ABSTRACT

The objectives of the Technology Watch process are to identify emerging, high-impact technologies that augment current ExMC development efforts, and to work with academia, industry, and other government agencies to accelerate the development of medical care and research capabilities for the mitigation of potential health issues that could occur during space exploration missions. The establishment of collaborations with these entities is beneficial to technology development, assessment and/or insertion. Such collaborations also further NASA's goal to provide a safe and healthy environment for human exploration.

EXPLORATION MEDICAL CAPABILITY

The Exploration Medical Capability (ExMC) Element, one of six elements within NASA's Human Research Program (HRP), is charged with managing the risk of the "inability to adequately recognize or treat an ill or injured crewmember" during an exploration mission.

To address this risk, the Element must:  
- Define requirements for crew health maintenance  
- Develop treatment scenarios  
- Extrapolate from the scenarios to health management modalities  
- Evaluate the feasibility of these modalities  
- Develop technology and informatics that will enable the availability of medical care and decision support systems

THE CONDITION LIST

There are approximately eighty conditions on the evidence-based medical condition list, approved by NASA's Space Medicine Division in July 2009.

The conditions were gathered from several sources:  
- Space flight- related incidents  
- Conditions on the Shuttle medical checklist  
- Conditions on the International Space Station medical checklist  
- Expert opinion

The conditions were prioritized by a panel of flight surgeons, physician astronauts, engineers, and scientists based on incidence, consequence, and mitigation capability.

The condition list is a “living document”  
- New conditions can be added to the list  
- The priority of conditions on the list can be adjusted as screening, diagnosis, or treatment capabilities change, or if mission assumptions are updated

IDENTIFICATION OF GAPS

From the prioritized condition list, ExMC annually identifies gaps in the following areas:  
- Validation of Medical Standards  
- High technology readout  
- Risk Mitigation  
- Monitoring and Treatment of Conditions of Concern  
- Enabling Capabilities

For each gap, ExMC conducts a Technology Watch to identify emerging high-impact technologies that  
- Augment ongoing efforts  
- Accelerate the development of medical care and research capabilities

ORGANIZATIONAL STRUCTURE

Human Research Program ExMC Site  
http://humanresearch.jsc.nasa.gov/elements/exmc.asp

ExMC Tech Watch Wiki Site  
TBD

LINUX

Human Research Program ExMC Site  
http://humanresearch.jsc.nasa.gov/elements/exmc.asp

ExMC Tech Watch Wiki Site  
TBD

HRP Roadmap  
http://humanresearchroadmap.nasa.gov/

APPROACH

Individual Technology Gaps are assigned to one of the NASA centers (Ames Research Center, Glenn Research Center, Johnson Space Center, and Langley Research Center) to manage associated technology watch activities. Each gap lead will utilize their expertise, support from other centers and the National Space Biomedical Research Institute as appropriate. Tech Watch efforts to maintain knowledge of the rapidly evolving biomedical technologies include: market surveys; workshops technology readiness level assessments; identification of collaboration and distributed innovation opportunities; and recommendations to the Element on future options.

AREAS OF INTEREST

- Novel medical screening technologies  
- Delivery of medical training to non-clinicians  
- Autonomous medical procedure systems  
- Noninvasive diagnostic imaging  
- Smart ventilators and oxygen concentrators  
- Minimally invasive laboratory capabilities  
- Stabilization and treatment of bone fractures  
- Wound care and wound closure  
- Rapid vascular access  
- Advanced dental care  
- Intravenous fluid generation  
- Inventory tracking for medications and other consumables  
- Medication stability and shelf-life preservation  
- Biomedical monitoring capabilities  
- Medical data management systems  
- Prevention and treatment of radiation sickness  
- Diagnosis and treatment of renal stones  
- Delivery of medications to a suited crewmember  
- Eye wash capabilities  
- Auscultation in a noisy environment

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