TEXAS SPACE GRANT CONSORTIUM
DESIGN CHALLENGE

TOPIC # - TDC - 105

LUNAR RESCUE CONCEPT FOR INCAPACITATED EVA CREW

BACKGROUND

NASA EHP is seeking an innovative design and operational solution to provide crew rescue capability to a fully incapacitated EVA suited crew member during a Lunar Surface EVA, without a lunar surface rover.

PROBLEM/DESCRIPTION

During a lunar surface EVA, one of the crew members could become fully incapacitated as a result of suit hardware failure, MMOD/MMLE damage, crew fall and/or crew injury, illness, etc. Therefore, an Incapacitated Crew Rescue (ICR) capability is needed to return the EVA crew member to safety (i.e., Lunar lander vehicle) in a safe and timely fashion.

Design Parameters:
The proposed ICR design and operational solution shall be capable of providing continuous full reliance rescue to a 250 kg (~551lb) fully incapacitated suited crewmember and shall be operable by a single “healthy” suited crew member (in 1-99 percentile) without resulting in additional injury/damage from ICR operations.

In addition, the proposed solution shall minimize mass, volume, and power impacts (i.e., not a unique dedicated rover) and be operable for a maximum walking distance of 2 km across the lunar surface.

The design shall consider the following lunar environment in the ICR design (Ref DSNE for additional details):

- Lunar Surface Gravity: 0.165g
- Lunar Surface Temperature Range: -361F to -31F
- Lunar Terrain Slope: Up to 20 deg
- Lunar Dust (Particulate size): Range from ~0.02 μm -10 μm

The design shall also consider the following operational constraints:

- Worst case drag/translation duration: 1 hour
- Position of incapacitated crew (lifting/transport) 30-60 deg reclined (optimal for most ICR cases)
- Supine position (extra capability)

Assumptions:

- Lunar Terrain Vehicle (LTV) has not arrived and is not part of ICR solution.
- The EVA suit will have attachment points.
- The ICR equipment necessary to aid with the rescue is carried along by the EVA crew during nominal EVA operations and will not need to be retrieved at the time of a crew incapacitation.

References:
Design Specification for Natural Environments (DSNE), Architecture Definition Document (ADD) Revision A, ADD Executive Summary EVA White paper, and The Apollo Lunar Cart

DELIVERABLES

Conceptual design, drawings and a Concept of Operations for use. CAD models are desired but not required. If design includes deployment before operational use, describe the mechanisms. (TBC)

DESIGN TEAM PROFILE

NASA MENTOR:	Anne Vaughan (anne.m.vaughan@nasa.gov)
LEVEL:	Undergraduate students of any level
MAJOR/DISCIPLINE:	Mechanical Engineering, Civil Engineering, Electrical Engineering or similar
TEAMS:	2
DURATION:	One or Two-Semester Project