ABSTRACT

Exploration Medical Capability (ExMC) is an element of NASA’s Human Research Program (HRP). ExMC’s goal is to address the risk of the “Inability to Adequately Recognize or Treat an Ill or Injured Crewmember.” This poster highlights ExMC’s approach, the gaps it has identified, and the technologies it is pursuing to address those gaps.

The poster outlines ExMC’s research and development priorities for improving the medical care available to astronauts. It also highlights the condition list developed by the Exploration Medical Capability (ExMC) Element, which includes a list of medical conditions that must be addressed in space exploration missions.

The poster is designed to inform the audience of gaps and tasks identified to achieve the research program’s goals. It encourages discussion of shared concerns and possible future collaborations.

THE HUMAN RESEARCH PROGRAM

NASA’s Human Research Program (HRP) conducts research and develops technologies that allow humans to travel safely and productively in the environment of space. The HRP is comprised of six elements:

- International Space Station Medical Project
- Space Radiation
- Human Health Countermeasures
- Exploration Medical Capability
- Behavioral Health & Performance
- Space Human Factors & Habitability

The National Space Biomedical Research Institute (NSBRI) is a partner with the HRP in developing a successful human research program.

EXPLORATION MEDICAL CAPABILITY

The Exploration Medical Capability (ExMC) Element is charged with reducing 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 systems

ORGANIZATIONAL STRUCTURE

TO address this goal, the Element has identified the capabilities needed to address the medical conditions of concern. These capabilities were not currently available, so a gap was identified. The element’s research plan outlines these gaps and the tasks identified to achieve the desired capabilities for exploration missions.

This poster is being presented to inform the audience of the gaps and tasks being investigated by ExMC and to encourage discussions of shared interests and possible future collaborations.

THE CONDITION LIST

The condition list is a “living document” that is regularly updated based on incidence, consequence, and mitigation approaches.

The conditions are prioritized by a panel of flight surgeons, physician astronauts, engineers, and scientists. From the prioritized list, the ExMC element determines the capabilities needed to address the medical conditions of concern. Where such capabilities were not currently available, a gap was identified. The element’s research plan outlines these gaps and the tasks identified to achieve the desired capabilities for exploration missions.

IDEA PROJECTS

- Inability to Adequately Recognize or Treat an Ill or Injured Crewmember: This gap is identified as a priority for the Exploration Medical Capability (ExMC) Element.
- Spaceflight medical incidents: The conditions on the list are prioritized according to mission type by the Element.
- Shuttle medical checklist: The conditions are prioritized by a panel of flight surgeons, physician astronauts, engineers, and scientists.
- Space Human Factors & Habitability: The conditions on the list are prioritized according to mission type by the Element.

The condition list includes approximately eighty conditions that must be addressed during exploration missions.

IDENTIFICATION OF GAPS

From the prioritized condition list, ExMC annually determines the capabilities needed to address the medical conditions of concern. Where such capabilities are not currently available, a gap is identified.

ExMC currently identifies gaps in the following areas:

- Validation of Medical Standards
- Risk Quantification
- 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 can address the gaps.

APPROACH

The Exploration Medical Capability (ExMC) Element is charged with reducing the risk of the “inability to adequately recognize or treat an ill or injured crewmember” during an exploration mission.

The conditions were gathered from several sources:

- Spaceflight medical incidents
- Conditions on the Shuttle medical checklist
- Conditions on the International Space Station (ISS) 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” that can be adjusted as screening, diagnosis, or treatment capabilities change.

AREAS OF INTEREST

- Novel medical screening technologies
- Delivery of medical training to non-clinicians
- Autonomic 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

LINKS

- Human Research Program Site: http://humanresearch.nasa.gov/
- HRP Roadmap: http://humanresearchroadmap.nasa.gov/