PONT is an initiative
of *Pontypridd Christian Concern*
Registered Charity No 515271
www.pont-mbale.org.uk

Mbale General Hospital

Engineering Report – November 2005, H A Smith CEng MIEE

1. **Background**
   As part of the twinning link between Pontypridd in the UK and Mbale in Uganda a team from Pontypridd visited Mbale arriving on 19 November and leaving on 26 November 2005. Various links and projects are being, and have been, set up as part of this link following from previous visits. The team on this visit included a hospital consultant from the Royal Glamorgan Hospital that serves Pontypridd and the surrounding area. One of the remits of the visit was to investigate the setting up of links between the two hospitals.
   I was on the team in my capacity as an engineer, with a remit to investigate the provision of clean water supplies to villages, and the potential to provide some additional IT facilities at the hospital.

2. **Initial Hospital Visit**
   On Monday 21 November the whole team made a tour of the hospital, and arrangements were made for me to look at the current IT provision at the hospital and to meet with relevant personnel to discuss the potential additional provision. During the tour, and initial discussions with the medical staff however, it became apparent that there was a significant amount of medical equipment and facilities at the hospital that were not in use due to a variety of faults.

   Note: It should be recognised in interpreting the content of this report that while as a Chartered Engineer I have a significant general engineering background, my specialist area of work is with IT and instrument and control systems for the steel industry. I have no specialist knowledge of medical equipment.

3. **IT Provision**

Centrally available IT provision is currently in the form of 2 PCs. These have the standard Microsoft Office applications installed, along with Internet access via a shared telephone land line modem.

Increased IT provision would benefit the hospital, particularly increased internet access. The central library of books at the hospital is severely limited, however the Internet would open up access to a huge range of publications, including the latest journals etc.

A networked computer system consisting of 2 servers and 12 clients, together with the associated keyboards, mice and screens has been made available to PONT for possible use in Mbale. It is considered that the most beneficial use of this system would be to install it at the hospital.

The clients currently have the standard Microsoft Office applications available, together with Internet access via the servers. PONT should confirm that all the software is fully licenced as the system has been made available due to the installation of a replacement system. (The cost of such replacement systems is often reduced by transferring the licences from the original to the replacement, thus leaving the original unlicenced as these would normally be taken out of service).

For convenience of use it would be ideal for the clients to be installed in the various departments around the hospital site. However these departments are spread over several buildings across a wide area. As a result, implementing this would require the installation of both copper and fibre optic cabling. Consequently it is considered that this approach would not be realistic due to the considerable expense involved.

An alternative implementation involving locating the clients in a single room provided for common access is the recommended solution as this will require minimal expense on cabling.

In addition to this cabling the following will also be required to provide a reliable and practical installation:

1. UPS (Uninterruptible Power Supply)
   Due to the unreliable performance of the local mains electricity supply a UPS is required to ensure reliable operation of the system, limiting the potential for corruption of files and other damage to the system due to brown outs and total supply loss.
2. Air Conditioning
   The room where the system is installed will require air conditioning to maintain a suitable ambient temperature. This is good practice in the UK where the weather is much cooler - in Mbale it would be essential.
3. Satellite Internet Connection
   The existing telephone modem connection would be inadequate to support several simultaneous access points. A satellite based connection would provide the bandwidth required to provide a usable level of service to several users simultaneously. Initial indications are that this would cost around £1000.
4. Virus Protection
   A suitable anti virus software package is required. To ensure continued protection against new threats this should include an ongoing subscription to receive regular updates.

4. **Medical Equipment Repairs**

In discussion it was discovered that there was minimal engineering support available to attend to faults with equipment and services at the site. This had resulted in a significant number of items of equipment etc. not being operational, which was impeding the service

being provided by the hospital. Although not in the original remit of the visit, as an Engineer, I agreed to look at some of these items of equipment to see if I could effect repairs. Fortunately I had brought a small tool kit with me to Mbale.
Initially I spent part of one morning on repairs. This was successful, but many other items of equipment still remained to be looked at. Following a revision to the visit programme for the week, a full day was made available for me to spend at the hospital on repairs. On this occasion the Hospital's part time contracted technician was available to accompany and assist me.
The following items were repaired/faults investigated:

1. **Slit Lamp (Opthamology Dept.)**
   The light source in this unit was reported as being dim and showing a double image. On investigation it was found that the bulb was fitted with the locating stud incorrectly positioned. The bulb was refitted correctly and the unit left working.

2. **Refractometer (Opthamology Dept.)**
   The control to move the head of this unit up and down in the vertical plane was reported as not working. On investigation it was found that the drive could be heard attempting to move the head, but the head was remaining stationary. The covers were removed from the unit. The head then moved up and down correctly from the control. It is suspected that a cable within the unit had been catching and was mechanically preventing the required movement. Cables were repositioned as required away from moving parts. Following refitting of the covers the unit was retested and left working.

3. **Blood Count Instrument**
   This unit was powered up, but failed the automatic self-test. This was due to one of the required reagent bottles being empty. No supplies of this reagent were available at the hospital. It was reported that the unit had become intermittent in its operation before the reagent had run out, hence no more reagent had been ordered. I was unable to investigate this fault as the lack of reagent was preventing the system proceeding through the operational sequence to the point of the intermittent fault. The departmental staff successfully located the manual for the equipment. This manual detailed a cleaning procedure. The staff seemed to be unaware of this. It is possible that the original fault was due to this cleaning procedure not having taken place, particularly in view of the high ambient temperature in the laboratory and the dusty atmosphere. It was noted that the windows have recently been glazed and an air conditioning unit installed to enable another item of equipment to function correctly. It is possible that if this air conditioning unit is used then with a supply of reagent and following cleaning this unit may operate correctly.

4. **Operating Theatre Lights (General)**
   Three portable operating theatre light units had various faults. These units included rechargeable batteries to provide for continued function of the lights in the event of mains power failure. Tests showed that all the bulbs in two of the units had failed, and most of the bulbs in the third unit. The power supplies and charging circuits were functioning correctly in all three units. The batteries in all three units had failed and were retaining no level of useful charge. As no spare bulbs or batteries were available no repairs could be carried out.

5. **Autoclaves (General)**
   The seal on the lid of one autoclave was worn and perished and no longer providing an adequate seal to enable the chamber to become pressurised. Due to the pressures etc involved only the correct replacement seal would provide satisfactory performance. A spare was not available so no repairs could be carried out to this unit.
   A second unit was also not functioning. It was reported that this had been electrically

isolated some time ago after repairs had been attempted. No information was available as to the original fault or if there was any plan to effect repairs. Investigation of the unit revealed a number of faults. The insulation of the heating element wiring had broken down leading to a short circuit and damage to the conductors. Fortunately sufficient good length of wire remained to enable them to be cut back and re-terminated. Tests showed the elements to be good and clear of earth. The safety interlock switch on the lid was found to have burnt out and had been disconnected thus preventing the heating stage of the sequence commencing. Fortunately the switch was of a generic type and I had a suitable spare with me. Also an identical autoclave was situated next to the faulty one so the required connections could be identified. The 15A circuit breaker supplying the unit was also faulty. This was temporarily bypassed to enable functional tests to be completed. This proved the Autoclave now to be fully operational. The hospital technician made unsuccessful attempts to locate a suitable replacement circuit breaker locally. I advised that one should be purchased at the earliest opportunity. In the meantime the fuse wire in the isolator should be replaced with 15A rated wire (which should be available from a local electrical store) and the isolator clearly marked to indicate this. This would enable the autoclave, which was desperately needed, to be brought back into service.

At some previous time the steam vents on both Autoclaves had been disconnected from the external pipe-work installed to discharge any steam safely to an exterior drain. The autoclaves were reconnected to this pipe-work.

6. **Surgical Tools (Orthopaedic)**

   There were various faulty surgical tools in the orthopaedic theatre. Several were mechanically worn beyond repair. One pneumatically operated device was repaired by freeing up the switch mechanism and oiling it. Two other identical devices were completely seized. Complete dismantling may have enabled repairs to have been effected, but there was insufficient time remaining on my visit to do this.

5. Recommendations

There is an obvious difficulty at the hospital with technical and engineering support of equipment and facilities, together with a lack of any spares holding.

1. **IT Provision**

   It is recommended that, should it prove feasible to implement the additional IT facilities, only eight of the twelve client units be put into service. This is consistent with the space available, and will also enable four complete units to be held as spares for use in the event of faults. The system comprises two servers which are configured together in a backup arrangement as standard.

2. **Engineering Support**

   Much of the equipment at the hospital is in a state of disrepair due to insufficient provision of Engineering support. While it is recognised that budgets are tight, serious consideration should be given to increasing and improving the engineering support at the hospital. The equipment has the capability to significantly increase the level of medical provision at the hospital, if maintained in working order.

   - Many items of equipment require some form of routine maintenance to keep them in working order, e.g. the surgical tools may have given uninterrupted service if they had been routinely lubricated. It is possible that some of these expensive tools have been rendered beyond repair due to a lack of relatively inexpensive on-going maintenance.
   - There is a need for a regularly available ‘first line’ repair capability. Inevitably some faults require specialist repair skills, and possibly expensive parts, but my visit

demonstrated that many faults are simple and can be rectified quickly and easily with little expenditure on parts.

- Some level of basic spares holding is required.

    1. A stock of consumable items such as bulbs, reagents etc should be held. A routine need for these is inevitable due to their consumable nature.
    2. A stock, at least of generic parts common to many items of equipment, should be held to enable rapid repair of basic faults.
    3. A system should be implemented to ensure replacements are purchased when these items are used in order to maintain a suitable level of stock.

    This would assist in keeping the equipment in the hospital in working order thus enabling it to fulfil the potential to facilitate the treatment of patients more effectively.

- The hospital buildings are in a state of disrepair. It is recognised that this is inevitable due to cost constraints, however I noticed that there were basic problems that could be addressed at minimal cost. E.g. doors were difficult to open due to the hinges and return springs simply requiring lubrication. In some cases the stiffness of the hinges was causing them to pull away from the frames causing further damage and misalignment. This was leading to two-way doors only being able to be opened in one direction, and even that with difficulty.

3. **Provision of Medical Equipment**

In the future PONT may be in a position to provide medical equipment to the Hospital in Mbale. This is likely to be equipment that has become redundant at the Royal Glamorgan Hospital due to updated equipment being installed there.

- The equipment should be shipped complete with all manuals and documentation, together with any relevant spare parts and consumables that were being held in the hospital stores.
- Engineering support should be provided to install and commission the equipment, and to provide technician training in first-line repair and maintenance procedures.
- Training in equipment operating procedures should be provided.
- The shipping of equipment would incur significant costs. With the current level of engineering support at the Hospital in Mbale, PONT should give serious consideration to the type of equipment involved. As such equipment will likely not be brand new there will be inherent reliability issues to consider. If the engineering support is not improved then there is considerable potential for such equipment to fall into a state of disrepair and become unusable in a relatively short period of time. In the current situation equipment shipped should be limited to that which is of a basic, non-technological type, e.g. drip stands, forceps etc.