



Design Brief

Context:

Spacesuits are one of the important enabling technologies that have permitted humans to explore outer space. To survive the hostile environment, humans had to be covered with a protective shell as they exited their spacecraft. This shell contained a part of Earth's surface environment while remaining flexible and impervious to the unique hazards, such as high-speed particle impacts, encountered there. These requirements meant that engineers and technicians had to spend long hours investigating and selecting appropriate materials, finding ways of fabricating and joining suit parts together, and providing operating pressure, power, and communications while assembling a garment that was tough but flexible. The task was achieved with such great success that astronauts and cosmonauts have safely conducted thousands of hours of extravehicular activity.

Challenge:

Design and build a protective garment that will permit future space travelers to explore the surface of Mars. The garment must protect the person inside from the hazards of the Martian environment while remaining comfortable to wear. Excursions on the surface will nominally last 8 hours, but the garment will have to function as long as 10 hours in emergency situations. The garment must be flexible enough to enable the wearer to walk up to 10 kilometers, collect geologic samples, and operate a variety of tools and experimental apparatus. Furthermore, the garment's design must be rugged enough to permit repeated use and be able to be serviced simply and quickly. Along with the garment, design a collection of geologic sampling tools, such as rock hammers, and a general set of tools for assembly and repair activities. These tools should be easy to use while wearing the protective garment, be safe and rugged, and interface with a general purpose tool carrier that must also be designed.

Procedures:

Select subcontractor teams to design and construct each of the garment's components, such as the helmet or gloves. Teams will coordinate their work with each other as materials for and sizes of the components are selected.

Materials:

Use whatever materials you find to construct the garment's components. Test these materials to ensure they will survive the Martian environment. Existing tools can be modified for use on Mars.

Evaluation:

Conduct periodic team evaluations of the progress of the garment and tool design process. When all components are completed, integrate them for a full test in a simulated Martian environment. Evaluate the garment and tools on the basis of the criteria presented in the context section.

