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NEUTRAL-BUOYANCY TESTS OF THE ADVANCED CREW MEDICAL RESTRAINT FOR COMMERCIAL HUMAN SPACEFLIGHT

Abstract

While government-employed astronauts are highly trained and exceptional medically-screened individuals, the upcoming commercial spaceflight participants will not have as perfect health history or emergency medicine practice. Moreover the ever growing number of outer space inhabitants will increase the chance of using life support procedures.

The effects of microgravity completely prevents emergency first responders from having a successful cardiopulmonary resuscitation of an incapacitated astronaut. Therefore in Space Shuttle and later in ISS era the Crew Medical Restraint device was invented and used. This artifact reenables efficient BLS procedures for care giver increasing patient's chance of survival. To achieve mutual stability, both patient and rescuer are restraint to the aluminum board. This allows participants not to free float from each other on every chest compression.

However, here down to Earth, what we take for granted in emergency situations is not only a CPR, but also an IV/IO access and airway management through implementing ALS or ACLS protocols in multi-rescuers scenario. In those live saving procedures care givers provide Epinephrine (Adrenaline) injections through intra-venous or Intraosseous infusions, but also do the tracheal intubation using laryngoscope and a plastic tube. Both of those procedures requires precision and timed tightly-coordinated choreography of rescuers. All of those is hardly impossible to achieve in microgravity without using devices such as Crew Medical Restraint (CMR).

While the current design of CMR fosters BLS procedures, it lacks support for ALS/ACLS protocols, especially in multi-crew scenarios. Authors addressed those issues in Mobile Medical Module (MMM) which can be an Advanced Crew Medical Restraint system for upcoming commercial spaceflight era. The MMM design was tested underwater in neutral-buoyancy environment which is an analog for microgravity. Several iterations of those underwater tests across multiple years allowed to do incremental changes to the project. Authors will present results and case study of the final design and takeaway notes for preparing neutral-buoyancy tests.