DELIVERY OF CARDIOPULMONARY RESUSCITATION IN THE MICROGRAVITY ENVIRONMENT. M. R. Barratt* and R. D. Billica*. KRUG Life Sciences and Medical Operations, NASA Johnson Space Center, Houston, TX.

INTRODUCTION. The microgravity environment presents several challenges for delivering effective cardiopulmonary resuscitation (CPR). Chest compressions must be driven by muscular force rather than by the weight of the rescuer's upper torso. Airway stabilization is influenced by the neutral body posture, and suction absence will consist of crewmembers of varying sizes and degrees of physical deconditioning from space-flight. Several ACLS is possible if CPR devices are designed to accommodate these factors were tested in the one g environment in parabolic flight, and on a recent shuttle flight. METHODS. Utilizing study participants of varying sizes, different techniques of CPR delivery were evaluated using a recording CPR manikin to assess adequacy of compressive force and frequency. Under conditions of parabolic flight, methods tested included conventional positioning of the rescuer and victim, free-floating "aircraft." The hardware planned for use during the MTC phase of the space station was utilized to increase the fidelity of the space station environment. Other constraints to delivery of ACLS onboard the space station developed a phased approach to health care for the crews of SSF. Beginning with a stabilization and transport phase, HMF will expand to provide the most advanced state of the art therapeutic and diagnostic capabilities. This presentation details the capabilities of such a phased HMF. As Freedom takes form over the next decade there will be ever-increasing engineering and scientific developmental activities. The HMF will evolve with this process until it is eventually reaches a mature, complete, stand-alone health care facility that provides a foundation to support interplanetary travel. As our experience in space continues to grow so will the ability to provide advanced health care for Earth-orbital and exploratory missions as well.

ADVANCED CARDIAC LIFE SUPPORT (ACLS) UTILIZING MAN-TENDED CAPABILITY (MTC) HARDWARE ONBOARD SPACE STATION FREEDOM. M. Smith, M. Barratt, C. W. Lloyd, NASA and KRUG Life Sciences, Inc. Medical Operations Branch, Johnson Space Center, Houston, Texas 77058.

INTRODUCTION. Because the time and distance involved returning a patient from space to a definitive medical care facility, the capability for Advanced Cardiac Life Support (ACLS) exists onboard Space Station Freedom. ACLS, changes were made to the ventricular fibrillation algorithm to accommodate the space environment. Other constraints to delivery of ACLS onboard the space station were also assessed. RESULTS. The delivery of ACLS in microgravity is hindered by the environment, but should be adequate. Factors specific to their environment were identified for inclusion in the protocol including immediate restraint of the patient and early intubation to assure airway. External cardiac compressions of adequate force and frequency were administered using various methods. The significant limiting factors appear to be crew training, crew size, and limited supplies. CONCLUSIONS. Although ACLS is possible in the microgravity environment, future evaluations are necessary to further refine the protocols. Proper patient and medical officer restraint is crucial prior to advanced procedures. Also, emphasis shall be placed on early stabilization and drug administration. Preliminary results and further testing will be utilized in the design of medical hardware, determination of crew training, and medical operations for space station and beyond.


The CMRS is a prototype system designed and developed for use as a universally deployable medical restraint/workstation on Space Station Freedom (SSF), the Shuttle Transportation System (STS), and the Assured Crew Rescue Vehicle (ACRV) for support of an ill or injured crewmember requiring stabilization and transportation to earth. The CMRS will support all medical capabilities of the Health Maintenance Facility (HMF) by providing a restraint/interface system for all equipment (Advanced Life Support packs, defibrillator, ventilator, portable oxygen supply, IV pump, transport monitor, transport aspirator, and intravenous fluids delivery systems), and personnel (patient and crew medical officers). It must be functional within the STS, ACRV, and all SSF habitable volumes. The CMRS will allow for medical capabilities within CPR, ACLS, and ATLS standards of care. This must all be accomplished for a worst case transport time scenario of 24 hours from SSF to a definitive medical care facility on earth.


INTRODUCTION. Surgical techniques in microgravity are being developed for the Health Maintenance Facility (HMF) on Space Station Freedom (SSF). This will be the presentation of the proposed surgical capabilities, validation hardware and procedures, and investigation. METHODS. Procedures and prototype hardware, which include a medical restraint system, a surgical overhead isolation canopy, a surgical device, and a regional laminar flow device were evaluated. This was accomplished by realistic sterile surgical simulations involving both mannequins and animals during KC-135 parabolic flight and in a high fidelity ground based HMF mockup. RESULTS. Animal surgery in the environment of microgravity allowed the observation of unique arterial and venous bleeding characteristics for the first time. The ability to control bleeding and prevent cabin atmosphere contamination was also demonstrated. CONCLUSIONS. The procedures and prototype hardware tested provided valuable information and should be investigated and developed further. The use of standard surgical techniques are possible in microgravity if the principles of personnel and supply restraint and operative field containment are adhered to.