

NASA Health and Human Performance in Spaceflight

Human Health and Space Exploration Panel
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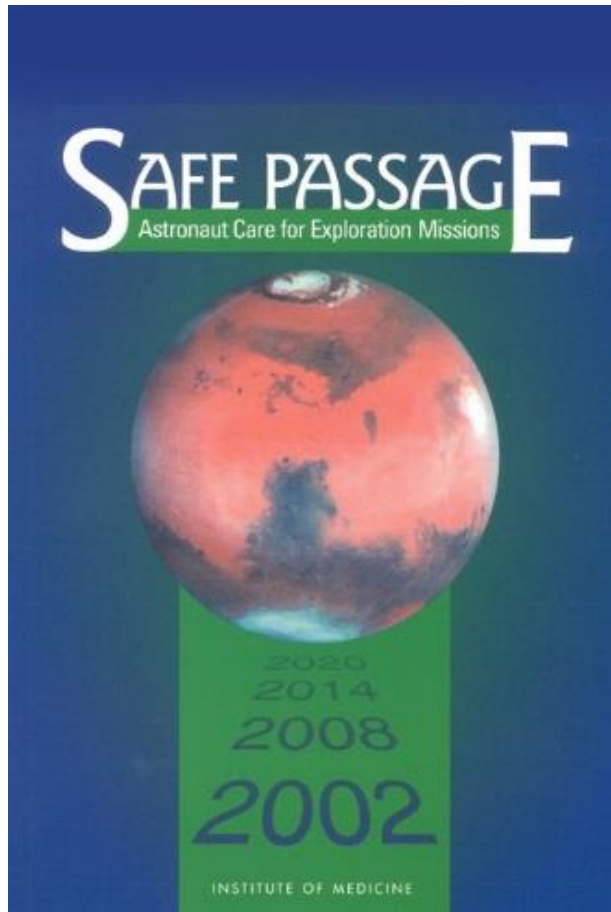
Conflicts of Interest Disclosure

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2. Assistant Professor of Space Medicine, Center for Space Medicine
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I have financial interests in the above entities.

The opinions shared here are my own and not necessarily reflective of the above institutions.



2001, Conclusion 6:

NASA, because of its mission and history, has tended to be an insular organization dominated by traditional engineering. Because of the engineering problems associated with early space endeavors, the historical approach to solving problems has been that of engineering. Long duration space travel will require a different approach, one requiring wider participation of those with expertise in divergent, emerging, and evolving fields. NASA has only recently begun to recognize this insufficiency and to reach out to communities, both domestic and international, to gain expertise on how to remedy it.

Project Mercury



FIGURE 4.1. Mercury medical kits containing items such as antibiotics, decongestants, stimulants, electrode paste, and medications to treat nausea and diarrhea. (Photo courtesy of NASA)



FIGURE 4.2. Mercury medical kit containing items such as saline solution, bandages, stimulants, and decongestants (Photo courtesy of NASA)

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Gemini and Apollo

TABLE 4.1. Contents of the Gemini VII medical kit [10].

Medication	Indication	Dose	Amount
D-Amphetamine sulfate	Stimulant	5-mg tablets	8
Aspirin-phenacetin-caffeine	Pain	Tablets	16
Cyclizine HCl	Motion sickness	50-mg tablets	8
Diphenoxylate HCl	Diarrhea	2.5-mg tablets	16
Meperidine HCl	Pain	100-mg tablets	4
Methyl cellulose solution	Eye lubricant	15-ml bottle	1
Parenteral cyclizine	Motion sickness	45 mg (0.9-ml injector)	2
Parenteral meperidine HCl	Pain	90 mg (0.9-ml injector)	2
Pseudoephedrine HCl	Decongestant	60-mg tablets	16
Tetracycline HCl	Antibiotic	250-mg coated tablets	16
Tripolidine HCl	Decongestant	2.5-mg tablets	16



FIGURE 4.5. Apollo clinical physiological monitoring kit and emergency medical kit (Photo courtesy of NASA)



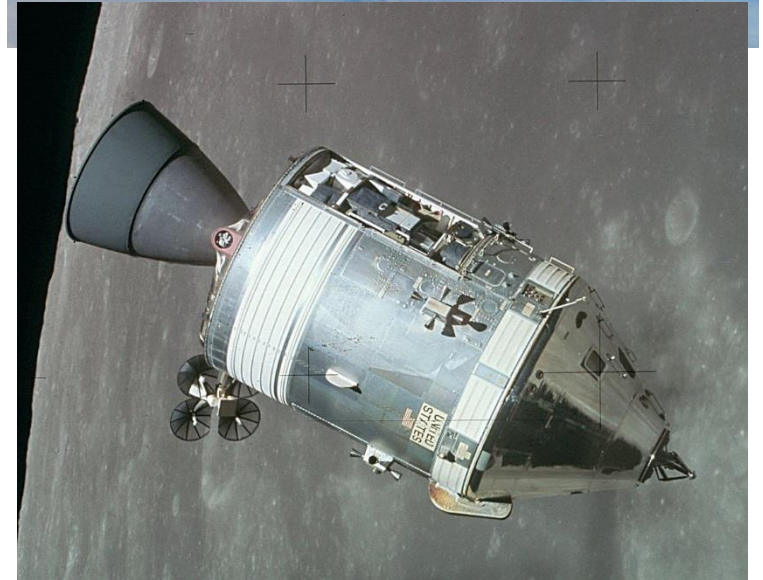
FIGURE 4.3. Apollo medical kit containing items such as skin cream, antibiotic ointment, nasal spray, band-aids, and stimulants (Photo courtesy of NASA)



FIGURE 4.6. Apollo emergency medical kit (Photo courtesy of NASA)



FIGURE 4.4. Apollo Command Module medical kit (Photo courtesy of NASA)



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Space Shuttle

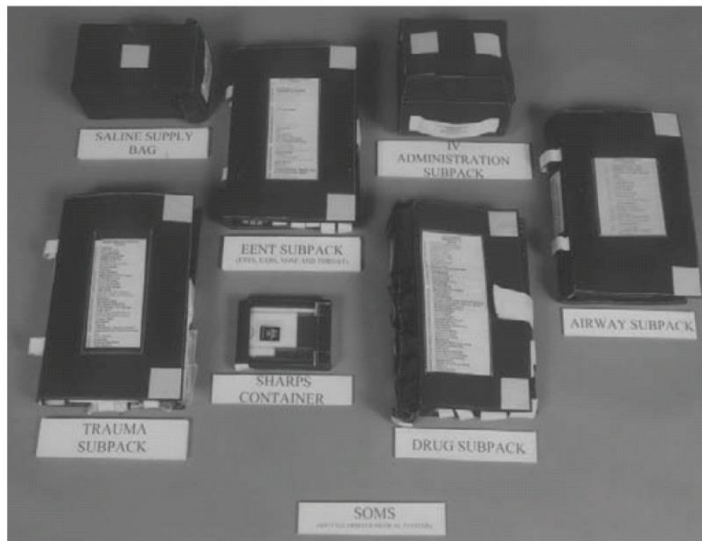


FIGURE 4.7. Shuttle Orbiter Medical System. Following redesign in 2000, components include Saline Supply Bag, EENT Subpack, IV Administration Subpack, Trauma Subpack, Sharps Container, Drug Subpack, and Airway Subpack (Photo courtesy of NASA)



A medical kit, not a system

Health and Medical on ISS

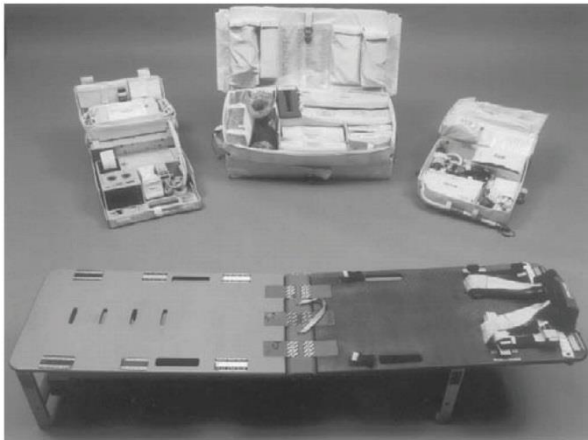
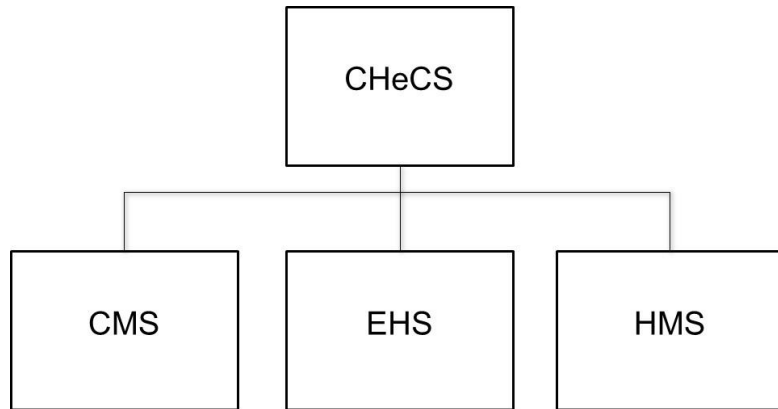
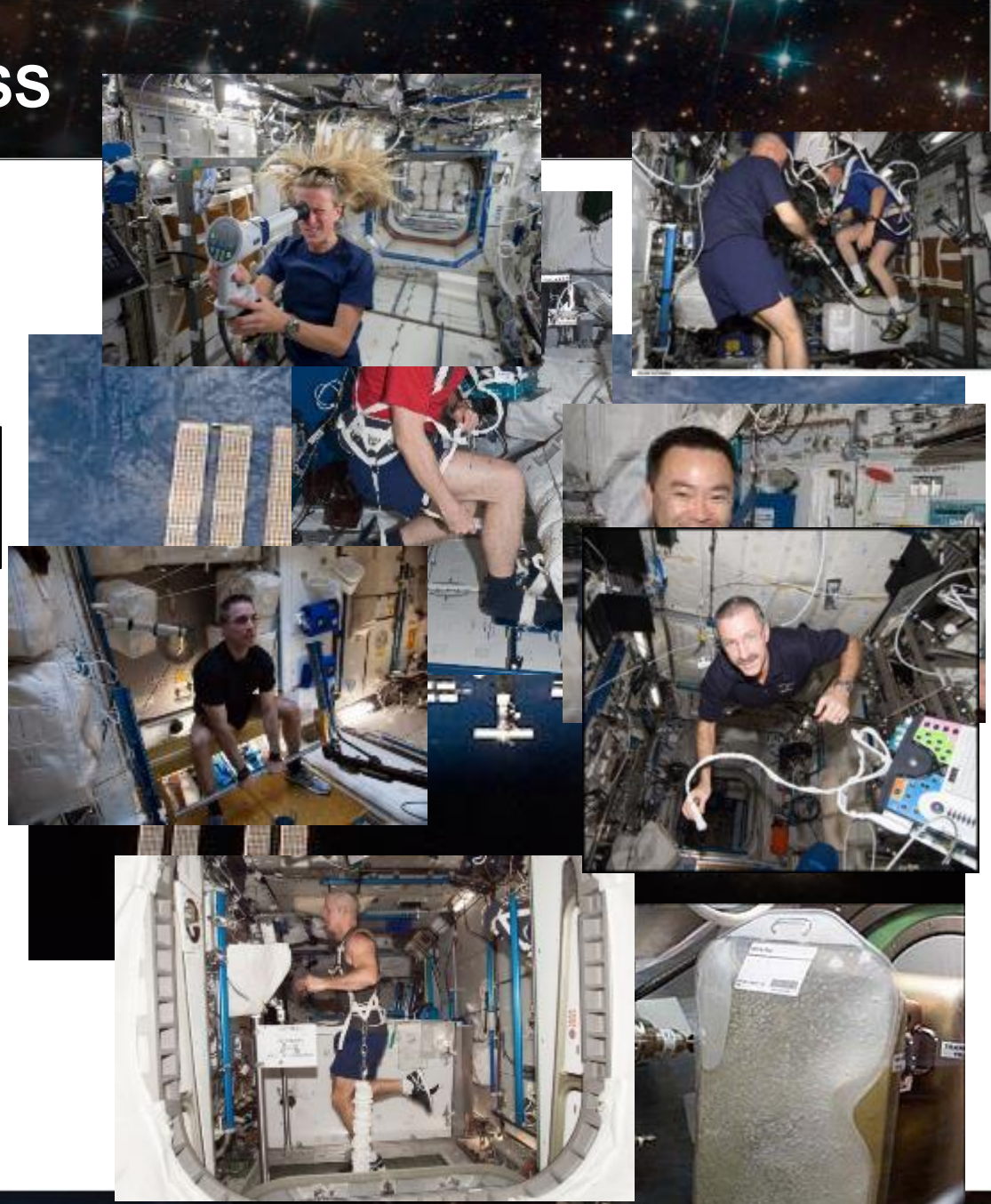
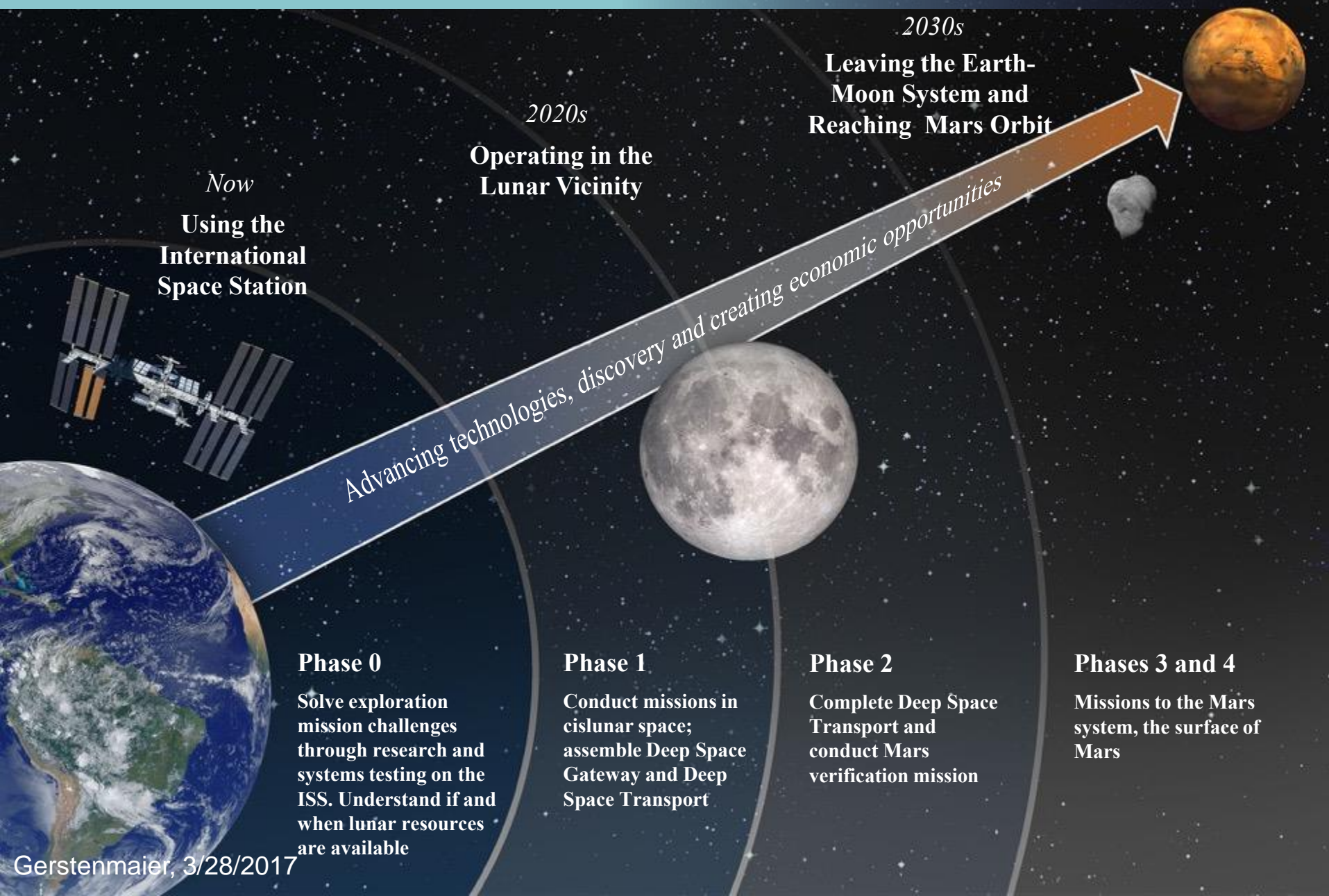


FIGURE 4.8. ISS Health Maintenance System. Components include (from left) defibrillator, Advanced Life Support Pack, Respiratory Support Pack, and Crew Medical Restraint System (Photo courtesy of NASA).


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Exploring Space In Partnership



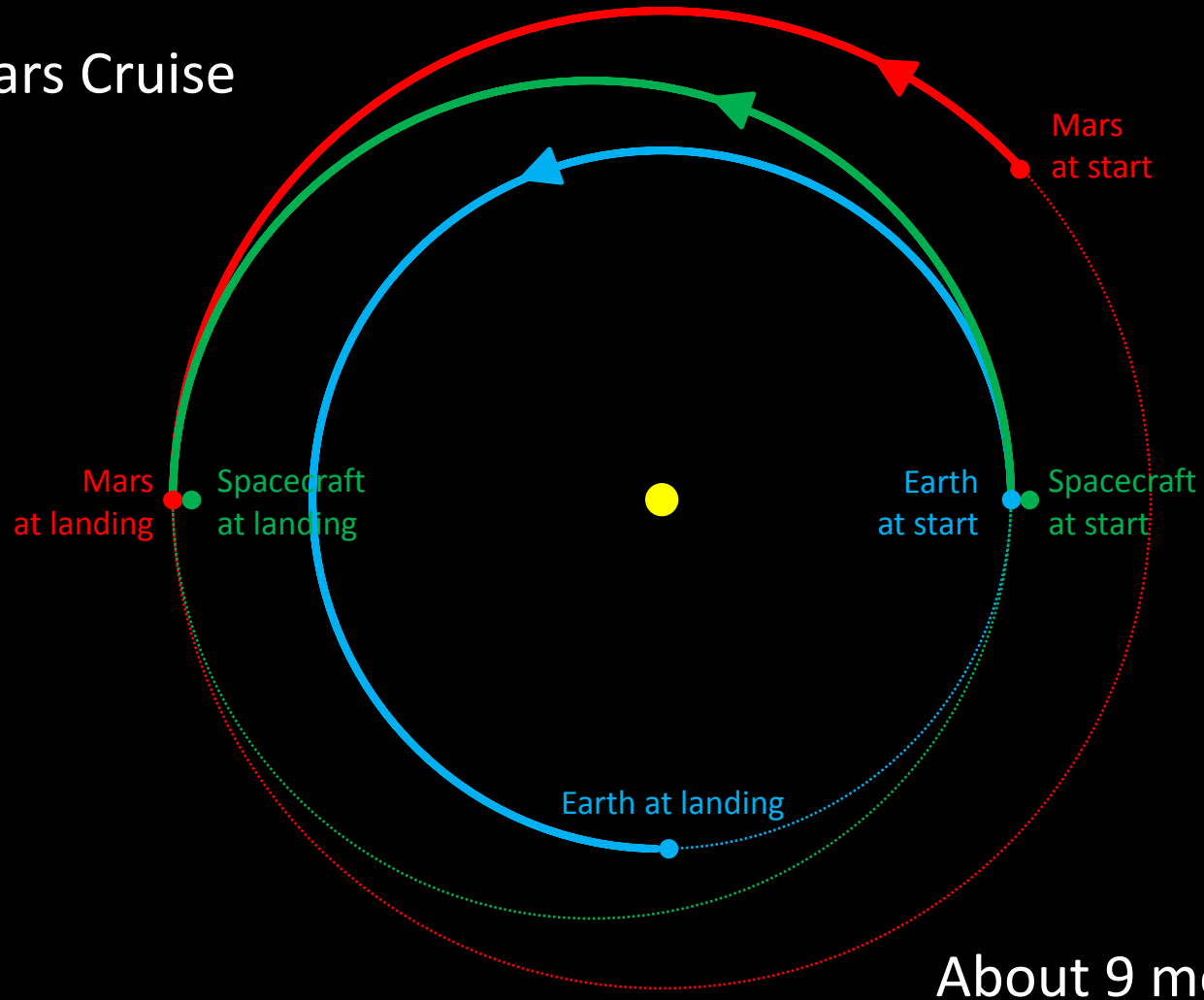
How are we leading future human exploration?

- 
- Maximizing utilization of the International Space Station
 - Actively promoting LEO commercialization
 - **Resolving the human health and performance challenges**
 - Expanding partnerships with commercial industry
 - Enhancing international partnerships
 - Building the critical *Deep Space Infrastructure*
 - Enabling the capabilities to explore multiple destinations

For Mars: some current operating assumptions fail

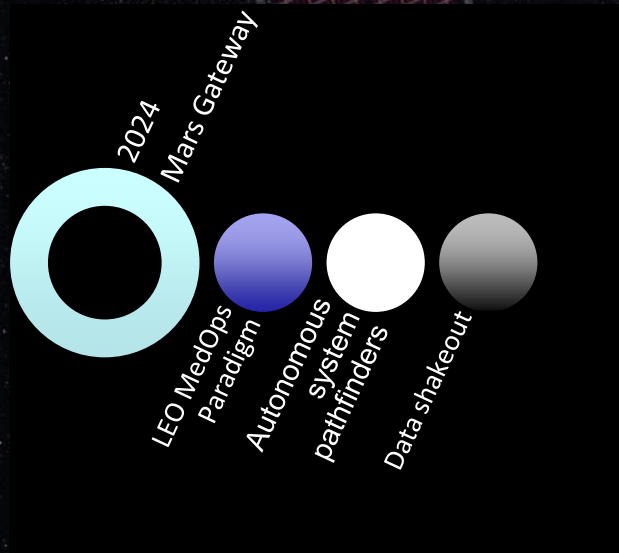
- No real-time communications
- No ability to resupply
- No ability to evacuate ill or injured crew

Trans-Mars Cruise



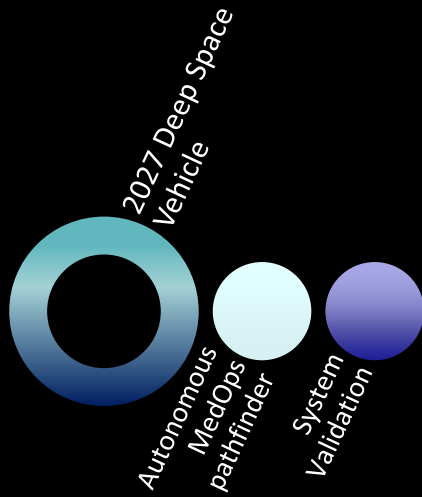
About 9 months

Phase 1: Deep Space Gateway

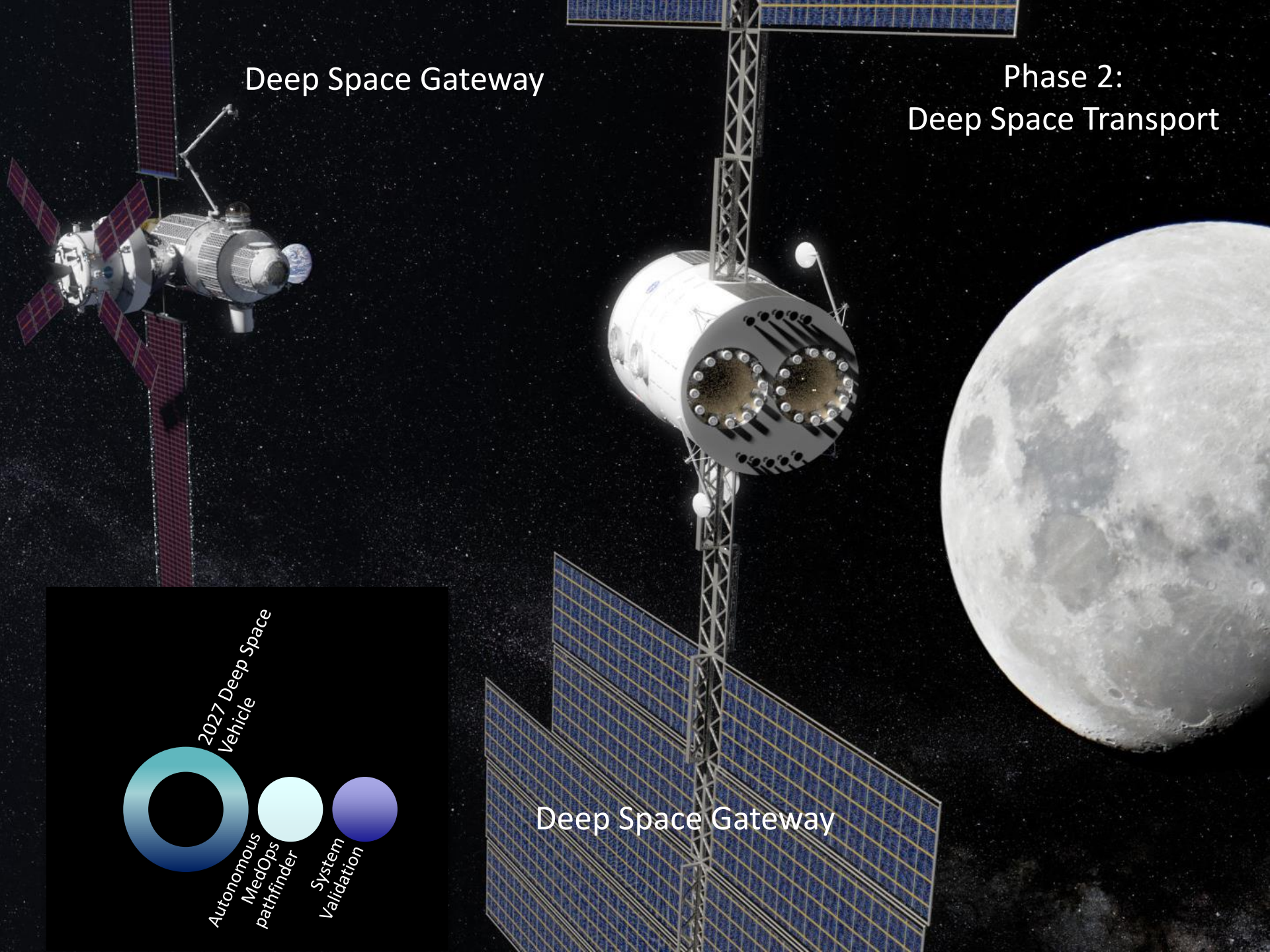


Deep Space Gateway

Phase 2:
Deep Space Transport



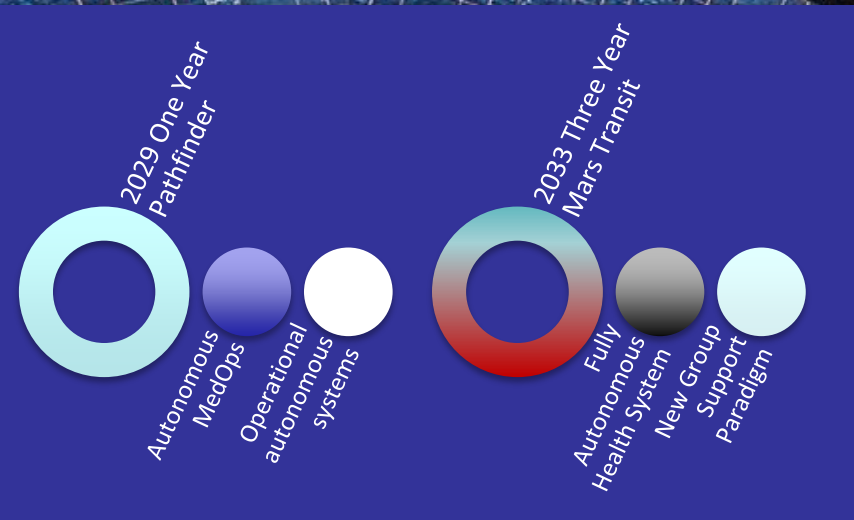
Deep Space Gateway



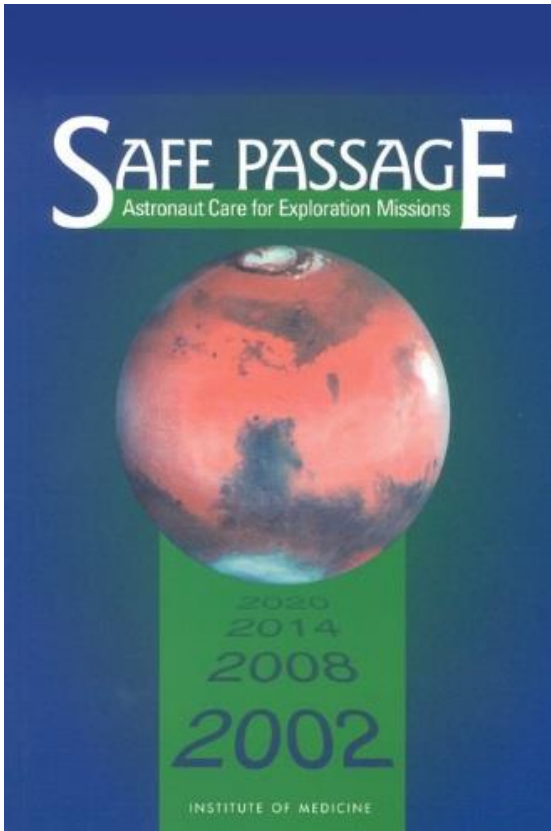
Mars Shakedown -> Mars Transit

Consider as Requirements:

- Crew Health and Medical Autonomy
- Medical Kit -> Medical System Integration



Safe Passage



- *From Conclusion 6:*
- *“The human being must be integrated into the space mission in the same way in which all other aspects of the mission are integrated.”*

Committee on Creating a Vision for Space Medicine During Travel Beyond Earth Orbit, Board on Health Sciences Policy and I. O. Medicine, *Safe Passage: Astronaut Care for Exploration Missions*, Institute of Medicine of the National Academies Press, 2001.

