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 torso. Airway stabilization is influenced by the neutral body posture of rescuers will consist of crewmembers of varying sizes and degrees of physical deconditioning from spaceflight. Several ACLS protocols 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 by using a recording CPR manikin to assess adequacy of compressive force and frequency. Under conditions of parabolic flight, methods tested included conventional positioning of rescuer and victim, free-floating “aircraft.” The hardware used for CPR was adequate but rapidly fatiguing. The CCAD was able to provide adequate compressive force, but positioning was problematic. CONCLUSIONS. Delivery of effective CPR in microgravity will be dependent on adequate rescuer and patient restraint, techniques, and rescuer size and preference. Free-floating CPR may be employed as a stop-gap method until patient restraint is available. Development of an adequate CCAD would be desirable to compensate for the effects of deconditioning.

ADVANCED CARDIAC LIFE SUPPORT (ACLS) UTILIZING MAN-TENDED CAPABILITY (MTC) HARDWARE ONBOARD SPACE STATION FREEDOM. M. Smith, M. Barratt, C. 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) onboard Space Station Freedom (SSF) is a critical requirement. In order to evaluate the effectiveness of terrestrial ACLS procedures and prototype hardware, a medical team conducted simulations during parabolic flight onboard the KC-135 aircraft. The software used for CPR was based on the Ventricular Fibrillation algorithm in order to accommodate the space environment. Other constraints to delivery of ACLS equipment were incurred due to the microgravity environment. Equipment and supplies were administered using various methods. The factors identified for inclusion in the protocol included immediate restraint of the patient and early intubation to insure airway. External cardiac compressions of adequate force and frequency were administered using various methods. The significant limiting factors appear to be crew training, crew deconditioning, and limited supplies. CONCLUSIONS. Although the capability for delivery of ACLS equipment 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 should be placed on early intubation for airway management 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 scenario of 24 hours from SSF to a definitive medical care facility on earth.

A presentation of the above design prototype with its subsequent one year SSP/HMF and STS/ACRV high fidelity mock-up ground based simulations testing will be given. Also, parabolic flight and underwater Weightless Environmental Test Facility evaluations will be demonstrated for various medical contingencies. The final design configuration to date will be discussed with future space program impact considerations.


INTRODUCTION. Surgical techniques in microgravity are being developed for the Health Maintenance Facility (HMF) on Space Station Freedom (SSF). This will be a demonstration of the proposed surgical capabilities and certain hardware and procedural investigations. 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 was achieved by preventing 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 person and supply restraint and operative field containment are adhered to.