LOCKHEED MARTIN

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Vital Systems: Life Support on the Moon and Mars Panel

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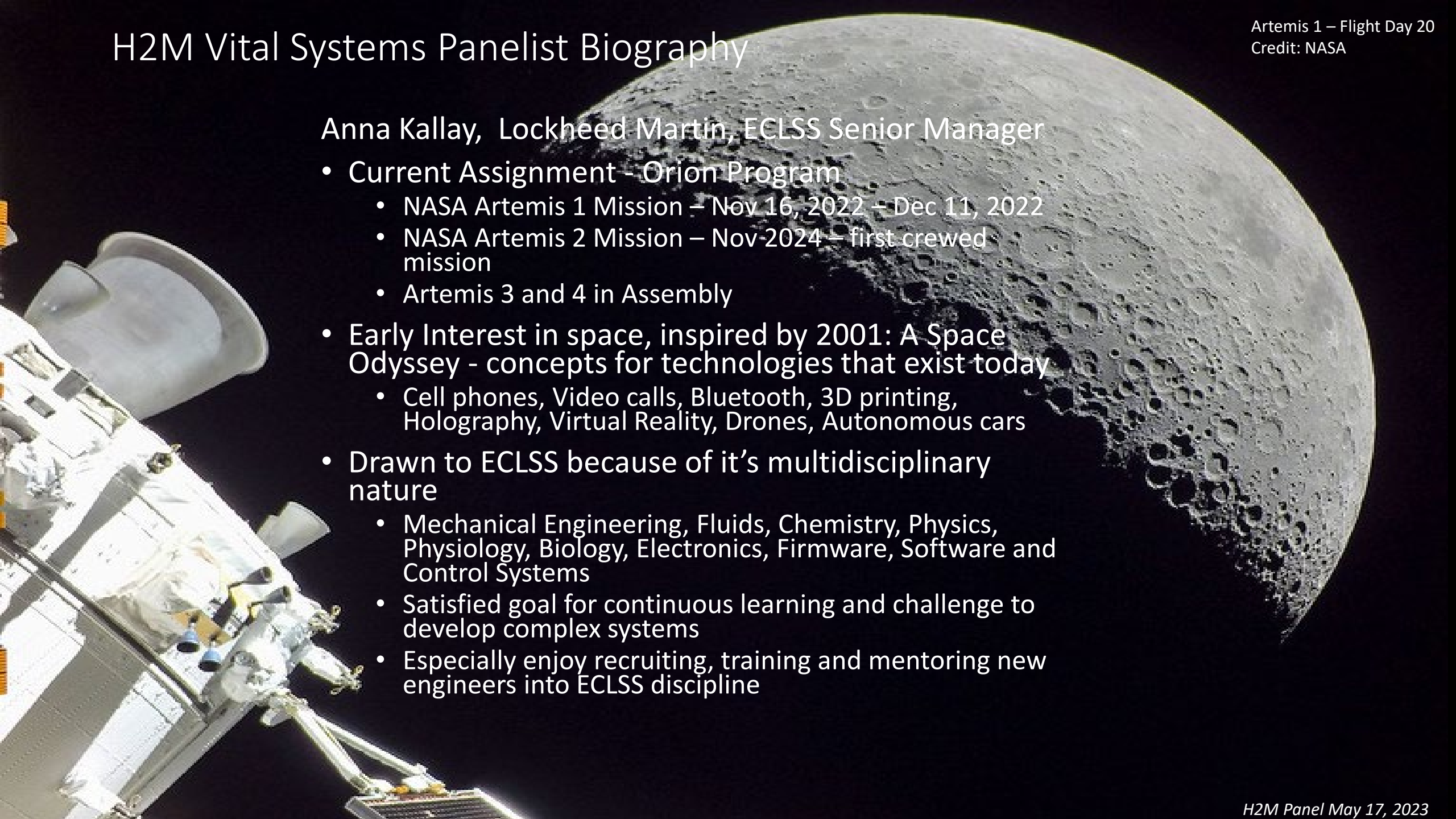
H2M Vital Systems Panelist Biography



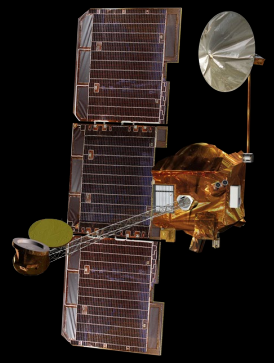
Artemis 1 – Flight Day 20
Credit: NASA

Anna Kallay, Lockheed Martin, ECLSS Senior Manager

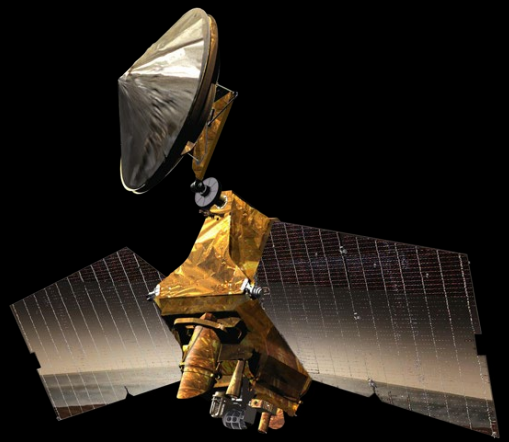
- Current Assignment - Orion Program
  - NASA Artemis 1 Mission – Nov 16, 2022 – Dec 11, 2022
  - NASA Artemis 2 Mission – Nov 2024 – first crewed mission
  - Artemis 3 and 4 in Assembly
- Early Interest in space, inspired by 2001: A Space Odyssey - concepts for technologies that exist today
  - Cell phones, Video calls, Bluetooth, 3D printing, Holography, Virtual Reality, Drones, Autonomous cars
- Drawn to ECLSS because of it's multidisciplinary nature
  - Mechanical Engineering, Fluids, Chemistry, Physics, Physiology, Biology, Electronics, Firmware, Software and Control Systems
  - Satisfied goal for continuous learning and challenge to develop complex systems
  - Especially enjoy recruiting, training and mentoring new engineers into ECLSS discipline

History of Collaboration on NASA's Mars Exploration Missions

- Lockheed Martin has participated with NASA on every one of its Mars exploration missions including the first lander on Mars, Viking I & II
- In conjunction with NASA Jet Propulsion Laboratory, and Goddard Space Flight Center, Lockheed Martin has developed 11 of NASA's 22 spacecraft that were sent to Mars
  - Landers - Viking 1 & 2, Mars Polar Lander, Phoenix, Insight
  - Orbiters – Mars Observer, Surveyor, Mars Climate Orbiter, Odyssey, Mars Reconnaissance Orbiter, MAVEN
  - We are currently working on NASA's Mars Sample Return mission in multiple systems including the Mars Ascent Vehicle
- Lockheed Martin is leveraging this heritage and Orion development and operational experience to develop the next level of advancements to further NASA's deep space exploration goals

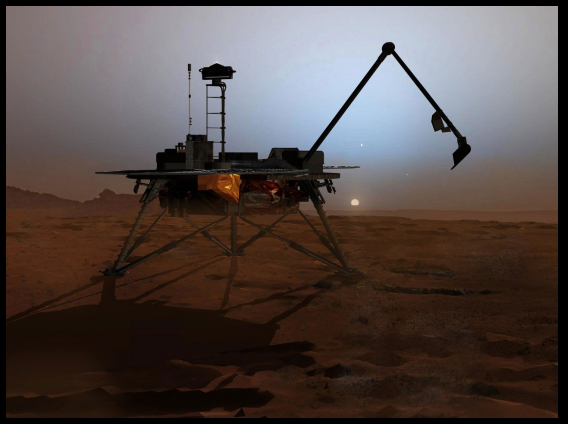


Mars Odyssey
Credit: NASA



Mars Reconnaissance Orbiter
Credit: NASA

Viking I & II Landers
Credit: NASA

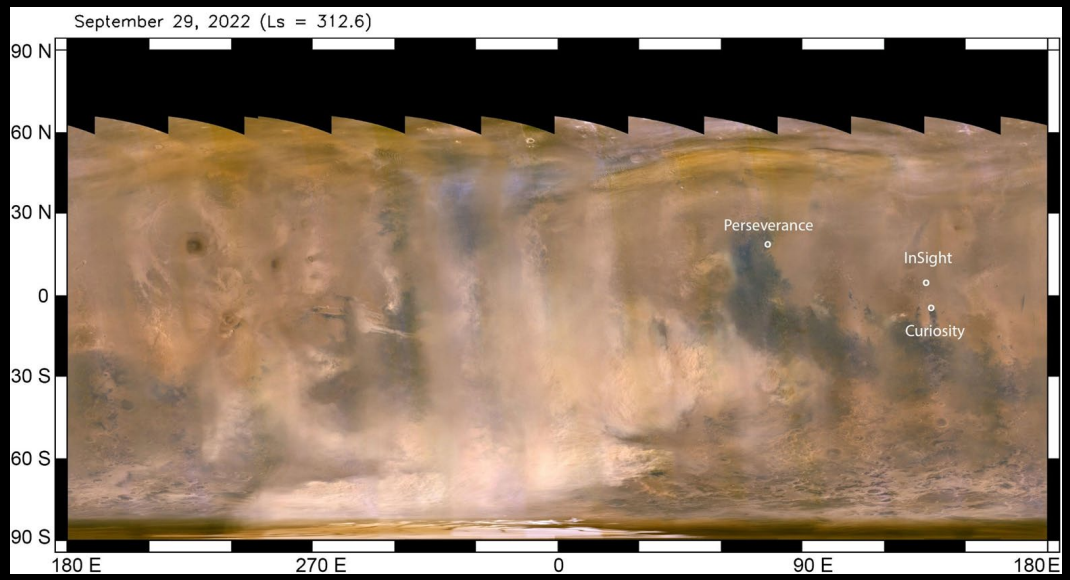


Phoenix Lander
Credit: NASA

Life support advancements are key to sustained deep space habitation

- Investments in advancing nascent technologies and utilizing existing technologies in novel ways
  - Novel sorbent solutions
  - Dust tolerant mechanisms
  - Cryogenic fluid management
  - Electrolysis
  - Solid and Liquid Waste Management
- Advanced manufacturing techniques
- In Situ Resource Utilization
- MEMs Technologies
- Modular architecture
- Predictive Diagnostics
- Reliability v. Redundancy

Ice near Mars Impact Crater. Credit: NASA



Continent size dust storm on Mars. Credit: NASA

"The further we go, the less and less we'll be able to look back to any capabilities of the home planet in order to help us," Lakiesha Hawkins, deputy manager, NASA Moon to Mars Program Office