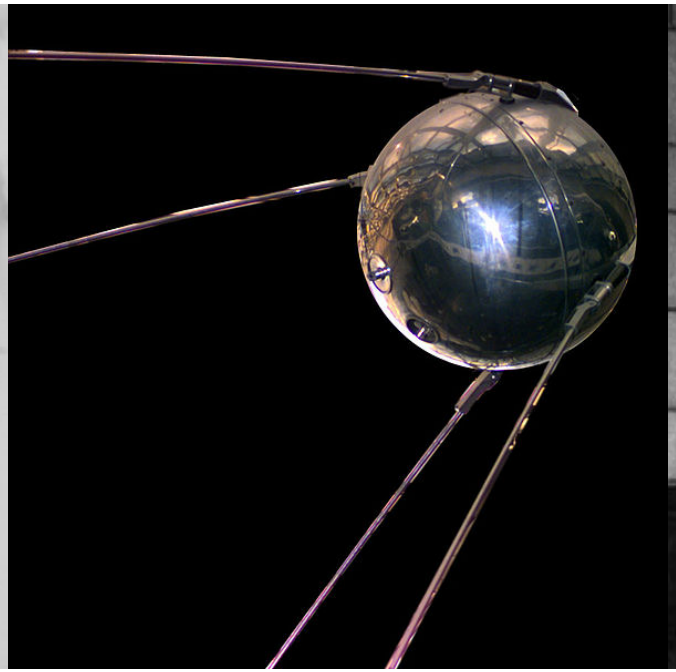
Women of NASA:
Pioneers in Mars Exploration and Beyond

David H. Lehman
NASA / Jet Propulsion Laboratory,
Project Manager (Retired) and
Volunteer Solar System Ambassador

Beginnings of the Space Age *



* Reference: From page 2 of a presentation by JPLer Brian Muirhead entitled "*Take Risk Don't Fail* - Challenges and Power of Exploration from Space" on March 18, 2023.

Human Computers at NASA

- At NASA's Langley Research Center in Virginia, previously Langley Memorial Aeronautical Laboratory, the first human computers were actually split into an East Wing, for white women, and a West Wing, for black women. The history of Langley's West Wing computers is profiled in a new called "Hidden Figures" (William Morrow, 2016)
- Dozens of African American women worked for NASA as expert mathematicians from the 1940's to the 1960's.

Paving The Way For Women Engineers

Above are shown members of the first women's class in engineering fundamentals at Hampton Institute, who will complete their 10-week course on May 8. Under the supervision of Dr. B. A. Turner, the course qualifies students for civil service appointments as junior engineers at $2,000 an- to right, front row, Miss Madelon Glenn of Hartford, Conn.; Mrs. Lucille Hibbler, Newport News; Miss Minnie McGraw, Columbia, S. C.; Miss Mary Cherry, Windsor, N. C.; Mrs. Miriam Mann, Hampton; second row, Misses Jean Sampson, Hampton; Mabel Stickle, Hampton; Pearl Bassette, Hampton; Miss L. Lucille Leath Burlington, N. C.; and Mrs Opehlia Taylor, Hampton. Applications will soon be availabl for qualified women colleg graduates to enroll in the sec ond series of courses in thi work which will begin at Hamp ton on June 15. Dr. Turner sai

Human Computers at JPL - 1

- Prior to the advent of electronic computers and digital computers, JPL relied on a group of female “human computer” to create essential calculations that supported experimentation. Prolific women such as ”Barby” Canright and Janez Lawson were included in this group.

Human Computers at JPL - 2

- A talented team of women, who were around since JPL's beginnings in 1936 and who were known as computers, were responsible for the number-crunching of launch windows, trajectories, fuel consumption and other details that helped make the U.S. space program a success. Image credit: NASA/JPL-Caltech

Barby Canright

- JPL has been hiring brilliant women for significant scientific and engineering roles ever since Barby Canright in 1939, the first JPL female “human computer.”
- Ms. Canright was responsible for fundamental calculations related to rocket trajectory and determined thrust ratios that made planes airborne.

The Early Days of Mars Exploration

Mariner 4

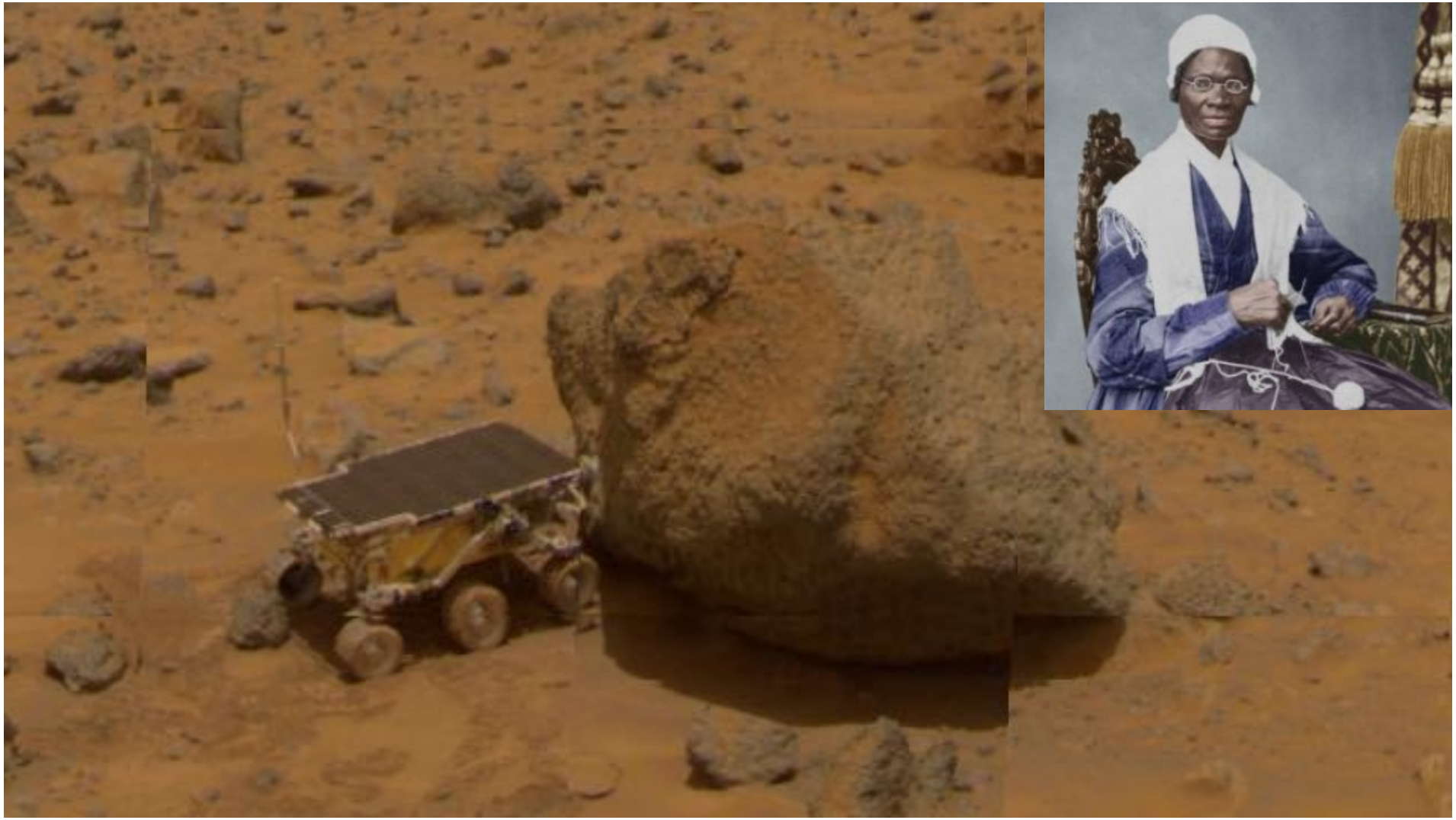
- JPL's Mariner 4 was the first successful mission to Mars, returning a handful of shocking images after a short 1965 flyby showing a cratered, Moon-like surface.
- In 1971, Mariner 9 became the first spacecraft to orbit another planet, imaging almost the entire surface of Mars.

CAPTION: JPL Director William Pickering with a model of the Mariner 4 spacecraft, circa 1965. Credit: NASA/JPL-Caltech

David's Background - 1

- I worked for 40-years at NASAs Jet Propulsion Laboratory of the California Institute of Technology (Caltech)
- Projects included Mars Pathfinder Avionics Technical Manager
    - First Planetary Rover (July 4, 1997)*

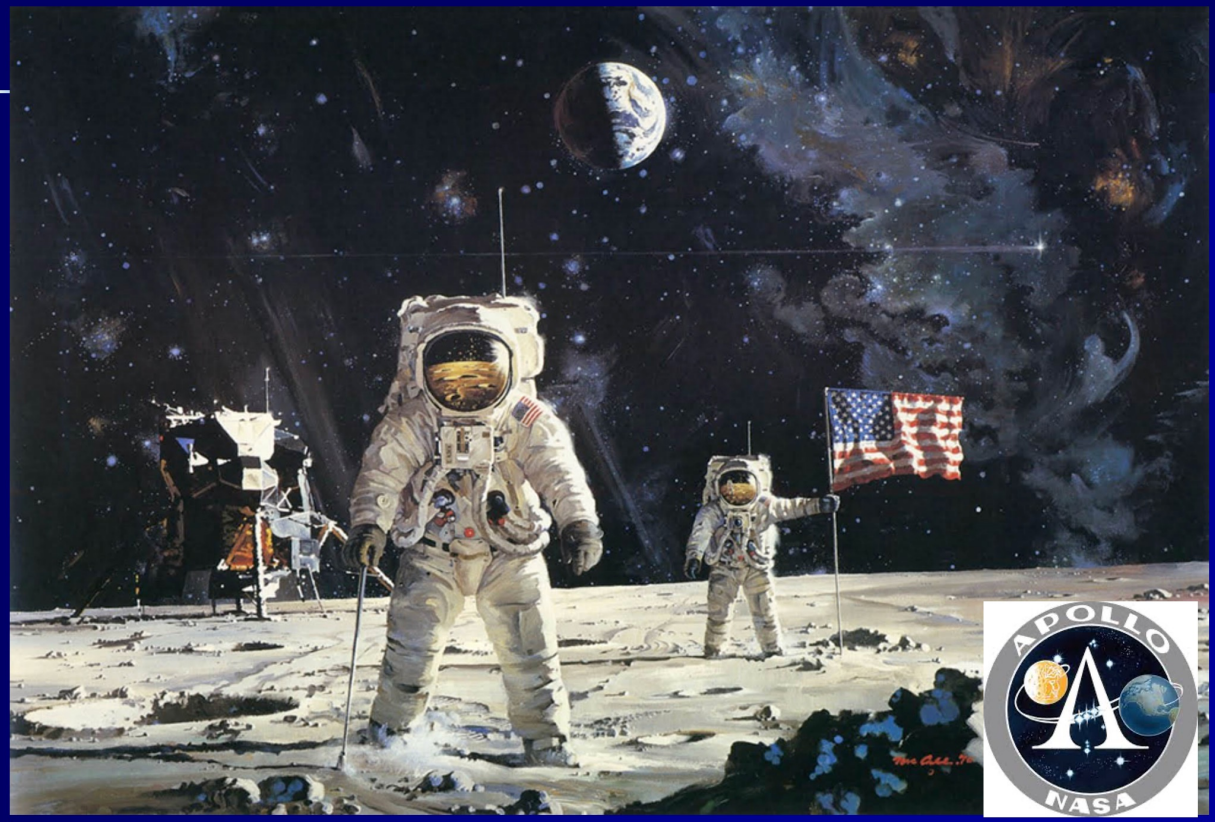
Reference* https://www.jpl.nasa.gov/timeline/




Donna Shirley
Manager of the Jet Propulsion Laboratory's Mars Exploration Program
with DANELLE MORTON
Managing Martians
The extraordinary story of a woman's lifelong quest to "get to Mars"—and of the team behind the space robot that has captured the imagination of the world
"An engaging story. . . . Anyone who wants an insider's look at America's space program or a glimpse of its strengths and weaknesses will enjoy Managing Martians."
—Discover

Demographics of NASA

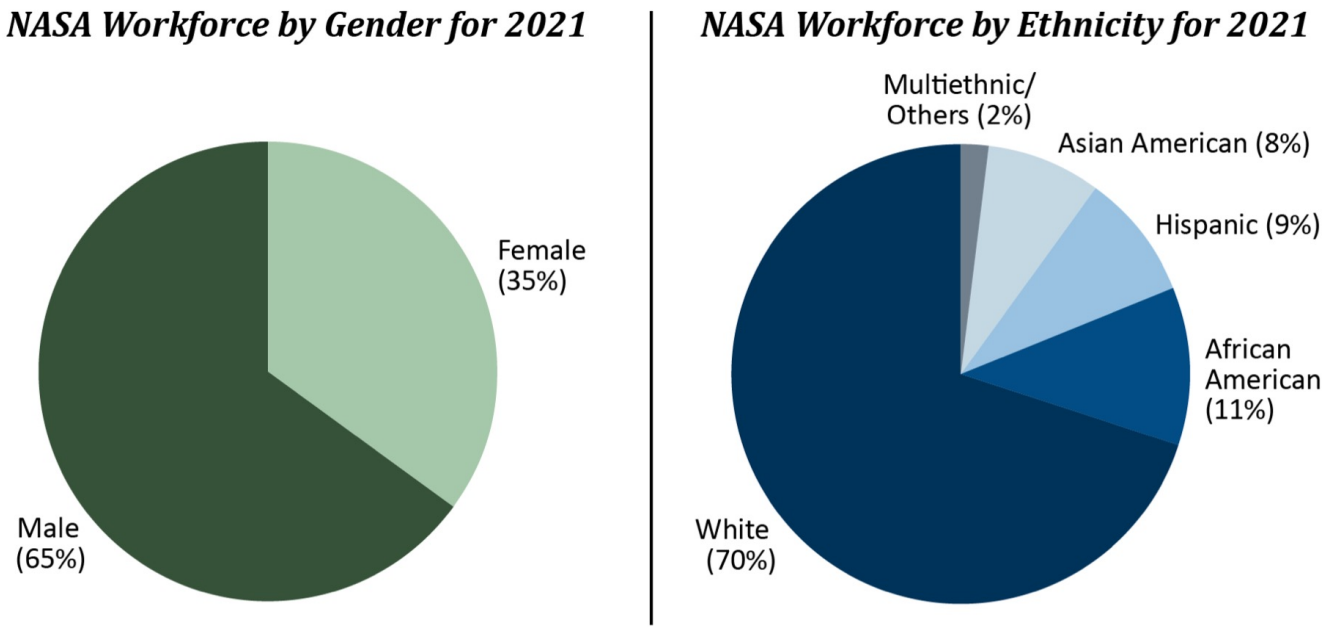
Apollo Moon Exploration



Joann Morgan in firing room.

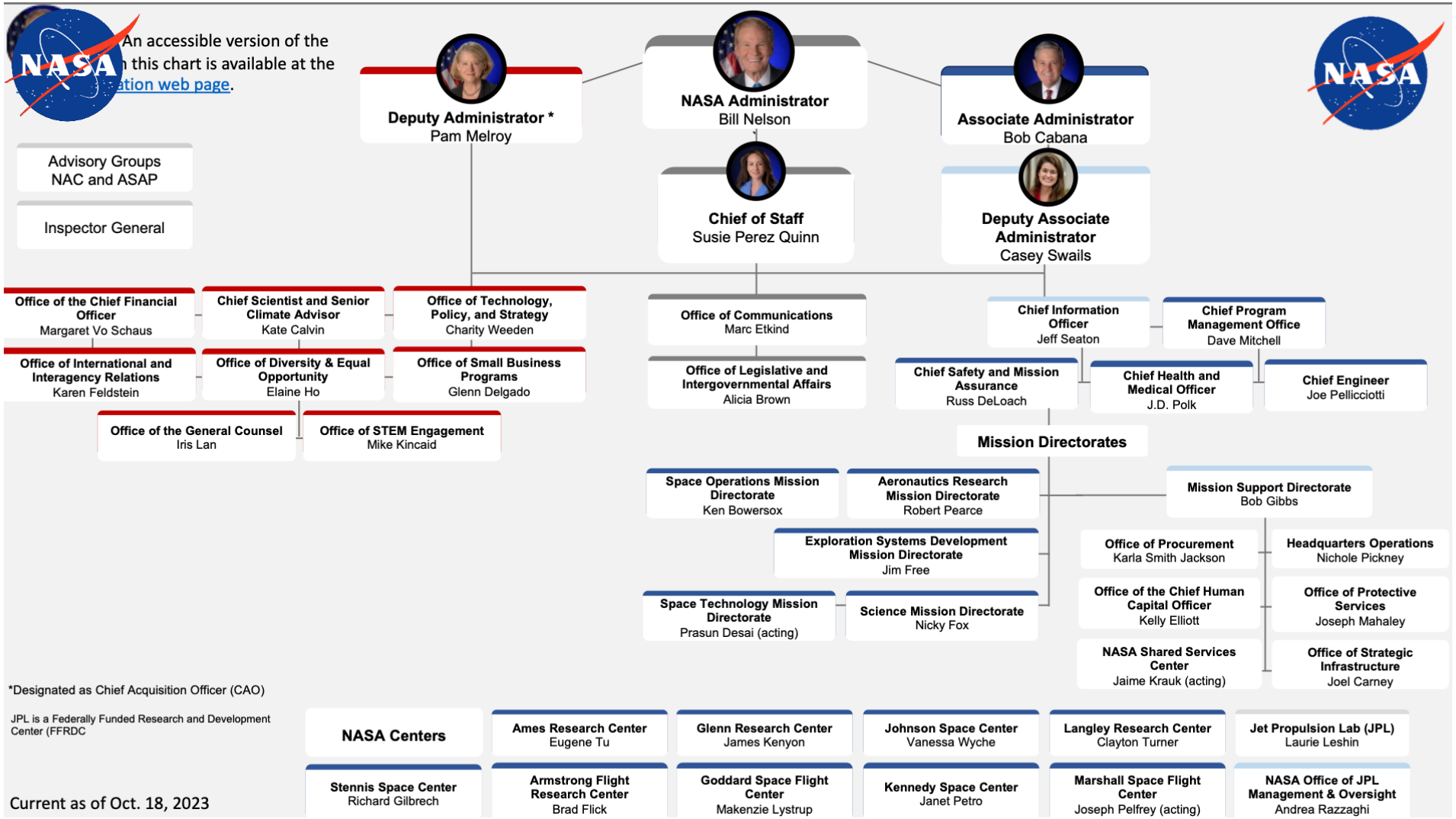
NASA's Civil Service Workforce by Gender and Ethnicity

Figure 1: NASA's Civil Service Workforce by Gender and Ethnicity (2021)



Source: NASA Office of Inspector General (OIG) analysis of NASA Business Objects (BOBJ) data as of February 2022.

The Martian Women of NASA Today


An accessible version of the this chart is available at the ation web page.
Deputy Administrator *
Pam Melroy
NASA Administrator
Bill Nelson
Associate Administrator
Bob Cabana
Advisory Groups
NAC and ASAP
Inspector General
Chief of Staff
Susie Perez Quinn
Deputy Associate Administrator
Casey Swails
Office of the Chief Financial Officer
Margaret Vo Schaus
Chief Scientist and Senior Climate Advisor
Kate Calvin
Office of Technology, Policy, and Strategy
Charity Weeden
Office of Communications
Marc Etkind
Chief Information Officer
Jeff Seaton
Chief Program Management Office
Dave Mitchell
Office of International and Interagency Relations
Karen Feldstein
Office of Diversity & Equal Opportunity
Elaine Ho
Office of Small Business Programs
Glenn Delgado
Office of Legislative and Intergovernmental Affairs
Alicia Brown
Chief Safety and Mission Assurance
Russ DeLoach
Chief Health and Medical Officer
J.D. Polk
Chief Engineer
Joe Pellicciotti
Office of the General Counsel
Iris Lan
Office of STEM Engagement
Mike Kincaid
Mission Directorates
Space Operations Mission Directorate
Ken Bowersox
Aeronautics Research Mission Directorate
Robert Pearce
Mission Support Directorate
Bob Gibbs
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Karla Smith Jackson
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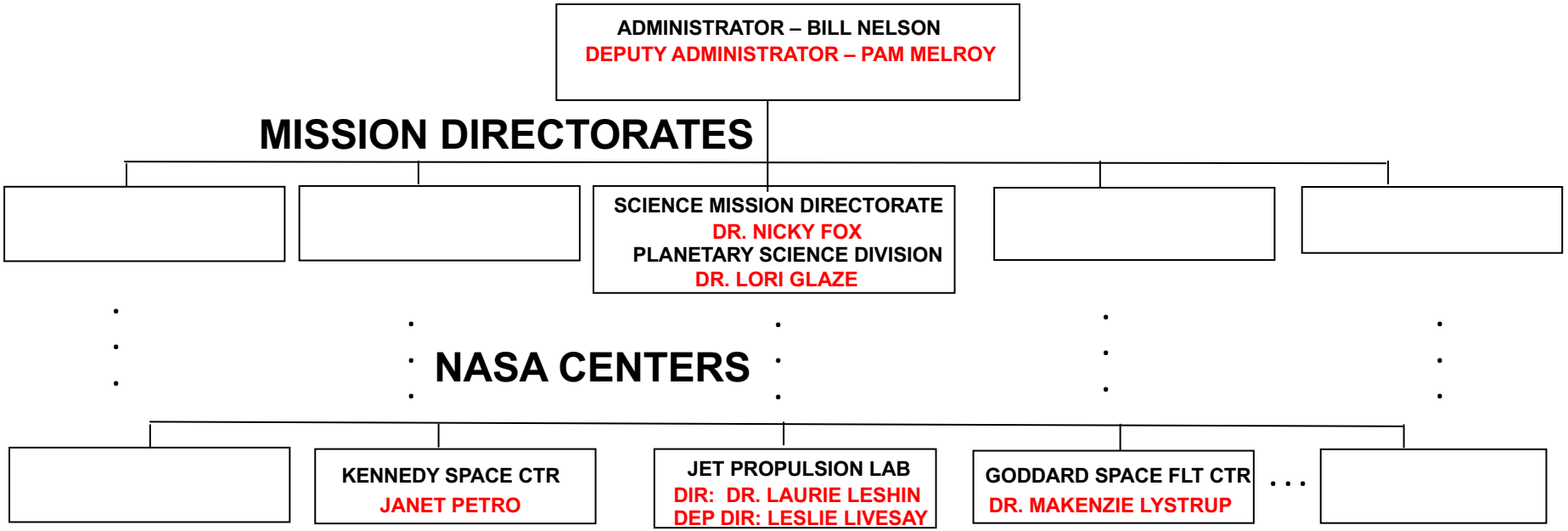
Kelly Elliott
Office of Protective Services
Joseph Mahaley
NASA Shared Services Center
Jaime Krauk (acting)
Office of Strategic Infrastructure
Joel Carney
*Designated as Chief Acquisition Officer (CAO)
JPL is a Federally Funded Research and Development Center (FFRDC
NASA Centers
Ames Research Center
Eugene Tu
Glenn Research Center
James Kenyon
Johnson Space Center
Vanessa Wyche
Langley Research Center
Clayton Turner
Jet Propulsion Lab (JPL)
Laurie Leshin
Stennis Space Center
Richard Gilbrech
Armstrong Flight Research Center
Brad Flick
Goddard Space Flight Center
Makenzie Lystrup
Kennedy Space Center
Janet Petro
Marshall Space Flight Center
Joseph Pelfrey (acting)
NASA Office of JPL Management & Oversight
Andrea Razzaghi
Current as of Oct. 18, 2023

A Very, Very Simplified NASA Organization Chart from a Martian's Perspective



NASA Administrator Bill Nelson

NASA Deputy Administrator Pam Melroy

NASA’s JPL Director Dr. Laurie Leshin.

NASA JPL’s Deputy Director Leslie Livesay


M
Marvina the Martian

What is going on at Mars? NASA is operating 3 orbiters and 2 rovers. ESA is operating 2 orbiters

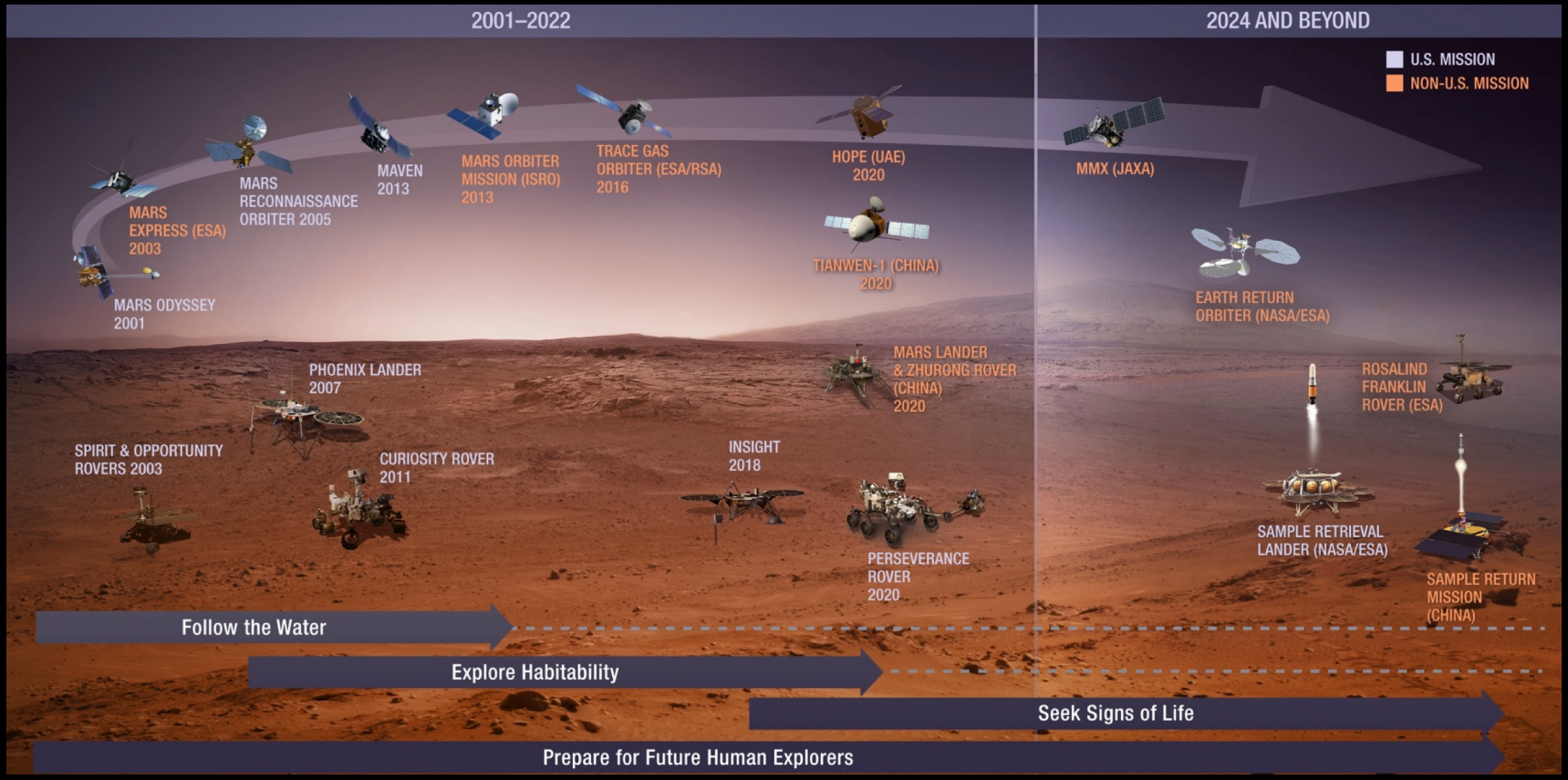
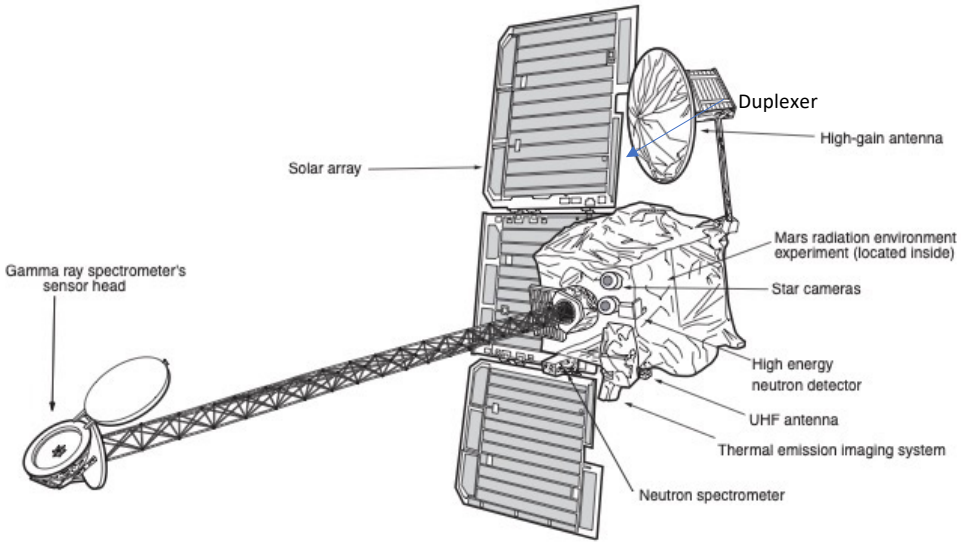


Chart is from A. Yingst at the Mars Exploration Program Analysis Group (MEPAG) meeting of Feb. 27, 2023

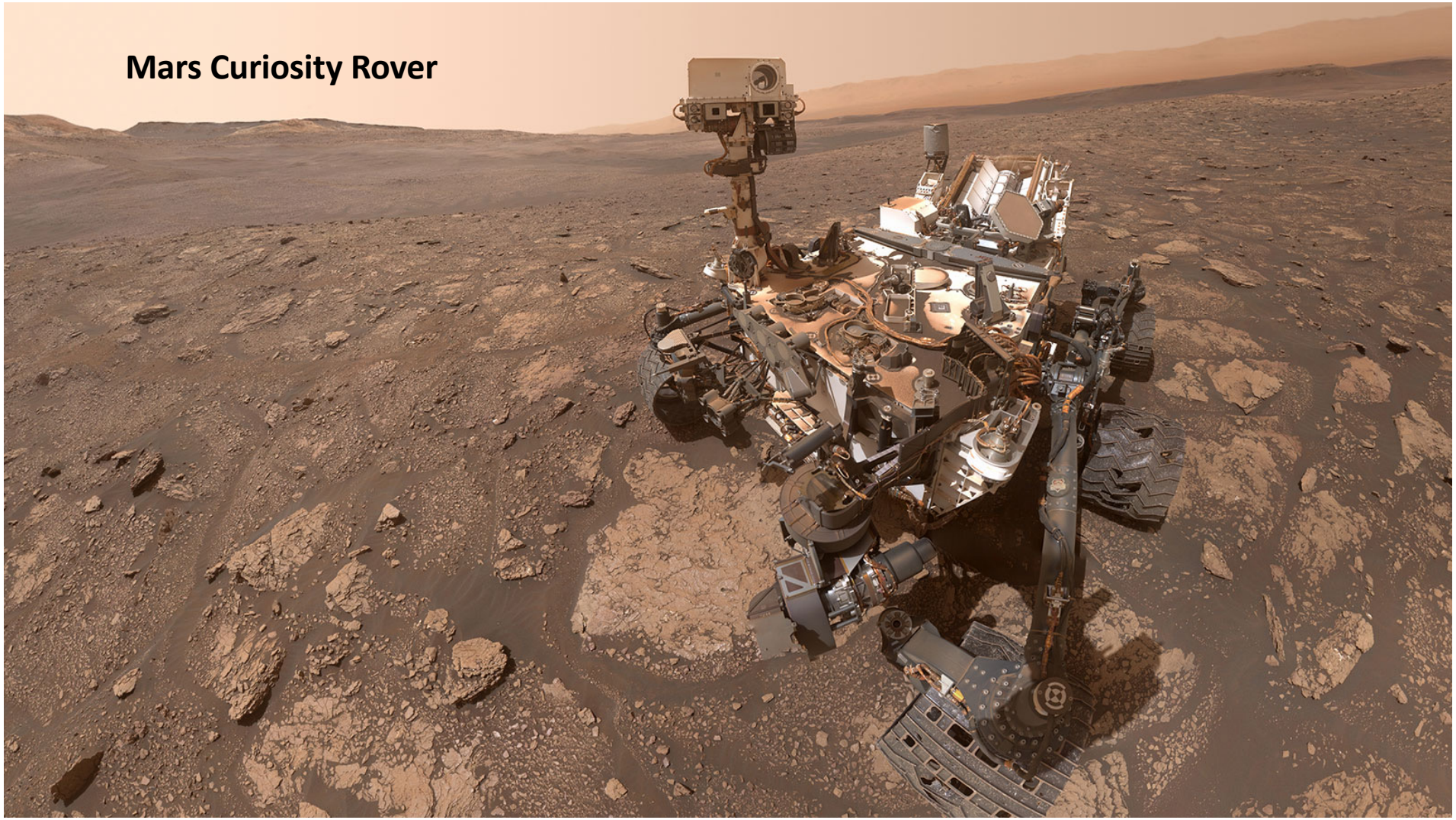
David's Background - 2

- Mars Odyssey Project Manager from 2013 to 2021
  - First Detection of Frozen Water Beneath the Surface of Mars (May 28, 2002)*



2001 Mars Odyssey spacecraft

Mars Curiosity Rover



Wheel of Mars Curiosity rover after 10 years of operations

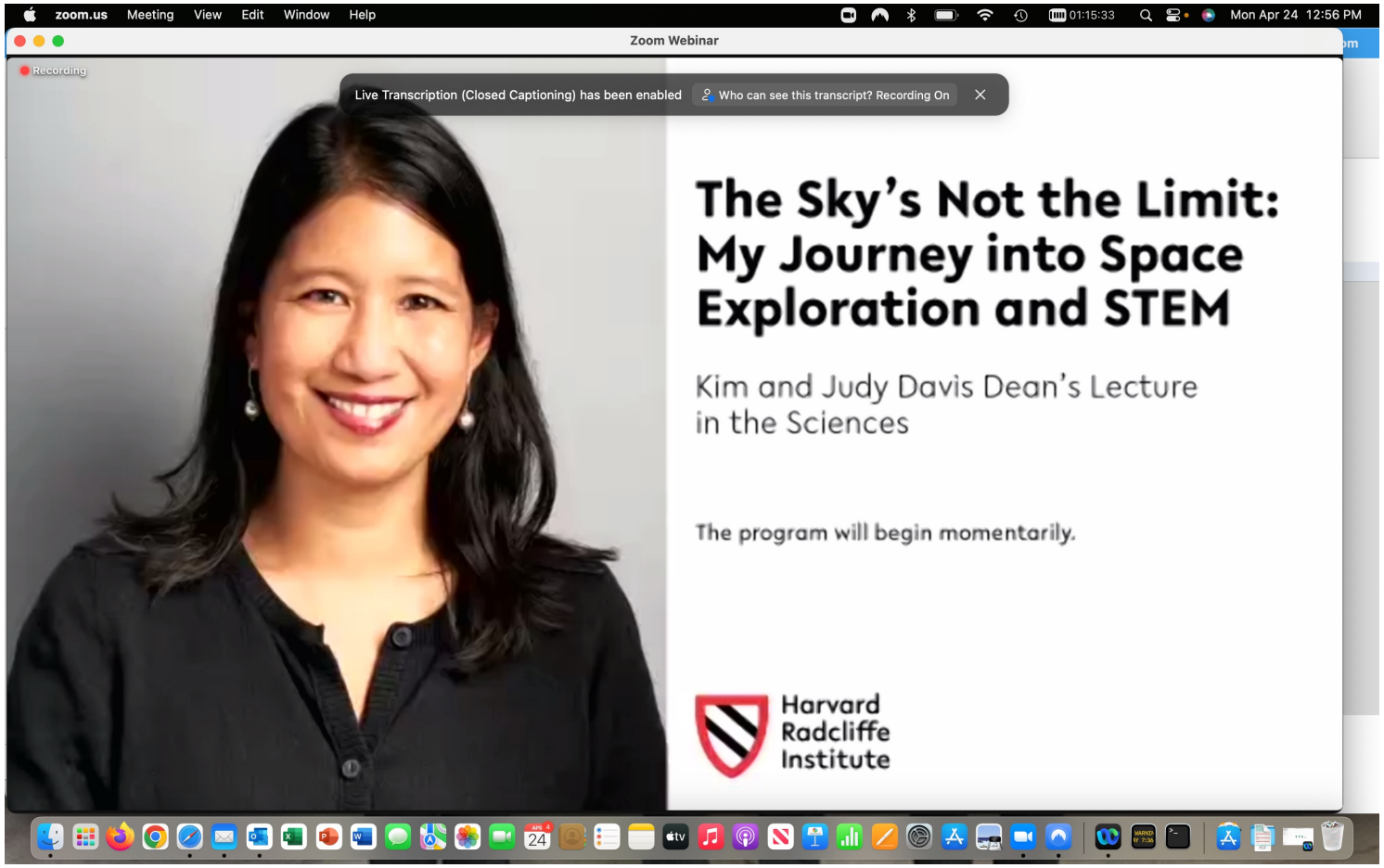

Dr. Joy Crisp – Mars Curiosity Rover Project Scientist

NASA's Perseverance Mars rover landed on Mars on February 18, 2021. It took this selfie over a rock nicknamed "Rochette," on September10, 2021

Jennifer Harris Trosper

- Positions held at JPL have included:[2]
- Cassini mission – Attitude control operations engineer
- Mars Pathfinder mission – Testbed and operations engineer and flight director
- 2001 Mars Odyssey missions – Operations development manager
- Mars Exploration Rovers – Project system engineer and mission manager
- Mars Science Laboratory and Curiosity rover – Deputy project manager and mission manager
- Mars 2020 *Perseverance* (rover) – Mission system development manager, project systems engineering lead, integrated systems engineering lead, and project manager

JPLer Dr. Swati Mohan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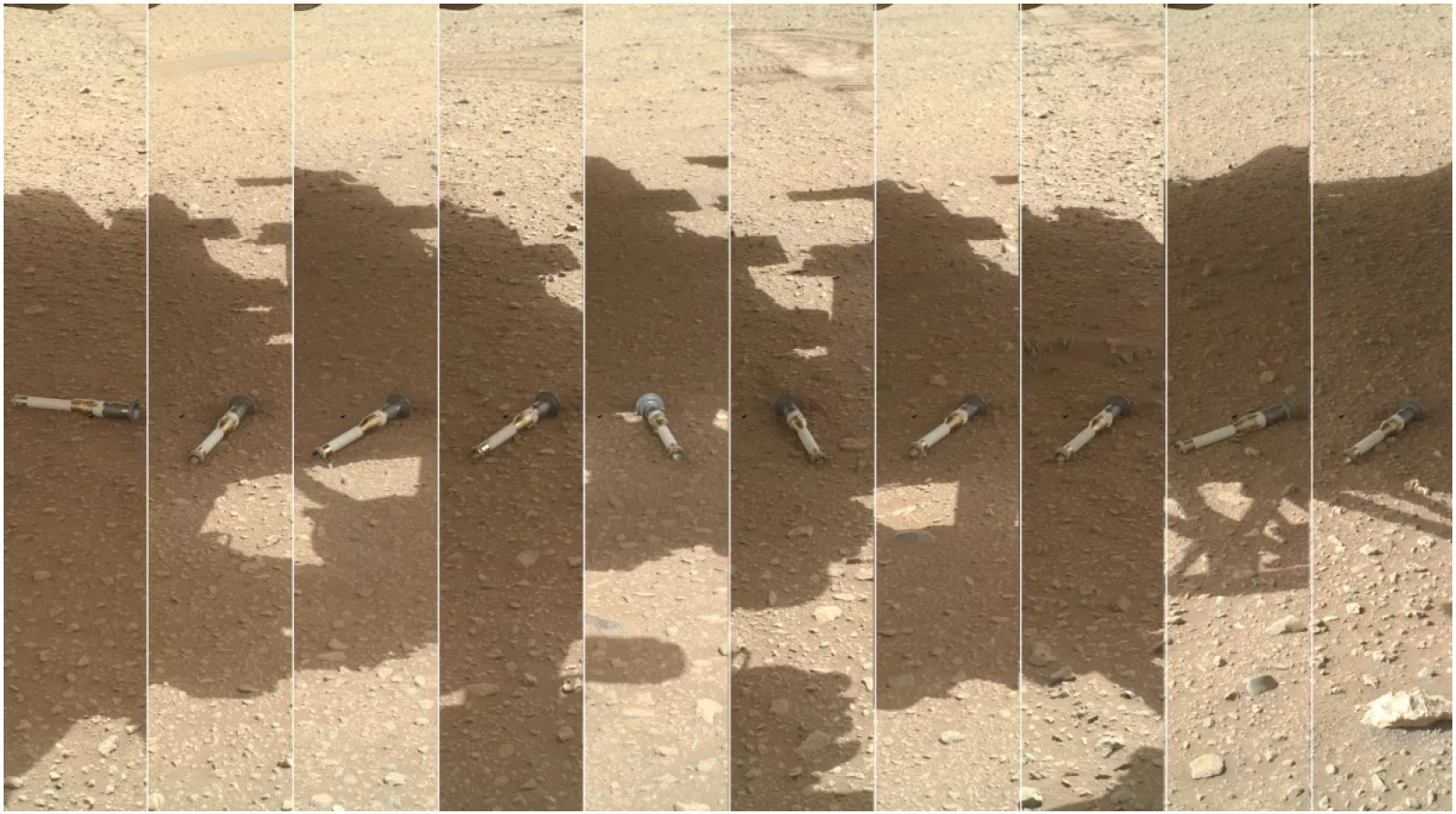
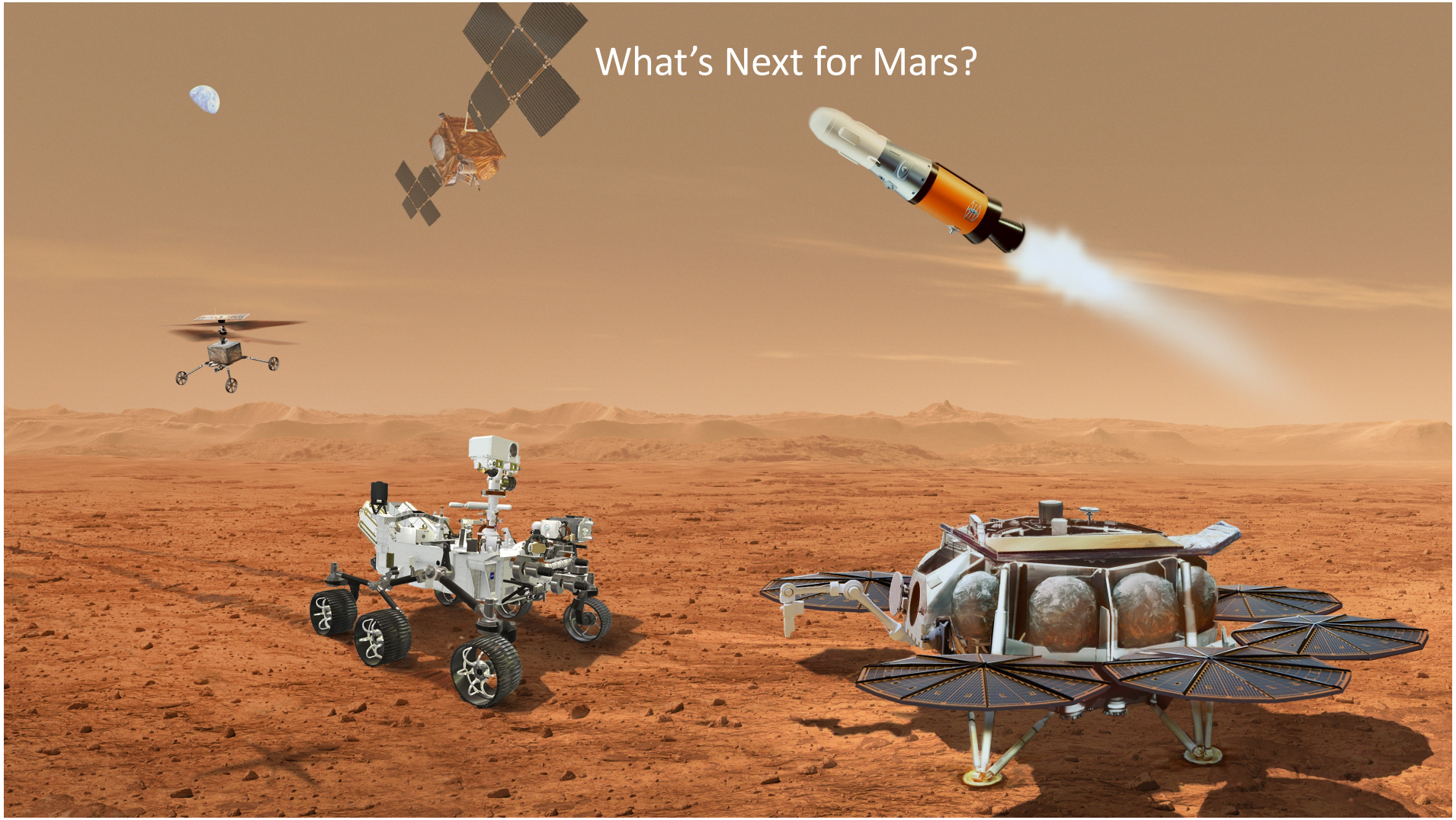
Zoom Webinar
Recording
Live Transcription (Closed Captioning) has been enabled
Who can see this transcript? Recording On
The Sky's Not the Limit: My Journey into Space Exploration and STEM
Kim and Judy Davis Dean's Lecture in the Sciences
The program will begin momentarily.
Harvard Radcliffe Institute


Ms. Brooklin Cohen

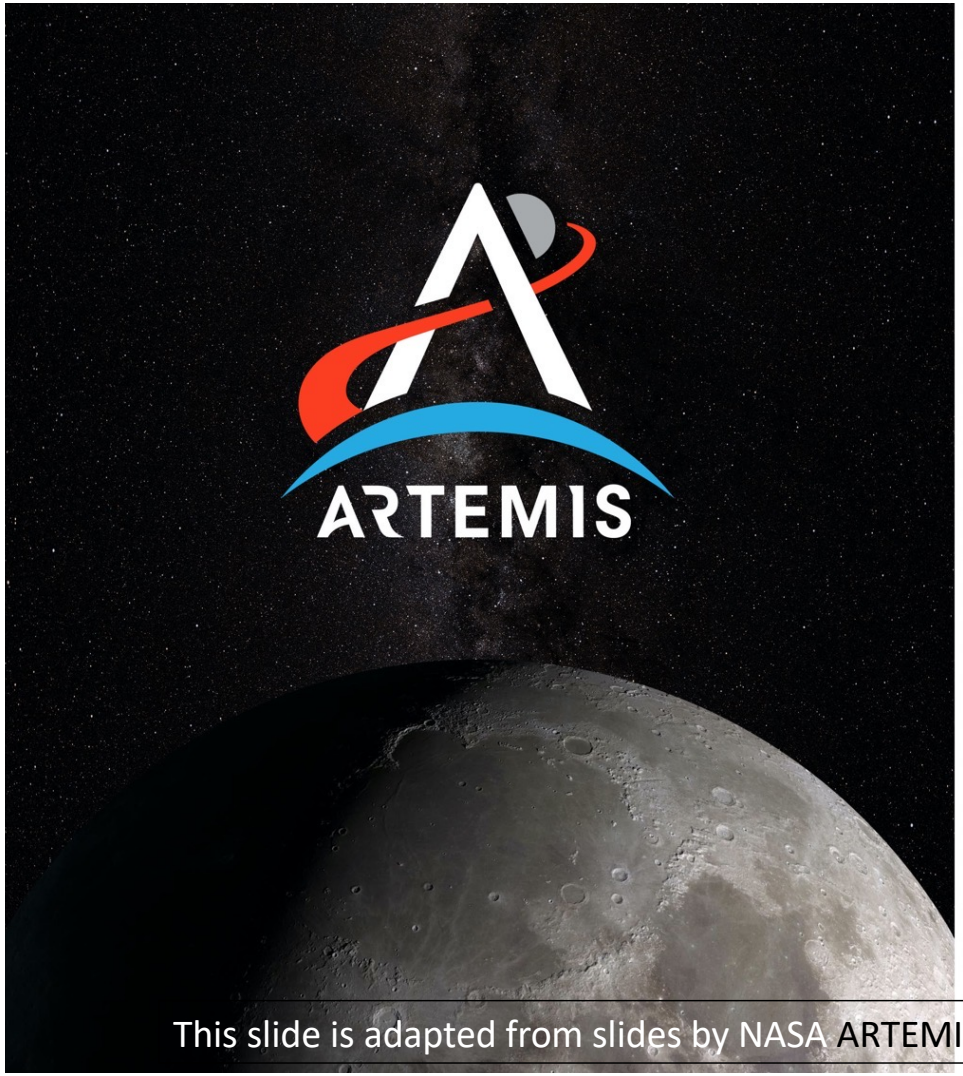
Caching Samples at Three Forks (10 samples)



What's Next for Mars?



What’s Next for Women at Mars



ARTEMIS

Twin sister of Apollo and goddess of the Moon in Greek mythology. With Artemis missions, NASA will:

- Collaborate with international and commercial partners to establish the first long-term presence on the Moon,
- Land the first woman and first person of color on the Moon, and
- Use what we learn on and around the Moon to take the next giant leap: sending the first astronauts to Mars.

This slide is adapted from slides by NASA ARTEMIS Chief Nujoud Merancy, dated Oct. 21, 2021.

Should future Mars missions have all-female crews?

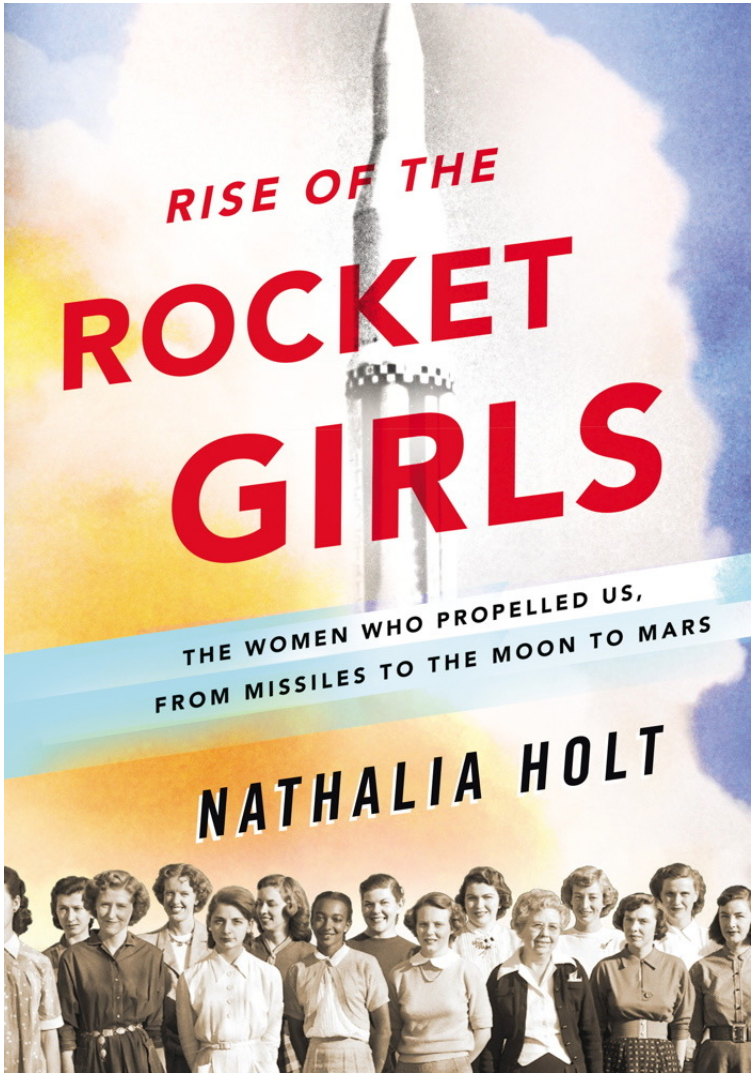
Artist's depiction of a female astronaut on the surface of Mars. (Image credit: janiecbros/Getty Images)


Thank You.

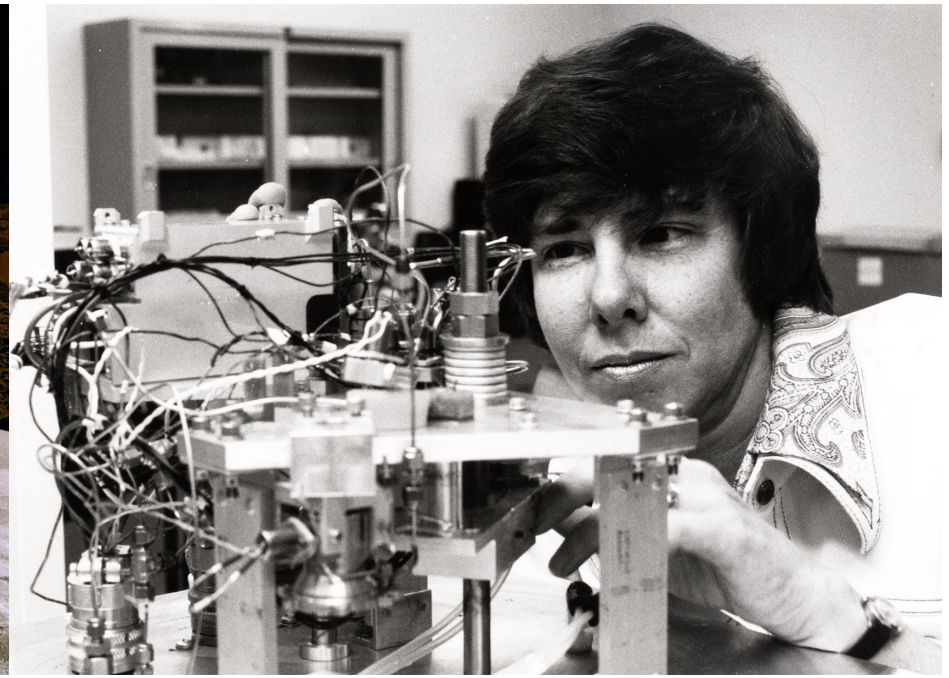
Back Up Charts

Jet Propulsion Laboratory

- Missile and rocket technology from the California-based Jet Propulsion Laboratory (JPL) has propelled American spaceflight for decades, and from the beginning that technology's success rested on a corps of expert mathematicians — women who crunched the numbers, plotted rocket trajectories and tested rocket designs, all on paper.
- Drawing from extensive interviews, Nathalia Holt's "Rise of the Rocket Girls: The Women Who Propelled Us, from Missiles to the Moon to Mars" (Little, Brown and Co., 2016) traces the history of spaceflight through those women's eyes, highlighting the fledgling lab's rocket tests in the 1940s; the United States' first orbiting satellite, Explorer 1; and the many craft flung outward to first explore our solar system. At the same time, it shows the rise and evolution of female mathematicians and, eventually, engineers — and the changing cultures that working women had to navigate at that time.



Viking Lander ‘76 and Dr. Pat Straat



Left: Graphic of Viking Lander on Mars in 1976; Right: Patricia Ann Straat working with the flight components of the Labeled Release instrument prior to the 1976 Viking Mission