

IAC 2017: Manned Missions to Mars over the next Two Decades

The start of human space travel emerged from passion for exploration. A manned mission to Mars will continue this legacy by providing a new perspective of our neighbouring planet. Sustaining life in the harsh environment will be the ultimate opportunity to demonstrate the technological development of the last half century in this sector, and will provide motivation to reignite human space exploration. In addition, there will be an alternative option available with which to mitigate the effects of climate change.

The International Astronautical Congress (IAC) provided an optimal environment for discussions about both the transportational and habitation plans for such a mission. Lockheed Martin and Elon Musk both revealed the plans for their respective vehicles and habitation plans, while countless technical sessions also discussed several different aspects of the missions from preparing the crew to constructing the propulsion systems required for such an endeavour.



Lockheed Martin's Mars Base Camp Orbiter
-*Lockheed Martin*

(SLS) could be used to transport astronauts to the DSG then take the DST to a final destination. Similarly, Musk's BFR is fully reusable and is capable of a variety of missions from travelling to the moon and Mars to travelling between cities on Earth (as a long-term goal) when spaceports have been built.

In addition to transportation, both companies provided details on their plans for arrival on the red planet. Pictured above is Lockheed Martin's Mars Base Camp Orbiter, designed with docking points for the DST system, also capable of travelling down to the Martian surface. This will allow the crew to explore the planet both from orbit and on the surface.

Musk detailed how the first mission will be to establish spaceports for future landings and to start developing an infrastructure similar to the Hub in *The Martian*. Once the initial setup is complete, the plan is to send more missions to expand on the habitat by building more landing pads and essentially building a city in the form of an artificial ecosystem.

These talks provided good detail on the technological aspects of a mission to Mars. Technical sessions held throughout the week detailed the physiological and psychological perspectives. Analog and simulation missions on Earth and the ISS have been performed to allow researchers to investigate the effects of the environment and isolation on humans. Exposure as long as expected for the Mars missions

Lockheed Martin provided more details on the Deep Space Gateway (DSG), a spaceport to be in lunar orbit, and Deep Space Transport (DST), designed to transfer humans from the DSG to any location reachable in a 1000-day mission, including Mars. Elon Musk also revealed his plans for and progress on the largest rocket to ever be built travelling to Mars.

Both rockets were designed with a focus being sustainably, such that all the major subsystems can be reused. The DSG is capable of providing support for missions to both Mars and the moon. The idea is that a launch vehicle, such as the Space Launch System



Musk's Long-term Mars Habitation Plan
-*Original Photo, IAC 2017*

are still being tested. Among the aspects which affect human health the most are radiation, microgravity and isolation.

While some types of radiation are manageable, other types, such as gamma rays, are more difficult to mask. Microgravity has obvious impacts on the physical health of the astronauts, but also significantly



Hi-SEAS Analog Mars Habitat
-Hi-SEAS

affects the mental health of an astronaut. A paper presented at the conference (*Utilizing the International Space Station as a Simulation Platform for Deep Space Travel*) by Eleanor Morgan also

went into detail about how isolation can have a significant impact on the psychology of astronauts. Analog missions, and missions on the ISS, have very quick response times and to escape a dangerous situation, the Soyuz is always available as an emergency escape.

While simulations have been held where a particular section of the ISS has been given a delayed communication system (to simulate the time delay in communication to Mars).

However, the reliability of this data is debatable as the crew member is still aware that the rest of the crew are still close and able to communicate quickly with Earth. This reassurance will not exist on Mars.

This conference contained a wealth of information and gave access to those at the forefront of the mission to Mars. While great research has been accomplished, significant work still remains. As of the IAC, the expected launch for the Orion program and for Musk are expected to be in the early 2030s or 2024, respectively. Thus, within the next decade, humans could quite possibly be an interplanetary species, making this a, exhilarating time to be entering the space industry.