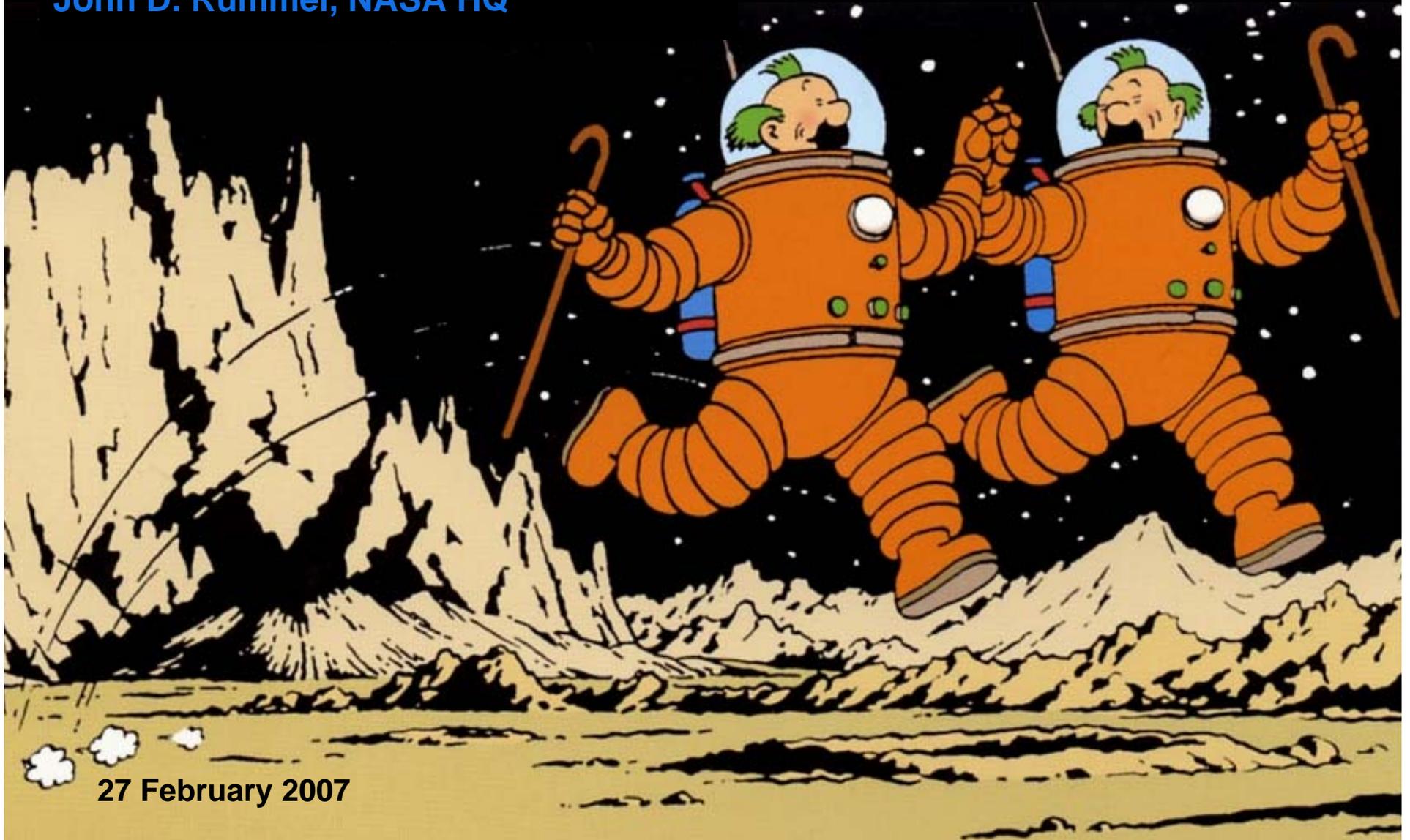


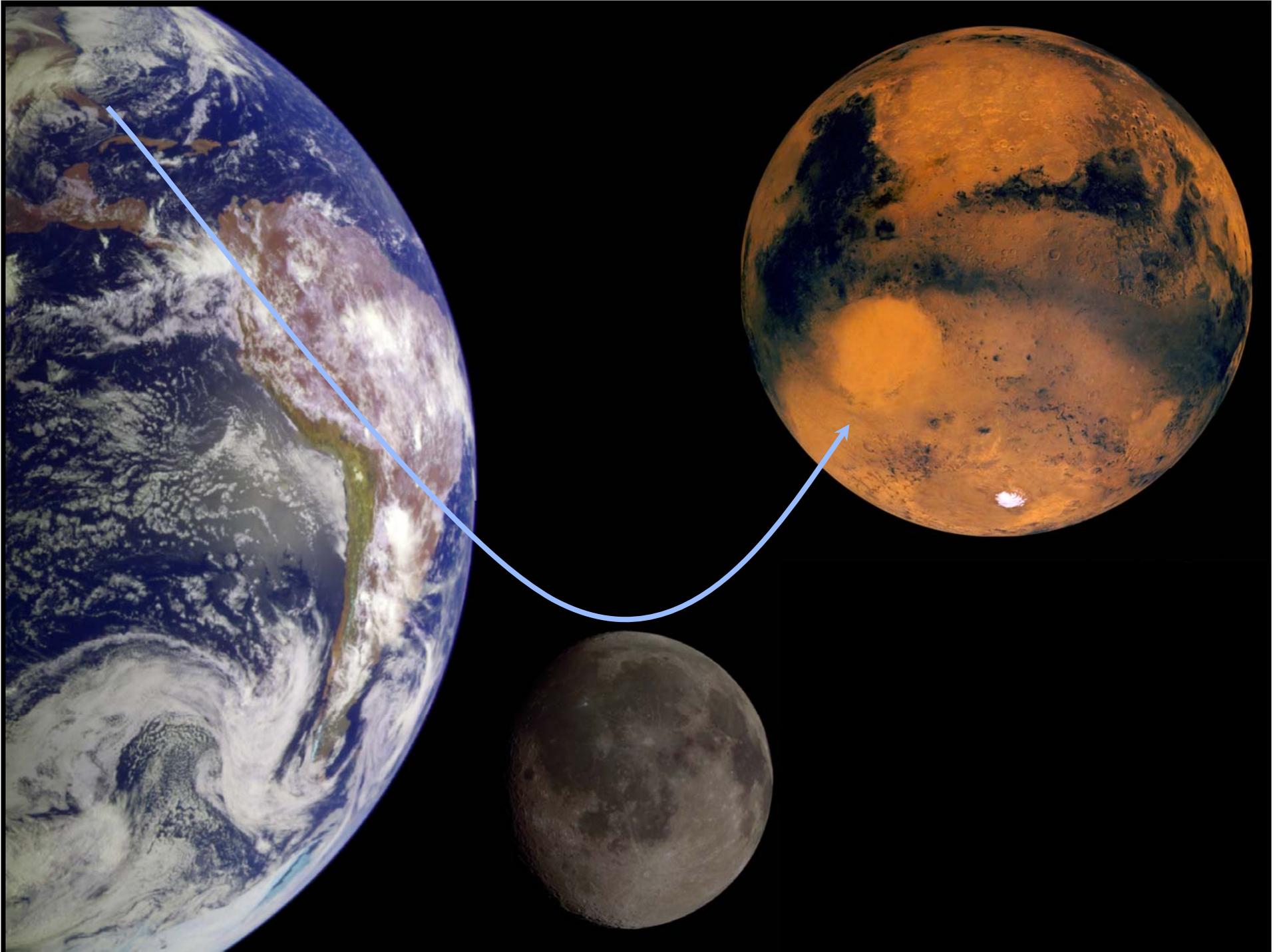
Planetary Protection and Lunar Science



John D. Rummel, NASA HQ



27 February 2007



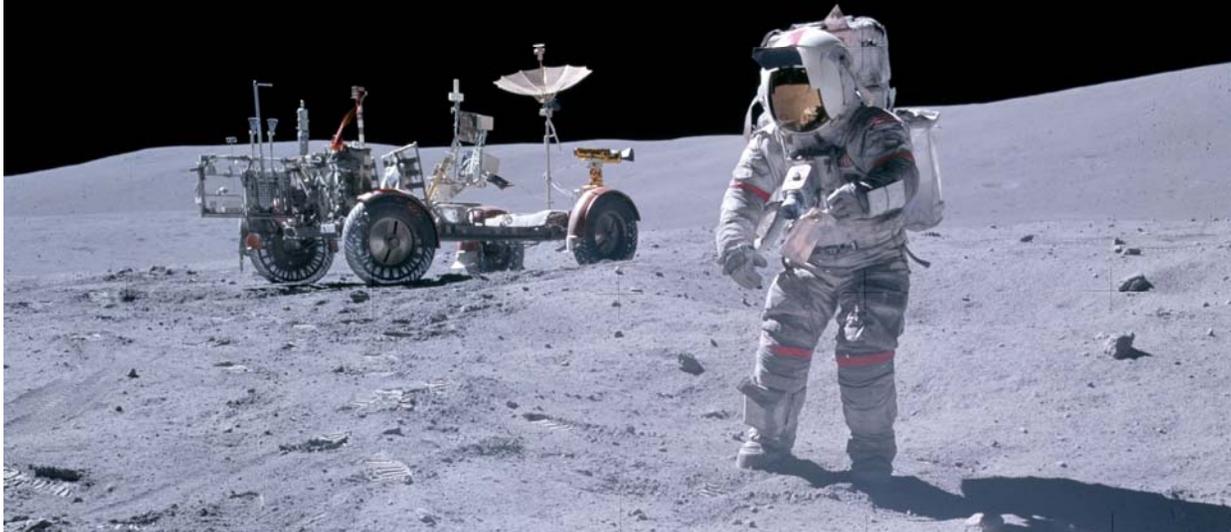


Nota Bene:

The Lunar Return is NOT a PP Issue

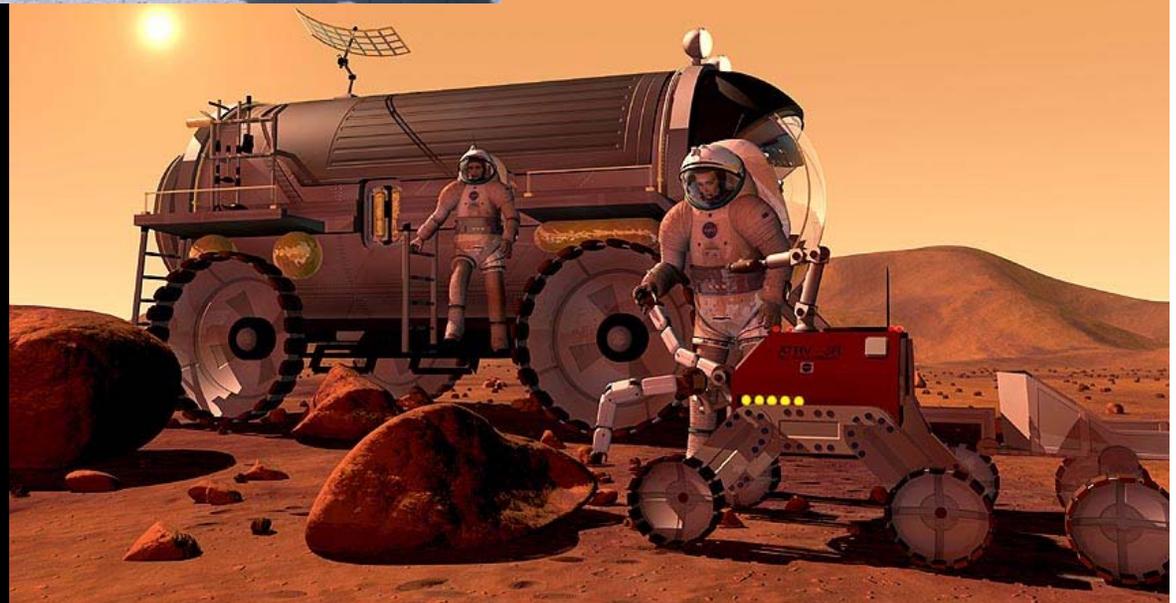
- Missions to the Earth's Moon are planetary protection Category I. NO requirements under NASA's Planetary Protection policy
 - or under COSPAR's policy, either
- Sample-return missions from the Moon are planetary protection Category V (all returns are), but they are "Unrestricted Earth Return" missions (e.g., NO requirements past the SMD AA's certification)

Human Exploration Theme:

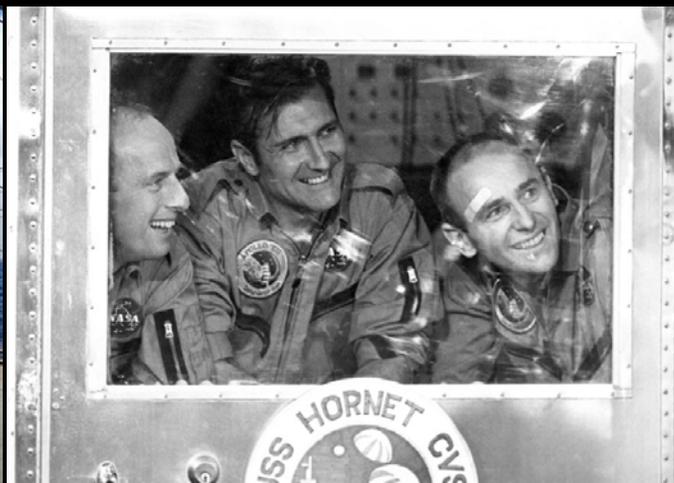
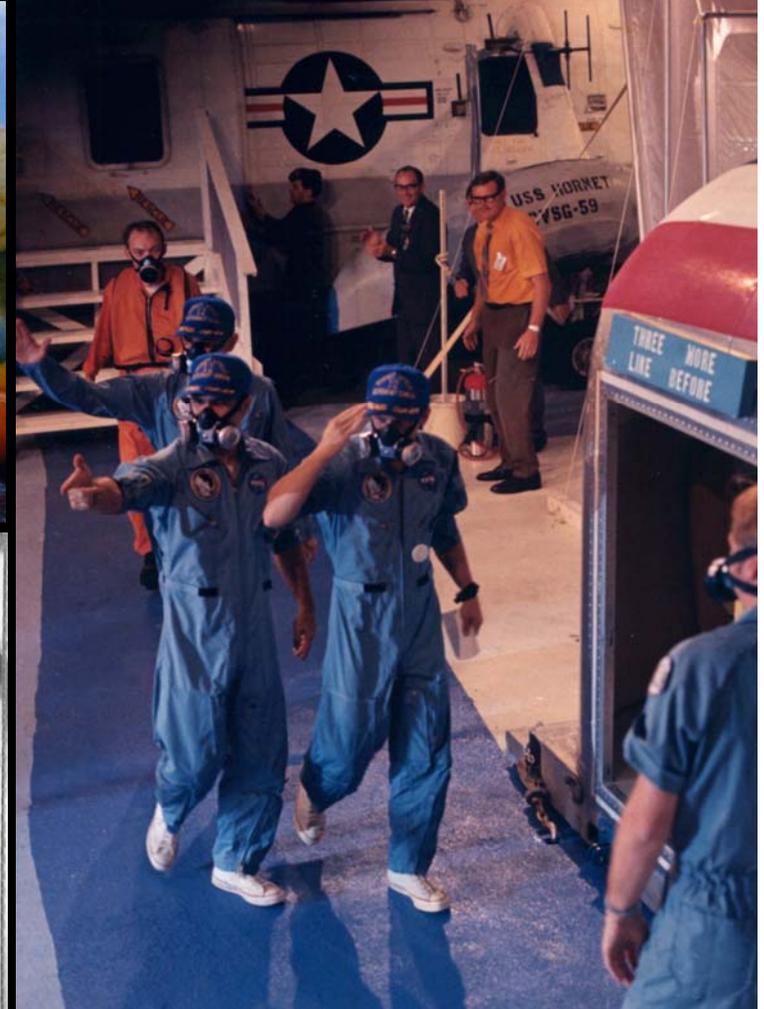


Learn lessons on the Moon (life support systems, EVA technology, mission operations, science)....

....to support development of future human missions to explore Mars, and look for signs of life (they may well find them).

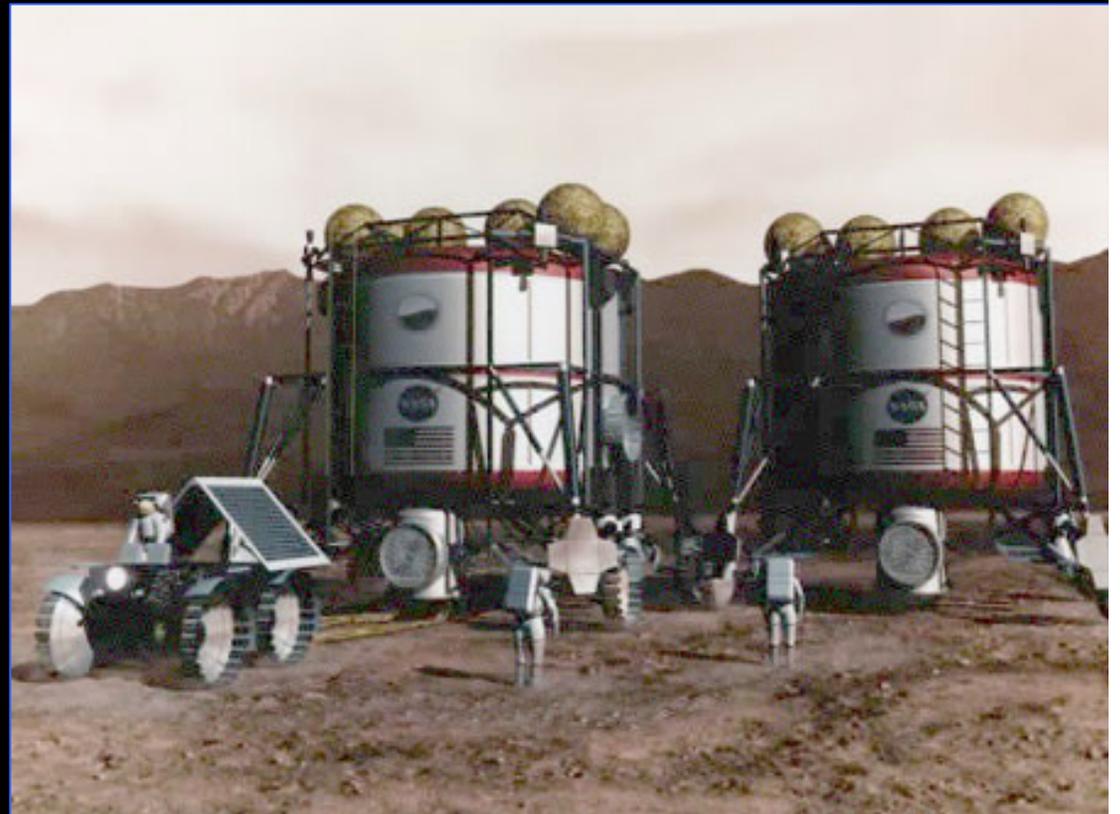
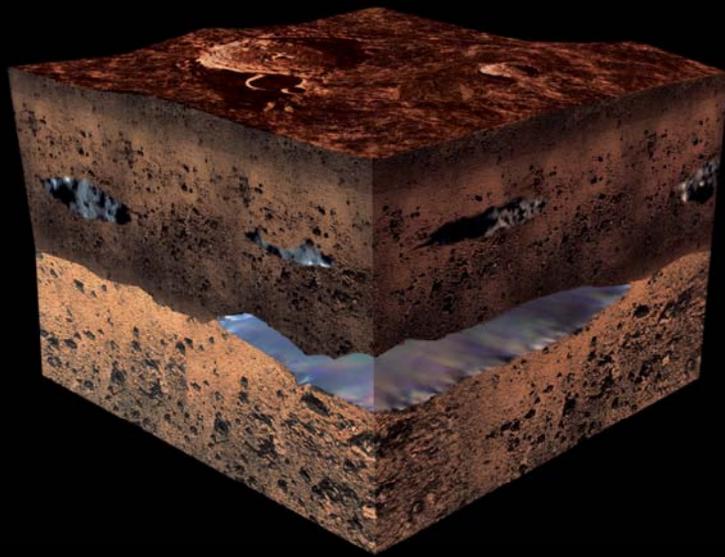


Lessons Can Be Learned from Apollo: Both Positive and Negative



But Further Knowledge is Required to Enable the Eventual Human Exploration of Mars

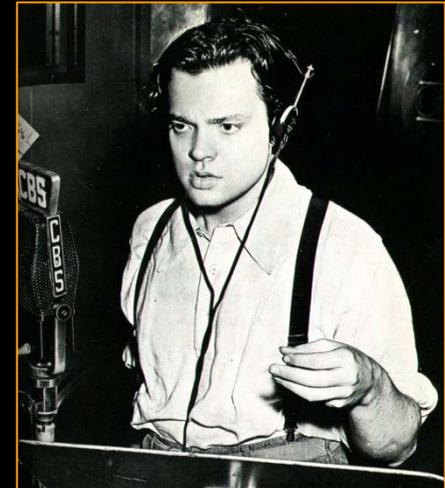
- Human capabilities may be required to explore deep subsurface aquifers, if they exist beneath the martian deserts
- Requires a preliminary robotic search for life, because....



Beware! *The War of the Worlds*



H.G. Wells
1898



Orson Welles
1938

And scattered about...
were the Martians—dead!
—slain by the putrefactive
and disease bacteria against
which their systems were unpre-
pared; slain as the red weed was
being slain; slain, after all man's devices
had failed, by the humblest things that God,
in his wisdom, has put upon this earth.

...By virtue of this natural selection of our kind
we have developed resisting power; to no
germs do we succumb without a struggle...

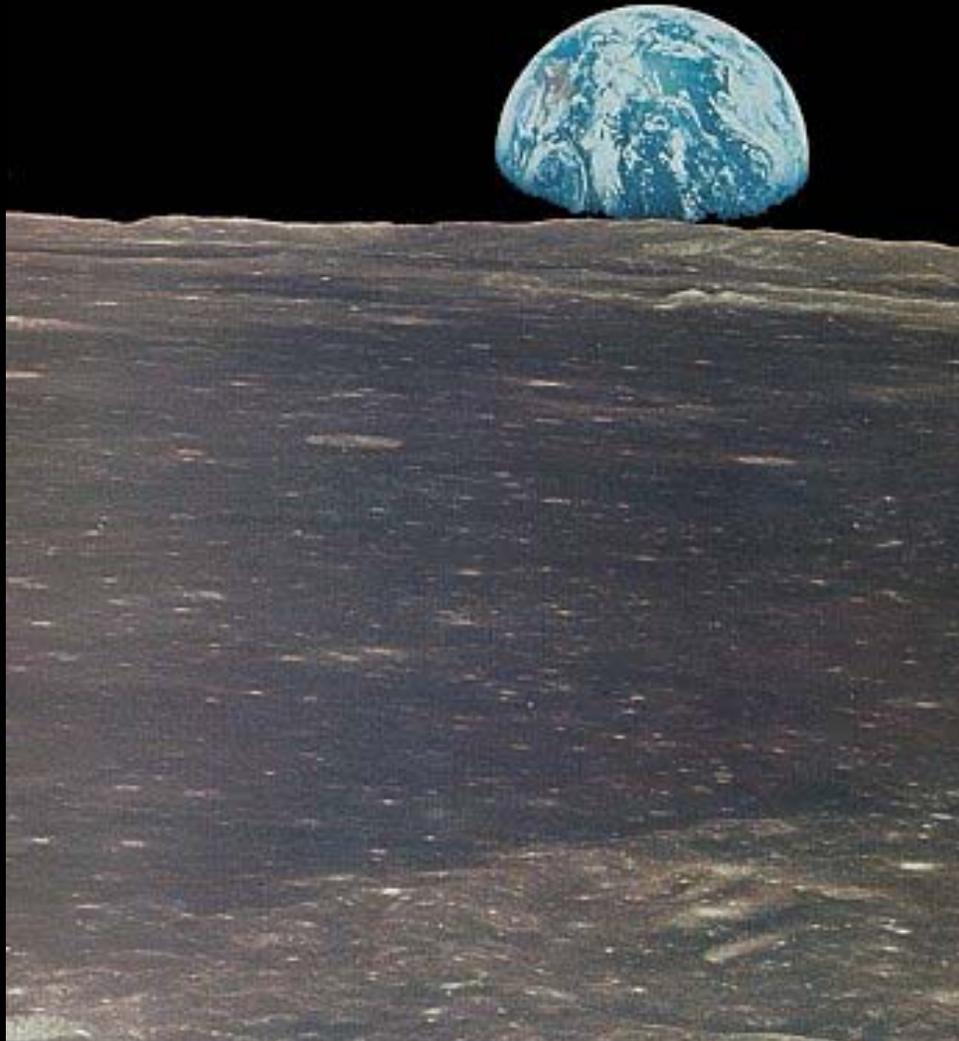


Planetary Protection Assumptions for Human Mars Missions (NASA-ESA 2005)



- The greater capabilities of human explorers can contribute to the astrobiological exploration of Mars only if human-associated contamination is controlled and understood.
- It will not be possible for all human-associated processes and mission operations to be conducted within entirely closed systems.
- Crewmembers exploring Mars will inevitably be exposed to martian materials. To the maximum extent practicable, these exposures should occur under controlled conditions.
- Safeguarding the Earth from potential back contamination is the highest planetary protection priority in Mars exploration.

**The Lunar Program Can Provide
Basic Science Opportunities to
Support Planetary Protection Goals....**



Concepts / Opportunities in Lunar Research



- Chemical and microbiological studies on the effects of terrestrial contamination and microbial survival
 - During the Apollo missions (study Apollo sites) *Requires sorties to Apollo sites*
 - During lunar robotic and human missions (dedicated experiments and “natural” experiments in a variety of lunar environments/depths, etc.) *At and around the Outpost*
- Future in situ investigations on the Moon by highly sensitive instruments designed to search for biologically derived organic compounds
 - Valuable “ground truth” data on in situ contamination of samples supports future Mars sample return missions (sample integrity)
- Use of the Moon and lunar transit/orbits as testbeds for procedures and technology involved with implementing human Mars mission requirements, prior to Mars missions being flown
- Track / control possible contamination of lunar ices with non-organically-clean spacecraft & tools (science and resource contamination concerns)

Concepts / Opportunities in Lunar Technology



- Evaluate and track lunar space suit competency:
 - Monitor solutions to containment and leakage issues, habitat ingress and egress (dust-free?)
 - Understand evolving suit requirements that impact Mars suit and PLSS designs and requirements
- Develop technologies for effective containment of samples collected by humans to prevent forward and backward contamination (preliminary to Mars use)

Exploration and Planetary Protection



For humans to explore Mars, there will be a need to:

- Enhance the range of planetary protection measures available to safeguard the crew (e.g., provide “informed consent”)
 - e.g., ‘Zones of Minimum Biological Risk,’ per the NRC’s *Safe on Mars* report
- Sharpen policy distinctions regarding the nature and location of allowable contamination, and its spread
 - Martian surface vs.
 - Martian deep subsurface
- Ensure measures are in place to deal with the possible discovery of martian life by human crew
 - Answer most questions earlier, in the robotic program
- Some of these activities can be enhanced by lunar science



Questions



