberg Training Centre) and Mr. Axisa G. (P.O. IIA Eng.), has been set up in April 1986, after Mr. Stoehr's resignation, to discuss and solve problems in line with the proposals made by myself (see Annex 7.6) and to monitor progress on this Project.

3.1.1. Premises and Equipment

As regards the premises including all inventory as well as all test equipment and tools no changes to 2.1 Paragraph I/II in quantity or quality can be reported by the end of August 1986. No additional items have been purchased. The stock of all electronic components and accessories has been built up to a satisfactorily standard and is well assorted to face the future workload.

3.1.2 Repairs and Services

Between 1st September 1985 and 30th August 1986, repairs and calibration on a number of different equipment from various Departments have been carried out in the workshop of the A.E.M.U. under direct supervision of the U.N. Experts and with the help of the staff mentioned within this report. As already indicated in 3.1, the majority of the present staff turned up from August 1986, that means, that during the past year certain jobs had to be carried out either by the Tech. Officer and/or with the help of E.S.T.S. trainees, student workers and/or trainees from the Department of Health or even by the Experts themselves.

The Health Department technicians have mostly assisted in repairs on medical electronic and laboratory equipment.

The total number of equipment repaired/calibrated, as well as its nature is listed under Annex 7.4.

Both Experts have permanently been involved in the day-to-day running of the Unit.

A number of organisative procedures to improve the Unit's day-to-day activities have been introduced by the Experts, such as:

- * proper lines of communication within the Unit;
- * proper lines of communication with Government Departments requesting services of the A.E.M.U. (introduction of special forms - See Annex 7.9);
- * administration within the Unit (e.g. work-plans, time-tables, inventory lists);

- * proper administration/procurement of items for A.E.M.U. stock (computer controlled stock-taking);
- * utilization of space;
- * sources abroad for supply of electronic components, test-equipment and tools (address lists copied onto computer files);
- * building-up of a well assorted library of books and data-books to cover the wide field of electronics (Telecom systems, Video/T.V., digital/analog) and even some information on mechanical technologies.

Very frequently, the Experts had to meet the requests by Government Departments, Parastatal Organisations and Private Industry for advising on problems in conjunction with electronic engineering.

3.2 Utilization of outputs

All activities as described in 2.1 and 3.1 might lead to the conclusion that the Unit is fully operational. It is more likely the case that all repairs carried out within the Unit resulted from practical training given by the Experts on site. Since no permanent staff, apart from the Technical Officer, had been employed with the A.E.M.U. within the life-time of this project, the Unit has mainly been utilized as a training ground for students, R.S.T.S. trainees or trainees/technicians from different Government Departments. The outputs listed under 3.1.2, give evidence that this Project had been very successful in this regard.

Due to the absence of a suitable understudy - no future head could have been identified up to April 1986 - the Unit has been

supervised by at least one of the U.N. Experts all the time so far. The P.O. IIA Engineer, who has been employed recently with the Unit, at the moment is still to be trained and prepared to prove his suitability to eventually take over this job in future.

The future has to prove whether the staff employed by the end of August 1986 will be capable to cope with the work-load or whether additional staff (on the Technician level) is to be taken in.

Although a place consisting of one workshop and one small office has been found within the premises of the Technical Institute, I doubt very much whether any further improvements in setting-up the Unit to become self-sufficient one day, can be made over there.

3.3 Conclusions

Several proposals of how to bring this Project to a successful end have been made early this year. (Annex 7.6)

Judging by the experience gained throughout the past year, and being involved in all day-to-day activities of the A.E.M.U., the following conclusions can be drawn:

- (a) The premises chosen for both the office and the workshop area are too small and cannot be considered suitable for the Unit's envisaged purpose of being a central place to carry out all maintenance and repairs, as well as advising and training in the wide field of electronics.

None of the proposals made by myself (as per Annex 7.6 Para.3) could have been put to practice so far.

(b) The number of skilled and well-trained staff at the Unit is still limited. A future intake of further selected and qualified personnel has to be considered.
(See Annex 7.6 Paragraph 1)

(c) The organisative structure of the Unit is far away from the objective of being in a position to offer all services expected and to become a self-sufficient body.

The intake of University graduates (Engineers) and setting-up of small work-teams which are specialised in certain fields (e.g. Telecom systems, Digital systems, Video/T.V. technology, etc.) is to be considered. No clerical assistance has been provided so far.

(d) Purchase of certain additional test-equipment and tools is necessary, e.g. Test pattern generator, colour monitors, signal generator with wobbling facilities, HF Spectrum analyzer, logic analyzer, logic comparator and tools for video repairs.

(e) Office furniture and equipment (e.g. typewriter, photocopier, etc.) have not been procured from the current approved budget.

(f) From the very beginning of this Project, it has been pointed out that the Unit requires a van-like transport to cope with repairs on various sites and for transport of both personnel and equipment. So far, no transport has been provided and is still urgently required.

4. Training courses and lectures

4.1 At the A.E.M.U.

Using the workshop and its facilities, mainly practical on-site training has been offered by the U.N. Experts whilst performing repairs, calibration or maintenance on equipment as listed under Annex 7.4 .

In particular, the following people have been trained between 1st September 1985 and 30th August 1986:

1 Professional Officer, Engineer, 4 months of attendance;

1 student worker, 6 months of attendance;

1 Technical Officer, during the whole period covered by this Project;

1 student Laboratory Technician, 5 months of attendance;

12 technicians (mainly from the Department of Health), 2 months of attendance;

5 E.S.T.S. trainees, 1 month of attendance.

During these training courses, the Experts concentrated on teaching certain methods of how to carry out repairs and calibrations, which can easily be adapted on all types of electronic equipment. Moreover, they explained the proper use of all available test-equipment and tools.

Lectures about basic principles of T.V. sets, video recorder techniques (introduction) and microcomputer techniques have been delivered by the two Experts according to a given time-table. (see Annex 7.7)

Based on these lectures, the trainees have been instructed how to design and to build up electronic circuits and smaller sets (prototypes) in order to apply the gained theoretical knowledge in practice.

4.2 At the Fellenberg Training Centre

I have delivered two lectures at the Fellenberg Training Centre for industrial electronics.

One lecture on "Microcomputer techniques" offered to technicians from all Government Departments and actually attended by 28 people (see Annex 7.2). Another lecture on "Data processing" has been delivered to the 4th year (final year) students at this Centre including a final practical and theoretical exam on a microcomputer (see Annex 7.1).

4.3 At St. Luke's Hospital

The lecture "Microcomputer techniques" has been extended to biomedical applications and been attended by some 20 technicians/engineers of St. Luke's Hospital. This lecture has been continued in a lecture room at the Hospital.

In addition, practical on-site training has been given to the hospital service technicians, both at the workshops and at the wards and laboratories (mainly at the Pathology Department on laboratory equipment).

5. Extension of Unit's outreach

5.1 Reasons and Background

In agreement between the Office of the Prime Minister, the Ministry of Health and the U.N. Experts, it has been decided in January 1986 to establish, as an adjunct to the A.E.M.U., an organization within the Health Department to cater for the repairs and maintenance of all Hospital equipment, but mainly to cover all biomedical electronic and laboratory equipment currently in use in the State Hospitals.

Several reasons lead to this decision as indicated below:

- (a) Delicate and high-sophisticated Hospital equipment (including X-ray) has obviously to be serviced and maintained to high standards within the hospital precincts;
- (b) Due to the nature of such equipment, it proved not be advisable to transport these sophisticated items via long distances to and from the Unit;
- (c) There already exists a technical staff of approximately 25 people at St. Luke's Hospital, partly trained on biomedical and laboratory equipment, but not yet sufficiently proficient to cope with the standards of repair and maintenance required to service such equipment;
- (d) Special items and spare-parts required during repairs are already stocked within the hospital precincts;
- (e) Repairs and calibration on hospital equipment requires special test-equipment which is not available at the A.E.M.U;
- (f) The so-called "Electrical and Mechanical Engineering Division" at St. Luke's Hospital catering for all electrical and mech-

anical repairs and maintenance requirements, was lacking organization, strengthening and guidance to perform its duties efficiently.

In order to ensure progress on this alterations, it has been agreed that Mr. E. Stoehr will continue on building up and guiding the A.E.M.U., and that I myself, shall be concentrating in specific, on the problems in conjunction with the Health Department's maintenance and servicing needs.

5.2 Activities/Outputs

In the following, a review on the activities at the Electrical and Mechanical Engineering Division (E & M Engineering Division) of the Department of Health is given covering the period from January to August 1986.

5.2.1 Infrastructural measures

New offices for the mechanical, electrical and electronic engineers as well as, for clerical staff have been built and furnished with a minimum set to start work.

The former offices situated in the humid and dirty environment at the basement of Karin Grech Hospital, did not provide a suitable place where to work concentrated and efficient.

The workshop area of the Medical Electronics Section has been extended, furnished and provided with suitable equipment. A lot of work is still pending and has still to be completed.

The store area for the biomedical electronics spares has been extended. A new office for the store-keeper and another clerk has been provided.

5.2.2 Equipment, Tools

Recommendations for the procurement of useful tool-sets and suitable test-equipment to cope with the requirements of repairs and service on hospital equipment have been made.

So far, only few of the necessarily required and recommended items could have been purchased because of funds not available:

- 2 tool pouches with tools for calibration and repairs;
- 1 logic comparator (HP);
- Several multimeters, digital.

5.2.3 Staff

Several proposals how to strengthen and how to make proper use of the abilities of the present staff have been submitted to the Ministry of Health and the Chief Government Medical Officer.

The re-organization of the E & M Engineering Division has been started.

It has been proposed to subdivide the Division into six subsections, each under the supervision of a qualified engineer:

- (A) Electrical Section;
- (B) Mechanical Section I (Plant-rooms, refrigeration systems);
- (C) Mechanical Section II (all others);
- (D) Medical Electronics Section;
- (E) Projects Planning Section;
- (F) Civil Section.

Each of these sections should take over as much responsibilities as possible and run all day-to-day activities self-sufficiently.

A draft staff set-up has been submitted to the Department of Health mentioning all vacancies especially on the middle-management level (chargehands, Technical Officers, Works Technical Officers), which ought to be filled.

Internal lines of communication and discipline could have been introduced between the Heads of Sections (A) to (D) and myself.

Subsections (E) and (F) are not yet integrated in the Engineering Division and dealing with the Department of Health, i.e., the Chief Government Medical Officer directly, without liaison to the other Heads of Sections.

All Engineers of Sections (A) to (D), but in particular the Head of the Biomedical Electronics Section, Ms. M.T. Bartolo Brockdorff, Professional Officer I, have been trained on how to supervise their staff and how to perform and manage their day-to-day duties efficiently.

5.2.4 Training

On-site training for the technical staff has been given on different types of medical electronics and laboratory equipment. In particular, it has been stressed on how to apply properly the available tools, test-equipment and theoretical knowledge to the practical maintenance and repair on actual equipment. Certain routines how to approach the fault in such equipment have been explained.

A lecture on digital electronics has been delivered to the maintenance staff at St. Luke's Hospital.

A number of technicians has been identified to be sent to special training courses on medical and laboratory equipment overseas.

5.2.5 Procedures

When starting my assignment with the E & M Engineering Division in January 1986, complete absence of organization and clear procedures has been found.

Therefore, certain basic procedures how to run the day-to-day duties of this Engineering Division smoothly and efficiently have been introduced:

- (a) a reporting system for faulty equipment;
(see Annex 7.10 "Work sheets")
- (b) setting-up of two first-line maintenance teams consisting of two experienced technicians for each team, one for I.T.U./ Operating Theatres, and one for the Pathology Department. These teams were placed on-site, equipped with basic tools and test-equipment;
- (c) paperwork within the Engineering Division has been reduced to a minimum by the introduction of new forms, which superseded a number of forms in use before;
- (d) elaboration of a record system for each piece of equipment at present in use in State hospitals, i.e., "Equipment history cards";
- (e) design and procurement of suitable equipment stickers with sealing character for later introduction within a planned preventive maintenance system for biomedical electronic and laboratory equipment (see Annex 7.11);
- (f) improved ordering system for electronic spare-parts elaborated together with the Government Medical Stores;
- (g) improved system for filing of addresses, book titles and data-books to be easily used in a computer system at a later stage.

5.2.6 General Considerations

All Engineering staff approached me nearly daily to seek advice on different technical and management aspects for improvement of their day-to-day activities.

Although not specifically assigned to, I followed several invitations to meetings with the Minister, the Chief Government Medical Officer, and other Health Department authorities to advise and to give recommendations from an expert's point of view in conjunction with technical aspects.

6. Recommendations

Both parts of this Project, the major part which is the set-up of the A.E.M.U., and the other part, which consists of the envisaged improvements of the Engineering Division of the Department of Health, have not been brought to a satisfactory end, and are still to be continued after termination of this project.

All following recommendations are numbered in descending order of priority:

6.1 As regards the A.E.M.U.

The following recommendations are addressed to the authorities in charge of this project at the Office of the Prime Minister, and considered as a guideline for a successful continuation of what has been started in the past:

- 1) The Unit is totally limited in space. Either extension to the room next door, or identification of other suitable premises;

- 2) Additional furniture (i.e., office furniture, cupboards, lockers, etc.) and test-equipment, e.g. spectrum analyzer to be purchased;
- 3) Setting up of the support services, i.e. clerk/typist, cleaner, messenger, driver;
- 4) Involvement of the Unit's professionals in selection of technical staff for Government Departments as well as placement of worker-students during their working-phase;
- 5) Revised set-up. Distribution of work into 4 subsections dealing with:
 - video/television equipment;
 - general electronics and Telecom systems;
 - electronics in conjunction with mechanics;
 - computers, digital electronics.
- 6) Each of these 4 sections under supervision of 1 engineer (University degree);
- 7) Due to the fact that no maltese understudy has been identified so far, selection of a suitable person for Head of the A.E.M.U.;
- 8) Permanent technical staff not yet sufficiently trained on-site. Employments only in August 1986!
- 9) Administrative improvements which could not have been reached through the lifetime of this project:
 - request for services from A.E.M.U. directly to Head of A.E.M.U. for approval;
 - procurement procedure for spare-parts and equipment too complicated and time-costy;

- 10) Closer co-operation with the relevant faculties at the University of Malta as regards as, selection of personnel (engineering level) and elaboration of syllabus for practical training courses;
- 11) Photocopier and typewriter of high quality to be purchased.

6.2 As regards the "Engineering Division"

The following recommendations are addressed to the authorities at the Department of Health in charge of the part of this project which is dealing with the Engineering Division at St. Luke's Hospital:

- 1) An "Engineering Division" independent from a particular Hospital administration or supervision with a separate budget for:
 - repairs and upkeep of all State hospitals;
 - procurement of spare parts, test-equipment and tools; and
 - training courses of technical personnel (overseas and local)should be set up to improve its efficiency and outputs;
- 2) Identification of a suitable "Chief Engineer" (Grade : Head/Director) with respective qualifications (see Annex 7.8), to fill this vacant post soon;
- 3) To overcome the complete absence of "middle-managers" and supervisors (Technical Officers, Chargehands), necessary actions are soon required;
- 4) Experts and professionals are to be involved in the selection of suitable technical and clerical staff for the Engineering Division;

- 5) Maltese engineers and technicians have to be sent more frequent on training courses to suitable places overseas (e.g. Companies, Hospital-workshops, Engineering departments, etc.);
- 6) Since a good contact to foreign counterparts is a must for the efficiency at Maltese technical departments, Maltese local representatives should be sent regularly to Trade Fairs and Seminars/colloquia abroad;
- 7) Introduction of the preventive maintenance system on medical-electronics and laboratory equipment should materialise soon. Plenty of equipment in this field creates problems and breaks down only due to lack of such a preventive care;
- 8) The Engineering Division should be given all personnel and means to meet the requirements in conjunction with a preventive maintenance system such as skilled technicians, adequate stock of spare-parts and a functioning infrastructure;
- 9) The procurement of a personal computer system to handle more efficiently all office work, stock-movements, equipment history, work-requisitions, staff-records, etc. is to be considered in the near future.

6.3 Final remarks

As it can be seen out of this report, only few of the expected outputs could have been reached successfully.

Therefore and in order not to have invested all efforts by all concerned in vain, I highly recommend to continue this project by involvement of some or if possible all of the recommendations made above.

S. CHOCHOIEK

DATA PROCESSING

2nd Module (4th Year)

- 1) **MICROPROCESSOR FUNDAMENTALS**
Introduction to Microprocessor Systems
Number Systems
Software Fundamentals
- 2) **INTRODUCTION TO PROGRAMMING**
Using the Microprocessor Lab
Basic Software Concepts
Inside the Microprocessor
- 3) **MICROPROCESSOR SYSTEM HARDWARE**
Basic Hardware Concepts
Addressing Decoding
Memories and Peripherals
Control Circuits
- 4) **MICROPROCESSOR SOFTWARE**
Registers and Breakpoints
The 8085 Instruction Set
Software Design Techniques
Software Control of Peripherals
Number Representations and Algorithms
- 5) **DIGITAL INPUT AND OUTPUT**
Introduction
Digital Input and Output
Input and Output Techniques
Memory Mapped Input and Output Ports
Input and Output Mapped Input and Output Ports
Programmable Input and Output Ports
Handshake Control
Port Initialisation
- 6) **ANALOGUE INPUT AND OUTPUT**
DAC
ADC
Interrupts

PRACTICAL WORK: Applying knowledge gained from theory and experiments.

LECTURE: MICROCOMPUTER TECHNIQUES

- BASIC TRAINING -

SYLLABUS

Lecturer: Dipl.-Ing. S. Chochoiek, U.N. Expert

Time required: 34 lectures, 90 minutes duration each
Place : Technical Institute, Corradine Hill, Paola
Start : Monday, 18th November 1985
End : 3rd April 1986
Time : From 2:15 p.m. to 3:45 p.m.
Days : Every Monday and Thursday

1. INTRODUCTION

2. COMPUTER ARITHMETIC

- 2.1 Binary numbers
- 2.2 Hexadecimal numbers
- 2.3 Nibbles, bytes and words
- 2.4 Binary arithmetic
- 2.5 Representation of positive and negative numbers in binary
- 2.6 Alphanumeric codes (e.g. ASCII)

3. LOGIC DEVICES, CIRCUITS, OPERATIONS

- 3.1 Introduction
- 3.2 Basic combinational logic systems
- 3.3 Examples of combinational logic systems
- 3.4 Tri-state gates
- 3.5 Flip flop types
- 3.6 Counters
- 3.7 Shift registers
- 3.8 Parallel/Serial adder circuits

4. MICROPROCESSOR ARCHITECTURE AND SYSTEMS OPERATION

- 4.1 Introduction
- 4.2 Architecture of a basic microprocessor
- 4.3 General concepts (memory, I/O ports, buses)
- 4.4 Microprocessor internal architecture (e.g. Z80)
- 4.5 Microprocessor "Fetch-Decode-Execute" cycle
- 4.6 I/O techniques
- 4.7 I/O control (software interrupt)
- 4.8 Dedicated PIO-chip
- 4.9 Tests and fault finding devices

5. MICROPROCESSOR PROGRAMMING

6. PERIPHERAL EQUIPMENT

- 6.1 Magnetic tape recorder
- 6.2 Floppy disc
- 6.3 IEEE 488 bus
- 6.4 RS232C serial interface
- 6.5 A/D - D/A converters

01-01-1983

TOOLS

No.	CODE	ITEM	LOCATION	STOCK	MIN.L	USED	PRICE/LR
1	TO	WITCH SET. 3-3.	BENCH	5	0	0	0.73
2	TO	A.C. TESTER	BENCH	5	0	0	0.00
3	TO	180/4.5mm SC.D	BENCH	4	0	0	0.81
4	TO	150/6mm SC.DRV	BENCH	4	0	0	1.04
5	TO	175/8mm SC.DRV	BENCH	4	0	0	1.08
6	TO	PHI.GR.0/60	BENCH	4	0	0	0.65
7	TO	PHI.GR.1/80	BENCH	4	0	0	0.73
8	TO	PHI.GR.2/100	BENCH	4	0	0	0.97
9	TO	PHI.GR.3/150	BENCH	4	0	0	2.21
10	TO	PHI.GR.4/200	BENCH	4	0	0	2.66
11	TO	PL.COMB.160mm	BENCH	4	0	0	1.57
12	TO	L/NOSE 200mm	BENCH	4	0	0	2.54
13	TO	S/CUT.145mm	BENCH	4	0	0	1.76
14	TO	STRIP.0.2-6mm	BENCH	4	0	0	2.65
15	TO	ADJ/KIT 1-180	BENCH	4	0	0	3.89
16	TO	SOLDER/S.WTCP	BENCH	4	0	0	23.35
17	TO	COMB/SCIS.	BENCH	4	0	0	1.22
18	TO	POINT/CUTTER	BENCH	4	0	0	3.86
19	TO	ANGLE 3-215-1	BENCH	4	0	0	3.27
20	TO	TWEEZER 5-117	BENCH	4	0	0	0.70
21	TO	TWEEZER 5-121	BENCH	4	0	0	0.47
22	TO/T	VICE (BLUE)	BENCH A	1	1	0	7.98
23	TO/T	VICE 9-251/2	BENCH	4	2	0	23.04
24	TO	DES/PUMP.	BENCH	5	0	0	3.68
25	TO	FILE SET	BENCH	5	0	0	1.16
26	TO	SLIDE CALIPER	DR.20	1	0	0	7.17
27	TO	R/METER 0-15mm	DR.20	1	0	0	4.83
28	TO	NUT SET 4-19mm	CU.1	1	0	0	2.48
29	TO	ANGLE 5mm	DR.20	1	0	0	0.33
30	TO	ANGLE 6mm	DR.20	1	0	0	0.38
31	TO	DRILLER SET	CU.1	1	0	0	15.12
32	TO	DRILL/S 1-10mm	DR.20	1	0	0	3.90
33	TO	P/HANDRILL	CU.1	1	0	0	26.97
34	TO	SET TAP M3	DR.21	3	0	0	1.28
35	TO	SET TAP M4	DR.21	2	0	0	1.46
36	TO	SET TAP M5	DR.21	1	0	0	1.44
37	TO	DIESTOCK M3	DR.21	1	0	0	1.44
38	TO	DIESTOCK M4	DR.21	1	0	0	1.44
39	TO	DIESTOCK M5	DR.21	1	0	0	1.44
40	TO	CENTRE PUNCH	DR.21	1	0	0	0.50
41	TO	HAMMER 200g	DR.21	1	0	0	0.71
42	TO	HANDSAW/S	DR.21	2	0	0	0.50
43	TO	W/PUMP PLIER/S	DR.21	1	0	0	2.06
44	TO	W/PUMP FLIER/L	DR.21	1	0	0	2.35
45	TO	TWEEZER.5-115.	DR.20	1	0	0	2.92
46	TO	HEAT GUN 333W	CU.1	1	0	0	60.05
47	TO	O/IRON 0.160W	DR.20	1	0	0	7.84
48	TO	S/IRON 100W	CU.1	1	0	0	4.81
49	TO	DRILL/MILL/M.	BENCH	1	0	0	26.77
50	TO	180/3.5mm SC.D	BENCH	10	0	0	0.81
51	TO	S/WRENCH SET	CU.1	1	0	0	6.24

Equipment used for repair

52	TO	TIN SNIPER/A	DR.20	1	0	0	1.68
53	TO	SET SC/DRIVERS	BENCH H	4	0	1	8.89
54	TO	PHILIPS SET	BENCH A	4	0	0	9.04
55	TO	ANGLE MIRROR	DR.21	1	0	0	0.99
56	TO	S/IRON 25W	BENCH A	1	0	0	3.85
57	TO	ALIGN. TOOL	BENCH H	4	0	0	1.85
58	TO	JOLLY S/SUCKER	BENCH A	1	0	0	11.50
59	TO	COMB/SCISSORS	BENCH A	1	0	0	5.15
60	TO	COMB/PLIER	BENCH A	1	0	0	0.80
61	TO	LONG NOSE PL.	BENCH A	1	0	0	0.85
62	TO	A/WIRE STRIP.	BENCH A	1	0	0	4.50
63	TO	IC INSERTER40w	DR.11	1	1	0	5.10
64	TO	TWEEZER POINT.	BENCH A	1	0	0	3.28
65	TO	TWEEZER FLAT	BENCH A	1	0	0	3.10
66	TO	SIDE CUTTER	BENCH A	1	0	0	6.37
67	TO	ANGLE FL.	BENCH A	1	0	0	3.37
68	TC	SIDE CUTTER	BENCH A	1	0	0	2.69
69	TO	ALLEN KEYS(MET	DR.21	10	0	0	4.83
70	TO	ALLEN KEY(BR)	DR.21	8	0	0	1.44
71	TO	IC EXTR TYP 40	DR.11	1	1	0	7.20
72	TC	CROC.CLIP 4mm	DR.13	32	0	0	0.09
73	TC	IC CLIP RED	DR.13	19	0	1	0.16
74	TC	IC CLIP GREEN	DR.13	21	0	0	0.16
75	TC	IC CLIP BLUE	DR.13	19	0	1	0.16
76	TC	IC CLIP YELLOW	DR.13	20	0	1	0.16
77	TC	RED SELF CLAMP	DR.13	17	0	3	0.76
78	TC	BK. SELF CLAMP	DR.13	18	0	2	0.76
79	TC	RED POINTED	DR.13	16	0	4	0.23
80	TC	BLACK POINTED	DR.13	20	0	0	0.23
81	TO	A-SCHUB GUN	DR. 20	1	1	0	1.32
82	TO/T	POP RIVITER	DR.20	1	1	0	7.92
83	TO	BELZER8000 9pc	DR.23	1	0	0	10.44
84	TC	40PIN IC TEST	DR.13	1	0	0	13.45
85	TC	20PIN IC TEST	DR.13	1	0	0	7.40
86	TO	CRIMP	DR.23	1	1	0	2.85

EQUIPMENT
01-01-1983

Card no. : EQUIP 1
Name of equipment : WAVE ANALYSER
Name of manufacturer : AIRMEC
Inventory no. : AEMU 1a
Model no. : TYPE 853
Serial no. : 2581
Manual no. : MAN 15
Location : ES2
Address of manufacturer : HIGH WYCOMBE BUCKINGHAMSHIRE U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR. E. STOEHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 2
Name of equipment : WAVE ANALYSER
Name of manufacturer : AIRMEC
Inventory no. : AEMU 1b
Model no. : TYPE 248
Serial no. : 1707
Manual no. : MAN 16
Location : ES2
Address of manufacturer : HIGH WYCOMBE BUCKINGHAMSHIRE U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR. E. STOEHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 3
Name of equipment : STANDARD SIGNAL GENERATOR
Name of manufacturer : RHOE AND SCHWARZ
Inventory no. : AEMU 3
Model no. : SMAF BN41404
Serial no. : FTZ NR4642/11
Manual no. : MAN 19
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR. E. STOEHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 4
Name of equipment : OSCILLOSCOPE
Name of manufacturer : PEN
Inventory no. : AEMU 4
Model no. : TYPE 1332
Serial no. : 125
Manual no. : MAN 21
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR.E. STOHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 5
Name of equipment : OSCILLATOR
Name of manufacturer : MARCONI INSTRUMENTS
Inventory no. : AEMU 5
Model no. : TYPE TF1246
Serial no. : 53789/12
Manual no. : MAN 18
Location : ES2
Address of manufacturer : ST. ABANS HERTFORDSHIRE U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR.E. STOHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 6
Name of equipment : ADJUSTABLE STABILIZER
Name of manufacturer : ADVANCE COMPONENTS LTD.
Inventory no. : AEMU 6
Model no. : TYPE V5072
Serial no. : 175
Manual no. :
Location : ES1
Address of manufacturer : BACK RD. WALTHAMSTOW LONDON U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR.E. STOHR
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 7
Name of equipment : TEST SET (INSULATION)
Name of manufacturer : TELEMECHANICS LTD.
Inventory no. : AEMU 7
Model no. : TYPE 115
Serial no. : 0194
Manual no. :
Date equipment was scrapped:

Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned : 2/1/85
Date when last faulty :
Last reported fault :
Serviced by : MR.E. STOENF
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 8
Name of equipment : POWER SUPPLY UNIT
Name of manufacturer : A.E.M.U.
Inventory no. : AEMU 9a-b
Model no. : PSU 01/85
Serial no. : 001-002
Manual no. : MAN 17
Location : ES3
Address of manufacturer : CORRADINO HILL PAOLA
Date of delivery : 1/3/85
Price : Lm PROJECT
Date last aligned : 1/3/85
Date when last faulty :
Last reported fault :
Serviced by : J.BORG/D.FACE HURREL
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 9
Name of equipment : LOGIC ANALYSER
Name of manufacturer : THURLBY
Inventory no. : AEMU 11
-Model no. : LA160
Serial no. : P0159-A
Manual no. : MAN 14
Location : ES4
Address of manufacturer : NEW RD. ST.IVES HUNTINGDON CAMBS U.K.
Date of delivery : 1/2/85
Price : Lm 253
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : AUDIOWORKS LTD.
Tel. no. of local agent : 512889
Date equipment was scrapped:

Card no. : EQUIP 10
Name of equipment : 100MHz STORAGE OSCILLOSCOPE
Name of manufacturer : PHILLIPS
Inventory no. : AEMU 12
Model no. : PM 3266
Serial no. : DQ-06-01841
Manual no. : MAN 7
-Location : ES4
Address of manufacturer : EINDHOVEN THE NETHERLANDS
Date of delivery : 1/2/85
Price : Lm 3154
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : 282 REPUBLIC ST. COLLETT-
Tel. no. of local agent : 624313

date equipment was scrapped:

Card no. : EQUIP 11
Name of equipment : LCR DATA BRIDGE
Name of manufacturer : RACAL-DANA
Inventory no. : AEMU 13
Model no. : 9341
Serial no. : 1508
Manual no. : MAN 8
Location : ES4
Address of manufacturer : WINSOR BERKSHIRE U.K.
Date of delivery : 4/3/85
Price : Lm 435
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 12
Name of equipment : DIGITAL METERS
Name of manufacturer : BECKMAN
Inventory no. : AEMU17a-f
Model no. : T1008
Serial no. :
Manual no. : MAN 4
Location : ES2
Address of manufacturer : AVENUE HAMOIR 1180 BRUSSELS BELGIUM
Date of delivery : 13/3/85
Price : Lm 33 ea.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : FABIAN ENTERPRISES 20 MSIDA RD. GZIRA
Tel. no. of local agent : 513283
Date equipment was scrapped:

Card no. : EQUIP 13
Name of equipment : CURRENT CHECKER
Name of manufacturer : R.S.
Inventory no. : AEMU 21
Model no. :
Serial no. : 424-541
Manual no. :
Location : ES4
Address of manufacturer : PO BOX EPWORTH STR. LONDON U.K.
Date of delivery : 4/4/85
Price : Lm 24.20
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : FABIAN ENTERPRISES 20 MSIDA RD. GZIRA
Tel. no. of local agent : 513283
Date equipment was scrapped:

Card no. : EQUIP 14
Name of equipment : DUAL POWER SUPPLIES 5A/30V
Name of manufacturer : RIM ELECTRONICS
Inventory no. : AEMU22a-d
Model no. : NT605
Serial no. :
Manual no. : MAN 3

Location : ES4
Address of manufacturer : BAYERSTR. 25 8000 MUNCHEN
Date of delivery : 9/4/85
Price : Lm 163.25 e
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 15
Name of equipment : SIGNAL GENERATOR
Name of manufacturer : DIGITAL TECHNIK
Inventory no. : AEMU 15
Model no. : SGB01
Serial no. : 40725
Manual no. : MAN 11
Location : ES4
Address of manufacturer : ING. RUDOLF HERZOG KIRCHSTRASSE 4 3005 HEMMINGEN
Date of delivery : 9/4/85
Price : Lm 152
Date last aligned :
Date when last faulty : 28/6/85
Last reported fault : LOW TTL OUTPUT
Serviced by : D. PACE HURRELL
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 16
Name of equipment : LOGIC PROBE
Name of manufacturer : ESCORT
Inventory no. : AEMU 16
Model no. : ELP 800
Serial no. :
Manual no. :
Location : ES4
Address of manufacturer :
Date of delivery : 9/4/85
Price : Lm 42.70
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 17
Name of equipment : HP 150 COMPUTER SYSTEM
Name of manufacturer : HEWLETT PACKARD
Inventory no. : AEMU 24
Model no. :
Serial no. :
Manual no. : COM3-9(M12
Location : OFFICE
Address of manufacturer : 1180 AMSTELVEEN THE NETHERLANDS
Date of delivery : 11/4/85
Price : Lm 3954
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : PHILIP TOLEDO NOTABILE RG. MRIEHEL

Tel. no. of local agent : 44 7
Date equipment was scrapped:

Card no. : EQUIP 18
Name of equipment : OSCILLOSCOPE 60 MHz
Name of manufacturer : HAMEG
Inventory no. : AEMU19a-b
Model no. : HM605
Serial no. : 3364/3366
Manual no. : MAN 22
Location : ES4
Address of manufacturer : 74-78 COLLINGDON STR. LUTON BEDFORDSHIRE U.K.
Date of delivery : 24/4/85
Price : Lm 273
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 19
Name of equipment : FREQUENCY COUNTER & PRESCALER
Name of manufacturer : THANDER
Inventory no. : AEMU 18
Model no. : TF200/TP600
Serial no. : 078375/076490
Manual no. : MAN 5
Location : ES4
Address of manufacturer : LONDON RD. ST. IVES HUNTINGDON U.K.
Date of delivery : 24/4/85
Price : Lm 139
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : PANTA LESCO BIRKIRKARA RD. MSIDA
Tel. no. of local agent : 41361
Date equipment was scrapped:

Card no. : EQUIP 20
Name of equipment : OSCILLOSCOPE 5MHz
Name of manufacturer : A.E.M.U.
Inventory no. : AEMU 8
Model no. : OSC01
Serial no. : 003/85
Manual no. :
Location : ES1
Address of manufacturer : CORRADINO HILL PAOLA
Date of delivery : 28/2/85
Price : Lm PROJECT
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by : J.BORG/M.LIA
Address of local agent : A.E.M.U. CORRADINO HILL PAOLA
Tel. no. of local agent : 622740
Date equipment was scrapped:

Card no. : EQUIP 21
Name of equipment : SIGNAL GENERATOR
Name of manufacturer : HEWLETT PACKARD
Inventory no. : AEMU 23
Model no. : HP 8656B
Serial no. : 251401470

Manual no. : Form 1-2
Location : ES3
Address of manufacturer : 1180 AMSTELVEEN THE NETHERLANDS
Date of delivery : 25/6/85
Price : Lm 3161
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : PHILIP TOLEDO NOTABILE RD. MRIEHEL
Tel. no. of local agent : 44747
Date equipment was scrapped:

Card no. : EQUIP 22
Name of equipment : TRANSISTOR TESTER
Name of manufacturer : A.E.M.U.
Inventory no. : AEMU 10
Model no. : TT01
Serial no. : 004/85
Manual no. :
Location : E64
Address of manufacturer : CORRADINO HILL PAOLA
Date of delivery : 4/7/85
Price : Lm PROJECT
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by : C.AGIUS/J.BORG
Address of local agent : A.E.M.U. CORRADINO HILL PAOLA
Tel. no. of local agent : 622740
Date equipment was scrapped:

Card no. : EQUIP 23
Name of equipment : U.V. EXPOSURE UNIT
Name of manufacturer : I.S.E.L.
Inventory no. : AEMU 26
Model no. : TYPE 1910
Serial no. :
Manual no. :
Location : LAB
Address of manufacturer : WEST GERMANY
Date of delivery : 10/7/85
Price : Lm 17.07
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 24
Name of equipment : ETCHING MACHINE
Name of manufacturer : I.S.E.L.
Inventory no. : AEMU 27
Model no. : TYPE 2020
Serial no. :
Manual no. :
Location : LAB
Address of manufacturer : WEST GERMANY
Date of delivery : 6/6/85
Price : Lm 52.35
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :

Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 25
Name of equipment : DRILLING MACHINE WITH VARIABLE TRANSFORMER
Name of manufacturer :
Inventory no. : AEMU 28
Model no. : MAXICRAFT JUPIT
Serial no. :
Manual no. :
Location : LAB
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm 39.82
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 26
Name of equipment : VIDEO RECIEVER
Name of manufacturer : A.E.M.U.
Inventory no. : AEMU 25
Model no. :
Serial no. :
Manual no. :
Location :
Address of manufacturer : CORRADINO HILL PAOLA
Date of delivery : 14/11/85
Price : Lm PROJECT
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : A.E.M.U. CORRADINO HILL PAOLA
Tel. no. of local agent : 622740
Date equipment was scrapped:

Card no. : EQUIP 27
Name of equipment : CALIBRATOR AC/DC
Name of manufacturer : TIME ELECTRONICS
Inventory no. : AEMU 20
Model no. : 9822
Serial no. : 1083D5
Manual no. : MAN 24
Location :
Address of manufacturer : BOTANY INDUSTRIAL ESTATE TONBRIDGE KENT U.K.
Date of delivery : 29/8/85
Price : Lm 4207
Date last aligned :
Date when last faulty : 8/1/85
Last reported fault : OF ERROR ON INITIALI
Serviced by : C.AGIUS
Address of local agent : AUDIOWORKS LTD 138 MANUEL DIMECH STF. SLIEMA
Tel. no. of local agent : 512889
Date equipment was scrapped:

Card no. : EQUIP 28
Name of equipment : WATT METER (RF BROADBAND)
Name of manufacturer : TELEWAVE INC
Inventory no. : AEMU 14
Model no. : TYPE 44A

Serial no. : 7395
Manual no. : MAN 9
Location : ES2
Address of manufacturer : MOUNTAIN VIEW CALIFORNIA U.S.A.
Date of delivery : 4/3/85
Price : Lm 258
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 29
Name of equipment : RECIEVER PANAROMIC
Name of manufacturer :
Inventory no. : AEMU 2
Model no. : 568
Serial no. :
Manual no. :
Location : ES2
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 30
Name of equipment : MULTIMETER
Name of manufacturer : MULTAVI
Inventory no. : AEMU 29
Model no. :
Serial no. : 204711
Manual no. :
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 31
Name of equipment : OHMETER
Name of manufacturer : MONAVI OI
Inventory no. : AEMU 30
Model no. :
Serial no. : 404904
Manual no. :
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :

Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

- Card no. : EQUIP 32
Name of equipment : OHMMETER
Name of manufacturer :
- Inventory no. : AEMU 31
Model no. :
Serial no. : 1805411
Manual no. :
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 33
Name of equipment : MULTIAMPERE METER DC
Name of manufacturer : ERNEST TURNER
Inventory no. : AEMU 32
Model no. :
Serial no. : 72400
Manual no. :
Location : ES1
Address of manufacturer : HIGH WYCOMBE U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 34
Name of equipment : VOLTMETER
Name of manufacturer :
Inventory no. : AEMU 33
Model no. :
Serial no. : 947185
Manual no. :
Location : ES1
Address of manufacturer :
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 35
Name of equipment : AMPERE METER
Name of manufacturer : SANGAMO WESTERN LTD
Inventory no. : AEMU 34

Model no. :
Serial no. : 10A/13382
Manual no. :
Location : ES1
Address of manufacturer : ENFIELD MIDDLESEX U.K.
Date of delivery : 6/6/85
Price : Lm N.A.
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent :
Tel. no. of local agent :
Date equipment was scrapped:

Card no. : EQUIP 36
Name of equipment : INSULATION TESTER YF-502
Name of manufacturer : YU FUNG
Inventory no. : AEMU 92
Model no. : YF-502
Serial no. :
Manual no. :
Location : LAB
Address of manufacturer : TAIWAN
Date of delivery : 3-10-86
Price : Lm 45
Date last aligned :
Date when last faulty :
Last reported fault :
Serviced by :
Address of local agent : LOUIS FILLETTI - VALLETTA
Tel. no. of local agent :
Date equipment was scrapped:

From September 1984 to December 1984

ITEM NO.	EQUIPMENT	QUANTITY
1.	Underwater Camera	1
2.	Video Recorder JVC HR 7660MS	1
3.	Electrical installation in workbenches	6
4.	Electrical installation in workshop	1
5.	Aerial installation in workshop	1
6.	HF Generator Marconi	1
7.	Test lead production	1
8.	RF Generator SMAF	1
9.	Wavetec Testreceiver	1
10.	Wavetec Testreceiver AM	1
11.	Volstat Insulation Transformer	1
12.	Oscilloscope PEK	1
13.	High voltage Power supply	1
14.	Video Recorder SLC 6 SONY	1
15.	Video Switchbox	1
16.	Video Recorder JVC Portable	1
17.	Video Recorder JVC HR 7700e	1
18.	Sono graph klein Enterprises	1
19.	T.V. set JVC	1
20.	Tape Recorder PHILIPS	1
21.	T.V. set ITT	1

From January 1985 to December 1985

ITEM NO.	EQUIPMENT	QUANTITY
1.	Dinner Switch	1
2.	Public Address Amp.	1
3.	Tape Recorder TX 241	1
4.	CTV Grundig	1
5.	OTV Grundig	2
6.	CTV Grundig	1
7.	Conductivity Test Sets	1
8.	Public Address System	1
9.	VCR SLC - 6BS	1
10.	VCR JVC	1
11.	Oscilloscope Philips	1
12.	VCR HR 7700	1
13.	Wordreceiver Sony ICF 2001	1
14.	Power Amplifier Philips	1
15.	Stereo Cassette Tape Deck	1
16.	Slide Projector	1
17.	PUNDIT	1
18.	VCR T9ME	1
19.	Sony Tape Recorder	1
20.	Intercom System	1
21.	Sequence Controller	1
22.	Slide Projector	1
23.	Double Beam Oscilloscope	1
24.	Glucose Tester	1
25.	Reel to Reel Tape Recorder	2
26.	Ultrasound Scanner	1
27.	VHF FM Transceiver	1
28.	Telequipment Oscilloscope	4
29.	Computer ZX Spectrum	1
30.	Computer Commodore C64	1
31.	Orion CTV	1
32.	Philips Double Sound Machine	1
33.	Telecom Ultrasound Scanner	1

(cont.)

ITEM NO.	EQUIPMENT	QUANTITY
34.	Video Recorder SABA	1
35.	Light Display	1
36.	Oscilloscope D67-D65	2
37.	Orion Analyzes	1
38.	Closed COT T.V. Camera	2
39.	Programmable Clock	1
40.	Cassette Radio Philips	1
41.	VCR Sony SL-8080	1
42.	Abbott Analyser	1
43.	Power Supply	1
44.	VCR JVC CR 8200	1
45.	Sodium/Potassium Analyzes	1
46.	Orion CTV Set	1
47.	Portable T.V. Sharp	1
48.	Gamma Counter	1
49.	Hantley Oscilloscope	1
50.	Marconi AM Signal Generator	3
51.	VHF - FM Transceivers	1
52.	Telephone-Answering Machine	1
53.	Golfball Electric Typ.	1

From January 1986 to August 1986

ITEM NO.	EQUIPMENT	QUANTITY
1.	Power Supply & Charger (Bosch)	1
2.	Ultrasound Telescan Unit	1
3.	AM/FM Radio Telephone Test Set TP 2952	1
4.	Clamp Testers	2
5.	Headphones	22
6.	Pocket receivers	26
7.	Video Camera	1
8.	Portable Video Recorder	1
9.	Projector (Missouri)	1
10.	Portable VCR	1
11.	Gamma Counter	1
12.	Centrifuge	1
13.	Multi Tester	1
14.	Water Level Cut-Out	1
15.	Amplifier (Tannoy)	2
16.	Hand Held Portable Radios	3
17.	Explosive Detector Type PD2	1
18.	Clamp Tester	1
19.	Hand Held Portable Radios	2
20.	VCR (JVC)	1
21.	Explosive Detector Type 4700	1
22.	VHF - FM Transceiver	1
23.	Explosive Detector Type PD2	2



Mechanical & Electrical Engineering Section

Establishments Division

Castille — Valletta — Malta

Telex No. 1409 MODMLT MT

Tel. 25231, 24901

20 May 1986

**LIST OF GOVERNMENT DEPARTMENTS AND PARASTATAL CORPORATIONS
ENTITLED TO ASSIGN WORK TO ADVANCED ELECTRONIC MAINTENANCE UNIT**

Civil Aviation
Computer Centre
Law Courts
Audit Office
Customs Department
Education Department
Electoral Office
Health Department
Department of Industry
Department of Trade
Department of Inland Revenue
Housing Department
Department of Labour and Emigration
Department of Land
Department of Public Libraries
Lotto Department
Milk Marketing Department
Police Department
Port Department
Post Department
Department of Social Services
Public Registry
Central Office of Statistics

Water Works Department

Public Works Department

Banks

Wireless Office

Enemalta

Telemalta

Sea Malta

Malta Drydocks

Proposals to reorganize/organize the A.E.M.U. in future:

1. Personnel:

a. During the next four months:

- 4 engineers (B Sc level)
 - 1 specialised in vidoc equipment
 - 1 specialised in digital electronics
 - 1 specialised in electronics (telecom)
 - 1 specialised in electronics and mechanics
- 4 technicians
- 3 students to be appointed

Divided in groups with two men (i.e. 1 engineer with 1 technician) working on 6 work stations.

b. From September 1986 onwards:

- 1 engineer being selected as head of the A.E.M.U. (preferably, one with experience in a wide field).
- 1 engineer being specialised in a different field, as deputy of the head of the A.E.M.U. (both of them to be selected out of the four engineers mentioned above).
- 10 technicians (some of them already selected, others being selected out of the above-mentioned).

c. Employed from now onwards:

- 1 Technical Clerk
- 1 Secretary/Typist
- 1 Cleaner
- Messenger used as driver

2. Training of Staff

- a. The ways and means how to train the staff (engineers, technicians, students, technical clerk, secretary) is in the responsibility of the U.N. Experts. They act as Head of the A.E.M.U. till one of the Maltese engineers will be selected.

2.

2. Training of Staff contd.

- b. With the help of the Maltese engineers, special lectures will be offered for technicians and students from different Government Departments.

The subjects can be: videorecorder techniques
digital electronics and microcomputers
calibration procedures
repairs and service on electrical equipment, etc.

The lectures have to refer to practical applications if possible, technicians and students are to be trained practically within the lectures on site.

3. Workshop/Office/Environment

- a. To gain more space for workshops and offices or study areas, a drawing room next to the A.E.M.U. has to be included in the A.E.M.U. area.
- b. The technicians' workshop close to the drawing room can be used as A.E.M.U. store.
- c. Additional inventory has to be procured (according to requirements).
- d. One spectrum-analyser has to be procured if the one donated by M.B.B., does not fulfil our requirements.
- e. Some of the donated equipment from M.B.B. should be kept at the Unit. Mainly, this equipment should be given to departments where most urgently required (i.e. Health Department, E & M Division).
- f. A photocopier of high quality has to be procured.
- g. A type-writing machine of a high standard (i.e. IBM - ball) is required.

3.

4. Administration

4.1 Requisitions for repairs/service by A.E.M.U.

- a. All requisitions are to be forwarded in writing to the Head of A.E.M.U. (or officer in charge). He decides which action to take.
- b. In cases, if Head of A.E.M.U. is not in a position to decide, he refer to OPM for final decision.

4.2 Procurement of spare-parts/components

In general, within the responsibility of the A.E.M.U.:

- a. Special funds/budget has to be made available for urgent payments (i.e. prepaid cheques, L.P.O.S.).
- b. A.E.M.U. decides from where to buy according to proforma invoice (or catalogue-price) and quality of the parts required.
- c. A.E.M.U. keeps all forms and records. Procedures for purchase of components can be aided by the HP-computer system.
- d. A.E.M.U. has to have direct access to TELEX facilities either to ask for technical information or to order spare-parts.
- e. It is necessary that the telephone at the A.E.M.U. can be used for overseas phone calls.

4.3 A.E.M.U. Stock


A technical clerk should be introduced to deal with the management of the stock. He should keep all records (computer-discs, proformas, bills, etc.) and report regularly to the Head of A.E.M.U. the actual state (whether components have to be purchased and whether all equipment/tools, etc. are in good working order).

He will be the only one dealing with the stock. No technicians, students and even engineers are entitled to get components out of the stock, unless the technical clerk has booked the request in the computer accordingly.

4.

The above-mentioned is to be considered as a proposal for the next months. However, to get the unit running efficiently, immediate action on this matter has to be taken. Everyone involved in the set-up of the A.E.M.U. should be open for further discussions but flexible enough to get the most benefit for the unit.

Therefore, the experts' advices should be transferred into practice whenever possible.



S Chochoiek, Dipl.-Ing.
U.N. Expert

Malta, 21st April 1986.

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
07.45	Group I-IV Practical Training	Group I-II Practical Training	Group I-II Practical Training	Group III-IV Practical Training	Group III-IV Practical Training
	<u>OR</u>				
12.30	According to requests: Current sets	Group III-IV Current sets	Group III-IV Current sets	Group I-II Current sets	Group I-II Current sets
----- LUNCH BREAK -----					
13.15 ADMINISTRATION				
14.30	LECTURE: 'MICROCOMPUTER TECHNIQUES" by	LECTURE: 'ANALOG TECHNIQUES" by	LECTURE: 'ANALOG TECHNIQUES" by	LECTURE: 'MICROCOMPUTER TECHNIQUES" by	TEST
16.00	Mr. Chochoiek	Mr. Stoehr	Mr. Stoehr	Mr. Chochoiek	All groups cleaning of workshop
17.15	----- PROCESSING OF LECTURES -----				

Tel. 622740

ADVANCED ELECTRONICS

MAINTENANCE UNIT

Corradino Hill,

Paola — Malta.



Our Ref.

Your Ref.

12th February 1986

JOB DESCRIPTION

- Post title : HOSPITAL CHIEF ENGINEER
- Duty station : Karin Grech Hospital, G'Mangia
- Grade : Director/Head
- Duties : - day-to-day running of Hospital Engineering Division;
- supervise a staff of estimated 150 technicians, fitters and engineers in the electrical, mechanical and electronical field;
- organization of the preventive maintenance system for the whole hospital;
- supervision of training and selection of personnel in agreement with the Chief Government Medical Officer;
- direct responsibility to the Chief Government Medical Officer;
- supervision of tender actions from a technical point of view;
- control over supply of all spares required for repairs and maintenance on all hospital equipment.
- Qualifications : M.Sc or B.Sc degree with a minimum of five years of practical experience with hospital equipment. Knowledge about physiological or medical principles are considered an asset.
- Training : By the Department of Health: on-the-job training at least for a period of six months under the guidance of an U.N. Expert. Another six months additional training at the Medical School (University of Malta) to gain basic knowhow on medical aspects.

Head,
Mechanical and Electrical Section,
Establishments Division,
Office of the Prime Minister

REQUEST FOR SERVICES OF ADVANCED
ELECTRONICS MAINTENANCE UNIT

Department: _____

Section: _____

Nature of Service Required: _____

Details of Equipment: _____

Priority: _____

Official Responsible for Equipment:

Name Telephone No.

Signature of Head of Department

Date

Roll No. _____

~~RIKMED~~ ELECTRICIAN, ~~ENG~~ DEPT

Date: _____

ST. LUKE'S HOSPITAL, G'MANGIA

WORK SHEET

Identification No.: _____

Name of Equipment: _____

Type of Equipment: _____

Model No.: _____ Serial No.: _____

LOCATION: _____ Tel. No.: _____

	<u>CAL. WEEK</u>	<u>COLOUR</u>
Date of next planned CHECK UP		
Date of next planned MAINTENANCE		
Date of next planned CALIBRATION		

FAULT(S) REPORTED: _____

ACTION TAKEN/SHORT DESCRIPTION OF WORK CARRIED OUT: _____

QUOTE DH/MS FILE NO. FOR UNIT AWAITING SPARE PARTS 'DH/MS

COSTS FOR SPARE PARTS/REPAIRS: _____

NAME OF SUPPLIER: _____

DATE OF COMPLETION OF REPAIRS: _____

NAME(S) OF TECHNICIANS ASSIGNED ON THE REPAIRS: (BLOCK LETTERS)

SIGNATURE(S)

BIOMEDICAL ELECTRONICS ENGINEERING SECTION	
CAL.	DATE
WANT	REF.NO.
REP.	CHECKED BY

BIOMEDICAL ELECTRONICS ENGINEERING SECTION	
CAL.	DATE
WANT	REF.NO.
REP.	CHECKED BY

BIOMEDICAL ELECTRONICS ENGINEERING SECTION	
CAL.	DATE
WANT	REF.NO.
REP.	CHECKED BY

BIOMEDICAL ELECTRONICS ENGINEERING SECTION	
CAL.	DATE
WANT	REF.NO.
REP.	CHECKED BY

The above stickers for the "Preventive Maintenance System" are placed in a descending order of priority, that is, RED - highest, GREEN - lowest.