

MIR

MOBILE INTENSIVE CARE RESCUE FACILITY
(MIRF)

9 FEB 1995

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**OPERATIONAL EVALUATION
OF THE
MOBILE INTENSIVE CARE
RESCUE FACILITY
(MIRF)**

OPERATION TAMAR
UNAMIR II
RWANDA

COL WARFE


SIR, I FOUND THIS LYING
AROUND, I DON'T KNOW IF
YOU HAVE SEEN IT

MSD Woe
8/3/95

FLIGHT LIEUTENANT TREVOR GARDNER
MEDICAL OFFICER
AUSTRALIAN SERVICES CONTINGENT
UNAMIR II
RWANDA

ONCE DAILY
ROCEPHIN[®]
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First verbal
mirf report for
your action.

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9 FEBRUARY 1995

INTRODUCTION

Background

100. The Australian Defence Force committed personnel to Operation Tamar in support of the "United Nations Aid Mission in RWANDA" (UNAMIR II) from August 1994. The primary role of the Australian Services Medical Support Force was to provide Level 3 medical care to UNAMIR forces and UN personnel. Significant humanitarian and Non Government Organisation medical support was also provided.

101. AUSMED occupied the private wing of the Central Hospital of Kigali and maintained a hospital comprising all essential departments. The RAP, Resuscitation Bay, Intensive Care Unit, Inpatient Wards and Operating Theatre were provided with Pathology, Radiology, Physiotherapy and Technical Support departments.

102. A Tactical and Strategic AME capability was provided by RAAF personnel. Rotatory wing assets in country consisted of three BELL 412 helicopters provided by Canadian Helicopters. Fixed wing assets were C130 aircraft from Southern Airlines and the twin turboprop aircraft, Casa (Spanish) and Antinov AN 26, both rear ramp load. The fixed wing assets were used for Strategic AME to Nairobi. The rate of effort for both strategic and tactical AME was low at about 1.5 missions per fortnight.

The MIRF

103. The Mobile Intensive Care Rescue Facility (MIRF) is described as a self contained air, sea and land transportable intensive care medical system packaged in a composite fibre housing. The MIRF was specifically engineered to meet the requirements of the military, ambulance and civilian rescue services as far as practicable and is suitable for field and hospital use. Its internal power and oxygen supply permits the patient to be treated at the trauma point and remain attached to the MIRF's medical equipment during transportation to hospital by various means.

104. One MIRF was provided during Operation Tamar; Model 3 S/N 002. Evaluation commenced on 28 November 94 and continues at the time of writing.

General Comments

105. During the short time available for critical evaluation the MIRF received variable acclaim. Its role in Strategic AME was validated and found to offer significant advantage over a conventional ICU configuration. However, the use of the MIRF in a tactical rotary wing AME role and its role in the resuscitation bay requires guarded recommendation. The single overriding comment/complaint during trials was the excessive weight and dependence upon a minimum of four very able persons to manoeuvre the MIRF during aircraft and vehicle transfers. The concept, however, was well received and ongoing evaluation is required to further validate the MIRF role and some of the new SOP's.

METHOD

Introduction

200. The MIRF was received from the crate after transport from Australia. The static ergonomic features and the impression to the de novo user were evaluated in the first instance. No member from ASC had any significant prior exposure to the MIRF. This facilitated an independent evaluation without prior prejudice or favour. As is common with new equipment brought into service there is initial resistance and significant subjectivity toward the evaluation. In some instances the subjective considerations are also valid but where possible objective evaluation was made.

201. After the initial familiarisation and evaluation the MIRF was placed on line for operation in the maximum number of functional roles available. In house tutorials were held for orientation and covered preliminary SOPs for use in the different special areas of operation. Real time No Duff and exercise scenarios were used to assess the MIRF. The AME team in particular spent considerable time in airframe static and airborne assessment.

202. It must be emphasised that the time available for assessment of the MIRF was less than eight weeks. This was insufficient time to critically and definitively evaluate the unit in some areas of operation. The learning curve was still relatively steep at the time of writing.

Conventions in Describing the MIRF

203. To avoid confusion in discussing the MIRF a standard will be used throughout this report. The 'front' refers to the long axis containing all the component units. All other descriptions assume the person is standing facing the front. The 'left end' is the short axis containing the oxygen cylinder supplying the gauge 'left'. The 'right end' contains the oxygen bottle and the smart power supply. The 'offside left' compartment, nearest to the left cylinder, contained MIRF consumable whilst the 'offside right' compartment contained the patient harness, oxygen hose and power cables and is closest to the smart power supply.

On Receipt of MIRF

204. An initial physical assessment was made of the MIRF on presentation from the Pharmacy. The unit was checked for damage and the consumable stores reviewed. Note was also made of damage to the packing crate and lining.

Instructions

205. The next step was the reading of the "MIRF Operating Level Manual" and the associated individual component manuals. The manual was assessed for the ease of reading and the adequacy of the information within. A note was made of specific areas that the reader felt were deficient or confusing. After subsequent use of the MIRF the manual was assessed again for the problems or idiosyncrasies noted with operation and not covered in the manual.

206. The manual was assessed for the amount and quality of technical information. In particular the information on the electrical and oxygen system was evaluated.

Static Functional Assessment

207. Prior to operational service the MIRF was evaluated by the de novo user. The individual components were examined for suitability, placement and access within the unit. The oxygen and electrical system were critically evaluated with respect to both function and serviceability. The composite body and unit in total were examined for ease of use, weight, serviceability and overall design concept.

Functional Assessment in the Resuscitation Bay

208. The MIRF was trialed in the resuscitation bay for several reasons. Resuscitations were a relatively frequent event at Ausmed and the placement of the MIRF in one of the two bays permitted maximum exposure of the unit to medical staff during real time situations. It was brought to the attention of the author that the MIRF may be placed into service with the ARA as a resuscitation vehicle and therefore deserved evaluation in this role to identify advantages and difficulties. The best way to assess durability of the unit was to maximise the use in anger and subsequently highlight weaknesses in the provisional SOPs and the functional design.

209. During resuscitation procedures there was requirement to transfer patients to radiology

for trauma series films and subsequently to the operating theatre. This was conducted with the patient on the MIRF and the problems and advantages were noted.

210. The staff were debriefed after each resuscitation and their comments and criticisms noted with respect to validity as a resuscitation vehicle and general design functionality. Specific SOPs written for use with the MIRF in the resuscitation bay were also evaluated.

Functional Assessment in Ambulance

211. In the majority of situations where the MIRF is used for transfer or retrieval there will be a requirement to use an ambulance for at least one component of the trip. The 6*6 Perentie ambulance was used by Ausmed in Rwanda.

212. The MIRF was evaluated for ease of loading and unloading into the ambulance and its overall fit. The unit was evaluated operationally with both exercise and No Duff patients during simulated and real transfers from the hospital to the airport, some twenty minutes drive. The compatibility of the external power and oxygen supplies in the ambulance to the MIRF were also examined.

Functional Assessment in Rotary Wing Aircraft

213. Rwanda is a small mountainous country with Kigali centrally located. The longest flight time from Kigali within country was 45 minutes utilising the Bell 412 helicopter. Most contingents in the theatre of operation co-located with a level 2 or level 1+ medical facility making Tactical AME by helicopter the logical means of conducting inter-unit transfer of casualties.

214. The Bell 412 is essentially a twin engine version of the UH-1H used by the Australian Army. The 412 utilises a standard NATO litter kit as used by the Australian Military, allowing the carriage of three litter patients positioned horizontally across the gearbox housing. Seating for four is provided facing rearward toward the litters.

215. The MIRF was evaluated in considerable depth with the Bell 412 despite the limited time available. Finite configurations were established and specific protocols were developed for the loading and unloading, with and without a patient on the MIRF.

216. The MIRF was subjected to multiple exercise sorties tasked specifically to evaluate the unit. Exercise casualties were fully monitored and where possible all equipment was operated and assessed for correct function. The crews were required to fly sorties involving 'hot' loading and unloading of the MIRF with 'patient' in situ. During one military operation over two days the MIRF was utilised preconfigured in the aircraft which was flown to and from the area of operation. No casualties were carried but further in flight assessment was made during these sorties.

217. There was one day when the MIRF was utilised continuously for 18 hours in the evacuation and treatment of No Duff casualties. Two head injured patients were flown by helicopter in two sorties. The MIRF was used for the air phase only on the first sortie but the second patient was intubated on the MIRF then remained attached during helicopter, road, hospital, road, fixed wing and road phases en route to Kenya.

Functional Assessment in Fixed Wing Aircraft

218. There were several Strategic AME operations from Kigali to Nairobi, Kenya. Three missions with the MIRF were conducted from Kigali to Nairobi. The first utilising an AN26, Soviet turboprop rear loading aircraft, transported a conscious head injured patient. The same patient was loaded onto the Casa the day prior but the mission was aborted before launch. The other missions utilised the Casa and transported intubated, paralysed patients making full use of all MIRF features. During both missions the MIRF was floor loaded centrally in the rear of the aircraft.

219. Despite the relative lack of time spent flying and training in fixed wing aircraft certain valuable observations were made. It was also possible to extrapolate the experience to other aircraft based on the prior experience of the team involved.

220. The above AME missions and aborted AME required movement of the patient from the Intensive Care Unit at Ausmed onto the MIRF, into the ambulance, a road trip to the airport and subsequent loading onto the aircraft. This process was then repeated for the movement of the patient to the relevant Nairobi hospitals. On one mission the patient had previously been flown by helicopter to Kigali on the MIRF.

RESULTS and RECOMMENDATIONS

On receipt

3001. It was immediately evident that the MIRF had sustained significant exposure to water at some period during the transport to Kigali. The timber packing crate was water damaged and the bubble wrap inside was soaked. It is unclear whether this damage was sustained on the ground in Nairobi or Kigali, or both.

3002. Free water was found within the offside left storage compartment. This had caused water damage to the contents therein; electrode packet, Heartstart pads, Propaq manual and the Heartstart battery.

3003. Free water was also found pooled in the bottom of the right front compartment which contains the syringe pump and the DC power lead. No malfunction of any component was attributed to the water contamination.

3004. The central securing screw for the syringe pump was rusted. The left fastener on this door had also sustained damage and was bent but functioned adequately. The lifting handle brackets on either end of the unit also had evidence of rust. One mounting screw was missing from the Propaq monitor housing on the upper surface rim. No structural damage was found on initial examination.

3005. The metal placard 'RIGHT' placed on the left oxygen cylinder gauge fell off almost immediately.

3006. A signal received prior to acquiring the MIRF indicated that the DC power lead was incorrectly wired for use in the Perentie ambulance. However, there was no indication that the adaptor for helicopter power takeoff was faulty. Consultation with the Canadian Helicopters engineer indicated that the pin wiring on the adaptor would also have to be modified to permit DC operations in the Bell 412. These modifications were undertaken and subsequently tested with satisfactory results.

3007. Initially very few of the MIRF consumable items could be located. A list of the items included in the MIRF consignment became available but the majority of the stores had been distributed throughout the pharmacy, theatre and the Intensive Care Unit. Some delay was

experienced in gathering all the stores together.

Instructions

3008. One of the most interesting omissions in the MIRF manual was the lack of explanation of the letters "MIRF". Nowhere in the manual is this decoded and many suggestions were offered. The "Mobile Intensive Care Rescue Facility" was assumed correct as this appears on the unit placard.

3009. Several typographic errors were noted. None of the errors caused dangerous confusion in operating equipment.

The written instructions were 28 pages in length. The description of the Operational Envelope was general in nature. No specific direction was given in the manual defining the actual areas of operation for which the MIRF was appropriate. There was no information with respect to the use of the MIRF in various transport modalities, limitations or suggested configurations.

3010. No instruction was given for using NATO litter kits in either fixed or rotary wing aircraft. The attachment points for the litter kit were not discussed and the MIRF was operated in aircraft based on assumptions.

3011. The ancillary equipment were complete with individual manuals. The operational limits specified for each component were highly variable. Paragraph 105 states the ancillary equipment is "designed to operate under high levels of temperature and humidity, are shower proof and can withstand normal shock and vibration levels present in road vehicles and aircraft". The stated limits deviated from the above statement.

3012. The manual was non-technical. No circuit diagrams were included. This created problems when consulting with Technical Support. There was no indication of what material was used for the internal battery or its rated amp/hours. Likewise, there was no indication as to the expected life of the auxiliary battery under different operating configurations. This is highly relevant to long distance strategic AME.

3013. No weight limitations specific to the MIRF were given. In particular, no net weight of the unit or maximum all up weight for litter kit carriage was listed. No indication was given whether the carrying handles were certified for use as primary carry points in litter kit configurations.

3014. The oxygen system description specifies an endurance at a fixed flow rate but does not state the total available oxygen to permit further calculations. No mention is made of the oversize cylinder wells and the need to use a spacer (supplied) with the alloy C-cylinders. Neither does the manual note that C-cylinders may be steel or alloy, each having different fits within the MIRF oxygen wells. There is no indication whether the MIRF oxygen system requires leak testing or has been constructed with seals that negate this standard check.

3015. The oxygen and the batteries within the MIRF make the unit liable for certification as Dangerous Cargo. No specific mention is made of this requirement and insufficient information is available to perform a DC check.

3016. Paragraph 615 discusses the issue of structural integrity. Subparagraph (a) lists several relatively minor structural injuries that require the MIRF to be marked 'unserviceable'. No advice was given to urgent field fix techniques should the unit be damaged whilst on operational important missions away from depot servicing, viz. Rwanda.

3017. After use servicing was covered in detail and introduced the Mission Code and Servicing Matrix. A MIRF Activity Log was included at the rear of the Manual and consisted of approximately eighty pages. There was no dedicated position or prompt for the Mission code or position for the medical officers signature block.

RECOMMENDATIONS

3018. The manual needs to be expanded and made more comprehensive. There is no other source of reference for the MIRF when in the field and therefore if technical support is required adequate technical details must be available including methods for limited structural repairs. Although relatively easy to work out, it would be valuable to provide more data with respect to the endurance of the oxygen supply under different usage configurations. Anticipated endurance of the electrical supply is more difficult to estimate and some manufacturer guidance would be useful. Worst case scenario with maximum power consumption is considered essential. The weight of the unit is needed when calculating finite aircraft loads.

3019. Mention should be made of the requirement or lack thereof for leak testing the MIRF. All information required for the unit to be Dangerous Cargo cleared in accordance with IATA standards should be provided as placards on the exterior.

3020. Specific information is required for the configuration of different aircraft. Acceptable attachment points on the MIRF for the litter kits need to be identified. The finite configuration with load plans for different aircraft would be useful for users required to load or plan missions

in unfamiliar aircraft. This information may not be available at present but can be readily obtained in the same manner that was used during Op Tamar.

3021. The major differences in SOPs for the different areas of operation should be identified. The unit is configured and utilised in a different manner during fixed resuscitation duties versus tactical and strategic AME. These differences became apparent during Op Tamar by trial and error but inclusion of this information in subsequent editions would be valuable.

3022. The MIRF activity log could be far less cramped with room available for comments. A separate box should be provided for the Mission Code and the Medical Officers signature block. Consideration could be given to placing the log in a book separate to the manual and having a harder wearing construction.

Static Functional Assessment

3023. Considerable evaluation of the MIRF was undertaken prior to being placed on-line. It was recognised that design constraints are multi factorial and there may well be overriding reasons for many of the features commented upon.

Oxygen System

3024. During the fitting and securing of the C size oxygen cylinders it was noted that the alloy cylinders required the supplied spacer to ensure a snug fit but that the steel cylinders (equally as common) were too long for the spacer to be fitted. The Steel cylinders were too short to fill the well fully and thus the steel cylinders were subject to and fro longitudinal forces.

3025. The camloc securing devices were adequate for obtaining closure of the cylinder well end caps but required the availability of a screwdriver hanging on a chain on each end. On more than one occasion the camlocs popped out and fell to the ground when cylinders were being replaced. At times it was quite difficult to achieve closure with the camlocs after they had fallen out. If the oxygen bottle was not recessed fully within the well then it was difficult or impossible to secure the end cap. This occurred on several occasions when the high pressure hoses, during their long loop course, became fouled either on the auxiliary battery housing or upon the opposite hose. This was quite easily alleviated by opening the offside compartment doors and adjusting the position of the hoses. However, in situations where the MIRF was located with the offside blocked it may be impossible to close the end cap after a cylinder change, viz. ambulance, helicopter.

3026. The chains securing the cylinder key and screwdriver were of poor quality. One key chain broke after several weeks leading to the potential of lost key. The chains were relatively short and the central fixing point did not permit the chain to freely rotate during opening or closing of the cylinders. This caused on at least one occasion the chain to wrap around the cylinder key and give a false indication that the cylinder had been turned off. It was not possible to fully turn the key either way more than a few turns. This occurred during an operational configuration when easy visual access to the end of the unit was difficult.

3027. The oxygen supply pressure gauges were calibrated in kPa * 100. The left hand gauge zeroed at 300 kPa. The low oxygen pressure alarm threshold was 200 kPa. Therefore, the alarm sounded prior to an empty indication on the gauge. Furthermore, at 200 kPa (2 ATM absolute) there was 3 litres of oxygen remaining if one bottle was selected and 6 litres remaining if both bottles had been turned on and bled together. This generally meant that less than one minute oxygen supply was available when the alarm sounded. If both cylinders were turned on the gas bled evenly as stated in the manual. However, both cylinders were then either partially full and required replacing or ran out together creating a dangerous situation.

3028. There were several instances when operators mistook the left gauge pressure for the pressure in the external cylinder. This occurred when only one internal cylinder was open and the external oxygen was connected and selected.

3029. It was noted that the pressure surge when turning on the gas supply would activate the Ventilarm and personnel not adequately trained were unable to silence the alarm, being unaware of the requirement to hold down the 'OFF' button for several seconds.

3030. The requirement to maintain AC power to the unit with a bled oxygen system necessitated using the low oxygen alarm silence switch. This means that the red alarm indicator light is permanently 'on'. There was no press to test feature for this globe should any doubt arise as to its serviceability during MIRF operation. In fact, after two months service while stored in the 'ready for use' mode the low oxygen light failed due to a faulty connection. This was not noted by the medics during routine servicing.

3031. The selector control switching between external and internal oxygen supplies was found to work very well with no perceptible interruption to the gas supply.

3032. The rotary knob for selecting free flow of oxygen had no functional problems. The fine white indicator line was found to be difficult to see without close examination, particularly when higher flows were selected.

3033. Appropriate dust caps were provided for the oxygen outlets except for the demand feed port. The chain securing the Oxylog output was of good quality and the centre spun easily. The chain securing the external oxygen supply cover was similar to the oxygen key chain and deformed early and was inadequate.

3034. No problems were experienced with the demand outlet function or the drive supply to the oxylog.

RECOMMENDATIONS

3035. Two different size cylinder end caps need to be supplied to suit the different cylinder lengths. That such a requirement exists needs to be identified within the Operations Manual. A more effective and reliable securing method could be identified for the end caps. Eventually a camloc or screwdriver will be lost rendering closure difficult or impossible. A Zeus clip type system is suggested.

3036. The possible fouling of the high pressure hoses within the storage bays must either be clearly identified within the manual with a suggested routine for correction, or the routing of the hoses must be in guides to prevent such fouling.

3037. Good quality security chains must be provided on the cylinder keys. A warning should be included in the manual identifying the risk of partial opening or false closure due to chain wrap.

3038. Strong recommendation is made to develop an SOP that involves opening one oxygen cylinder at a time. This will prevent two partially empty cylinders being replaced. This will also prevent the embarrassing situation of having both cylinders run out of gas at the same time with inadequate time to prevent interruption to supply.

3039. Press to test functions should be employed on all critical alarm devices including the low oxygen light.

3040. The flow meter rotary knob needs the detent position identified by a solid white band and not the fine white line. During operations on night AME the position of the selector is very difficult to identify. Dust caps need to be supplied for all the oxygen outlets.

Electrical System

3041. The endurance of the internal power supply was unknown and not tested. The battery was established as a 12 amp/hour unit from the rear placard. The longest period of operation on the auxiliary battery was 8 hours. It was not noted whether the power supply had defaulted to the component supplies but there was no loss of power to any part of the unit.

3042. The internal power supplies of each ancillary unit were operational and no interruption to function was noted when switching between the auxiliary battery and other external power means. All ancillary components (except the Heartstart) remained on charge with all three power supply options.

3043. The smart power supply was only challenged with 240V 50Hz AC and 28V DC during trials. Frequent power cuts and generator to mains power supply switching occurred in the hospital without causing circuit breaker trips or fusing. The charging circuit operated correctly. The orange charging light cancelled at full charge. There was no satisfactory method to assess whether the MIRF was fully charged or on charge if the orange light failed. Likewise, the 'power on' green light had no 'press to test' function.

3044. The three different types of circuit breaker and the positioning of one on the front panel caused some confusion amongst operators. The DC breaker was observed to be inadvertently knocked into the off position by persons using and folding the carrying handles. The majority of operators expressed a preference for aircraft style 'Push To Set' breakers.

3045. The origin of the DC power cable in the syringe pump bay was thought unwieldily by most persons. The use of the lead prevented closure of the compartment door and considerable care was required when stowing the cable to prevent damage to the syringe pump and the charging lead to the pump.

3046. The author and a member from Technical Support examined the smart power supply and the available space on the right hand end of the MIRF. It was considered feasible to provide male outputs and breakers on the end for both AC and DC power supplies.

3047. The two white lights on short flexible stalks were both serviceable. The flexible arms were too short to manoeuvre to other than the immediate proximity and the unshielded light was found to be highly irritating requiring one hand to cover the bulb so that the back lighting could be utilised.

RECOMMENDATIONS

3048. The charging circuit indicator lights must either have a press to test function or be of the kind that change colour when the cycle is complete.

3049. Strong recommendation is made for the consolidation of the power supply to the one end of the unit. Female ends for DC and AC should be located on the end. Dedicated aircraft type circuit breakers would be the ideal selection with all mounted on the one end. A lead sufficiently long enough to meet all routine requirements or extensions leads must be supplied. If the breaker box to the right of the IVAC pump was moved to the end (the light switches could be anywhere) there would be more room to operate the IVAC pump.

3050. The two light sources need to be modified. The stalks need to be longer to permit light application to different components or the patient area and ideally the head would have limited capacity for rotation. The backward glare must be eliminated. If the stalks are not to be made longer then recessing a fixed lamp, possibly of the fluorescent type, under the lip of the upper edge would be a satisfactory solution.

Ancillary Equipment

3051. All the electrical ancillary components powered up and functioned normally.

3051. The Heartstart Defibrillator was housed in the front left compartment. When slid out into the operating position the unit was well secured by the handle hook and elastic bungy. The leads that connect to the defibrillator pads arise from the rear of the unit and were significantly jammed by the metal frame. This caused some impingement to the egress of the unit but more significantly bent the leads to an unacceptable degree. Cracking and altering the impedance of the leads may lead to a software driven interruption to defibrillation or simply electromechanical failure.

3052. Within the Heartstart compartment a set of recording electrodes and defibrillator pads were stored on top of the Heartstart. Underneath the Heartstart at the front across the long axis was stored a spare Heartstart battery. To the right of the Heartstart at the front a Hudson oxygen delivery mask was stored.

3053. The Terumo syringe driver was housed in the front right compartment. It was found that non Terumo 20ml syringes were interpreted as 30ml syringes by the unit. Non standard 50ml syringes were interpreted correctly. A 50ml syringe and extension tubing both unopened were stored in location on the driver under the syringe barrel clamp.

3054. The IVAC Volumetric Infusion Pump was small and space effective. The loading door was prevented from fully opening by the proximity of the Control Box to the right. Although possible to load the infusion line into the unit some considerable extra difficulty was noted by all operators. The Pump was found not to function with both of the 'universal' infusion lines available despite superficially there being little difference. The fluid bag pole was well located and frequently used.

3055. The Propaq monitor functioned well. All non-invasive functions were assessed on a ventilated intensive care patient as a bench test. It was noted that a special right angle set of ECG leads had been provided with the MIRF and Propaq to permit connection to the ECG port on the left side of the unit in the cramped space. No such leads were provided for the invasive pressure monitoring ports. Therefore, the capability to monitor arterial pressure and central venous pressure was effectively removed from this unit, a capability worth several thousand dollars.

3056. The carbon dioxide sensor and oximetry sensor were placed with coiled leads in the small bay under the Oxylog. A set of ECG dot electrodes were also stored in the bay. The non-invasive blood pressure cuff was coiled up and stored on the left side of the Propaq. The ECG leads were coiled and housed on the right side of the Propaq with a new cassette for the IVAC.

3057. The Laerdal suction unit was well located and functioned correctly. During operation the resonant vibration through the MIRF was extremely loud. A sucker head was attached to the coiled tubing and stored with the tip toward the back right corner.

3058. The Drager Oxylog ventilator performed adequately. During the "Bench Test" with the ventilated patient the Oxylog was also connected to the patient. A Wrights spirometer was utilised to check calibration. It was observed that with "Air Mix" selected the ventilator delivered a Minute Volume (MV) reflected on the control knob. When "No Air Mix" was selected the MV fell by 35%. This is said to be a recognised feature of this style of ventilator but no statement reflecting this observation was found in the Oxylog or MIRF reference manuals.

RECOMMENDATIONS

3059. The Heartstart frame must be modified to provide relief to the defibrillator leads to prevent structural damage.

3060. A warning should be provided that non Terumo brand syringes, although functional within the syringe driver, will have the size misinterpreted by the machine and thus incorrect

flow rates will be delivered.

3061. Strong recommendation is made to supply with the MIRF with custom right angle leads for the invasive pressure monitoring ports on the left of the Propaq. Such leads are supplied for the ECG capability. The unit is not fully capable until invasive monitoring is available.

3062. Consideration should be given to the mounting of the suction unit on a non porous closed cell type foam to reduce the resonance and amplification of the operating noise. This noise was a source of repeated complaints during later operations.

3063. Consideration should be given to supplying a Wrights spirometer with the MIRF. Although the capnographic function effectively allows accurate setting of ventilator parameters, if power is lost or the Propaq fails the spirometer is invaluable in ventilator operation. This is especially true when differing altitudes require readjustment of the ventilator. The Operations manual must clearly note that the Oxylog will not provide calibrated volumes per the front selectors and that large differences in tidal volume exist between AIR MIX and NO AIR MIX. These changes should be monitored via the capnograph or the Wrights spirometer.

MIRF as a Unit

3064. The concertina front was an effective closure. It was not immediately obvious that the door folded up neatly onto itself and sat on the seat belt webbing, although this seems somewhat obvious in hindsight. The carrying handles folded and locked as designed. The overall weight of the unit was estimated to be 85kg with oxygen cylinders and stores in situ. A two person carry without a patient was not universally acceptable. The MIRF with patient required a minimum of four lifters and this was borderline for some personnel.

3065. The door closures on the MIRF were generally effective. They were difficult to open with flying gloves on and it was possible for the door to be closed with latch not deeply engaged such that the door would fall open during transit. A gentle push on the latch was generally enough to facilitate security.

3066. The ancillary components included in the MIRF were well thought out and each appropriate for the perceived role of the unit. The overall layout of the components within the MIRF was also good. However, to the unthinking it was not immediately obvious that there was a head end preferentially and this should be identified within the manual. No component could have been deleted and the ventilator disconnect facility by way of the Ventilarm was a valuable fail safe.

Functional Assessment in the Resuscitation Bay

3067. The MIRF was configured in the bay on two standard NATO A-frame litter stands. A D-cylinder of oxygen was connected to the external oxygen inlet. The unit was left with the gas supplies off and bled and the electrical supply switched to AC and on charge. One appropriate consumable was placed with each of the separate individual front panel monitors or machines.

3068. On notification of a pending resuscitation the MIRF was brought to state of readiness per the SOPs, enclosure 1. On completion of the task the unit was serviced in accordance with the manual and returned to normal standby.

3069. The A-frame stands prevented adequate opening of the compartments containing the Heartstart and syringe driver. Significant damage occurred to the pin hinge and surrounding body in an incident caused by the stands. The sloping part of the MIRF rails rested on the stands. This created an unstable situation. If great care was not taken when moving the MIRF, the unit "walked" toward the edge of the rails and could fall. The operating height was adequate for tall people but criticised by those shorter, observing that effective CPR would be difficult. The MIRF was also operated from a position on the flat rails further inboard. Although permitting the end doors to be opened the added height was unacceptable to most personnel.

3070. The observation was made during use that less clutter occurred with leads from monitors and oxygen hoses, the components being under the patient. A full height drip stand to augment the mini stand would have decreased further the need to drape tubing from the sides and assisted in transfers. The seat belt style harness was found unexpectedly useful when extremely agitated trauma patients were flailing about spraying blood everywhere. The harness was quickly set up and the patient safely secured.

3071. Difficulty was experienced in viewing the front panel sensors when a small resuscitation bay was utilised. When able to stand back in more open areas no complaints were received. In fact, all monitors and alarms were visible from the one position.

3072. On several occasions patients entered the resuscitation bay on Non-NATO litters. Despite similar appearance no other litter encountered fitted onto the top of the MIRF functionally. Patients had therefore to be transferred onto a NATO if the MIRF was to be used. Frequently in the heat of the moment the resuscitation team used the standard bay if it meant transferring a VSI trauma patient.

3073. The all up weight with a patient was universally regarded as too heavy. Transporting the patient between departments with stretcher bearers was awkward and at times dangerous as doorways were negotiated. A system was developed whereby the MIRF was lifted onto a theatre trolley and then moved about the hospital on these means. This was facilitated by the continuous ramp nature of the hospital environs. This method of transportation was generally accepted as satisfactory.

3074. Having all the equipment and monitoring leads immediately to hand was found to be useful. The sucker was especially useful in this regard. However, the sucker was sufficiently loud during operation to prevent communication between team members. It was extremely distracting and necessitated the intermittent operation of the unit. It is generally preferable to leave the suction on during critical periods if possible but this was not a viable option.

3075. An integral part of the resuscitation procedure was obtaining standard trauma series films. Placing the MIRF onto the X-ray table made the patient too high to obtain adequate chest films with the equipment available. The moving of the MIRF, whether carried from the resus. bay or wheeled, onto the X-ray table required four persons. This was unacceptable. However, with the MIRF on the trolley it could be parked adjacent to the table and the patient lifted across on the NATO litter. All monitoring leads and oxygen remained connected and the MIRF then pushed sufficiently away to permit access to the table for loading films. In this configuration it was unnecessary carry the usual oxy-viva, Propaq and suction to X-ray. This system was found very effective after it had been used several times and staff were familiar with the concept.

RECOMMENDATIONS

3076. A dedicated stand needs to be constructed for the MIRF for use in the resuscitation bay. This should be designed so that the working surface of the MIRF approximates the current height of a NATO litter on stands. Further consideration must be made to clearance of the left and right end compartment doors so they open freely. The ideal solution was perceived to be a dedicated trolley of the appropriate height with brakes. This would then facilitate movement about the hospital, to X-ray and theatre. Many people expressed an interest in equipping the MIRF with integral folding wheels similar to many ambulance stretchers.

3077. Specific SOPs must be developed for use in the local environment and posted clearly. Many different resuscitation teams were on rotation and to maintain uniformity it was essential to post specific instructions for the configuration on standby and the procedure during warning out of a resuscitation. Comprehensive training and supervised hands on experience are needed to ensure adequate familiarity with a novel unit.

Functional Assessment in the Ambulance

3078. The MIRF could fitted into the ambulance head first on the right side or feet first on the left side. Thus configured the front panel faced the attendants. A second patient above the MIRF was not viable due to the increased height of the unit with patient.

3079. The MIRF with patient was awkward to manoeuvre into the ambulance and a minimum of four operators were required. After practice it was found quite easy to load the MIRF empty and user acceptance increased. The unit was able to slide along the rails per a standard NATO litter but the offside was hard against the cushion of the upper litter carrier. Minor damage was also sustained to the lower body of the unit each time it was slid into the ambulance due to contact with ambulance fittings.

3080. Retrofitted seat belt reels outboard on the litter tracks physically prevented the fitting of the MIRF in some ambulances on at least one side. The small differences in the position of the reels could only be established empirically by attempting to fit the MIRF into the ambulance.

3081. When the MIRF was positioned in the vehicle head first the DC power lead did NOT reach the power take off in the front cab of the ambulance. External power was available if the MIRF was loaded feet first into the vehicle. The MIRF harness would only be effective in preventing the patient submarining if loaded with the head forward.

3082. No difficulty was experienced utilising the ambulance oxygen supply so long as a high pressure hose was brought the unit. No such hose was supplied with the MIRF but was obtained from the RAAF AME inventory.

3083. The locking mechanism for NATO litters engaged on the curved composite body of the MIRF and not on any metal rail. This led to damage of the body during transportation by vehicle and inadequate security.

3084. The offside compartments were inaccessible once the MIRF was in the vehicle. The vehicle had to be stopped and the MIRF moved to change internal oxygen cylinders or to remove any equipment forgotten prior to loading .

3085. Care of the patient on the MIRF presented no problems and the custom harness was useful in preventing submarining during high deceleration. Visibility of the monitors, access to

the ancillary equipment and working height were considered good. Many ambulance transfers were conducted with the MIRF and for ICU style patients it was generally accepted that the MIRF offered considerable advantage over standard configurations.

RECOMMENDATIONS

3086. The MIRF is an excellent vehicle for transferring ICU patients by road. Consideration must be given to the lack of access to the offside compartments prior to loading. All ambulances likely to be used with the MIRF assessed to ensure that the unit does fit without obstruction from the seat belt reels.

3087. An adequate length DC power lead must be supplied with the MIRF to permit use of the ambulance power supply. A high pressure hose must be available with the unit if external oxygen sources are to be utilised.

3088. The manner in which the MIRF locks into the ambulance tracks must be examined. It is not acceptable that the composite body is repeatedly damaged by routine tasks. Providing a strip of rail on the bearing surface would be adequate.

Functional Assessment in Rotary Wing Aircraft

3089. The only satisfactory position for the MIRF in the Bell 412 was the middle litter position. No other litter patients can be carried with the MIRF.

3090. Too little room was available to use the upper position. The lower position was unavailable due to attachments on the gearbox housing. Floor mounting was likewise impossible; the relief from the gearbox housing placed the MIRF front against the feet of the crew and prevented access to the ancillary equipment.

3091. Whilst mounted in the middle litter position the offside was flush against the gearbox housing. The rivets on the housing caused damage to the body of the MIRF, the coarse vibration in flight ideally suited to this end.

3092. The middle litter position provided the crew with an ideal working height with good view of the monitors and access to the ancillary equipment. This configuration found considerable favour with the AME crews.

3093. It was assumed that the litter clips attached to the lower handle bracket immediately where they arose from the body of the MIRF. The lengthwise distance between these points was correct. The flanged area of attachment was the correct width in theory but in practice the

litter clips did not fit. The clips were fouled by the body of the MIRF and thus pushed outboard. Thus, the litter clips were closed in part around the flange making it technically difficult to secure the unit adequately and quickly. This was perceived as a major design flaw. During some missions it was found very difficult to secure the unit in the litter kit and considerable time and manoeuvring were required. The tightness of the fit against the gearbox housing had subtle inter aircraft differences creating variability in the difficulty of securing the MIRF between aircraft.

3094. The carrying handles did not appear adequate to endure litter loading, there being too much lever moment. The detent locking pin on one handle broke off in the first week of trials. This created an unsatisfactory situation of a floating handle. Thus, it was quite dangerous and awkward during stretcher carries.

3095. Positioning the MIRF in the aircraft required a minimum team of four. It was relatively straightforward to load and secure the MIRF without patient. The AME personnel quickly became comfortable with this configuration. Loading the MIRF with patient required a minimum of four physically very capable personnel. Risk of injury to crew was still high and the possibility of dropping the unit a real risk. Shorter females were effectively excluded from loading duties unless backed up. One member sustained significant back injury. Specific SOPs developed were used and no confusion occurred even during engine on loads.

3096. It was found practical to preconfigure with the MIRF secured in the aircraft in the litter kit and then to insert a patient on a NATO litter on top of the unit. Few difficulties were encountered using this configuration but some upper surface damage was sustained by the MIRF due to the metal heels of the litter. One patient was transferred in this manner, fully monitored during the flight and then transferred on the NATO litter to the ambulance. This method had high acceptance by the AME personnel.

3097. The VSI head injured soldier demonstrated the upper end of rotary wing ICU retrieval. The MIRF was removed from the aircraft onto the hardstand and the patient secured on the litter. The patient was then intubated, paralysed and stabilised. The capnograph was used to fine tune the ventilator and the unit with patient was loaded into the helicopter. The airborne phase utilised most of the assets of the MIRF and the patient was subsequently transferred by road to hospital. This style of tactical AME was universally regarded as an excellent use of the MIRF but did require a qualified medical team to take full advantage the MIRF capability.

3098. Once loaded into the aircraft access to the offside compartment was denied. Access to the oxygen cylinder keys was not a problem but it was not possible to change the cylinders in

flight. The oxygen carried was equivalent to the oxy-viva plus spare but there was no interruption to therapy when cylinders were switched with the MIRF.

3099. A standard Thomas Pack was the only other item of the Tactical AME kit carried. By utilising the MIRF, the 12v sucker, oxy-viva, oximeter and additional oxygen were deleted and the items did not have to be secured within the aircraft. This offset the added effort in carrying the whole unit despite the capacity supplied being excessive for most missions.

3100. The DC power cable reached the 28V outlet and the unit was run from this power source. However, not all the aircraft had 28V outlets available.

3101. The in-flight noise and vibration created MIRF specific and general problems. No ancillary equipment alarms could be heard. The Low Oxygen Alarm was just audible if listened for specifically. It was considered unlikely to attract attention. The red light was easily seen.

3102. The Non-Invasive Blood Pressure monitoring (NIBP) was at times disabled by the vibration. The low frequency component appeared to confuse the oscillometric sensor at the terminal end of pressure assessment. Placement of the recording arm upon a pillow to isolate the vibration lead to more reliable sampling.

3103. All other sensors provided reliable data.

3104. The IVAC pump and syringe driver functioned in flight.

3105. The door of the right hand compartment contained the syringe driver. When the door was open the coarse vibration caused destructive oscillations to occur. It was anticipated that structural damage would occur to the attachment point, door hinge and unit given sufficient exposure.

RECOMMENDATIONS

3106. The MIRF probably has no role in Forward AME. The swoop and scoop type of mission over short distances are generally crewed by medics. The level of sophistication provided by the MIRF is in excess of the mission requirements and doctrine (ADFP 53). Use of the MIRF also seriously restricts the capacity of the aircraft to carry further casualties.

3107. Tactical AME missions utilising adequately AME and medically trained personnel are an appropriate use of the MIRF for rotary wing missions. Once fully trained and familiar with the unit it is more convenient to take the MIRF and a Thomas Pack than the standard kit, the

advantage being the additional specialist equipment is available if required. However, the retrieval is limited to one litter patient in the Bell 412. It is expected that finite loads for the Blackhawk would be greater. Tactical AME remains a medically hostile method of transportation and the majority of tactical AME missions in Australia are completed using fixed wing assets with far better patient control.

3108. The use of the MIRF preconfigured in the aircraft was validated and should be used as the standard method of operation in the current area of operation when one casualty is retrieved.

3109. Modification to the litter clip attachment points must be made as a matter of urgency. The current design is marginal at best and not adequate for entering general service. The point of litter attachment, even if obvious, should be identified within the manual.

3110. Modification to the detent pin method of securing the handle positions needs urgent review. One early failure and a second serious cracking indicates a major structural inadequacy. The free floating handle is extremely dangerous and justifies the unit being removed from service.

3111. The SOPs developed for loading the MIRF into the aircraft in different configurations were validated. It is essential that personnel who intend to use the MIRF in rotary wing aircraft are adequately briefed and complete the ground and airborne components of the familiarisation developed in country.

3112. To avoid the consequences of destructive cyclic vibration to the syringe driver door it is recommended that driver be operated with the door closed and latched. This necessitates a modification of the door at the top left corner, viz. removal of the corner to permit the passage of the tubing and the power lead. Such a modification was completed in country.

Functional Assessment in Fixed Wing Aircraft

3113. The Casa contained NATO litter kits that were totally different from the Australian stock. These were large crescent shaped clips and it was not possible to attach the MIRF. The Casa configures bilateral side seating and off centre stanchions that provide middle seating on the left of middle only. A second rail is available for the seat legs. The MIRF was floor mounted midline between the two rails, utilising the last two stanchion depths. The MIRF was secured with standard cargo ratchet tie-downs from the four points provided to rings placed into the rails or from side to side over the litter kit attachment points at either end and to the ring in the rails. Two cotton blankets were placed under the unit to prevent metal to metal contact and provide

vibration isolation. This overall configuration was found highly acceptable and very secure in the worst turbulence.

3114. The custom patient harness was found very effective in securing the patient without creating undue impingement to the chest. The length adjustment was adequate and the quick release feature useful and an obvious safety benefit.

3115. The AME team were able to sit in chairs on the sides and maintain observation of the monitors. The patients on the Casa flight were ventilated. Suction of the endotracheal tube was performed every 30 minutes and the availability of the integral sucker was convenient. The capnography function of the Propaq was found invaluable in maintaining an accurate end tidal carbon dioxide and provided earlier warning than oximetry of ventilation complications. The Oxylog ventilator performed well and the Ventilarm was an added security when tired personnel crewed the night mission. The Oxylog was universally preferred to the Birds ventilator or TXP. There was more confidence expressed in the Oxylog and the staff were generally more comfortable with its operation. A Wrights Spirometer was carried to provide a backup for setting the tidal volume and to assess minute volumes. The IVAC pump and the syringe driver were both used and performed well.

3116. Use was made of the Heartstart compartment to store Y-suction catheters and made-up drugs. The offside compartments were used for additional fluids and additional nursing consumables not normally carried on Tactical AME operations. The patient was placed on a Strategic mattress on top of the NATO litter. This was found to be highly satisfactory for both patient comfort and the delivery of nursing care. There was no requirement for a wide litter, nor did any of the staff express any concern that the configuration lacked the same.

3117. Whilst transporting the MIRF through the hospital via narrow doors it was necessary to close the syringe driver door. The pump functioned well in this position but the line was pinched in the door. The in country modification to the corner of the right hand door permitted the syringe driver to be operated whilst the door was closed.

3118. The AN26 does not carry litter kits. The MIRF was again floor mounted in the rear of the aircraft centrally and orientated down the long axis. Folded cotton blankets were placed under each end of the MIRF to avoid metal to metal contact. This was effective in preventing sliding of the MIRF and damped vibration. The patient commented that he was comfortable. The tie down rings on the MIRF were used to secure the unit to the floor via standard cargo tie-downs. The AME team sat in seats on the side and had good access visually and physically to the ancillary equipment.

3119. During both missions an additional D-cylinder of oxygen was secured within the aircraft and connected to the MIRF external oxygen inlet. Flight times of 120 - 150 minutes would have left unacceptable stores in the internal cylinders for making safe transfers at either end. This oxygen, some nursing stores and the Thomas Pack with augmented drugs were the only additional equipment carried on the five hour missions.

3120. A four man carry was used to move the MIRF from the ambulance into the aircraft via the rear ramp. The unit weight was found to be acceptable over the short distance. The ramp surfaces were uneven and slippery and great care had to be taken to avoid a disaster. After delivery of the patient to the receiving intensive care units it was found very convenient to place the Thomas Pack, oxygen cylinder, blankets and sundry gear on the NATO litter attached to the MIRF and secure the load with the transverse belts. A longitudinal cargo tie down was then used for definitive security and the whole package transported by various means around Nairobi and loaded onto the return aircraft.

RECOMMENDATIONS

3121. There was overwhelming acceptance of the MIRF in Strategic AME. It is highly recommended that the MIRF be used for all further Strategic AME in the current area of operation. Further, it is recommended that the RAAF consider early acquisition of the MIRF for strategic AME. A significantly enhanced standard of care is provided with far greater flexibility and mobility when compared with the current Strategic configuration. The MIRF provided the AME team with enhanced confidence when dealing with complicated high dependency patients.

3122. The use of the strategic mattress on the NATO litter is recommended for all missions. Augmentation of the general stores in preparation for Strategic AME is made convenient by the use of the MIRF storage compartments. A D-cylinder of oxygen (1000 litres) will provide at least three hours of ventilator time in addition to the 900 litres in the MIRF. It is recommended that all Rwanda to Kenya AME missions utilise one D-cylinder supplement.

DISCUSSION

Use in different Areas of Operation

401. The MIRF is a novel and sophisticated unit that has immediate and obvious advantages in some areas of operation such as Strategic AME. However, it is not suitable or perhaps justified in other areas such as Forward AME or Level 1 facilities. Where the line is drawn may depend as much on politics and emotion than hard operational criteria.

402. The ancillary components within the MIRF provide a capability approaching that found in a hospital based intensive care unit. This was validated during trials and would appear to be the vision behind the design concept. However, the use of such specialised equipment and understanding the limitations in application depend upon relatively advanced standards of training. This standard is not commensurate with the majority of medics or even non ICU nursing staff. Application can therefore be immediately excluded from areas where appropriately trained staff are not available.

403. The basic elements of the MIRF are found in CCP resuscitation bays, viz. suction, oxygen therapy, Propaq monitor, ECG and defibrillation. Primary resuscitation requires basic equipment and skills and although the MIRF packaging arrangement was found convenient it is difficult to justify the excess capacity that is unlikely to be used at this level. Also, the MIRF was found to be very heavy when configured with a patient and is not suited to litter carriage type scenarios.

404. Although designed for field use the MIRF was not found to be indestructible. The composite body in fact sustained frequent damage in routine and relatively soft operations. Comment was received from field medics that the MIRF would almost certainly be seriously damaged if placed into general operations in the field.

405. Use of the MIRF at field hospital level may be justified. The unit can be conveniently used in the resuscitation bay when provided with an custom stand and appropriate personnel will be available. Should the need arise to evacuate a patient then the MIRF can be used for a land or air evacuation.

406. The majority of RAAF Medical Flights have access to either fixed or rotary wing assets suitable for AME. Consideration should be given to the placement of one unit in the resuscitation bay of the Medical Flight. This unit would then be available for resuscitation and

subsequent transfer or preconfiguration to an aircraft for response to a retrieval request.

407. The RAAF area of responsibility includes providing Tactical and Strategic AME support. The MIRF would be ideally suited to field use in an Aeromedical Evacuation Staging Facility (ASF). These CCP-like facilities are staffed by a AME trained Medical Officer, Nursing Officer and medics. The primary function is to provide fixed wing (or rotary) Tactical AME rearward to level 3 facilities. The MIRF could be used in one of the resuscitation bays and then moved directly onto the aircraft with the patient as dictated by the clinical condition. The use of the MIRF in rotary wing Tactical AME was validated in Rwanda where fully trained AME teams completed the missions.

408. As previously commented the MIRF is an outstanding design concept for Strategic intensive care type AME operations. The RAAF should move immediately to examine the feasibility of procuring the MIRF for inventory at 3 Hospital, RAAF Base Richmond. Use of the MIRF in Strategic AME was validated during operations in Rwanda.

409. Application clearly exists in the civilian sector for the MIRF. One consultant expressed interest in using the MIRF for intra-hospital movements of ICU patients, eg. when moved from ICU to radiology for a CT. The unit would need wheels or a trolley but the storage compartments can be stocked with emergency resuscitation drugs providing a very convenient and safe method of transfer.

Training

410. Before the MIRF can be placed into an area of operation personnel must be adequately trained. Experience gained in Rwanda showed that the MIRF was not a trivial piece of equipment that could be operated on the basis of experience with the individual ancillary components. There were many MIRF specific idiosyncrasies of which the staff needed to be aware. In general it was found that as personnel became better trained and more familiar with the MIRF so increased the desire to use the unit in preference to a standard configuration.

411. There was a general orientation that included the use of the MIRF in the resuscitation bay. Specific SOPs were in use that identified the state of readiness and the actions to follow during warning out of a resuscitation. Where these were not followed problems arose. Adequate training of staff for AME operations was considerably more involved. Ground briefing was followed by repeated loading and unloading of the MIRF in differing configurations. Finally, exercise missions were flown for in-flight familiarisation and the

demonstration of 'hot' loading and unloading operations. The teams were also required to move a 'patient' from ICU via the ambulance into the aircraft with all the appropriate vehicle transfers. This was the minimum training required to be adequately qualified during Operation Tamar. The benefit of this training structure was validated by subsequent Tactical evacuations of VSI patients.

412. Recommendation is made that specific training packages be developed for the MIRF. This should include the theoretical and practical training but also SOPs for use as a resuscitation tool, during ambulance transfer and, finally, fixed and rotary aircraft configuration. A MIRF specific feature to emphasise is the necessity to continually 'check oxygen, check power', referring to the supply source. Inadvertent selection of the wrong supply during repeated transfers can create dangerously low internal oxygen and electrical stores.

MIRF RESUSCITATION DRILL

STAND TO

Upon notification of a pending resuscitation the MEDIC is to prepare the MIRF as follows:

1. TURN ON **external** oxygen supply, check contents
2. TURN ON **left** internal oxygen supply, check contents
(N.B. Front guages reflect internal supply only)
3. SELECT **external** at oxygen source selector
4. SELECT **on** low oxygen alarm
5. DISCONNECT AC **power** lead and place in right
offside compartment
6. SELECT **aux battery** and CHECK front breaker set
7. TURN ON the Propaq, ensure electrodes available
8. CONNECT Hudson mask to oxygen outlet
9. CONNECT sucker head to tubing
10. NO need to pull all the leads and cuff out yet

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MIRF RESUSCITATION DRILL

AFTER USE SERVICING

Upon completion of a resus. or on return to standby the MIRF is to be left configured as follows:

1. CLEAN AND DECONTAMINATE per the photocopied instructions and mission matrix therein
2. TURN OFF **external** oxygen supply after checking content, replace as necessary
3. BLEED **external** system, low oxygen alarm should sound. SWITCH to **internal** to silence alarm
4. TURN OFF **internal** oxygen supply after checking content. Must be minimum 3/4 full.
5. BLEED **internal** system by operating the Oxylog and check Ventilarm. When low oxygen alarm sounds cancel with mute switch, light will flash
6. CHECK OPERATION of all ancillary equipment in accordance with the appropriate manufacturer's handbook
7. CONNECT **AC power** lead to MIRF and SELECT **AC** on the rotatory power knob. Green power light and orange charge light should illuminate. Charging indicators on each of the individual components should also be illuminated (except Heartstart)
8. REPLACE consumables as required, including the Heartstart battery and any equipment taken from the offside storage compartments
9. ROLL UP the leads of the sensors from the component end to avoid twists and place back in relevant compartments

10. ENSURE stands are placed correctly under unit, especially if the MIRF was moved
11. MISSION CODE and mission activity is to be recorded in the MIRF Activity Log by the Medical Officer in charge of the resuscitation. Details for constructing the Mission Code are located in the 'After Use Servicing' photocopy or MIRF manual
12. SIGN the record of 'After Use/Weekly Servicing'. Ensure to revise the date for next service. First line servicing is completed after every 7 days of storage without operational use

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MIRF FIRST LINE SERVICING

After every 7 days of 'Ready for Use' storage without operational use the MIRF is to undergo the following First Line Servicing. The due date for this servicing is recorded on the 'After Use/Weekly Servicing' record. The procedure is essentially the same as the after use servicing.

Reference: MIRF Operating Manual

1. OXYGEN SYSTEM

- a. Open both installed oxygen cylinders and the external oxygen cylinder. Note that the MIRF gauges indicate only the content of the internal bottles. Replace as required with full bottles.
- b. Test the Oxylog and Ventilarm systems as per the manufacturers hand book.
- c. Bleed oxygen system by operating the Oxylog, switching between external and internal supplies until all gauges read zero. Note the correct function of the low oxygen alarm.

2. ANCILLARY EQUIPMENT

- a. Check operation of all ancillary equipment in accordance with the appropriate manufacturers hand book.
- b. Ensure that the working side of the MIRF contains in situ one each of the consumable items for each component ie. Ivac cassette, electrode dots, syringe and extention set, defib. pads and dots, Hudson mask and spare Heartstart battery.
- c. Ensure that the right offside storage bay contains at least two each of the consumeable items of the MIRF including the ventilator tubing and non-rebreathing valves.

3. Finally, return the MIRF to Standby per the 'After Use Servicing' protocol. Refer any problems or questions to the undersigned.

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