

**EXPLORATION ZONE:
GUSEV CRATER-APOLLINARIS SULCI**

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Extra incentive for revisiting site is that Spirit can be inspected and possibly crated up and brought home:
Apollo 12 and Surveyor III

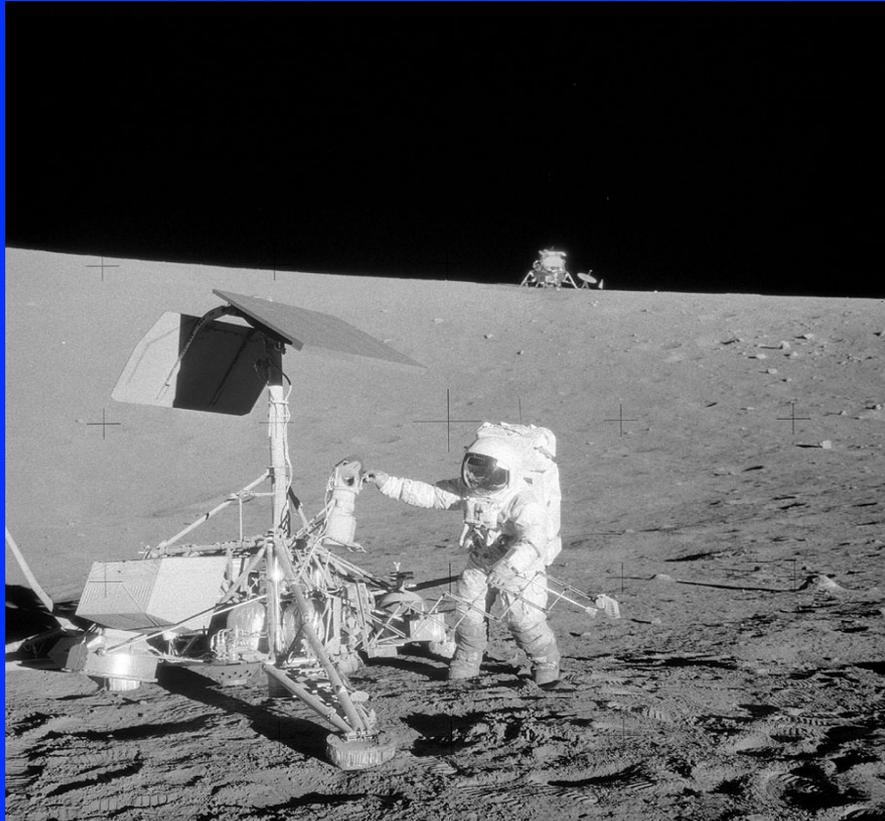
By this time Spirit exposed to Martian environment for >30 yrs

Excellent long duration exposure experiment providing long term data on the Martian environment (Weathering, Micrometeorites) and its effects on materials
Degradation: Solar Arrays (cracks, discoloration, broken wires), Cable Ties and Lacing (delamination, discoloration, degradation), Cal Target Paint Chips
Condition, Did Batteries Leak?

Data will aid in design of surface systems, equipment and structures for both future robotic and manned exploration of Mars.

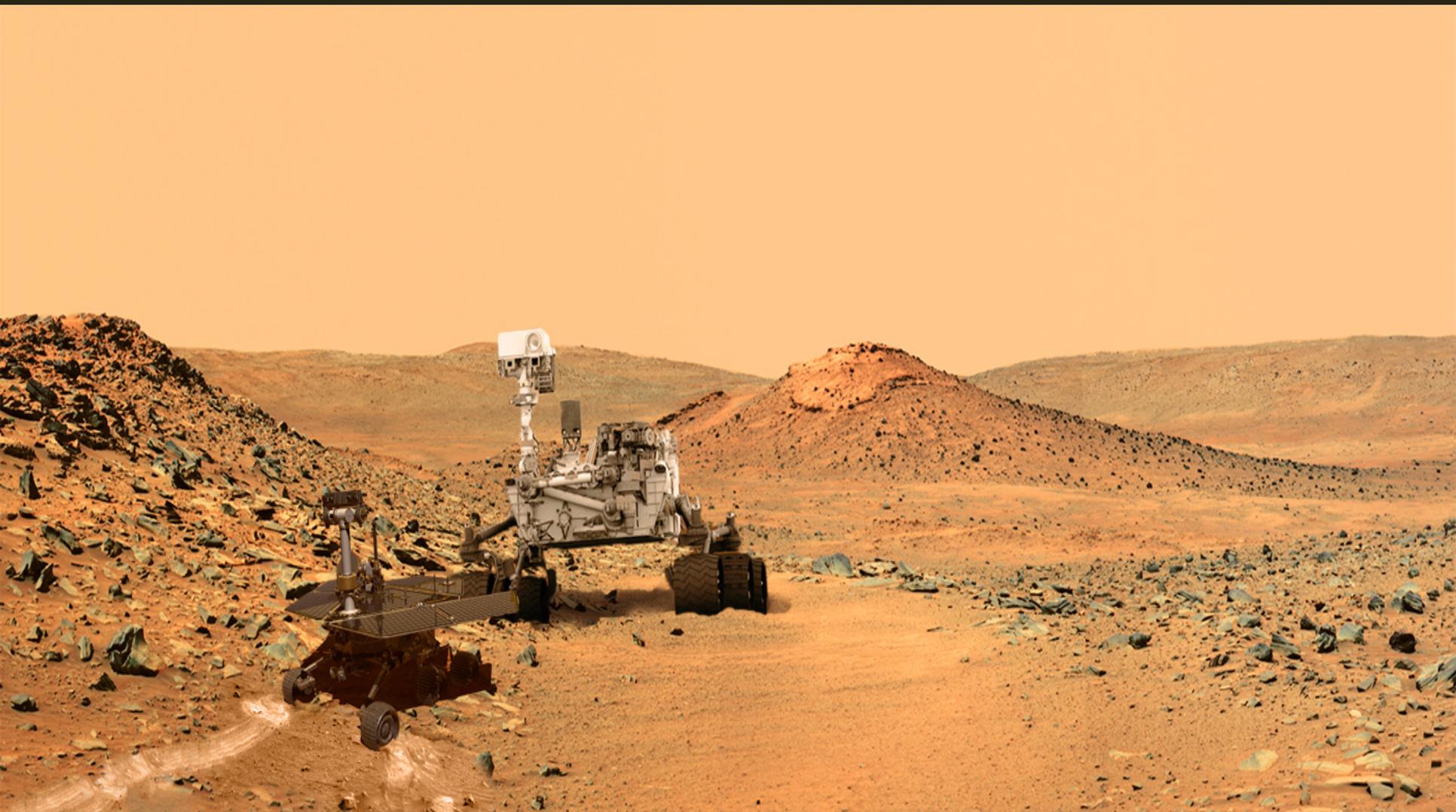
Previous Long Duration Exposure Experiments

Apollo 12 retrieved components from S-III exposed 2.5 yrs



LDEF: materials, coatings, electronics, optics, thermal systems exposed 5.7 yrs





Rationale for Analog Sites and Facilities

- Reduce Operational Risk to Crew**
- Assess Crew Productivity**
- Maximize Scientific Return**
- Provide Training for Crews and
Mission Developers**

Risk Reduction

1. Training

Ensure that crew can meet the challenge of doing science on Mars

2. Operations and Procedures Development

Assess procedures and related operations in real world environment and conditions

3. Technology Development

Verify how technology will work with real slopes, rock configurations, soil conditions, dust, etc

4. Operational Command / Control Validation

Understand how Command / Control works in a remote environment. Prove out and understand limitations of communication between ground and flight crew

Rationale Continued

- **Ultimately, the primary justification for the use of any analog site is to reduce overall mission risk to the flight crew and provide crews and mission developers with a unique perspective which supports this risk reduction for the surface exploration of Mars.**
- **Pre-mission activity without any analog site and facility testing in a “real world setting” will be inadequate for any mission which seeks to undertake the surface exploration of Mars.**

Nature of Field Work: The Best Geologist is the One Who Sees the Most Rocks



Field Geology requires the constant iteration of what one sees and has seen in order to formulate and build hypothesis to test. This can only be learned by actually performing field investigations and this comes with experience from the field.

The Sooner the Better

When should the Mars analog field training program begin? Not too early to begin preparing for the first Mars expeditions and several reasons are mentioned below:

(1) The art and skill of Field Geology can only be learned by being in the field.

(2) Additionally, Field Geology is a cumulative science, meaning the more experience you get the better you get.

(3) Links should be forged between the science, operations, and astronaut communities now because it will take time to achieve the collective experience level necessary for the proper interaction of these communities.

Full Scale Test

1. Astronauts complete tour of duty lasting 6-8 months on ISS in order to simulate the interplanetary cruise phase of Mars mission



2. Crew then brought to Earth receive medical exam, then flown out to Dry Valley “unknown test site” to begin surface exploration phase of test



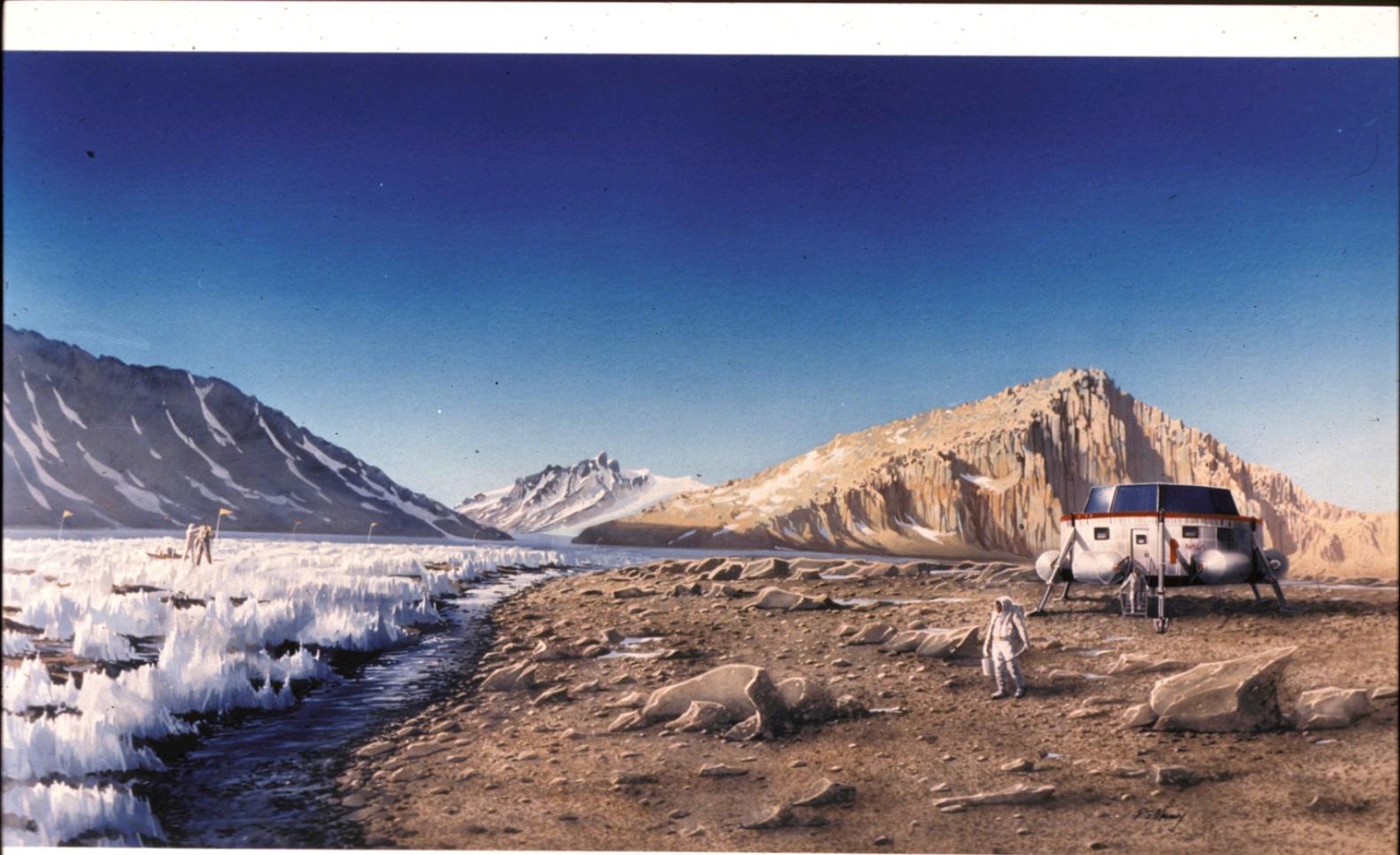
3. Crew would live in same type of habitation module and use the same, tools, techniques, technology (i.e., life support systems) and equipment that they will use on their actual mission. The crew would also eat the same food planned for the actual mission and experience a Mars time delay in communications
4. After this phase of the training is complete the crew could either return and be launched back to the ISS to simulate the voyage back to Earth. Or return home for post-analog mission debriefing and evaluation of surface science results and operations

It is understood that this type of full up testing may be prohibited by both time and costs.

Other scenarios could involve the testing and demonstration of various critical subsystems (life support, power, waste management).

Additionally, Antarctic astronaut crew training could focus primarily on just the surface exploration activities phase and not involve ISS duty.

Antarctica: Gateway to the Human Exploration of Mars



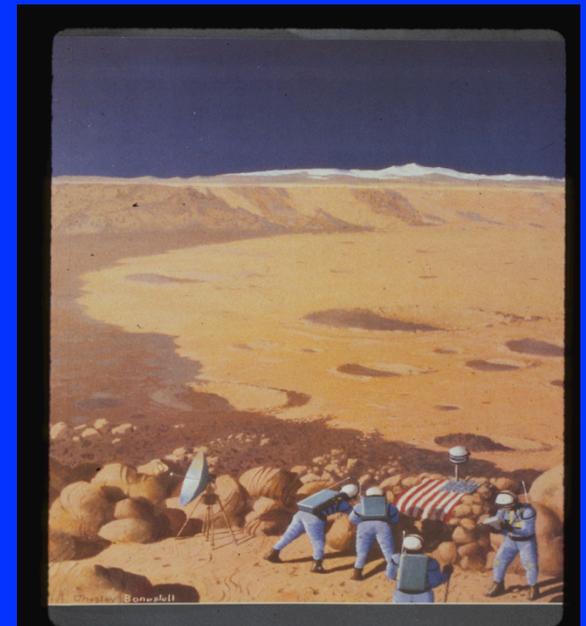
Antarctic Expedition Crew Traits

Conducting field work in Antarctica exposes an expedition member to physically remote territory, hazardous environments, rugged terrain, isolation, logistical constraints and limited human contact.

Perseverance, flexibility, self motivation, and a team work ethic are some of the qualities required to successfully conduct field based operations in these remote realms.

Bunger Hills: Mars Mission Similarities

- 6 month long expedition
- International team
- Last will & testament
- Dive physical
- Antarctic burial
- 1.5 months at sea before drop, low physical activity period







106 total days in Bunger Hills

56 days for base camp repair, ice camp set up, camp maintenance, bad weather, SCUBA Ops, packing gear and samples etc.

50 days with dedicated geology EVAs (304 hrs) Equal to 38 (8 hour long EVAs).

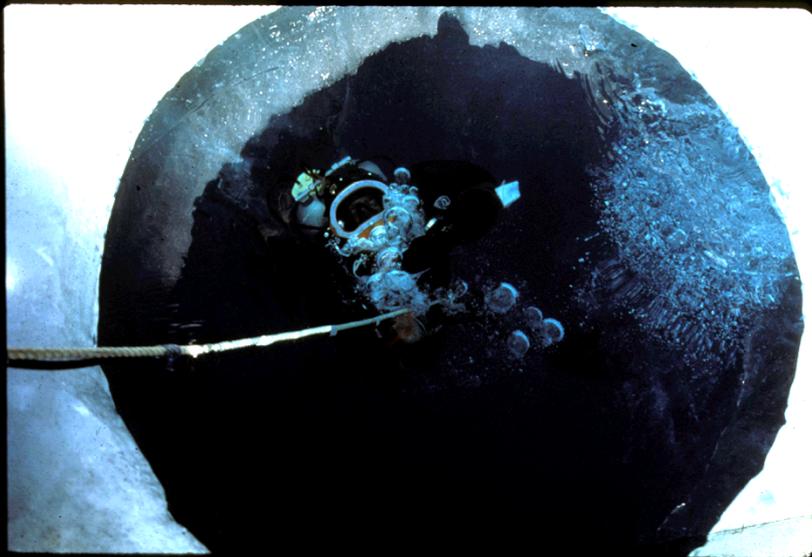
Things will go wrong:

1 of 2 diesel generators out within 1st month, second generator out last night at base.

Lost one of two tracked vehicles in frozen lake.







Joint Russian-American Antarctic Expedition

**Akademik Fedorov Ice Breaker 48 day voyage from
Monetvideo, Uruguay to Bunger Hills**

106 days in Bunger Hills, Eastern Antarctica

**Akademik Fedorov Ice Breaker 35 day voyage to
Capetown, South Africa**

Total expedition time: 189 days

