Support to the Ministry of Health Palestinian National Training and Calibration Center

PALESTINIAN HEALTH SECTOR REFORM AND DEVELOPMENT PROJECT

SHORT-TERM TECHNICAL ASSISTANCE REPORT

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3 February 2013

Contract No. 294-C-00-08-00225-00

This publication was produced for review by the United States Agency for International Development. It was prepared by Mark A. Heydenburg
## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAMI</td>
<td>Association for the Advancement of Medical Instrumentation</td>
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<tr>
<td>ACCE</td>
<td>American College for Clinical Engineering</td>
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<td>AHSE</td>
<td>American Society for Healthcare Engineering</td>
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<td>BEU</td>
<td>Biomedical Engineering Unit</td>
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<td>ECRI</td>
<td>Emergency Care Research Institute</td>
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<td>FDA</td>
<td>Food and Drug Agency</td>
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<td>GMDN</td>
<td>Global Medical Device Nomenclature</td>
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<td>HIS</td>
<td>Hospital Information System</td>
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<td>IEC</td>
<td>International Electro-Technical Commission</td>
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<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>MEMS</td>
<td>Medical Equipment Management System</td>
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<td>MOH</td>
<td>Ministry of Health</td>
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<td>NFPA</td>
<td>National Fire and Protection Agency</td>
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<td>PACS</td>
<td>Picture Archiving and Communication System</td>
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<td>PM</td>
<td>Preventive or Predictive Maintenance</td>
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<td>PMC</td>
<td>Palestinian Medical Complex</td>
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<td>SOP</td>
<td>Standard Operating Procedures</td>
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<td>SOW</td>
<td>Scope of Work</td>
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<td>STTA</td>
<td>Short-Term Technical Assistance</td>
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<td>UMDNS</td>
<td>Unified Medical Device Nomenclature System</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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ABSTRACT

The importance of improving and expanding the capacities of the medical equipment support system is vital to improving the safety, quality, life expectancy and cost of medical devices within the Ministry of Health (MOH). Findings during this consultancy outline the need for improvements in specific areas; most notably the need to continue to support the institutionalization of a Preventive Maintenance (PM) system at the MOH.

The Palestinian Health Sector Reform and Development Project (the Project) has employed a preventive maintenance program for medical equipment donated by the Project to the MOH, and has worked closely with the MOH Biomedical Engineering Unit (BEU) to raise their awareness on the need to establish a mechanism internal to the MOH to address maintenance needs outside the warranty period for all MOH medical equipment. To this end, the Project has supported the MOH in establishing the first Palestinian National Calibration and Testing Center, which is now beginning to establish best practices in medical equipment management.

Other areas for improvement include the need to modernize the management of medical equipment through integration of policies, procedures, PM protocols, improvements in communications and unification of services through the use of the Health Information System (HIS).

The medical equipment management program of the MOH BEU in the West Bank could be improved through collaboration and unification of various components of technical human resources within MOH institutions including technicians, engineers and support staff. Unifying technical staff will improve communications and monitoring capacities.

In response to these needs the Project team has provided a HIS module for medical equipment management to improve communication, unify maintenance staff, and develop standards. The Project has also provided calibrators, analyzers, and engineering management tools to the MOH’s National Calibration and Training Center.

This consultancy was designed to support the BEU management in the following areas:

- Provision and acceptance of standard international coding for HIS integration.
- Development and formatting for implementing management policies, procedures and protocols for BEU and Biomedical Engineering management.
- Handing off of the HIS maintenance module responsibilities from the Project team to the BEU team.
- Providing a framework to guide the next steps to enact the medical equipment management system (MEMS) for the BEU and implement a PM program in the very near future, starting with life support equipment.
- Provide technical training for engineers at the BEU in the areas of preventive maintenance and use of the Project’s newly donated biomedical testing calibrators and analyzers.
SUMMARY OF RECOMMENDATIONS

Within the next month the MOH BEU with support of the Project should:

- Schedule regular meetings between the BEU, HIS contractor and Project staff to provide necessary HIS modifications to accommodate the medical maintenance management priorities and finalize data fields.
- Bring the HIS inventory and maintenance module on line at the Palestinian Medical Complex (PMC) as an example to all other health facilities. This should start with the basic inventory, newly adopted coding system and equipment categorization.
- Up-load the first resource aids for biomedical engineers, beginning with the medical equipment service manual library and work toward supplier provided protocols and maintenance aids. Include policies, procedures and coding indexes.
- Complete all entries (including up-to-date protocols, stock parts required, PM schedule, warranty information, external service work orders and work request system) for selected life-support equipment for the purpose of familiarization and training of all HIS management capacities.

Within the next six months the MOH BEU should:

- Start the PM scheduling and management function for all life support devices. Completing this first step will be a significant move towards improving quality and reliability of equipment. This should eventually be done for all patient care equipment.
- Provide finalized protocols, specific for life support equipment within the HIS, this is vital to keeping life support equipment risks and down time to a minimum. Four protocols have been prepared and provided as an example (see Annex E1. Sample Maintenance Protocols for Existing Life Support Equipment).
- Promote the establishment of regulations and standard operating procedures (SOPs) specifically targeted toward providing authority and accountability for the management of medical equipment. These standards will establish goals for improvement and change in the care and quality of equipment. (See Annex E11. Standards).
- Facilitate training for all engineers on the use of the new calibration equipment.
- Train engineers on how to write protocols (protocol writing provides the engineer with insights on how to calibrate, what parts are needed for stock and what calibrators are required)
- Connect all engineers via networking to other engineers both locally and globally. Networking will amplify the knowledge base and increase the resource base.
- Integrate HIS with the BEU software (Ansur). This will allow collected calibration and repair/PM data to effortlessly transfer automatically from test equipment to the main HIS database and save valuable technical time for priorities.

Within the next year:

- BEU Director and relevant MOH units such as the Procurement Unit, and facility level engineers should shift or balance BEU management priorities to a more holistic management philosophy that includes preventive maintenance
• BEU management should develop regular training for engineers and biomedical technical staff who are not working at the BEU. This will require additional resources for vehicles, as BEU engineers must travel between all MOH health facilities.
• BEU management should promote MEMS training for the next generation of leaders.
• Encourage the MOH to require medical equipment suppliers to include training for relevant MOH staff on the proper use and maintenance of the equipment, as part of their contracts.
• MOH BEU should bring all patient care devices into the preventive maintenance schedule and monitor up-time benefits. This will be a continually expanding process.
• MOH BEU should shift the majority of work from reactive to preventive services.
• MOH BEU should develop protocols for all equipment requiring routine part replacement to develop an inventory of common spare parts. Efforts to leverage donors to include spare parts and contracted PMs should be standard practice for the MOH.
• MOH BEU should join the International Biomedical Associations and begin to plan for a Palestinian Biomedical Association. This will expand the resource capacity of biomedical engineers throughout the region.
SECTION I: INTRODUCTION

The Palestinian Health Sector Reform and Development Project (the Project) is a five-year initiative funded by the U.S. Agency for International Development (USAID), designed and implemented in close collaboration with the Palestinian Ministry of Health (MOH). The Project’s main objective is to support the MOH, selected non-governmental organizations, and selected educational and professional institutions in strengthening their institutional capacities and performance to support a functional and democratic Palestinian health sector able to meet its priority public health needs. The Project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

The Palestinian MOH has received significant quantities of advanced medical instrumentation in recent years from USAID and other donors. This equipment has significantly improved the capacities of the health sector to diagnose and treat illnesses throughout the region. Highly technical equipment allows for great strides in medical advancements and at the same time, creates a need for sustaining these gains over the foreseeable future.

The Project currently employs a preventive or scheduled maintenance program for medical equipment during the warranty period. The MOH recognizes the need to create mechanisms to address maintenance needs of medical devices outside the warranty period for the purpose of extending the usability and reliability of health services.

In response to the growing need for improved equipment maintenance the Project, in collaboration with the MOH has established a national biomedical repair and calibration center. This center is now beginning to implement best practices in medical equipment management for the purpose of improving medical safety, reducing maintenance expenditures and equipment down time and improving equipment life expectancies. This consultancy will help to develop policies and practices that promote strengthening of the BEU capacities and improve performance to maintain support of all MOH institutions.
SECTION II: ACTIVITIES CONDUCTED

- Review the Scope of Work (SOW), strategy and plan for the short-term technical assistance (STTA) with the Project leadership. The plan focused on setting objectives to be obtained and specific tasks to help meet the goals outlined in the SOW. Meeting highlights are included in Annex B.

- Made an initial visit to the BEU to meet with the MOH BEU Director, Eng. Ibrahim Elian, and discuss objectives, to coordinate activities and gain insight into his priorities. It was the teams roll to achieve agreement for establishing a framework for policies, procedures, and management of medical equipment at the BEU.

- Provided summary and developed strategy to help with creation of templates and example policies and procedures for the BEU to begin layout of a framework for management of medical equipment maintenance (See Annex E5. MOH BEU suggested SOPs Template).


- Created drafts of both the SOP and policy formats. Worked with Project staff to translate existing unformatted SOPs to the new format. Used recognized formats and policies to adapt into the medical equipment management policy. Submissions of new SOPs and policies were reviewed and accepted by the BEU to be included as part of future management policies, procedures and protocols (See Annex E4. Draft Medical Equipment Policies and Procedures for the BEU, and see Annex E2. Draft BEU current SOPS_ Translated and reformatted).

- Received international coding data for standard medical equipment nomenclatures from both the Global Medical Device Nomenclature (GMDN) Company and Emergency Care Research Institute (ECRI) Unified Medical Device Nomenclature System (UMDNS). Presented coding system to the BEU director for approval. It was noted that the BEU was in the process of creating its own coding system and was encouraged to change to an internationally accepted system. These coding inclusions will help standardize and make the HIS medical equipment system more consistent (See Annex E6. Coding System for nomenclatures using UMDS and GMDN Codes).

- Instructed BEU Engineers on the use of selected of calibrators

- Provided summary of Safe Limits for Electrical Safety, Anesthesia, Defibrillators, X-ray, and Ventilators as requested by BEU engineers (See Annex E9. Safety measurement Limits).

- Received inventory from the PMC in Ramallah, prepared it by correcting errors and adding data columns for equipment categorization and donor information for smooth transfer to the HIS system. Internationally standardized nomenclatures and codes were submitted, adopted and approved by Ibrahim Elian, Director of BEU. The work was then reviewed by the HIS Contractor, two BEU Engineers and Project team
members for finalization. (See Annex E8 PMC inventory with new codes and nomenclature).

- Developed a picture archiving and communication system (PACS) questionnaire for interview of PACS consultants preparing for the upcoming plan to begin coordination of the HIS system with the imaging storage. Provided service manuals for PM Life Support Training, and provided protocols for several life support devices. Reviewed instruction manuals for the test calibrators.

- Inventoried new Fluke test instruments, met with Ibrahim Elian to discuss next steps and HIS integration as well as installation of Ansur software and planning for testing medical equipment.

- Coordinated a meeting to bring together stakeholders for HIS and Biomedical Maintenance Management. Stakeholders included, HIS Contractor – MOH Director of BEU, two BEU Engineers, BEU Data Entry Clerk and the Project team members. Extensive discussions and input culminated in a unified agreement for the next steps in transfer and integration of the MOH, HIS maintenance management module. The meeting also became an opportunity to allow the BEU a leadership role in the activation and use of the Biomedical Equipment Management module part of the HIS.

- STTA Report writing, review with Project team, edits, and submission
SECTION III: FINDINGS, CHALLENGES, RECOMMENDATIONS, AND NEXT STEPS

A. Findings
There are significant gaps in the medical maintenance management program in place.

1. Policies and procedures are focused on procurement and reactive maintenance. BEU policies are not well known amongst key stakeholders such as the engineers within health facilities and within the MOH procurement unit. Policies and procedures do not include the new HIS system.

2. Preventive maintenance is looked at by some of the MOH engineers as a waste of time. The only current PM in effect is that which is carried out under warranty or under contract from suppliers.

3. There are currently only a few MOH engineers with the breadth of required knowledge and skills to perform calibrations and PM. Engineers have not been involved in writing protocols in order to know how to do calibration.

4. Engineers are involved in low priority tasks (such as in-putting nonmedical hospital furniture and writing specifications for non-technical items). These responsibilities limit their capacities to focus on priority maintenance needs.

5. There is no current system of standardized international coding for equipment nomenclatures or classifications, nor a system for scheduled maintenance.

6. The MOH has not established regulations that mandate medical equipment management in a wide area of safety.

7. Technicians for repair service are not used to their capacities and do not play a significant role in maintenance management.

8. There is no process or system in place to predict spare parts stock and purchasing prior to breakdowns.

9. Equipment downtime is excessive and an excessive amount of time is spent on reactive maintenance due to lack of regularly scheduled maintenance and due to gaps in management within the regions outside the BEU involving technicians and engineers throughout the West Bank.

B. Challenges

1. There is no consensus among all MOH management and engineers on the importance of PM or the need for HIS integration with their work. This includes biomedical staff at the hospitals and clinics. This may limit or slow the changes toward improved maintenance outcomes.
2. There is a lack of standards, policies, protocols and procedures to direct BEU staff in their daily routines and to define broader areas of responsibility.

3. The BEU is only a support mechanism to many of the health facilities, not an authority, leader or resource provider.

4. Procurement and donations use some of the vital human resources that may be better focused on repairs, preventive maintenance and managing the services and priorities or essential tasks within the Biomedical Maintenance sphere of responsibility.

5. Engineers are tasked with non-essential and low priority responsibilities and are therefore, not utilizing their time efficiently for PM, and causing them to be overburdened.

6. There is a lack of spare parts and ordering replacement parts can take up to six months. There is no predictive repair parts program in place.

7. Biomedical Engineers and technicians in outlying health facilities do not regularly interact with manufacturers and suppliers to assist in troubleshooting and resource utilization.

8. There is no established biomedical network within the Palestinian territories or with international organizations leaving a significant gap in developing biomedical staff skills and leaving them unaware of possible resources.

C. Recommendations

1. **PREVENTIVE MAINTENANCE:** The most significant impact and change needed to improve the effectiveness of health services with regard to medical equipment is to implement a management program that would dedicate MOH staff to PM. This would allow for a proactive approach to maintenance through prevention and predictive maintenance methods. The operating environment is now ready for PM scheduling and implementation given the calibration and training center, access to the HIS by BEU staff, and the newly developed framework of policies. PM should begin with life support equipment and then phase in additional equipment according to their risk classification. Integrate donors and suppliers of new devices into the preventive maintenance and parts planning process as the Project example has proven effective.

2. **HOSPITAL INFORMATION SYSTEM (HIS) INTEGRATION WITH MAINTENANCE:** The HIS adopted by the MOH has an integrated medical equipment management module. This module provides mechanisms for most maintenance needs. The HIS should be used to schedule, monitor and manage all aspects of medical equipment integrations within the MOH. To make the best use of the system, the BEU and MOH HIS staff with support of the Project’s HIS team should meet regularly - starting with weekly meetings and adjust as the need changes. Meetings will help the BEU suggest inputs that will promote efficiencies and shorten the time to fully implement the features available.
It is important to bring the HIS medical equipment inventory and maintenance work request module online in the PMC in Ramallah as soon as possible to set an example of best practices to all other health facilities. Priority equipment can be uploaded with their manuals, protocols, preventive maintenance schedule, spare parts needed, warranty information, and equipment histories. These resources will improve efficiencies to users and maintenance staff. Encourage suppliers of medical devices to participate in provision of manuals, protocols and checklist.

The HIS system allows for uploading of technical literature and resources. The Project should contribute its full library of technical manuals to the BEU and from all shared biomedical staff in the MOH. These manuals will be the base for writing protocols for PM and for calibrating and repairing medical devices. The BEU should also input all warranty and contract information and dating.

All maintenance of life support equipment within the authority of the MOH should be placed in the maintenance management system with the highest priority (superseding all other maintenance and procurement activities) This priority should address implementing all protocols, policies and PM in the HIS ahead of other items.

Integrate HIS with the BEU software (Ansur) to reduce the time for manual data entry. Most medical equipment calibration reports can and should be uploaded to the HIS if interfaced properly.

3. REGULATIONS, POLICIES, PROCEDURES AND STANDARDS: The MOH can significantly affect priorities and effectiveness for maintenance of medical equipment through the establishment of regulations and standards to provide the BEU with the authority and accountability to specifically target the management of medical equipment. These regulations will mandate preventive maintenance as well as other equipment safety criteria.

4. BEU MANAGEMENT BUY IN FOR PREVENTIVE MAINTENANCE: To promote a change from reactive maintenance to proactive, preventive and predictive maintenance, BEU Management should attend a formal MEMS training session. These trainings are provided by several organizations and help administration and management staff to realize the benefits of a holistic management approach. Organizations providing such training include Medisend International, Ditec, Open Sesame Net Learning, and World Engineering Health.

5. TRAINING FOR ALL ENGINEERS AND TECHNICIANS: Training on the use of the new calibration equipment is necessary. Training on more sophisticated equipment such as anesthesia, radiology, ventilators and other equipment by experienced technicians and engineers should be considered. Regular trainings on subjects such as how to write protocols, or how to develop PM checklists would also benefit the BEU. Training can and should be included in future equipment donations.
This is an effective way to bring new training about as demonstrated by recent Project donations.

6. **COMMUNICATION WITHIN THE BIOMEDICAL COMMUNITY:** It is important that biomedical engineers and technicians share their concerns, skills, knowledge and expertise within the local community of experts. The BEU could begin a biomedical society for Palestinian Engineers via networking with internet and blog sites. This community could connect to international biomedical societies such as AAMI, ECRI, and others to expand their resource base and learn from peers.

7. **SECOND TIER BIOMEDICAL SUPPORT:** The current system within the MOH for medical equipment service personnel, places most of the responsibilities on the few biomedical engineers within the system. Staff at the technician levels and below are underdeveloped and underutilized, causing a greater burden to be placed on the engineers than is necessary. The BEU could promote training of technicians and other non-technical staff to take on the responsibilities for uncomplicated low risk tasks and duties and relieve the engineers to focus on more complex work including preventive maintenance and using their skills to predict breakdown before the break down. Some suggested areas to consider are (inventory of equipment, repair of hospital furniture, lighting, suction, sterilization, non-electrical devices, beds etc.

D. **Next Steps**

1. **RAMALLAH HIS UPLOAD EXAMPLE:** Coordinate the Project, BEU and MOH, HIS subcontractor staff to bring the HIS Maintenance Module online within the next two weeks. This can be done by uploading the current updates and data collected once uploaded, schedule regular meetings to correct and improve the data collection process with the attitude of continual improvement with no end to quality enhancements. Once the team is satisfied with the information and accuracy the management functions can be put in place. It is important to unify all MOH health facilities through expansion and improving through examples the lessons learned and the gains achieved. Keep developing the HIS fields and drop down menus to eliminate errors caused by free hand entries (See Annex E10. Drop down menus suggestion for the HIS AVICENNA Software).

2. **PREVENTIVE MAINTENANCE AND PROTOCOLS:** After the PMC’s inventory is uploaded, the BEU should immediately schedule the life support equipment for PMs. PMs require routine part replacement so part numbers and recommended replacement information should be gathered and an order for these priority parts should be placed as soon as possible. While waiting for parts, engineers should collect and/or develop protocols for the life support equipment first in the PMC, Ramallah and then within the MOH hospitals. Encourage the MOH hospital engineers’ involvement and help to standardize formats to be followed by suppliers, as well as engineers. Suppliers can provide many of the protocols but requiring engineers to write them will help them focus and refine their knowledge and skills.
3. **TRAINING:** Engineers should break-out the instruction manuals and separate the most complicated calibrators for study and practice among a variety of engineers. Once an engineer is confident and has practiced the use of the instrumentation the engineer can share the experience gained with the others and supervise skill transfer. Training should also be considered for hospital engineers and technicians and they can share their experiences and learn from the BEU staff. Attend all suppliers training when available as new equipment is procured. A needs assessment should be put together as soon as possible to identify areas of weakness within the MOH. Schedule training in response to the needs assessment. Engineers should be individually assessed annually as a tool to target weak areas.

4. **MOH BEU MANAGEMENT:** Follow-up for policies, procedures and creating a system tailored to the HIS and the support software will be necessary to fill the current gaps in the management system. Begin by identifying areas of duplication, making better use of human resources through better separation of tasks (complex from common). Connect with an international biomedical society to share challenges and seek improvements.
ANNEX A: SCOPE OF WORK

Short-Term Consultancy Agreement Scope of Work

SOW Title: Support MOH in Managing a Palestinian Medical Equipment Training and Calibration Center
Work Plan No: Technical, E. Choose Sub-activity No.
SOW Date: 7/2/2012
SOW Status: FINAL
Consultant Name: Mark Heydenburg
Job Classification: Short-Term US Expatriate Consultant
Reporting to: Hazem Khweis – Procurement Manager

I. Palestinian Health Sector Reform and Development Project Objective

The Project is a five-year initiative funded by the U.S. Agency of International Development (USAID), and designed in close collaboration with the Palestinian Ministry of Health (MOH). The Project’s main objective is to support the MOH, select non-governmental organizations, and select educational and professional institutions in strengthening their institutional capacities and performance to support a functional, democratic Palestinian health sector able to meet its priority public health needs. The Project works to achieve this goal through three components: (1) supporting health sector reform and management, (2) strengthening clinical and community-based health, and (3) supporting procurement of health and humanitarian assistance commodities.

The Project supports the MOH in implementing health sector reforms needed for quality, sustainability, and equity in the health sector. By addressing key issues in governance, health finance, human resources, health service delivery, pharmaceutical management, and health information systems, the MOH will strengthen its dual role as a regulator and main health service provider. The Project also focuses on improving the health status of Palestinians in priority areas to the MOH and public, including mother and child health, chronic diseases, injury prevention, safe hygiene and water use, and breast cancer screening for women.

II. Specific Challenges to Be Addressed by this Consultancy

A congressional hold on funding to the USAID/West Bank Gaza (WBG) mission since September 2011 has resulted in a reduction of activities and staffing. With the release of partial funding in late December 2011, it has been programmed to procure test lab equipment to support the MOH in establishing a Palestinian Medical Equipment Training and Calibration Center in Huwarra. In order to further support MOH’s Biomedical Engineering Unit (BEU) in managing the center, after equipment arrival and installation, this consultancy aims to introduce international practices in managing such a facility and provide on the job coaching for BEU staff.

The importance of an equipment support system for medical devices is necessary to maintain quality medical care. MOH in the West Bank does not currently have established programs and systems to properly monitor, schedule and repair medical equipment. In addition, appropriate calibration and test analyzers are unavailable or outdated and un-calibrated. The Project is currently procuring advanced instrumentation for the purpose of establishing the first of this kind, calibration and repair center in the West Bank. Challenges to successfully implement this comprehensive system include, hands on training and mentoring for advance instrumentation, establishment of new safety standards, installation and use of the new calibration equipment and computer management system implementation.

III. Objective and Result of this Consultancy

The Project started the procurement process to provide the Palestinian MOH with testing equipment and calibrators for medical equipment in response to a request from MOH in 2010 to support in establishing a national biomedical equipment calibration center. After consultation with USAID, the Project decided to support MOH in such a request as it would feed towards improving the quality of essential clinical services for Palestinians and will play a major role in extending the usability of the equipment donated by USAID and other donors. The activity of procuring such equipment was part of the Project’s year three work plan. However, due to congressional hold on funds it was not possible to achieve and the activity is carried over as part of year four activities.
The testing equipment and calibrators for medical equipment will be used to set up a Palestinian National Calibration and Certification Center for medical equipment, which is intended to institutionalize the practice of preventative maintenance and facilitate for annual medical equipment calibration.

The consultancy period is planned after the delivery and installation of the equipment in the Center that will serve all MOH health facilities. The consultant will conduct training which will target the management of the BEU, and other Biomedical Engineers working at MOH health facilities.

The main objectives of this consultancy can be summarized by the following:

To develop a framework to effectively implement policies and procedures for the purpose of establishing a working preventive maintenance program and calibration standards.
To provide individual and group mentoring and training for all Engineers specific to calibration and testing analyzers, first in the lab and then in real situational conditions on equipment in field locations.
To assist MOH in establishing formal communications with International Associations in a related field for the purpose of further education.

Specific Tasks of the Consultant

Under this Scope of Work, the Consultant shall perform, but not be limited to, the specific tasks specified under the following categories:

A. Background Reading Related to Understanding the Work and Its Context. The Consultant shall read, but is not limited to, the following materials related to fully understanding the work specified under this consultancy:

Work Plans for year 1-5
TPO(s) for test equipment and analyzers.
Most recent quarterly report

B. Background Interviews Related to Understanding the Work and Its Context. The Consultant shall interview, but is not limited to, the following individuals or groups of individuals in order to fully understand the work specified under this consultancy:

Kirk Ellis, Chief of Party
Dr. Jihad Mashal, Deputy Chief of Party – Technical Programs
Nadera Shibly, Procurement Director
Hazem Khweis, Procurement Manager

C. Tasks Related to Accomplishing the Consultancy’s Objectives. The Consultant shall use his/her education, considerable experience and additional understanding gleaned from the tasks specified in A. and B. above to:

Assist in the development of working policies and procedures specific to the tasks of the calibration center
Work with appropriate management and technical staff to apply management software and new policies and procedures
Assess the planned location for the test equipment and calibrators to propose the optimum set up suitable for the workflow.
Provide onsite training for MOH Biomedical Engineers at the Center and selected MOH hospitals, on the proper use of the testing equipment
Arrange training sessions for best practices in preventive maintenance, corrective maintenance and documentations
Assist MOH in establishing a planned preventive maintenance system for different medical equipment categories that are in operation at different MOH facilities.
Introduce a Plan for ready stock of common failure parts, as well as a plan for the provision of loaner devices for high risk or critical life support devices that the management of the Center can use for planning purposes.
Review currently used medical equipment coding and work with MOH team to develop a coding system according to best practices.
Update equipment electronic files already uploaded to the Health Information System (HIS) with the appropriate coding system as well as other fields that can be added to maximize the utilization of the features and processes offered by the HIS.

Assess the workflow between the Center (previously BMU) and different Biomedical Engineering Departments at different MOH Hospitals to identify bottlenecks and propose solutions. Bottleneck entry clerk identify remaining gaps and address them through subsequent engagements.

In the event that new priority tasks are introduced during the consultancy, the consultant will work with the Project staff to revise the tasks and expected products to accommodate for the new priorities.

In addition to the above-listed tasks, the Project welcomes additional contributions and creative ideas in support of the Project objectives.

The consultant is encouraged to support the identification of additional STTA and scopes of work to help accomplish Project goals and objectives.

Expected Products.

Within three days of the consultant’s first day of work (unless otherwise specified), the consultant should provide the methodology for successfully completing the work (using Annex I: STTA Methodology). The substance of, findings on and recommendations with respect to the above-mentioned task shall be delivered by the Consultant in a written report, policy statement, strategy, action plan, etc. for submission to USAID (using Project-provided STTA report template provided in the Welcome Packet). A draft of this report is due no later than 3 business days prior to the consultant’s departure (unless otherwise specified) and final no later than 7 business days after the consultant’s departure. Please note that USAID requires a debrief to be scheduled prior to your departure. You will find a list of debrief topics in the STTA Methodology template to cover with your team leader before you meet with USAID.

Working policies and procedures

STTA report

Timeframe for the Consultancy.

The timeframe for this consultancy is on or about 11/15/2012 and will conclude on or about 12/21/2012.

LOE for the Consultancy.

The days of level of effort (LOE) are estimated to be 30 days of LOE up to 22 days for work in West Bank. Unless otherwise specified, up to two (2) days may be allocated for preparation of the work and up to two (2) days upon conclusion of work in West Bank to complete the assignment.

Consultant Qualifications.

The Consultant shall have the following minimum qualifications to be considered for this consultancy:

Educational Qualifications

A degree in biomedical engineering or equivalent in experience

Work Experience Qualifications

At least 10 years of experience in the field biomedical engineering

Experience with training and/or teaching

Experience with international standards development

Familiarity with USAID and international experience

VII. Other Provisions.
This Scope of Work document may be revised prior to or during the course of the assignment to reflect current project needs and strategies.
Annex B: Assignment Schedule

Nov 18: Meeting held to discuss this consultancies initial plan with the Project procurement team. Agenda items included, building of a framework for medical equipment management with Policies, SOPs, Protocols, providing examples and new formats, working with HIS integration of maintenance, development of coding for the HIS system, provide resources to the BEU.

Nov 18: Meeting with Project leadership:
- Agenda – Discussion and plan to hand off the medical equipment resources and program to MOH with focus on completing our work,
- Develop a program or system to support MOH engineers
- Review and make recommendations for HIS Integration
- Work with BEU to get PM systems in place
- Make presentation/training to MOH Engineers about PMs, use of calibrators and encourage their success.

Nov 19: Meeting with the BEU Director and MOH BEU Management Team to review the strategy and plan for management inputs.
- Review of policies and procedures
- Standardization of terms and coding for nomenclatures
- Preventive maintenance
- HIS and ANSUR integration
- Protocols

Nov 23: Meeting with the Project HIS team to request for HIS maintenance module overview and screen shots, fields names and dropdowns and capabilities.

Nov 27: Meeting with Project HIS team to submit field name changes and proposed new drop downs to enhance the maintenance module.

Nov 28: Meeting with all MOH BEU Engineers at Huwarra Palestinian National Training and Calibration Center
- Made presentation to promote the benefits of PM to all BEU Engineers.
- Provided training on calibration equipment

Nov 29: Meeting with BEU Engineers.
- Review of Policies and Procedures
- Review and proposal of International coding standards for the BEU. Review of translated procedures with a new format introduced

Dec 3: Meeting with Project HIS team:
- Receipt of screen shots
- Tested possibilities for Ansur integration

Dec 4: Meeting with the MOH BEU Director to present and get approval to move forward with Standardized Coding
Dec 10: Meeting at PMC with MOH IT and two key BEU Engineers
- Bring responsible engineers up-to-date on new procedures
- Review HIS capabilities
- Promote involvement from BEU in making the system work

Dec 16: Meeting with Director of the BEU in Huwarra to discuss HIS concerns:
- Review of questions and set up a meeting to bring stakeholders together
- Receive new test calibration devices from the Project

Dec 17: Meeting with HIS Subcontractors and Project Engineers to review BEU concerns and to set up next meeting for MOH BEU leadership

Dec 18: Meeting with MOH BEU leadership and MOH IT at the Project office
- Bring all management module stakeholders together
- Finalize fields and discuss his integration of maintenance
- Make suggestion for future adjustment
- Set schedule for continued communication

Dec 19: Meeting with Project Staff to review draft STTA report and discuss.

Dec 20: Final review, modifications, additions, clarifications and submission of final draft for STTA report with the Project Procurement Manager.
ANNEX C: CONSULTANT CV

Curriculum Vitae

EDUCATION

1981 – US Army  Graduate: Basic Course-U.S. Army Biomedical & Ophthalmic Training Program

1982 – US Army  Graduate: Advanced Biomedical Course U.S. Army Biomedical & Ophthalmic Technician

1986 - Regis University  Denver, CO.  Under Graduate - Biomedical Engineering


TEACHING EXPERIENCE

Ethio China University  2010 – Biomedical Equipment Management and Repair
Muskegon Community College  1995-Present - Biomedical Equipment Repair
University of Eritrea  1997 - Laboratory Equipment Maintenance Five Week Sessions for Lab. Technicians and Medical Professionals

International Aid  1997- Present - Medical Equipment Training Program
Ghana West Africa, Pristina University, Kosovo Yugoslavia, Laboratory Instrumentation Philippines
WORK EXPERIENCE – ACCOMPLISHMENTS

IMEC  2012 – Present - Director of Medical Technology for International Medical Equipment Consortium, Consultant, Procurement, Project/program development

International Medical Technology Consulting Governments, Non- 2009 - Executive Director and Technical Director of IMTC Providing Technical Consulting to Corporations, Government Organizations (NGOs) and Educators

International Aid 2005-2009 - Director of HealthCare Technologies - Completed technical work in 87 nations, responsible for field assessments and technical consultation, Development of surgical training programs in Africa, Lead technical grant writer culminating in 11 awards for projects and program grants.

International Aid 1997 – 2005 Director Medical Equipment Services Responsible for repair production, international medical equipment installations, training of medical staff and biomedical engineers, site evaluation, health management training, donor account representative, technology procurement officer. Program officer for Kosovo & Ghana operations

PQMD  2001 – Published the current Medical Donations Standards for Biomedical Equipment. WHO committee member for medical equipment guidelines and the Partners for Quality Medical Donations

Mercy General Hospital  1992-1997- Director Biomedical Engineering, responsible for corrective and preventive medical equipment maintenance, asset management and patient safety.

ServiceMaster Inc.  1982-1992 - Various positions from Technician to Director of Medical Engineering

US Army Reserve  1980 -1986 - Biomedical Technician, preventive and corrective maintenance on therapeutic and diagnostic medical devices
PROFESSIONAL AFFILIATIONS

WHO
Appointed for 2009 as Consultant and member of the World Alliance for Patient Safety as Expert Panel Committee Advisor

AAMI
Member of the Association for Advancement of Medical Instrumentation since 2004

TECH
Technical Exchange for Christian Healthcare since 1997

Mid-West Biomedical Society
Since 1990

Pathologist Overseas
Volunteer Advisor Since 1997

World Health Organization
Kosovo Health Rehabilitation Team 2000 – 2002

SIDA
Swedish International Development Agency
Kosovo Desk Officer for Medical Equipment Training 2004 – 2005

Rotary International
Member since 2001

SELECTED INTERNATIONAL PROJECTS / PROGRAMS - 10 of 43

➢ Eritrea - Pathologist Overseas: Re-established functional central Laboratory and radiology services after more than a year without functioning services following the Ethiopian / Eritrean War

➢ Ghana - Appointed as primary laboratory analytic equipment instructor for the Medical Equipment Training Repair Program of International Aid. This training program is the first of its kind in Africa and is recognized by the World Health Organization as one of the most significant health support needs in developing countries. Granted funding for treating thrush in HIV Patient in Ghana, Granted Funding for Advance Trauma Operative Management introduction to the West African College of Surgeons. Granted Funding for telesimulation, live interactive video conferencing and long distance learning in developing countries. Appointed to complete research for telesimulation and patient safety by the WHO. Established the Medical and Surgical Skills Training Institute at Korle Bu Teaching Hospital in Accra Ghana. Acting Desk Officer for all International Aid programs and project from 2005 -2010.

➢ Benin - Served as technical advisor and project manager for the First Lady of Benin and Minister of Health in the design and outfitting of the only Women’s and Children’s Hospital in Cotonou.
- **Philippines** - Participated in establishment of biomedical engineering and technical repair of laboratory equipment at Lorma College in San Fernando.

- **Kosovo** - Advisor to UN for rehabilitation of medical services, engineering and training of biomedical engineers after the Serbian/Albania crisis. Acting Kosovo Desk Officer awarded a grant from the Swedish International Development Agency (SIDA) for reconstruction of health infrastructure for technology.

- **Rwanda** - advisor, with on-site field assessments for Partners In Health (Paul Farmer) to establish HIV focused healthcare treatment hospitals and clinics with USAID & Clinton Foundation for Partner in Health.

- **Indonesia** - Lead the Technical Components and negotiations for the Collaboration for Healthcare rehabilitation between the provincial Ministry of Health in Aceh province, Johnson & Johnson Corporation, WHO and International Aid. Lead inventory and Installation projects for equipment replacements in 23 hospitals after the tsunami. Participated in field technical training and opening of a central repair facility to service all provincial hospitals.

- **N. Korea** - 1997-2012 Technical Trainer, Repairs, installations and writer for Policies and procedure surgical rooms, radiology equipment and micro biological equipment. Installed diagnostic equipment on 24 separate visits. Worked WHO, Christian Friends of Korea, Mercy Corps, Stanford University and the US Nuclear Threat Initiative to plan and establish the National TB Lab in Pyongyang DPRK.

- **China** - Provided Technical Consulting for rebuilding of the Rehabilitation Hospital of Chendu after the 2008 Earthquake.

- **West Bank** - 2009- Chemonics International: Flagship Program provided consulting services for medical equipment procurement, training, policies and site assessments.

- **Ethiopia** - Chemonics International AHSE Program, Technical Consulting for Health Clinics, hospitals, training of biomedical engineers, repair Support, policies development, alternative energy, field assessment.

**PRESENTATIONS**

- **MSRO Conference, July** - Medical Surplus Recovery Organization
2012, Expert Panel for medical equipment placement and procurement for developing countries

- **PQMD**
  Published and presented the Standards for Quality Medical Donations at the 2005 Annual meeting for the 15 Largest Pharmaceutical and NGOs Organizations worldwide.

- **Global Medical Conference USA**
  Presented (Establishing a Health Facility in developing Nations.)

- **World Alliance Tele – For Patient Safety**
  WHO Presentation on Patient Safety and training using Simulation over broad band communications in Challenging Environments.
ANNEX D: BIBLIOGRAPHY OF DOCUMENTS COLLECTED AND REVIEWED

D1. Global Medical Device Nomenclature (GMDN) coding: GMDN license and access to codes
D2. Universal Medical Device Nomenclature System (UMDNS) - ECRI: UMDNS
D3. International aid digital service manual library
D4. Fluke digital manuals
D5. BC group digital manuals
D6. Biomedical engineering advisory group –
D7. Medical Equipment Life expectancies
D8. Sample policies and procedures from 4 organizations, University of Kentucky, US Navy, Columbia University Medical Center, Duke University Medical Center
D9. Current SOPS from the BEU
D10. ECRI – anesthesia comparison guide
D11. MOH list of west bank engineers
D12. NFPA 99
D13. AHSE risk codes
D14. IEC 61601 electrical safety standards
D15. BEU organizational chart
D16. BEU current protocols
D17. BEU existing coding systems
D18. Avicenna equipment cards
D19. PMC Medical Equipment Inventory
D20. AHSE Protocols
ANNEX E: LIST AND COPY OF MATERIALS DEVELOPED AND/OR UTILIZED DURING ASSIGNMENT

E1. Sample Maintenance Protocols for Existing Life Support Equipment *
E2. Draft BEU current SOPs_ translated and reformatted.*
E3. Presentation: Importance of Preventive Maintenance *
E4. Draft Medical Equipment Policies and Procedures for the BEU* (submitted to MOH for review and acceptance)
E5. MOH BEU suggested SOPs template*
E6. Coding system for nomenclatures using UMDS and GMDN Codes*
E7. ASHE Protocols for base Protocol format development (utilized)*
E8. PMC inventory with new codes and nomenclature*
E9. Summary sheet for Safe measurement limits per engineers request
Reviewed Equipment Inventory for Ramallah PMC Hospitals / Added Donors, standardized Nomenclature and group categories for HIS Upload*
E10. Drop down menus suggestion for the HIS AVICENNA Software*
E11. Used NFPA 99, and IEC 60601 International Standards to provide MOH with base standards for medical equipment regulations and policies*
E12. Life Support Protocols PMS_Resource*

*All materials developed or utilized have been made available to USAID via external link.
The Palestinian Health Sector Reform and Development Project is required by USAID to share success stories and where feasible implement communications and public awareness campaigns. The work of the Project short-term consultants such as yourself constitutes much of our assistance to the West Bank and Gaza, and therefore should be a meaningful part of these campaigns. The information from this form will provide the seeds on which many of our outreach efforts will be based and is a good way to gear our consultancies in a results-oriented manner. Please complete as soon as possible after arriving in the field.

Your Name: Mark Heydenburg

Focus Area/Purpose of Consultancy: Biomedical Engineering - Introduction of standards, policies, training of engineers, resource development, HIS integration with maintenance module. Provision of medical equipment resources,

Date of Consultancy: November 18- December 21, 2012

1. Briefly describe the nature of the assistance you will provide in West Bank and Gaza:

Biomedical Engineering equipment management development, improvement and support of the donations of medical equipment supplied to the west bank. The goal is to create mechanisms to promote sustainable methods within the Ministry of Health for the care, safety and improved delivery of health care services through improvements in management and repair skills development of Health care staff.

2. If you will participate in a seminar, conference, work shop or other event while in West Bank or Gaza, please describe your specific contribution (e.g. what you will speak about):

...................................................................................................................................
.....................................................................................................................................

1. Can you provide a few sentences about any stories that need to be told about the work that you’re doing or the changes you’re seeing as a result of the Flagship Project efforts? Please include a few sentences herein. A member of the results, reporting, and communications team will follow up with you if there are any questions.

When arriving at the BEU for the first time during Flagship team members sensed a resistance to changes and introduction of preventive maintenance. Some of the engineers openly express their feeling saying that preventive maintenance and the HIS system were wasting their time and was worse then what they are currently doing. After several visit with training and presenting information showing differences PMs and the HIS maintenance management module will make. The Flagship team is now happy to say they can turn over the reins of championing this project to the BEU team. The BEU management team is not only convinced of the value of the new equipment and software, but are encouraged to implementing the program as soon as possible.
2. Can you please share any noteworthy quotes or photographs?

Pictured left to right, Mark Heydenburg Flagship STTA, Engineer -Yulia Shadid –Director Ibrahim Elian
Meeting with MOH BEU Engineers and BEU Director

Pictured left to right, Issa Hababa, Sa’ead Basheer
Arrival of New Calibration devices Biomedical Engineering Unit Dec 2012