

EVA ROADMAP: NEW SPACE SUIT FOR THE 21st CENTURY

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Regenerable CO₂ Removal

- Swing Beds (Currently not practical in Mars atmosphere)
- Liquid and solid amines - absorption of CO₂
- Biologic process - carbonic anhydrase
- Laser ionization - requires high power laser
- Cryo freeze out of CO₂ - would be practical with use of cryogenic O₂ PLSS

PLSS Oxygen Systems

- Use of Cryogenic oxygen produced from in-situ manufacture
- Breathable Oxygen produced "real-time" from martian atmosphere as astronaut walks
- Stored gaseous oxygen (non-regenerable, finite supply)

EVA Power Supply

- Batteries - must reduce weight, increase power, reduce recharge time (current shuttle EMU battery requires 22 hours of recharge for 8 hour EVA)
- Fuel Cells - fully regenerable, recharge quicker than batteries

PLSS Thermal Control Systems

- Radiator cooling system which uses low quality water (current EMU sublimator uses 8 lbs of high quality purified water for each PLSS - sublimator is designed to work in a vacuum environment - not on Mars surface)
- Heat exchangers/Heat pumps

Systems Engineering and Architecture

- PLSS packaging/modularity - component miniaturization
- Ease of maintenance and replacement of components
- Commonality of component parts with life support systems in habitat, pressurized rover, etc.

Space Suit Systems

- Stronger, lighter weight suit materials
- Highly mobile suit with flexible joints
- Power assisted joints, gloves

Human Considerations

- Improved biomedical sensors and monitoring
- Improved astronaut comfort in suit (thermal, muscular, etc.)
- In suit food/drink
- Waste management

Displays and Controls

- Smaller suit sensors
- Improved suit/PLSS caution and warning (failure identification, rapid reconfiguration)
- Robust two-way voice and video communications. Improved display technology (Heads Up/Retinal)
- Voice recognition command systems

Robotics Interface

- Small, self-propelled EVA caddies (provide back-up PLSS and/or PLSS recharge capability)
- Unpressurized and pressurized rovers
- Telerobotic command and control interface

EVA Research and Technology Roadmap

