

**EVALUATION AND RECOMMENDATIONS FOR CONTINUED SUPPORT
OF THE
REPAIR AND MAINTENANCE CENTERS FOR SCIENTIFIC EQUIPMENT
AT
ALEXANDRIA, TANTA, CAIRO, EL-MINIA AND ASSUT UNIVERSITIES**

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INTRODUCTION

The purpose of this report is to assess the operation of the repair and maintenance centers at Alexandria, Tanta, Cairo, El-Minia and Assuit Universities which were developed during Phase I of the Instrument Technology Project. This evaluation is based on information obtained during numerous visits to these universities during the course of Phase I, evaluations of trainees at NIH, and a final site visit made in May 1982.

During Phase I of the project, BEIB worked with these universities to establish repair and maintenance centers for scientific equipment. This work fell into three major areas:

1. Development of physical plant-establishment of the necessary facilities for the centers and equipping them with tools, test equipment, replacement parts and technical literature.
2. Implementation of Center Management - development of a management manual for the operation of the centers, training of a center management personnel and establishment of a charter for the center.
3. Training of repair personnel.

Early in Phase I BEIB personnel evaluated the repair requirements of each university and purchased the necessary tools, test equipment, replacement parts and technical library. This material is presently in place at each university. BEIB also developed an administrative manual for the management of a repair and maintenance center, provided training in the management of the centers and worked with center and university administration in the development and implementation of a charter for the centers. Personnel from each of the centers traveled to BEIB and were trained in the repair and maintenance of scientific equipment. Of the twelve people trained at BEIB, only five are presently working in their university repair and maintenance centers. The remainder either did not return to their centers or left shortly after returning.

An overall evaluation of the program indicates that the centers are presently well equipped, have a management plan with varying support from the university administration, and with the exception of Assuit University do not have sufficient staff or meet even the minimum repair needs of their university.

Because of the lack of qualified repair specialists to staff these centers we would recommend as a priority goal of Phase II the development of a training center in Egypt for scientific equipment repair personnel. This center would provide training at a lower cost than training in the United States and would eliminate the temptation to trainees of not returning to Egypt after completing their training.

EVALUATION OF INDIVIDUAL CENTERS

In reviewing the operation of the individual centers and evaluating their potential for successfully meeting the repair needs of their universities, the following factors were considered:

1. **Administrative support:** Does the Center receive the necessary administrative support from the University to assure its proper operation? Examples of administrative support are evidenced by interest in and an understanding of the function of the center by university officials; approval of a charter for the center by the university; and the development of an incentive program for Center employees.
2. **Faculty support:** Is the faculty in favor of the establishment of a Repair and Maintenance Center and will they make use of the Center?
3. **Center staffing:** Does the Center have reasonably qualified repair personnel or is there a reasonable expectation of recruiting such personnel?
4. **Technical assistance:** The major portion of personnel available to staff the Centers are junior engineers who will require technical assistance in performing more difficult repairs. Does the Center have an experienced repair engineer available to provide technical assistance to junior personnel?

Alexandria University: The Center at Alexandria University is headed by Professor Hamdi. The Center presently has no full time staff. Two people were trained at NIH for the Center, one did not return to the University and the other returned to the university but was not assigned to the Center. Professor Hamdi is presently recruiting staff to work in the Center on a part-time basis. Full-time positions will be offered to those employees who prove themselves capable of successfully repairing scientific equipment. It is estimated that the center will require the equivalent of three full time electronic and two full-time electro-mechanical journeymen repair specialists.

Professor Hamdi has developed and is implementing a well thought out program for the development of the Alexandria Repair and Maintenance Center. This program has been approved by the university administration. During his stay at NIH, Professor Hamdi has demonstrated his capability to quickly and efficiently repair a wide variety of scientific instruments. This capability will permit him to both train new center personnel and provide technical assistance to the center staff. Because of his position in the faculty of Engineering and his history of previously providing repair assistance to faculty members, we feel that the center will be accepted and used by the university faculty. We recommend full support of the Alexandria center in Phase II of the project.

Tanta University: The Center at Tanta University is presently managed by Engineer Mohamed Abdu and is meeting about 15% of the repair and maintenance needs of the university. It is estimated that the center will need the equivalent of three full-time journeymen electronic repair specialists and two full-time journeymen electro-mechanical repair specialist.

Tanta University (cont): As with Alexandria Univeristy, Tanta University appears to have the necessary conditions for the development of a successful center. During his visit to NIH, Dr. Hassan Mustafa, the Vice-President of Tanta, met with Mr. Metz to discuss the operation of the center and expressed his desire to assist in the development of the Center. A separate budget and an incentive plan for Center employees has been established by the University.

During a previous visit to the University, Mr. Metz met with the chairmen of a number of departments to discuss the operation of the Repair and Maintenance Center and how it could best meet their needs. During these meetings they showed Mr. Metz numerous pieces of equipment in need of repair which they would like to have repaired by the Repair and Maintenance Center.

Engineer Mohamed Abdu, the Chief Engineer for the Center, demonstrated a potential to become a well qualified repair engineer during his training at NIH. Prior to coming to NIH he performed repairs in the faculty of Science and is known to many faculty members. In addition to Engineer Abdu, the center has a number of other technicians and engineers who have elementary to intermediate levels of repair skills.

Tanta University (cont): Based on the universities support of the Center, the willingness of faculty members to use the Center, Engineer Abdu's technical and administrative skills and the potential of the other Center personnel, we recommend continued full support of the Tanta University Center. Due to the fact that none of the members of the Center staff have extensive experience in the repair of scientific equipment, we would recommend that the University arrange for a consultant to be available to the center on a weekly basis to provide assistance in complex repairs.

Cairo University: The Repair and Maintenance Center at Cairo University is headed by Professor El-Sobki of the Faculty of Engineering, Electrical Department. Three engineers from the Repair and Maintenance Center were trained at NIH, one did not return to Egypt and the other two returned to the center but have subsequently left. The Repair and Maintenance Center presently has no experienced electronic repair personnel, one experienced electrical engineer (power) and no mechanical personnel. It is estimated that the Repair and Maintenance Center is capable of meeting little or none of the demand for electronic or mechanical repair and about 10% of the demand for electrical repair. The Repair and Maintenance Center would require the equivalent of about seven full time journeymen electronic repair specialists and four full time journeymen mechanical repair specialists to meet the repair needs of the university.

Cairo University (cont): The Center has been given a charter and a procedure has been established for paying incentives to its employees. Center employees have often been unsuccessful when attempting to solicit repair work from faculty members. These faculty members appear to prefer to have their repairs contracted out by the University to private sector companies. The Center does not have anyone available to provide technical assistance for difficult electronic repairs on a regular basis. We feel that part of the problem of attracting and keeping qualified personnel is the availability of numerous higher paying positions in the private sector in Cairo.

Based on our review of the Repair and Maintenance Center, we would recommend that the Center initially recruit and hire a senior repair engineer; two electronics engineer; and a mechanical engineer to be at the ITU. As the Center has received significant tools, test equipment, replacement parts during Phase I, it could become operational with a minimum cost of hiring those personnel. We believe that recruiting the senior repair engineer is essential to the operation of the Center and that no significant additional resources be allocated to the center until he is hired.

Cairo University Repair and Fabrication Center: A repair and fabrication center managed by Engineer Hussein Eissa, is located in the Physics Department of the Faculty of Science. The Repair and Fabrication Center appears to be operating very successfully with a very minimal amount of resources and is well thought of by members of the faculty of Science.

Cairo University Repair and Fabrication Center (cont): Based on this Center's success, we would recommend supporting it immediately during Phase II with test equipment, supplies, training and technical assistance. After a period of one year both centers at Cairo University would be evaluated and a decision be made by the Academy as to which, if any, of the centers should continue to receive support.

El-Minia University: The center at El-Minia is directed by Dr. Kamal Abdul Hadi, Dean of the Faculty of Science. The one engineer trained at NIH has left the center. There were no other engineers other than Rokaya at the center, leaving the center without a staff. The Center will require the equivalent of two full time journeymen electronic repair specialists and two full time journeymen electro-mechanical repair specialists to meet the repair needs of the University.

During previous visits of BEIB personnel to El-Minia, the University administration voiced support for the center. The faculty has also indicated a need for the Center during these visits and has sent equipment to the Center for repair. The Center was staffed by one engineer who has been trained at NIH and it appears unlikely that the University will be able to recruit experienced repair personnel. It is our opinion that if a center director with a background in equipment repair could be recruited, there is a chance of the Center becoming functional. Allocation of additional resources to this center should be held in abeyance until a suitable center director and engineers have been recruited.

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Assuit University: The Center at Assuit University is headed by Professor Abdul Karim of the Electrical Engineering Department. Professor Karim is well versed in all aspects of scientific equipment repair and for many years prior to the establishment of the Center, he repaired equipment both at Assuit and El-Minia Universities.

Professor Karim is presently on a leave of absence and the Center is being managed by Mohamed Abd El-Wahab. The Center has a staff of three technicians and one engineer and is meeting about 60% of the repair needs of the University. We would recommend that the Center hire two additional electronic repair specialists and one electro-mechanical repair specialist.

The Assuit Repair and Maintenance Center is by far the most successful of the five centers and will probably be able to fully meet the repair and maintenance needs of the University within a few years. The success of the Center is directly attributable to the support given to it by the University's administration and the fact that it has as its director and assistant director a highly qualified electronics repair engineer and a highly qualified mechanical technician who can provide technical support and training to the Center staff. We would recommend continuing full support for this Center and using it as a model for the other centers to emulate.

APPENDIX

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Cost of Training	III
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Evaluation of the repair and maintenance centers of Cairo, Tanta, Alexandria, Assiut and El-Minia Universities as of May 1982.

This evaluation is the result of on-site visits to the facilities listed. The amounts of repairs per month given in the text are based on verbal estimates supplied by the directors and chief engineers of the Repair and Maintenance Centers. In no case were documents produced to substantiate the claims made, except for the Assuit Center. In a more established center, this would lead to questions regarding the reliability of the data. However in a relatively new center, there is a natural reluctance to take the additional time required for burdensome paper work. Therefore, it is not surprising that the paperwork normally associated with a repair and maintenance center has been deferred for a future stage of development.

It was not possible to inventory all of the equipment at each site because some of the laboratories had been closed down. To get an idea of the types of equipment models recorded. While it would be desirable to have a complete inventory of equipment for purposes of estimating repair needs, such a list might generate misleading conclusions. At several universities the utilization of equipment was found to be variable, with muc gathering dust on shelves and other laboratories actively using all the equipment they owned. This uneven utilization would make any funding estimates based on inventory value inaccurate. A better method might be to require that a repair order be drawn up for each piece of equipment delivered for repair. The number of repair orders per year and the growth rate could be used to predict future needs. Of course this would mandate that more resources be devoted to paperwork.

CAIRO UNIVERSITY

The Cairo University Repair and Maintenance Center (R&M Center) is repairing equipment at the rate of 20/month. The R&M Center also provides repair service for the Faculty of Medicine for Monsoura, Zagazig, Tanta and Einshams Universities. The director of the center is Dr. El Sobki, who has a background in electrical power engineering. The staff is composed of the following engineers:

1. Mohammed Hanza, electrical engineer (power), chief engineer
2. Wafaa Abbasi, Electronic Engineer for electronic repairs
3. Ibrahim Iskaros, Electrical Engineer (power) for electrical repairs
4. Ibtesam Mohamed, Electronic Engineer for electronic repairs

Two pieces of equipment were observed to be idle because of the lack of troubleshooting expertise by staff and management. They were a solid state oscilloscope and a vacuum tube audio amplifier. The R&M Center is in dire need of an experienced electronics troubleshooter. Interviews with staff members confirmed the fact that this deficiency is a serious drawback because most equipment contains electronic circuitry.

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A Repair and Fabrication Center (R&F Center) is located in the Physics Department, of the Faculty of Science. This center, completely independent of the R&M Center, has been repairing and fabricating instruments for several years. It is headed by Hussein Eissa who is an experienced designer and is well versed in electronic repair. He and his staff of 3 engineers were able to display numerous examples of equipment they had fabricated. Interviews with professors in the Faculty of Science, attest to the high regard for which his work is held. It would appear that Hussein Eissa, with a Masters Degree in EE would be a good choice to head the R&M Center in addition to the R&F Center he presently supervises.

Additional components needed by the R&M Center are:

- comparators (IC)
- photocells
- electrodes for pH meters
- contact thermometers
- transformers (various types)
- transistors (BF258 & BD259).

An incentive program is in effect for the R&M Center in the amount of 50% to 60% of the repair labor charges being returned to the engineers. This has helped recruiting and staff retention.

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The following is a sample of the equipment found at Cairo University:

audio-amplifier

electronic balance

35mm SLR camera

colorimeter

liquid scintillation counter

radiation counter

incubator

LASER

mass spectrometer

microtome

oscilloscope

oven

pH meter

power supply

pulse generator

spectrophotometer

stimulator

temperature controller

vacuum system

water bath

TANTA UNIVERSITY

The R & M Center at Tanta University had only been operating for a period of three weeks when this evaluation was performed. A total of 8 repairs had been performed and several memoranda listing equipment needing repairs had been received. The director of the Center is Dr. Tayser El Shamy, a chemist with the Faculty of Science. The staff of the Center is composed of the following engineers and technicians:

1. Mohammed Abdu, an electrical engineer, is the chief engineer.
2. Helen Rezk, a chemist, does electronic repairs.
3. Sosan El Shafei, a biomedical engineer, does electronic and biomedical repairs but has no experience.
4. Layla Fared Shenashen, an electronic engineer, does electronic repairs but has no experience.
5. Hasan El Medany, a technician, does general repairs.
6. Azhar El Zeftawy, a technician, does general repairs.
7. Ahmed Badawy, a technician, does general repairs.
8. Abd El Lateef, a technician, does general repairs.

The R & M Center is located in a building used for central research laboratories with a common budget for both. Dr. Mustafa, a Vice President of the University, initiated a memorandum during the evaluation to separate the two budgets. As part of this action, an incentive program is planned which would return 50 to 60% of the repair

labor charges to the engineers. However Tanta University has not finished the approval process for incentives as have the other universities. Tanta University also provides repair services for the research center at Alexandria University. Mohammed Abdu spends one day per week every two weeks and Helen Rezk spends one day in Alexandria for this purpose.

Interviews with faculty members of the Faculty of Science revealed that some of the professors were familiar with the R & M Center and others were not. Interviews with the staff revealed optimism and enthusiasm for the center with the acquisition of the new facilities and equipment. A need was expressed for 2 portable oscilloscopes with basic functions only, and 2 portable multimeters suitable for use in the field. Additionally 2 portable tool kits are needed to supply the expanded staff.

The following is a sample of the equipment found at Tanta University:

- spectrophotometer, Varian
- oscilloscope, Polish
- oscilloscope, Gould
- oscilloscope, Heathkit
- function generator, Heathkit
- power supply, East German

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UV spectrophotometer, Shimadzu
spectrophotometer, Pye Unicam (3)
colorimeter, Zeiss
spectrophotometer, atomic absorption, Shimadzu
centrifuge, Heraeus Christ
gas chromatograph, Micro Cab
cooling centrifuge, Sigma
centrifuge, Pegasus
electronic balance, Polish
pH meter, Chinese
mass spectrometer, Varian
fluorometer, Corning
microcomputer, Commodore
nuclear magnetic resonance apparatus, Varian
pH meter, Radiometer
voltage regulator, Amir
flame photometer, Corning
spectrophotometer, atomic absorption, Dupont
4x5 camera, Zeiss
glucose analyzer, Beckman
photocopier, Xerox
vacuum chamber, Deton
oscilloscope, Telequipment
pulse generator, Continental Specialties (2)
sweep generator, B & K

voltmeter, Marconi
multimeter, Metrix (3)
tape recorder, Hewlett Packard
multimeter, Kyorissu
oscilloscope, Tektronix
x-y recorder, French
power supply, French
voltage compensator, Phonovox
power supply, Polish
vacuum pump, Edwards (6)
null detector, Tunsley
programmable temperature regulator, French
recorder, Houston Instruments
voltage stabilizer, Poland
current stabilizer, British
oscilloscope, Hungarian
Q meter, Marconi
oscilloscope, Phillips
VTM, Heath
VTM, East German
electronic thermometer, Polish
pyrometer, Polish
oscilloscope, Scopex
oscilloscope, Hungarian

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ALEXANDRIA UNIVERSITY

The R & M Center is presently in the implementation stages. A memorandum has been routed to all deans announcing the mission and availability of the facility. The concept and budget have been approved by the University administration. Dr. Handi, the director of the Center, plans to start by utilizing part-time engineers and technicians until the center is self-sufficient. It will be housed in the mechanical engineering building and has enough space for more than 4 benches. The work force will be recruited from technicians already working for the Faculty of Engineering and from graduate students. Since those already working for the University normally finish work in the early afternoon, it is felt that part time workers could easily be recruited from the regular work force. This would give management an opportunity to evaluate the staff before offering them full time employment. Since Egyptian workers are rarely fired, even if they possess less than desirable competency, Dr. Handi feels this cautious approach will assure a good permanent staff.

A sample of the equipment found at Alexandria is as follows:

- oscilloscope, Metrix
- oscilloscope, Telequipment
- pulse generator, Continental Specialities
- sweep generator, B&K
- voltmeter, Marconi
- sound level meter, B&K
- multimeter, Metrix

multimeter, Polish
oscilloscope, Tektronix
oscilloscope, Hungarian
oscilloscope, East German
Q meter, Marconi
DMM, Phillips
x-y recorder, French
power supply, French
thermometer calibrator, Aois
voltage compensator, Phonovox
power supply, ZRK
vacuum pump, Edwards (4)
null detector, English
temperature regulator, French
voltage stabilizer, Poland
DMM, English
null bridge, English
Voltmeter, Heath
function generator, Heath
VTVM, German
power supply, Heath
thermocouple thermometer, Poland
pyrometer, Polish

DM, Heath

counter/timer, English

power supply, Heath

recorder, Heath

audio generator, Heath

frequency counter, Heath

oscilloscope, Tektronix

EVG counter, Orion

ASSIUT UNIVERSITY

The R & M Center at Assiut University is the most impressive of the 5 centers evaluated. This is borne out by the numbers of repairs performed, 50 to 70 per month. This is further evidenced by the work experience of the staff, and the access the chief technician, Mohamed Abd Elwahab, has to the president of the University. The Center is quite similar to its counterpart in the U. S. in that both the first line supervisor and the staff are technicians rather than engineers. This has apparently occurred because the technicians at Assiut are far more capable than those found at the other universities. The chief technician also serves as the director of the center.

The following is a list of the staff:

1. Mohamed Abd Elwahab, chief technician and director, does fine mechanical and electronic repairs.
2. Ramadan Abd Elmabood, a technician, does electronic repairs.
3. Ahmed Ezat, an engineer, does electrical repairs.
4. Shereef Ahmed Hamza, a technician does fine mechanical repairs.
5. Gamal Essa, a secretary, issues stock and equipment.

Professors in the Faculty of Medicine indicated they were aware of the capabilities of the R & M Center and many of them had made extensive use of it. The staff members seemed to be quite satisfied with their working conditions and were observed to be busy repairing equipment at the time of the visit. This represented a contrast to many of the other

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centers. The incentive program (60% of the labor charges for the repairs) seemed to be working well. There is a need for 3 additional tool kits and 3 portable oscilloscopes with basic functions. The library is in need of up-to-date cross references for semiconductors. There is a need for 3 portable digital multimeters. Special supplies needed are microscope lubricant and lens polish.

The following is an example of the equipment found at Assuit:

scanning electron microscope, Juel

scintillation counter, Nuclear Chicago

blood gas analyzer, Searle

pH meter, Wild Heerbrugg

water bath, GFL (2)

microtome, Reichert-Jung

conditioning oven, Heraeus

microscope, wild Heerbrugg

pH meter, Prolabo

pH meter, Orion

microscope, Meopta

Centrifuge, Janelski

microtome, Leitz

incubator, German (CO 2)

vacuum oven, Heraeus

freeze dryer, English

conditioning oven, Heraeus

incubator, German

centrifuge MSE (2)
balance, Sartorius (3)
digital ion analyzer, Orion
spectrophotometer, Jasco
colorimeter, English
stimulator, Nihon Kohnder
fluorimeter, German
scintillation counter, HP
portable computer, HP
electronic balance, English
oscilloscope, Marconi
vibration meter, B&K
oscilloscope, Trio (3)
function generator, Heathkit
vacuum tube voltmeter, Advance
frequency meter, Marconi
oscilloscope, Russian
power supply, Trio (2)
power supply, Trio (2)
oscilloscope, Advance
R C oscillator, Marconi
oscilloscope, Tektronic
DMM, HP

oscilloscope, low frequency, Hungarian

function generator, B&K

power supply, Trio (2)

oscilloscope, Trio

frequency counter B&K

voltmeter, Univolt

water bath, German

electronic balance, Satorius

EL-MINIA UNIVERSITY

The R & M Center at El-Minia University is presently repairing equipment at the rate of 4 per month. The director of the Center is Dr. Kamal Abdul Hadi, Dean of the Faculty of Science. The most serious problem is the impending loss of the only staff member this summer.

The only staff member of the center is:

Rokaya Zakaria Hassan, does electronic repairs, leaving the summer of 1982.

The Center at El-Minia has had serious growing pains. Rokaya Hassan, trained at NIH could not devote all her time to repair and maintenance due to time spent performing her former job with the Engineering Department. Efforts to recruit engineers to replace those leaving have not been fruitful. It does not appear favorable that El-Minia will be able to overcome the recruitment obstacle to develop a viable program.

A sample of the equipment found at El-Minia is as follows:

flame ionization amplifier, English

gas chromatograph, Pye Unicam

recorder, LN

bridge, General Radio

vacuum pump, Edwards

thermal analyzer, Japanese

pH meter, Cambridge

electronic balance, Polish

voltage stabilizer, Zenith

laboratory shaker, English

centrifuge, Heraeus Christ

pH meter, Sargent Welch

laboratory dryer, Chriss

electronic balance, Satorious

incubator, Lotis

thermal oven, Heraeus

water bath, GFL

electronic balance, Sartorius

microtome, Bright

UV spectrophotometer, English

conditioning oven, Heraeus

incubator, Heraeus

IR spectrophotometer, Japanese

UV spectrophotometer, Japanese

incubator, Heraeus

Directorate questions regarding the R & M Centers

The main thrust of this assignment was to answer several questions for each center. This report will use a format which first states the questions and gives a reply for each center for which the question is applicable.

1. How much equipment is being repaired? Are other University facilities used to repair equipment?

Cairo University-20 per month

Tanta University-8 repairs total as of May, 1982

Alexandria University-none

Assiut University-50 to 70 per month

El-Minia University-4 per month

Cairo University is the only repair and maintenance center which has a significant number of repairs performed in other university facilities.

At Cairo University, a repair and fabrication facility is maintained in the Physics Department of the Faculty of Science. It is completely independent of the R&M Center. The staff is composed of 3 engineers who design and construct equipment and do a small amount of repair. The scope of work performed is limited to the equipment owned by the Faculty of Science.

None of the universities provided numerical figures for repairs performed outside their universities, except Assuit. In the majority of cases, equipment is not repaired if it cannot be repaired locally.

2. How well are these sources presently meeting the needs of the University?

Interviews with Faculty of Science personnel in Cairo University, indicated most of the needs of the university were being met by either the F&M Center or the R&F Center in the Physics Department. Outside sources (manufacturers mostly) were used for some electronic equipment. At Assiut University most of the needs of the University were being met however, a substantial amount of equipment was on a list for repair. At Tanta and El-Minia Universities the programs were not at the level of fully meeting the needs of the staffs. Alexandria University had not yet gotten started.

3. How much equipment is idle because there is no source of repair or for any other reason?

At Cairo University, an oscilloscope and an audio amplifier could not be repaired because of the lack of an experienced trouble-shooter (electronics).

All other repair centers stated they had no equipment for which they could not find a source of repair. Since it was not practical to turn all the equipment on for a test, this could not be verified.

4. Are the owners of the equipment satisfied with the repair services they are receiving from these services? If not, what improvements would they like to see?

None of the owners of the equipment at the centers expressed dissatisfaction with the repair services, however there is obvious room for improvement at Cairo University (electronic troubleshooting) and El Minia (personnel).

5. How does the university recruit staff? How successful have they been in the past? Are there plans to improve recruitment procedures? Is there presently an operating incentive program? If not what plans are there for establishing an incentive program? Status of present and future in-house training programs for Center employees?

Staffing for all the University Centers is done on a local basis using the incentive program. The incentive program consists of returning 50 to 60 % of the labor costs of a repair job to the engineer who performs the work. The

incentive program has been approved by management of all the Universities except Tanta. At Tanta the approval process has not been completed but approval seems favorable. None of the University Centers has a formal training program and all anticipate using the training center being set up in Cairo.

6. Management of the center--Does the center have a manager? What is his technical background? If the center does not have a manager what plans are there for hiring one? Does the center have a management plan? How does it operate? What plans are there for any changes in the operation of the center?

One center has an unusual management plan, Alexandria University. Dr. Hamdi has decided to start the Center with part time and student workers. This way he proposes to evaluate their performance before hiring them full time. He believes this will work because of the tradition in Egypt of personnel working both a full time and a part time job due to the high cost of living. None of the centers has a formal management plan, as evidenced by the lack of paperwork to document repairs. The establishment of a management plan containing numerical goals should be a high priority for the future at each center. El-Minia is in serious need of a viable recruitment plan to fill its engineering positions. No formal program has been developed to accomplish this goal.

The managers of each center are as follows:

Cairo University-Dr. El. Sobki, electrical (power)
engineer

Tanta University-Dr. Tayser El Shamy, chemist

Alexandria University-Dr. Hamdi, engineer (control)

Assuit University-Mohamed Abd Elwahab, technician (fine
mech and electronics)

El-Minia-Dr. Kamal Abdel-Hadi, physicist

7. Support to staff members--Is technical assistance available to repair engineers? Are there plans for providing technical assistance if it is not available? Is there an operating system for obtaining replacement parts? If so, how does it work and how effective is it? Are there plans for modifying the procurement system?

At Cairo University electronic trouble-shooting assistance is not available, and at El-Minia neither assistance nor working engineers are available. None of the centers have a formal system for obtaining replacement parts, they either get them through manufacturers or from NIH on an as needed basis. The ground work needs to be laid for a procurement system but only after sufficient number of repairs are performed per month to support such an effort. Tanta University and Assuit University both have sufficient technical assistance. The director of the Alexandria University Center also has the technical competence necessary, however there is some question of his daily availability since he also has teaching and administrative responsibilities.

LIST OF TRAINEES

ACADEMY TRAINEES

<u>Name</u>	<u>University</u>	<u>Training Period</u>
ABBASSI, Wafaa A.	Cairo	3/1/80 - 8/1/80
AHMED, Samir Anwar	Assuit	3/1/80 - 8/1/80
AHMED, Mohamed Abd El Wahab	Assuit	3/1/80 - 4/1/80
BANAWAN, Ahmed Samir	Alexandria	3/1/80 - 8/1/80
FAWZI, Madiha	Assuit	6/17/81 - 11/17/81
HAMDI, Dr. Aly R.	Alexandria	8/17/81 - 9/30/81
HASSAN, Rokaya Zakaria	El-Minia	5/1/79 - 10/1/79
LATIF, Ahmed Nabil Abdel Latif	Cairo	5/1/7 - 10/1/79
MAHMOUD, Mohamed Abdou	Tanta	7/7/81 - 12/7/81
MAHMOUD, Yoursri Amin	Alexandria	2/16/81 - 7/16/81
MAKKY, Mohamed Youseff	Assuit	5/1/79 - 10/1/79
MOHAMED, E. Khalid	Cairo	3/1/80 - 8/1/80
RISK, Helen Farid	Tanta	5/1/79 - 12/1/79

COST OF TRAINING FOR ACADEMY TRAINEES

	\$	LE
Contracted Training	14,000	
BEIB Salary	45,000	
BEIB Travel		
Per Diem		10,000
International Travel, baggage	4,000	20,000
Trainees Travel		
Per Diem		40,000
International Travel, baggage		10,000
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TOTAL	63,000	80,000

Chapter III

Training of University Personnel in the Repair and Maintenance of Scientific Equipment

From the beginning of the project we realized that the training of repair personnel would be the most important aspect of the project. With this in mind we placed considerable effort both into the selection and training of repair personnel.

Selection of Engineers for Training

Most of the personnel proposed for training in the United States did not have previous repair and maintenance experience or significant laboratory experience during their university training which we could use to evaluate their potential to effectively learn to repair scientific instrumentation. Because of the high cost both in project funds and personnel time in providing training in the United States, it was decided to extensively evaluate potential trainees in Cairo.

Potential trainees were given a three to four week course in Applied Electronics. The course consisted of a one hour lecture followed by a three hour laboratory session. During this laboratory session students would design, build and evaluate basic circuits typically found in scientific instrumentation. These laboratory sessions permitted the instructors to evaluate the student's manual and analytical skills which they would also use in troubleshooting scientific equipment. In addition to providing a mechanism for evaluating the potential trainees, this course familiarized them with typical circuits found in scientific instrumentation. We have found this type of evaluation to be very effective and plan to continue using it.

Training of Engineers at NIH

The training program at NIH began with a review of the use of test equipment and a short period of training in the use of hand tools. This training was usually completed within one week. Following this training the majority of the students participated in a 14 session course in troubleshooting, calibration, maintenance, repair, and safety of scientific instrumentation.

The course began with lectures on the general theory, orientation, and importance of instrumentation calibration, servicing, cleaning, preventative maintenance, and repair. This was followed by lectures in the following areas:

1. The safe, proper, and effective use of hand tools and test equipment.
2. Identification, analysis of operation, and troubleshooting of typical analog and digital electronic circuits.
3. Descriptions of techniques for identifying, treating, and discovering typical faults in scientific instrumentation.

The main thrust of the course involved the concepts of logical troubleshooting, organization, and use of operation and service manuals, documents, operation,

Training of Engineers at NIH (cont)

...installation, assembly, modification, calibration, troubleshooting, maintenance and repair of scientific instrumentation.

Following this introductory training the students began their on-the-job training in our repair facility. Each student was given a work bench and complete set of tools and electronic test equipment. The remainder of his or her training was provided on an individual basis geared to the students skills and rate of progress. The goal of the training was to train the students to repair a variety of the basic scientific instruments such as PH meters, power supplies, spectrophotometers, and fraction collectors. The training format was as follows:

1. Introduction to the instrument - the student would read the service manual followed by a discussion of the instrument with a senior repair specialist. These discussions included theory of operation, typical faults associated with the instrument, and techniques for troubleshooting and repairing the instrument.
2. Controlled repairs on the instruments - The student would perform repairs on instruments modified to simulate actual faults. He would attempt to find the cause of failure and "repair" the instrument.

Training of Engineers at NIH (cont.)

3. Repair - the student would repair instruments sent to our facility for repair. When possible he would also either independently or in the company of one of our repair specialists respond to requests for repair from various laboratories at NIH. He would then either make the repair in the field or if needed return the instrument to our facility for repair.

The major portion of the training at NIH was as a member of a large repair and maintenance facility. The students worked along side our employees who were available to provide technical assistance when needed. This practical hands-on training permitted the students to return to their university and immediately begin functioning with a minimum amount of supervision.

During the course of the project, we send a few trainees to manufacturer's training courses but found that the training provided was usually not effective. In general most of these courses assume that the student is familiar with and has worked on the instrumentation in question. The courses move at too rapid a pace for our students and generally they would not be able to follow the course after the first day.