

**‘Basic Maintenance of  
Medical and Laboratory Equipment’**

A course held at  
Royal Victoria Hospital, Banjul  
and  
Bansang Hospital,  
The Gambia  
April/May 2001

**DRAFT Preliminary Report**

## **1. Summary**

The course was held over three weeks from 23<sup>rd</sup> April – 11<sup>th</sup> May 2001. Participants were maintenance staff and laboratory staff, drawn from the Government sector – comprising the hospitals and rural health centres - and from the Medical Research Council (MRC). The backgrounds of the candidates, in terms of qualifications, education and experience, as well as job title, varied considerably. Some had spent several months or more studying in the UK, whereas others were only semi-literate (approximately 25% of the candidates were unable to complete the questionnaires unassisted).

A total of 35 candidates were registered for the course, with just one candidate unable attend for any of the sessions. Of the 34 who attended, 16 candidates were from the Banjul area, with the remaining 18 coming from up-country. Banjul-area candidates were drawn from the Royal Victoria Hospital, MRC Fajara, and the Department of State for Health (D.o.S.H.) maintenance team, who are responsible for maintaining the rural health centres. Up-country candidates were from Farafenni and Bansang Hospitals, Farafenni and Keneba MRC Stations, Kuntaur Health Centre, Bansang D.o.S.H. Maintenance Team, Basse MRC Station and Basse Health Centre. A total of 11 sites were thus directly represented, with the D.o.S.H. maintenance teams each being responsible for a number of rural health centres.

Overall, the course was felt to be very useful and successful, with all candidates keen to improve on their maintenance skills. Despite the limitations of a relatively short-duration course, candidates were motivated by being able to discuss common problems and by the hope that they might be given the means to solving at least some of these. Lack of basic tools – let alone specialist ones - was felt to be as great a need as for training, with a similar need for appropriate spares. An unanticipated benefit of the course was that of simply bringing together a relatively diverse and scattered group of people, so that they could share ideas as well as frustrations!

Many candidates would benefit from further training, although this would not necessarily mean specialist biomedical training: basic engineering skills such as electronics servicing – which is accessible locally - would enable a far greater understanding of much of the equipment they work on. Such training would really be a pre-requisite for any ‘advanced’ course, as it would not be feasible to cover both the basic electronics skills and equipment-specific biomedical training. Any further training would also have to be accompanied by the provision of suitable resources: not just advanced tools or test equipment, but basic spares and components.

## **2. Structure and Programme**

The course was planned to be mornings-only (9am – 1pm), with the intention of allowing scope in the afternoons either for extended work on particular pieces of equipment requiring attention, or for candidates to catch up on some of their regular duties (NB: in lieu of a public holiday on 1<sup>st</sup> May, a full day was scheduled for 3<sup>rd</sup> May).

Due to the difficulty in candidates being away from their normal posts for three consecutive weeks, the course was structured such that each candidate would attend for two out of the three weeks. All candidates (where possible) attended the first week, which was designated as a ‘core’ week and held at RVH Banjul. The second and third weeks were duplicated, with candidates from the Banjul area attending for week 2 (held in Banjul), whilst candidates from up-country returned to their normal posts; in week 3 (held at Bansang Hospital) only those candidates from up-country were in attendance.

Because the course was intended to promote an awareness of the importance of maintenance, rather than focus solely on solving immediate needs, the first ‘core’ week was a more ‘theoretical’ week, covering issues relating to some of the principles and philosophy of maintenance, of the implications of maintaining or not maintaining equipment, and so on. Weeks 2 and 3 were designated as ‘hands-on’, i.e. practical equipment-focused sessions. It had originally been intended that all candidates would be in attendance for all three weeks, i.e. for one week of ‘theory’ followed by two weeks of ‘practical’; however this was not possible for the reason outlined above.

### **Week 1: ‘Theory’ (RVH Banjul)**

Although nominally designated as a ‘theoretical’ week, it was always intended that this would be at a basic level, be interactive, and participatory. The week made extensive use of overhead projector transparencies to introduce ‘bullet points’, with discussion following wherever possible. Candidates were keen to both contribute and ask questions. Despite the fact that some were of a far higher educational standard than others, all were united in their enthusiasm to improve on their maintenance skills, and there was very much a sense of ‘solving common problems together’. It was apparent that there considerable benefit in simply drawing together participants from a diverse range of locations, sectors and job descriptions.

The week covered the following topics: (1) General Concepts of Equipment Maintenance – an introductory session looking at subjects such as ‘Reasons and Goals of Maintenance’, ‘Types of Maintenance’ (repair, planned maintenance etc.); (2) Implementing a Maintenance Programme – looking at Involving Maintenance in Equipment Management, Implementing Planned Preventative Maintenance etc.; (3) General Principles of Mechanical Maintenance – an overview of some of the important factors common in mechanical maintenance, including lubrication, bearings, gaskets and seals, filters; (4) General Principles of Electrical Systems – covering single- and three-phase electricity supplies, cables, fuses etc.; (5) Safety Considerations in Maintenance of Electrical Equipment – including electrical safety hazards, factors important in ensuring electrical safety, etc.; (6) Medical Equipment Safety – covering the specific precautions required with medical equipment, safety categories of medical equipment etc. Copies of all materials prepared were issued to the candidates in the form of hand-outs.

## Week 2: 'Hands-on' (RVH Banjul)

The types of equipment that the week was able to focus on were necessarily constrained by that equipment which was available to the course. At RVH Banjul there was fortunately a wide selection of available equipment, either awaiting repair, 'out of service' (not necessarily meaning awaiting repair!), or which could be 'borrowed'. There were conflicting priorities however between selecting commonly-found equipment - which might not necessarily be faulty, and equipment which required attention but was either unusual or specialised – and therefore would be of lesser general benefit to the candidates. In general, before undertaking the actual 'hands-on' work there was an introductory session covering the basic principles of operation of the equipment in question, factors important for maintenance, etc.

The first day of this week had been designated as a 'Laboratory Equipment' day, enabling those candidates who were laboratory staff with relatively little involvement in maintenance (and not needing to become significantly further involved) to attend just this session, and then not need to attend on subsequent days, which would cover medical equipment only. Equipment selected for inclusion was a basic colorimeter (Corning 252), bench-top and haematocrit centrifuges, and microscopes. The availability of a Service Manual and some specific spares meant that calibration and repair of the colorimeter and haematocrit centrifuge respectively could be achieved. With the bench-top centrifuge and microscopes, it was possible in the case of the centrifuge to accomplish minor dismantling only, to identify principal components and point out parts often requiring attention. The microscopes were instruments in current use (not broken or requiring attention), so work on these was limited to cleaning procedures only.

Equipment covered in the remainder of the week included electrical suction pumps, gas cylinders/cylinder storage and regulators, the EMO anaesthetic vaporiser, infant incubators, cardiac monitors and electrocardiographs. An abortive attempt was made to cover laboratory incubators also, but due to a misunderstanding there was not a suitable unit available. The depth to which each type of equipment was covered varied considerably, according to availability of time and spares/tools/manuals etc. With the suction pumps, the focus was on the 'SAM12' type of pump, a model which is in widespread use and in widespread need of repair. Spares specific to this type of pump had been brought in anticipation of this, and the candidates were able to re-build three working units from four previously thoroughly 'dead' units. Additionally, modifications were introduced to help prevent similar failure in future. With the remainder of the equipment, the practical sessions were limited to minor dismantling and/or examination, enabling identification of those features requiring maintenance attention. With the EMO vaporiser, the use of a video demonstrating the dismantling procedure helped to vary the format of the sessions.

## Week 3: 'Hands-on' (Bansang Hospital)

"It will be very hot in Bansang, but don't worry - the hospital's air-conditioned, and so is your accommodation". What everyone neglected to say was that nothing happens as predicted in Bansang; that the electricity – and hence the air conditioning - is only available when you don't need it, and that the person you're looking for will always have 'gone to the market' when you need them. The first problem to be encountered was that the original venue was unsuitable, but fortunately an alternative was quickly found. On the second day the tables in this venue were spread with tablecloths and with vases of flowers on, and we

rightly assumed that these were not for the course! We duly transferred to another room, and the phrase ‘this is Bansang’ came to symbolise all the subsequent ‘incidents’ such as this which came to characterise the week! Nevertheless, ‘Week 3 at Bansang’ did take place, and overall was a very useful and interesting experience for all!

As at RVH Banjul, the types of equipment that the week was able to focus on were constrained by that equipment which was available – at Bansang however, the choice was more limited, and accessibility sometimes ‘restricted’! It had always been intended that the week would primarily focus on the equipment requiring attention at Bansang Hospital itself, and on equipment to be brought by the candidates from other sites. As it turned out, the range of equipment covered was almost identical to that covered at Banjul in week 2. With a smaller amount of equipment in Bansang however, the quantity of ‘spare’ equipment available was severely restricted – usually to only one example of each. Originally it had been envisaged that only 5-10 candidates would be present for this stage of the course; in the event however, there were a total of 16 candidates in attendance. This meant that it was unfortunately not possible for all candidates to work on the equipment together – the majority had to just watch others ‘perform the surgery’. We were able to repair another ‘SAM12’ suction pump, a haematocrit centrifuge, and even an overhead projector! An EMO vaporiser was ‘salvaged’ from outside the maintenance unit (where it had been languishing in the heat and dust – no-one knew how long it had been there or why) – again making use of the video (once Bansang’s video recorder had been ‘resuscitated’!) Other equipment brought in for repair was ‘diagnosed’, but could not be repaired due to the required spares being unavailable.

The majority of candidates attending this part of the course were either of a low educational standard, or were laboratory staff; i.e. few had substantial maintenance skills. They all therefore found it of great interest and benefit simply to open-up pieces of equipment and see what was inside them, whether or not a repair could be effected.

### **3. Candidates' Feedback and Evaluation**

In order to provide some measure of establishing how useful and effective the course might prove to have been, the candidates were issued with pre- and post-course questionnaires. These are appended to the rear of this document, annotated with the mean responses. The pre-course questions were devised to assess the candidates' backgrounds and skill levels, how much the course was likely to be of benefit to them (taking into account their present roles), and what they themselves hoped to gain from the course. The post-course questionnaire was both an evaluation of how much each candidate had gained from the course, as well as feedback on how to incorporate improvements to any similar course in future.

As has been mentioned already, there was a general enthusiasm prevalent amongst the candidates, reflecting their keenness to exploit any opportunity to improve their abilities and workplace facilities. Despite the widespread abundance of out-of-service equipment to be found in every hospital or health centre, it was clear that the maintenance (and laboratory) staff would far rather be in a position to be able to keep it up-and-running. Therefore a very positive reaction to the course was generally expressed, both through the questionnaires and throughout the course.

Although it had been originally intended to make the course one week of theory followed by two weeks of practical, rather than the one week of each which is how it turned out, perhaps surprisingly more candidates indicated that they felt the balance was about right than those who would rather have had more practical and less theory. There were – unsurprisingly - no candidates who indicated that they would rather have had more theory and less practical!

On the question of the 'least useful session' (relating only to the theory week), many candidates selected 'mechanical maintenance'. This was not investigated further, but could be due to (i) the content of the session itself, which was not very thorough (only half a morning), or (ii) the fact that most of the candidates were more involved in electrical maintenance, and this was their main area of interest. The 'most useful session' was not so clearly identified, with all the sessions (*except* mechanical maintenance) being selected by different candidates. Several candidates put 'none' for the 'least useful session' and 'all' for the 'most useful'.

The questions identifying the candidates' perceived level of knowledge of electrical, mechanical and medical equipment maintenance before and after the course drew a somewhat ambiguous response, with as many candidates indicating a deterioration in their knowledge as those indicating an improvement! This is almost certainly due to deficiencies in the questionnaire more than anything else, but could also reflect some candidates' difficulties in reading, understanding and answering the questionnaire; it could also reflect in some cases a legitimate realisation that they don't know as much about maintenance as they thought they did before!

Other clearly-expressed views were a serious lack of tools and spares as well as training; also a desire for further training (both more in-depth and covering a greater variety of equipment).

#### **4. ‘With the benefit of hindsight’**

Given that the course was put together within a relatively short and hurried time-frame, it is felt to have gone extremely well. There were no major problems incurred through not bringing something essential, and no need to make many frantic calls back to ECHO. There is always room for improvement however, and this course has proved invaluable in identifying what works well and what doesn’t work so well; what is useful and what is not so useful.

#### **Preparatory Visit**

The pre-course visit was absolutely essential for the following important reasons: (i) meeting those ‘on the field’ who will be involved in the running and organisation of the course; (ii) seeing the venue and facilities in which the course will take place; (iii) meeting some of the potential candidates and getting an idea of the kind of facilities and working environment they have; (iv) identifying commonly-found types of equipment (i.e. makes & models) – not just that in maintenance departments awaiting repair, but also in labs, wards, theatres etc. In this case it was not possible to visit Bansang Hospital, which meant that to a certain extent assumptions had to be made about what would be available there, based on visits to RVH Banjul and Farafenni Hospital. In the event, this led to problems relating to (a) the venue and (b) equipment availability. A visit to *all* sites where a course is to be held should therefore be considered a must.

#### **Materials**

Due to the limited time available for preparation of the course beforehand, the vast majority of it had to be prepared ‘on location’. Whilst this offered the advantage of increased flexibility, it did consume a considerable amount of time which could otherwise have been used for e.g. attending to broken-down equipment in the hospital (which would not be covered by the course). It would also have been advantageous to have had the time to be able to produce materials which were not text-only but included more diagrams, drawings/illustrations, even cartoons (some diagrams were included, but were mostly limited to those which could be photocopied from textbooks). A supply of photocopiable overhead-projector transparencies was invaluable, as were the basic OHP pens and write-on transparencies (NB: bringing a spare bulb for the OHP was considered a wise precaution – in the event, one was used for repairing one of the OHP’s at Bansang!). Other materials used included samples, e.g. anti-bacterial filters, voltage protection modules; incomplete pieces of equipment, e.g. rotary suction pump; tools and test equipment. Extensive reference was also made to the two principal books used in the course and afterwards distributed amongst the candidates, published by WHO and VSO\*. Mention has been made of a video demonstration of dismantling the EMO vaporiser; this type of presentation could also be used more extensively, e.g. to show dismantling of other types of equipment which it might not be possible to physically dismantle on the course (see later).

---

\* VSO “Care and Safe Use of Hospital Equipment”; WHO “Maintenance of Laboratory, Diagnostic Imaging and Hospital Equipment”

## Topics Covered

Overall, the theoretical topics covered seemed to meet the needs of the majority of candidates, taking into account their greatly differing backgrounds and roles (some were more interested in acquiring basic maintenance skills, whereas others were looking for ways of planning and organising their maintenance more effectively). The issue of mechanical maintenance is slightly more difficult to resolve, as this inevitably leads into areas of non-medical or laboratory equipment, diesel generators being a notable example. One cannot ignore however the fact that many members of maintenance staff have a remit which covers all types of equipment – including buildings services, generators and so on – and are not limited to having responsibility only for medical or laboratory equipment. Indeed many find that more of their time is taken up with maintaining the ‘infrastructure’ equipment than the medical or laboratory equipment itself.

## Timescale and Structure

It was universally agreed that a longer course would have been better. There are conflicting requirements however between the desirable length of a course, and the period of time for which a candidate may be absent from their normal post. In this case a compromise was reached whereby each candidate was only away from their post for one week at a time (on the assumption that Banjul-based candidates were able to return to their duties in the afternoons if necessary); two weeks however was considered too short really for a total course duration. When the course was being planned, it was envisaged that approximately two-thirds of the candidates would be from the Banjul area, with up-country candidates being a relative minority. The number of candidates who were finally registered in this course though was sufficient to justify two entirely separate courses (setting aside funding issues) – one for Banjul-based candidates, one for up-country candidates. However, this would still not have resolved the issue of candidates being away from their bases for several weeks consecutively. One possible solution in similar circumstances in future might be to hold two ‘parallel’ courses for alternating groups of candidates, i.e. week 1 group 1, week 2 group 2, week 3 group 1 again, and so on.

## Tools, Test Equipment and Spares

It would be almost impossible to conduct a useful hands-on course without bringing a selection of tools and spares (test equipment being useful but of lower priority). Even the most rudimentary spare parts are likely to be unavailable – or at least difficult to obtain – locally, and this is an important point to be borne in mind when making a preparatory visit (especially in regard to equipment-specific spares). Service Manuals are also useful, but can only be brought in limited numbers due to their size and weight.

## Equipment Availability

In order to conduct hands-on sessions, suitable equipment needs to be available to work on. In certain cases – e.g. SAM12 suction pumps at Royal Victoria Hospital – there were plenty of broken-down units available for candidates to work on. With other equipment however, it could only be borrowed for a short time and not taken apart, due to the fact that it was in



regular use. At Bansang Hospital, certain equipment could not even be ‘borrowed’, but could only be viewed in-situ. This latter situation was not solely due to equipment inavailability, but also because of insufficient planning and prior arrangement – something which again needs to be borne in mind for future courses, but might prove difficult to implement in practice unless one knows exactly which types of equipment will be required, and the course can be planned to fit around them. Another problem was lack of sufficient quantities of equipment: ideally, no more than (say) four candidates should have to share a piece of equipment. If necessary, suitable equipment could be shipped out from ECHO; however, this would only be appropriate if it was of the same type as commonly found in the local situation. Another solution might be to make use of pre-recorded videos (filmed at ECHO?) to show ‘the insides’ of equipment which cannot be dismantled then-and-there, illustrating dismantling procedures, parts often requiring replacement, maintenance procedures etc. Although this would be an inferior substitute for ‘hands-on’, it would be better than being restricted to only seeing the outside of the equipment in question. Copies of the video could then be left behind for future reference.

### Course Organisation and Administration

The demands of actually ‘running’ the course – as opposed to preparing and delivering it – were not inconsiderable. In addition to trying to ensure the availability of a suitable room, suitable equipment and so on, there were also tasks such as organising the photocopying of handouts, supplying stationery to the candidates, organising candidates’ refreshments, calculating and administering candidates’ attendance and travel allowances, and so on. These latter points are covered below. Taken together, all the above represented a considerable amount of time which could perhaps have been better used working on equipment. The only solution would have been to have someone on-hand to deal with all these issues; however, realistically this was not possible due to the already-heavy workloads of all those providing assistance with the course.

### Allowances and Expenses

Candidates’ ‘demands’ were something which had not been adequately anticipated and prepared for! Although travel and accommodation were factors which were agreed and understood, it only became apparent at the start of the course that candidates would customarily also expect an allowance simply for being in attendance. This was something which had not been budgeted for, and could have amounted to a considerable sum of money (WHO might typically pay D250 – approximately £10 – to each candidate per day of attendance, for example). A compromise was reached based on the fact that this was a relatively long-duration course (not the normal two or three days) and that it was mornings-only, allowing overall allowances paid out to candidates to remain in budget. ‘Refreshments’ – which basically ended up being a small meal – were also expected, although these were able to be provided at relatively little cost. Other unanticipated ‘provisions’ the candidates required were notepaper, a pen(!), and a folder to keep everything in.

## **5. Further Thoughts**

Although such a course has to have its emphasis on maintenance as a ‘concept’ and on covering common, ‘generic’ types of equipment, the needs of the locations represented are likely to be both specific and pressing. These cannot be ignored, so an element of a ‘service visit’, over and above the element of on-site repair which can be incorporated into the course-proper, has to be planned into the time-frame allowed.

It is especially discouraging, if not depressing, to see ‘ECHO Reconditioned’ equipment lying not just idle, but gathering dust and rust. Several such examples were seen at both Bansang and RVH Banjul, and these are not items of equipment which were delivered ten years or so ago, but just two or three years ago. Typically the original problem is only very minor, but on the assumption that ‘it cannot be repaired’ the equipment has been taken out of service, stored in unsuitable conditions, and often ‘cannibalised’ for spares for other equipment – rendering it by then almost truly unrepairable (viably). ECHO has an after-sales support policy which covers reconditioned equipment, yet this does not seem to reach those who need to make use of it. A recommendation might be to attach a large, durable label to all items of ECHO-reconditioned equipment saying simply “If this equipment breaks down or requires spare parts, please contact ECHO”.

An equipment-specific problem relates to the SAM12 suction pump. These seem to be prolific throughout the developing world (I even saw one on a Gambian Television programme about bee-keeping), yet are particularly prone to serious damage through fluid being drawn into the pump mechanism. At RVH Banjul, there were approximately 15-20 of these pumps out of service, with probably only 5 in use. A simple modification – the fitting of an automatic shut-off valve, as implemented on those pumps worked on during the course - should prevent this problem from recurring. An immediate recommendation would be to fit all such pumps supplied by ECHO, whether new or reconditioned, with such devices, together with supplying a quantity of necessary replacements (they are single-use devices). It would also be a good idea to draw this problem to the attention of the manufacturers.

## **6. For Follow-Up**

Apart from a follow-up visit to assess the impact of the course, there remains the task of putting together a package of tools, test equipment, books and spare parts specific to each base represented. Also, there are some specific spares and manuals to be sourced for some of the faulty equipment which was identified during the course.

## **7. Appendices**

1. Pre-course questionnaire
2. Post-course questionnaire
3. Questionnaires: Summary of Answers
4. Course Candidates/Attendance

## **Basic Maintenance of Medical and Laboratory Equipment Pre-course Questionnaire**

Name: .....

Job title: .....

Base: ...

MRC/Govt. Hosp./DoSH

Please give an answer of 1-5 for each question:

1 = none or very little

2 = some

3 = more than some, but not a lot!

4 = quite a lot

5 = very much

or N/A ('not applicable') where necessary

1. How much involvement in maintenance is there in your job at present? .....
2. How well do you think you understand how the equipment which you use/maintain works (in general)? .....
3. Do you think you know what the important points are in how to take care of/maintain the equipment you use/maintain? .....
4. If you had more knowledge about how the equipment you use works, and how to maintain it, would that be useful to you? .....
5. How much do you feel you already know about maintenance in general? (maintenance programmes, routine maintenance etc.) .....
6. How much do you feel you know about maintenance of mechanical equipment? .....
7. How much do you feel you know about maintenance of electrical equipment? .....
8. How much do you feel you know about maintenance issues specifically related to medical equipment (equipment which is used on patients)? .....
9. Do you feel you have the right tools/equipment/manuals etc. for any maintenance you are doing or would like to be able to do? .....
10. Do you feel you have the right skills, training etc. for any maintenance you are doing or would like to be able to do? .....
11. Do you feel you have the right spare parts etc. for any maintenance you are doing or would like to be able to do? .....
12. Are there some maintenance jobs which you do not do because you do not feel confident/experienced/knowledgeable enough? (but not because it's not your job to do them) .....
13. Please write a few words below to summarise what you hope to learn/gain from this course:

# Basic Maintenance of Medical and Laboratory Equipment

## Post-course Questionnaire/Evaluation

Name: .....

Job title: .....

For questions 1 to 8 please give an answer of 1-5:

1 = none or very little

3 = more than some, but not a lot!

5 = very much

2 = some

4 = quite a lot

or N/A ('not applicable') where necessary

1. In general, do you think that your understanding of how the equipment which you use/maintain works has increased? .....
2. *How much more* do you think you now know about what the important points are in how to take care of/maintain the equipment you use/maintain? .....
3. *How much more* do you feel you now know about maintenance in general? (maintenance programmes, routine maintenance etc.) .....
4. How much do you feel you now know about maintenance of *mechanical* equipment? .....
5. How much do you feel you now know about maintenance of *electrical* equipment? .....
6. How much do you feel you now know about maintenance of *medical* equipment? .....
7. Are there any maintenance jobs which previously you did not do because you did not feel confident/experienced/knowledgeable enough, but which now you might feel able to do (if you had the right tools/test equipment/spares)? .....
8. If the course was any longer, or if further training was available to you, would that be of use to you? .....

For questions 9-11 please give an answer of (a) to (e):

9. Would you have preferred (a) more 'theory' and less 'practical'  
(b) more 'practical' and less 'theory'  
(c) the same as it was? .....
10. Which subject did you find *most* useful? (see below) .....
11. Which subject did you find *least* useful? (see below) .....  
  
(a) General Equipment Maintenance, (b) Implementing a Maintenance Programme,  
(c) Mechanical Maintenance, (d) Electrical Systems,  
(e) Safety of Electrical Equipment, (f) Medical Equipment Electrical Safety
12. Are there any subject(s) or type(s) of equipment which you would have liked to have been covered by the course but were not (please write below)?
13. Are there any suggestions you would like to make about what to include or how to improve a similar course in future?

## Pre- and Post-course Questionnaires: Summary of Answers

Name	Pre-course Questionnaire												Post-course Questionnaire										
Question no.	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Kebba Njie	5	4	4	4	5	4	4	4	2	3	2	3	4	4	4	4	4	4	3	4	c	b	a
Modou Joof	4	2	2	5	2	4	2	2	1	2	1	2	2	4	4	3	4	3	2	5	b	f	d
Ebrima Nyassi	4	3	2	4	2	3	3	3	2	2	2	3	3	4	4	3	4	4	2	4	b	b,d	a
Baboucarr Mbye	4	3	2	4	2	1	1	1	2	1	2	2	3	4	4	4	1	2	1	4	b	e	c
Joseph Mendy	4	2	2	5	4	3	5	3	3	1	1	2	2	2	2	2	2	2	1	5		a	c
Haddy Bah	1	3	3	5	3	3	3	2	2	1	2	5											
Janet Fullah	3	4	5	5	1	1	1	1	1	1	2	1											
M.L. Jammeh	2	3	3	5	2	2	2	2	1	1	1	2											
M.C. Jaye	2	5	4	5	4	3	3	2	2	4	1	4											
Olaleye Ostetade	5	4	5	5	4	3	4	4	5	4	5	2											
Edrissa Manneh	2	3	1	5	2	4	4	4	3	4	4	4	5	5	5	5	5	5	4	5	c	b	e
Lang Dibba	5	3	3	5	4	2	4	1	2	3	1	5	3	3	4	2	4	3	4	5	b	all	0
Boto Jaiteh																							
Samuel Jones	4	3	3	4	3	2	3	2	3	2	4	2	4	4	3	3	4	3	1	5	b	d	
Lamin Fatty	4	2	2	5	2	2	3	1	5	1	2	2	2	3	2	3	3	3	1	5	b		c
Mbye Njie	4	2	2	5	2	2	2	1	5	1	2	2	4	2	4	3	3	3	4	5	b	a	c
Karamo Camara	4	2	4	5	2	1	1	1	1	1	1	4	4	4	3	4	4	4	4	5	c	e	
Buba Bah	4	4	4	4	4	4	3	2	2	3	3	1											
Sako Jabo	4	4	4	5	4	3	4	2	2	2	2	2	4	4	4	5	4	4	4	4	c	a	
Pa B. Babou	3	4	4	5	4	3	3	3	5	3	2	2	4	4	4	3	3	4	3	5	c	b	
Omar Sey														4	5	4	3	3	4	4	c	a	d
Landing Faal	1	5	2	4	3	3	3	1	2	2	4	5	4	5	4	2	4	4	5	5	c	f	c
Lamin Jobe	2	1	1	4	2	2	2	3	2	5	4	2	2	4	5	3	3	3	4	5	c	f	0
Nfansu Colley	4	4	4	5	4	4	4	3	2	2	2	2	4	4	3	4	3	3	2	3	c	b	c
Hubert Ballaman	5	4	4	5	4	4	4	3	2	4	1	1											
Bunja Saidy	5	4	4	5	4	4	5	3	2	4	1	1	4	4	4	5	5	5	5	5			
Lamin Njie	4	2	2	5	3	1	1	1	2	3	1	2				5	2	4					
Saran Colley	4	1	1	5	2	1	1	1	1	5	1	5	5	4	3	3	2	2	3	5	c	all	0
Alkalo Sonko	4	3	4	4	3	2	2	2	3	1	2	3											
Amadou Mballow	4	4	4	5	4	3	5	4	5	5	1	1											
Ousman Bah	4	4	4	4	4	4	4	2	2	3	3	1											
Lamin Jobe	4	5	5	5	4	3	4	3	3	3	2	1	5	4	4	3	4	4	4	5	c	a,d	0
Ekow Biney	5	5	4	4	4	4	2	2	2	3	2	5	3	3	4	3	3	3	2	4	c	b	c
Modou Bah	1	3	4	5	1	1	1	2	5	1	1	5	3	4	2	2	2	2	4	5			
<b>Average score:</b>	3.6	3.3	3.2	4.7	3.1	2.7	2.9	2.2	2.6	2.5	2.0	2.6	3.5	3.8	3.6	3.3	3.3	3.4	3.0	4.6			

### Basic Maintenance Course: Candidates/Attendance

Hospital/Clinic		Name		Job Title	Background and Experience	RVH Banjul											Bansang					Total																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
						23	24	25	26	27	30	1	2	3	4	7	8	9	10	11																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
						M	T	W	T	F	M	T	W	T	F	M	T	W	T	F																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Banjul	RVH	1	Kebba Njie	Hospital Engineer		✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		2	Modou Joof	Maintenance Technician	7 yrs. experience, 9 months in UK, 2 years Biomedical Engineering (Nigeria)	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		3	Ebrima Nyassi	Maintenance Technician	6 yrs. experience, inc. 6 months in UK, electronics and electrical qualifications	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		4	Baboucarr Mbye	Maintenance Technician	4 yrs. experience at RVH, mainly in electrical and refrigeration work.	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		5	Joseph Mendy	Maintenance Technician	9 yrs. experience, Refrigeration & Air Conditioning + Basic Engineering quals.	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		6	Haddy Bah	Lab. Technician	12 yrs. experience	✓					✓											2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		7	Janet Fullah	Lab. Technician	10 yrs. experience	✓					✓											2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		8	M.L. Jammeh	Lab. Technician	10 yrs. experience	✓					✓											2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		9	M.C. Jaye	Lab. Technologist		✓					✓											2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	MRC Fajara	10	Olaleye Osetade	Head of Planned Maint.	Has Higher Education qualification	✓	✓	✓	✓					✓								5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		11	Edrissa Manneh	Jnr. Electronics Tech.	Little formal training - mainly experience	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		12	Lang Dibba	Jnr. Electronics Tech.	Little formal training - mainly experience, mostly in telecomms.	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		13	Boto Jaiteh	Lab. Technician										✓	✓							2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		14	Edward Demba	Lab. Technician																		0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	DoSH Maint. Team	15	Samuel Jones	Maintenance Technician	22 yrs. experience at RVH and medical HQ maint. team	✓	✓	✓	✓	✓	✓		✓	✓	✓							10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		16	Lamin Fatty	Electrician			✓	✓	✓	✓	✓	✓		✓	✓	✓						9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		17	Mbye Njie	Electrician			✓	✓	✓	✓	✓	✓		✓	✓	✓						9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
Keneba MRC		18	Karamo Camara	Lab. Technician	none	✓	✓	✓	✓	✓						✓	✓	✓	✓	✓	10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Farafenni	AFPRC Hospital	19	Buba Bah	Generator Operator	Little formal training; mainly involved in mechanical maintenance												✓	✓	✓	✓	5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		20	Sako Jabo	Generator Operator	Little formal training; involved in mechanical and electrical maintenance	✓	✓	✓	✓	✓	✓		✓	✓	✓						10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		21	Pa B. Babou	Lab. Technician	17 yrs. experience, responsible for all lab equipment	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		22	Omar Sey	Lab. Assistant	4 yrs. experience						✓		✓	✓	✓						5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	MRC Station	23	Lamin Jobe (1)	Handyman	Has only been employed there a few months. Little formal training	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		24	Nfansu Colley	Lab. Attendant	Some electronics background; also some informal lab equipment repair training	✓	✓				✓				✓	✓	✓	✓	✓		8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Kuntaur DoSH		25	Landing Faal	Lab. Assistant	17 yrs. experience		✓	✓	✓	✓						✓	✓	✓	✓	✓	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Bansang	Hospital	26	Hubert Ballaman	Maintenance Supervisor	VSO Volunteer (general maintenance background, has only just arrived at Bansang)	✓	✓	✓	✓	✓					✓	✓					7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		27	Bunja Saidy	Electrician/Engineer	8 yrs. experience (refrigeration and air conditioning)	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		28	Lamin Njie	Lab. Technician	17 yrs. experience	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		29	Saran Colley	Lab. Technician	20 yrs. experience	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	DoSH Maint. Team	30	Alkalo Sonko	Plumber	3yrs experience, plumbing and electrical work										✓	✓	✓	✓	✓		5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		31	Amadou Mballow	Electrician	4 yrs experience, plumbing and electrical work										✓	✓	✓	✓	✓		5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		32	Ousman Bah	Mechanic	3 yrs experience										✓	✓	✓	✓	✓		5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Basse	MRC Station	33	Lamin Jobe (2)	Handyman	Has only been employed there a few months. Little formal training	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		34	Ekow Biney	Lab. Technician	MSc + 13yrs. experience in Biomedical Sciences, inc. 5yrs. in UK	✓	✓	✓	✓	✓					✓	✓	✓		✓	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	DoSH	35	Modou Bah	Lab. Technician											✓	✓	✓	✓	✓		5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

