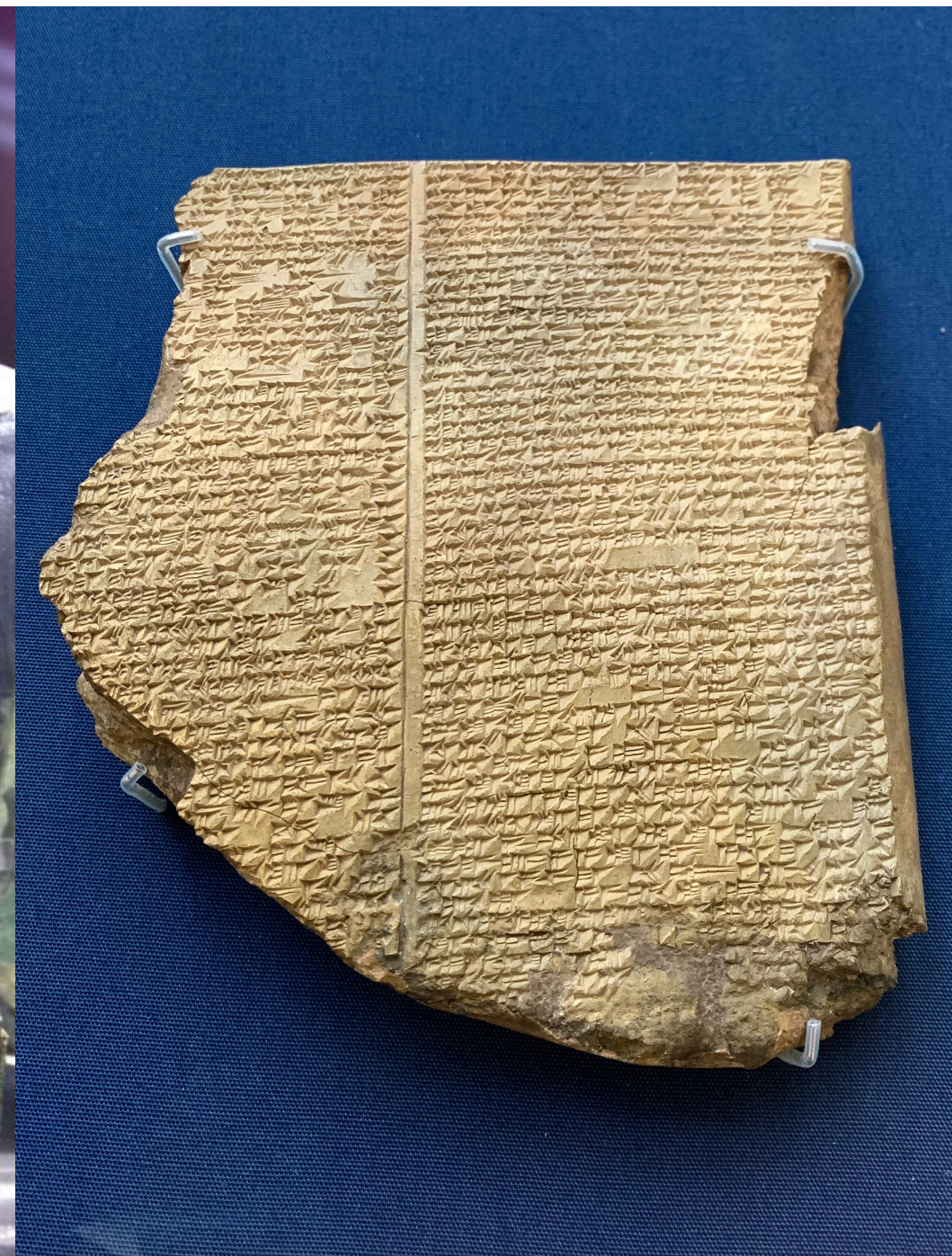
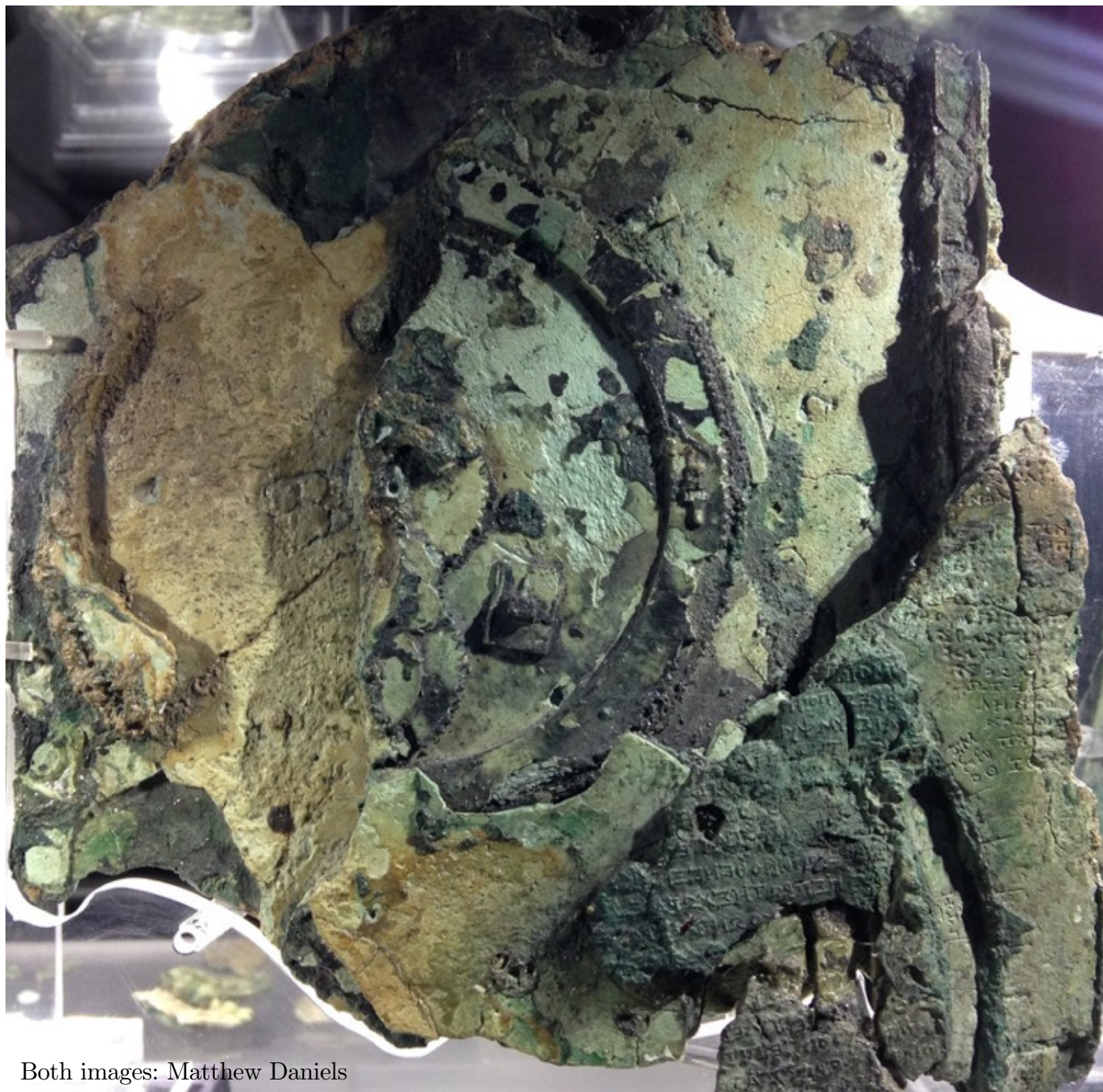


New Voyages of Discovery: The Value of Crewed Expeditions to Venus

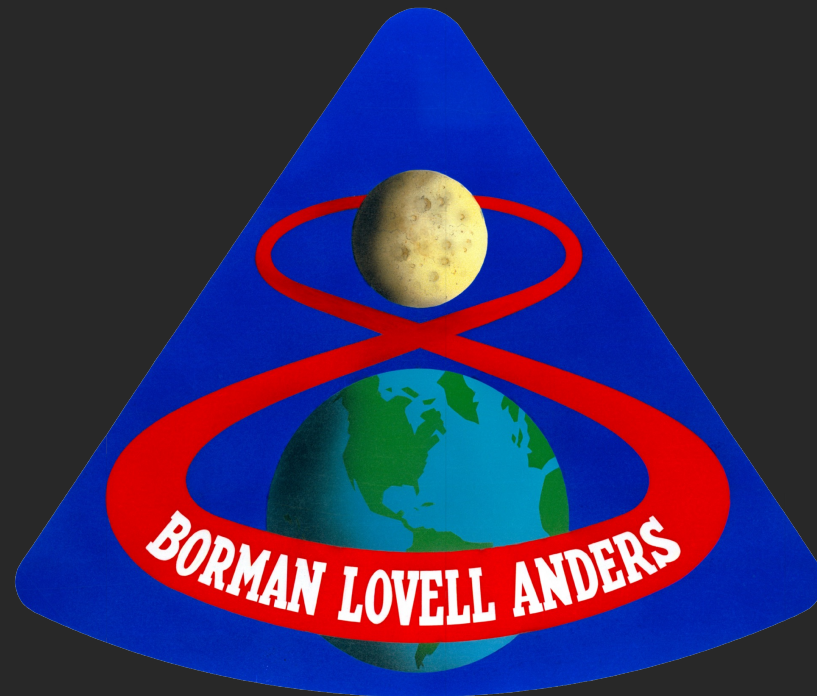
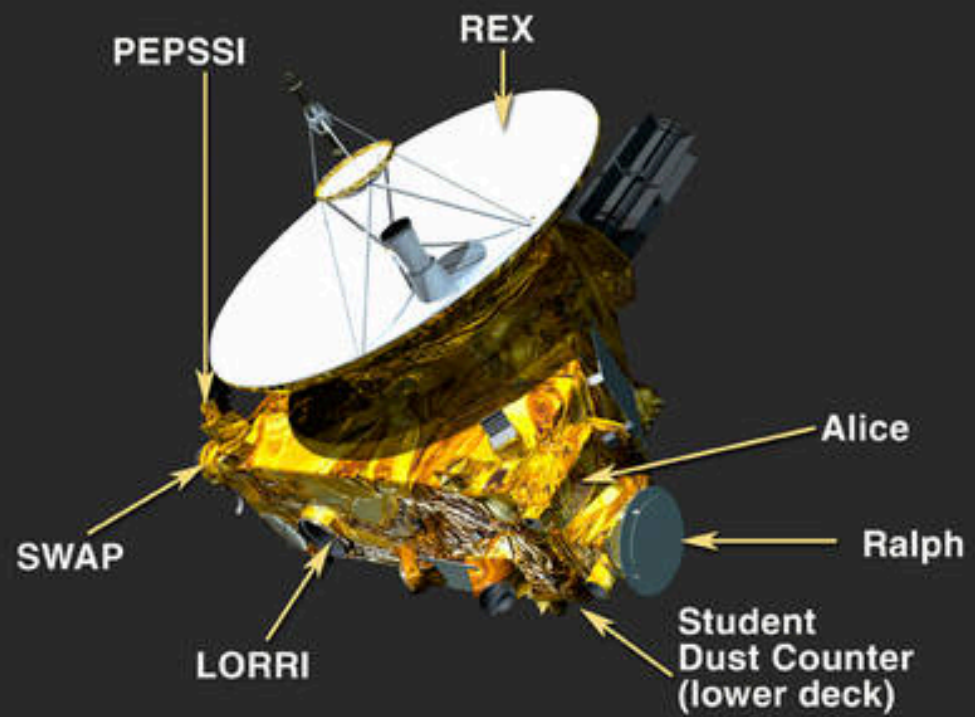
Matthew Daniels

Keck Institute for Space Studies
California Institute of Technology
July 20, 2022

The views expressed in this talk
are those of the author and do
not necessarily reflect the views
or policy of the US government.



Both images: Matthew Daniels





Apollo 8: looking northwest into the Sea of Tranquility, where Apollo 11 would land seven months later.

Image: NASA
<https://www.nasa.gov/feature/a-bold-step-apollo-8-sends-first-human-flight-beyond-earth>



Lunar far-side landscape

Image: NASA (AS08-18-2834)
https://history.nasa.gov/afj/ap08fj/14day4_orbit2.html

Earthrise

As the Apollo 8
crew saw it with
a vertical horizon



U.S. National Archives

306-PSD-68-4049c

<https://www.archives.gov/exhibits/eyewitness/html.php?section=25>

Webb-McNamara memo of 1961

technological power and organizing capacity of a nation.

It is for reasons such as these that major achievements in space contribute to national prestige. Major successes, such as orbiting a man as the Soviets have just done, lend national prestige even though the scientific, commercial or military value of the undertaking may by ordinary standards be marginal or economically unjustified.

This nation needs to make a positive decision to pursue space projects aimed at enhancing national prestige. Our attainments are a major element in the international competition between the Soviet system and our own. The non-military, non-commercial, non-scientific but “civilian” projects such as human exploration and communication in this space must be

...

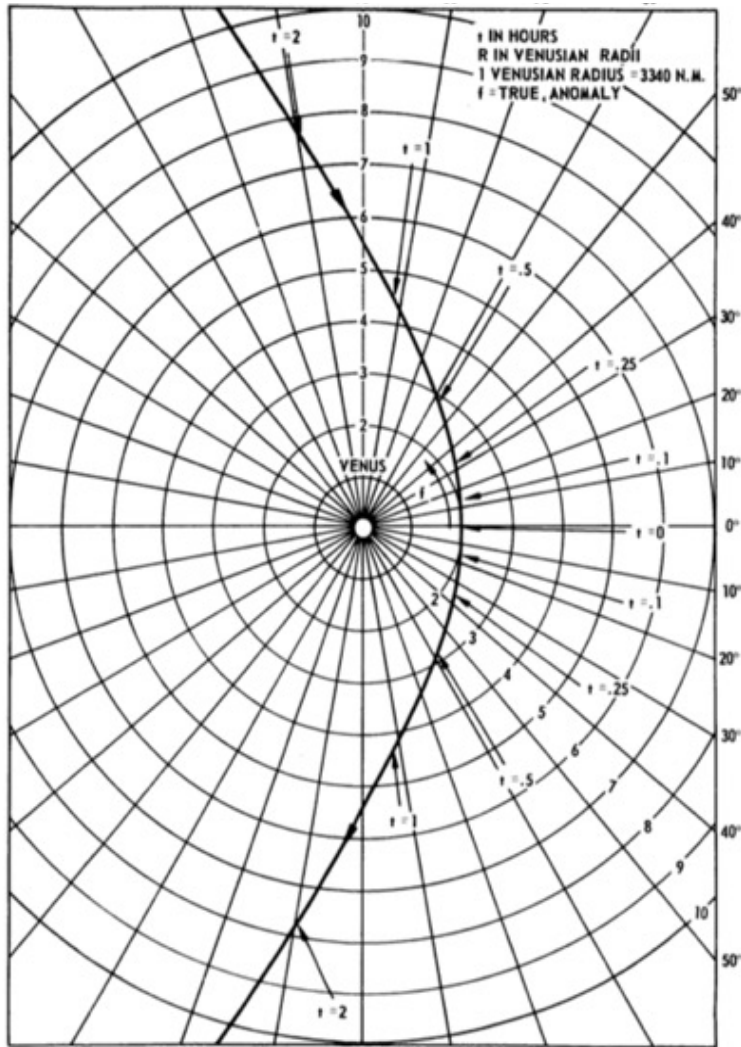
Our space efforts, like many of our military weapons developments, have suffered because of our tendency to “improve” and to embellish our designs. We have allowed ourselves to strive for the optimum solution to nearly every problem project-by-project. We have often tried to “integrate” very complex system elements at minimum weight and with very little margin for safety or for error. Many have come to think that such techniques are the natural and obvious way to get jobs done. They are not, they will not succeed and they must be changed.

We must address ourselves to these problems more effectively in the future than in the past. We must create mechanisms to lay out and to insist upon achievement, not mere improvement. We must stress performance, not embellishment. We must insist from the top down, that, as the Russians say, “the better is the enemy of the good.”

James E. Webb, NASA Administrator,
and Robert S. McNamara, Secretary of
Defense, to the Vice President on May 8,
1961, with attached: “Recommendations
for our National Space Program: Changes,
Policies, and Goals.”

<https://history.nasa.gov/SP-4407/ETUv1.pdf>

Three types of crewed expeditions



Flyby



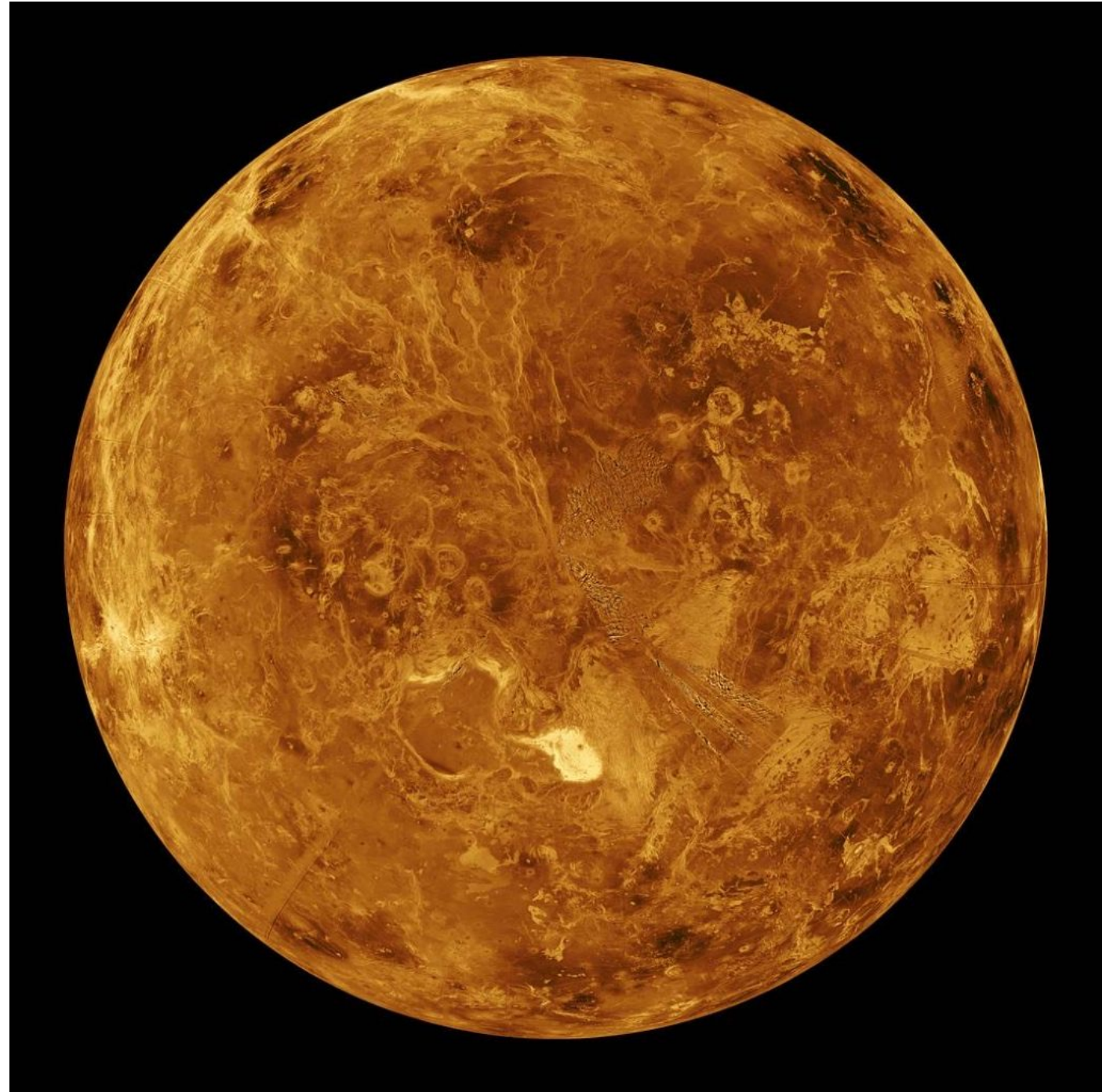
Orbit/Rendezvous



Landing

Why Venus

- I. **Achievable** crewed missions in the foreseeable future
- II. **Advances human exploration** as part of a class of stepping-stone missions to destinations across the solar system
- III. **Advances science** connected to fundamental questions about life

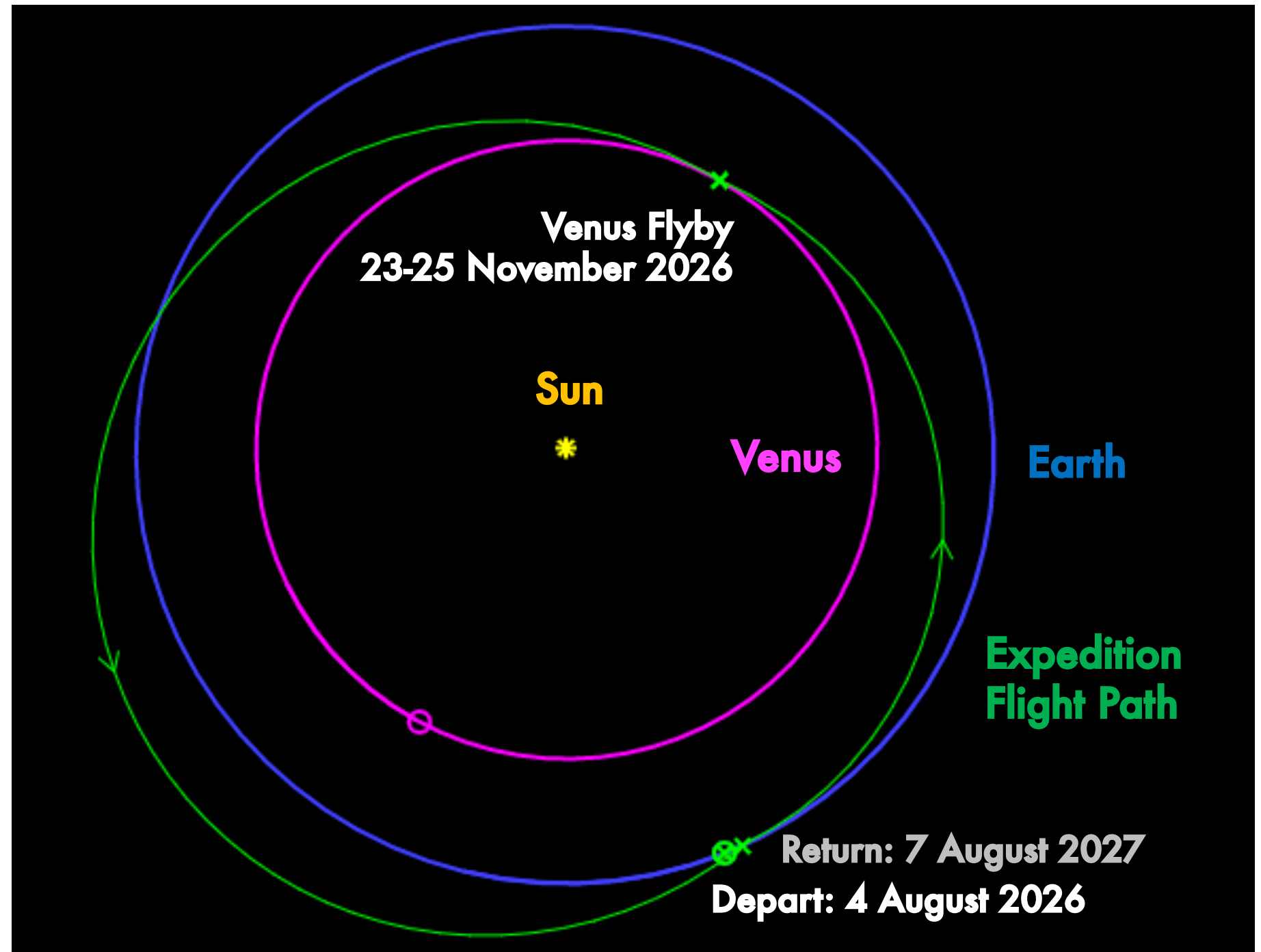


I. Achievable

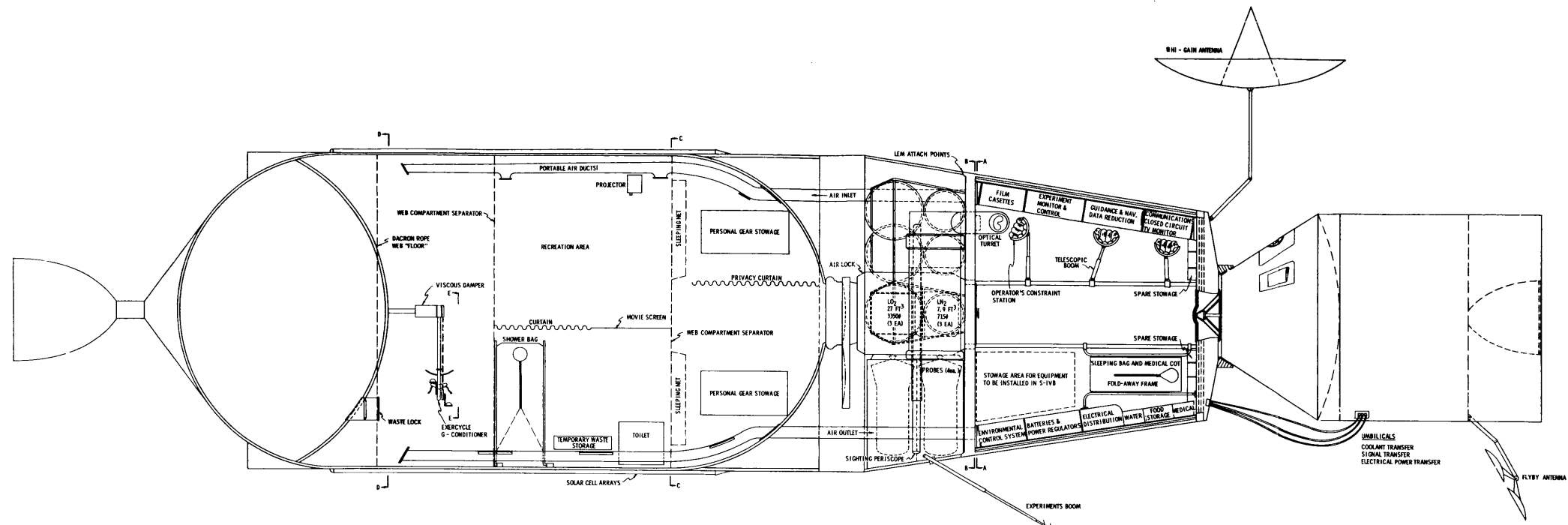
Crewed Venus Flyby Mission: Thanksgiving 2026

A flyby of Venus as
preparation for landing on
Mars. Analogous mission
opportunities reoccur every
1.6 years.

Image and trajectory created using
NASA Ames Trajectory Browser:
trajbrowser.arc.nasa.gov
a tool created for NASA by **Cyrus Foster**



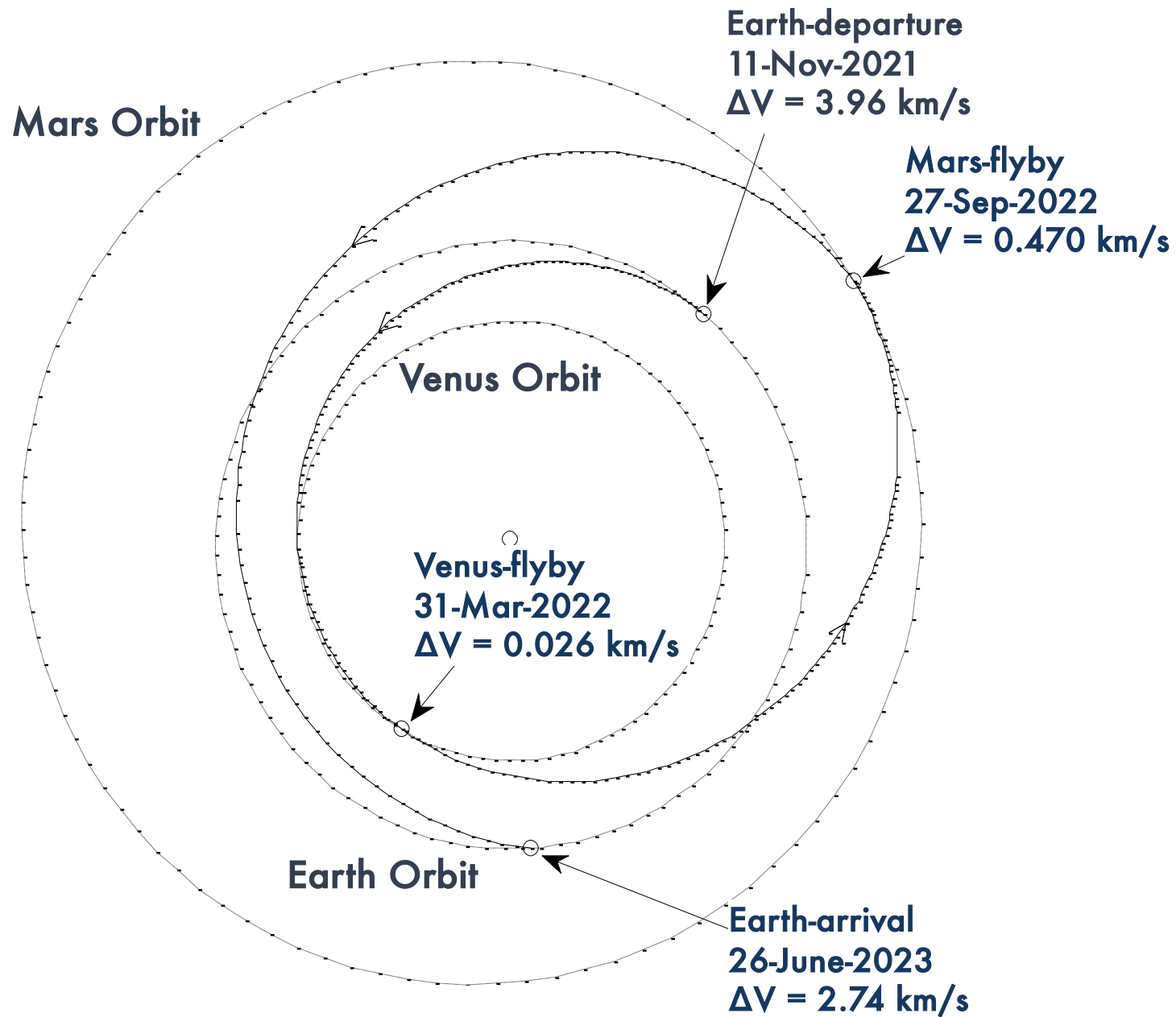
I. Achievable



Crewed Venus Flyby using Apollo Hardware

M.S. Feldman, et al., "Manned Venus Flyby," Bellcom, NASA Technical Reports Server, TR-67-600-1-1, February 1967, <https://ntrs.nasa.gov/search.jsp?R=19790072165>

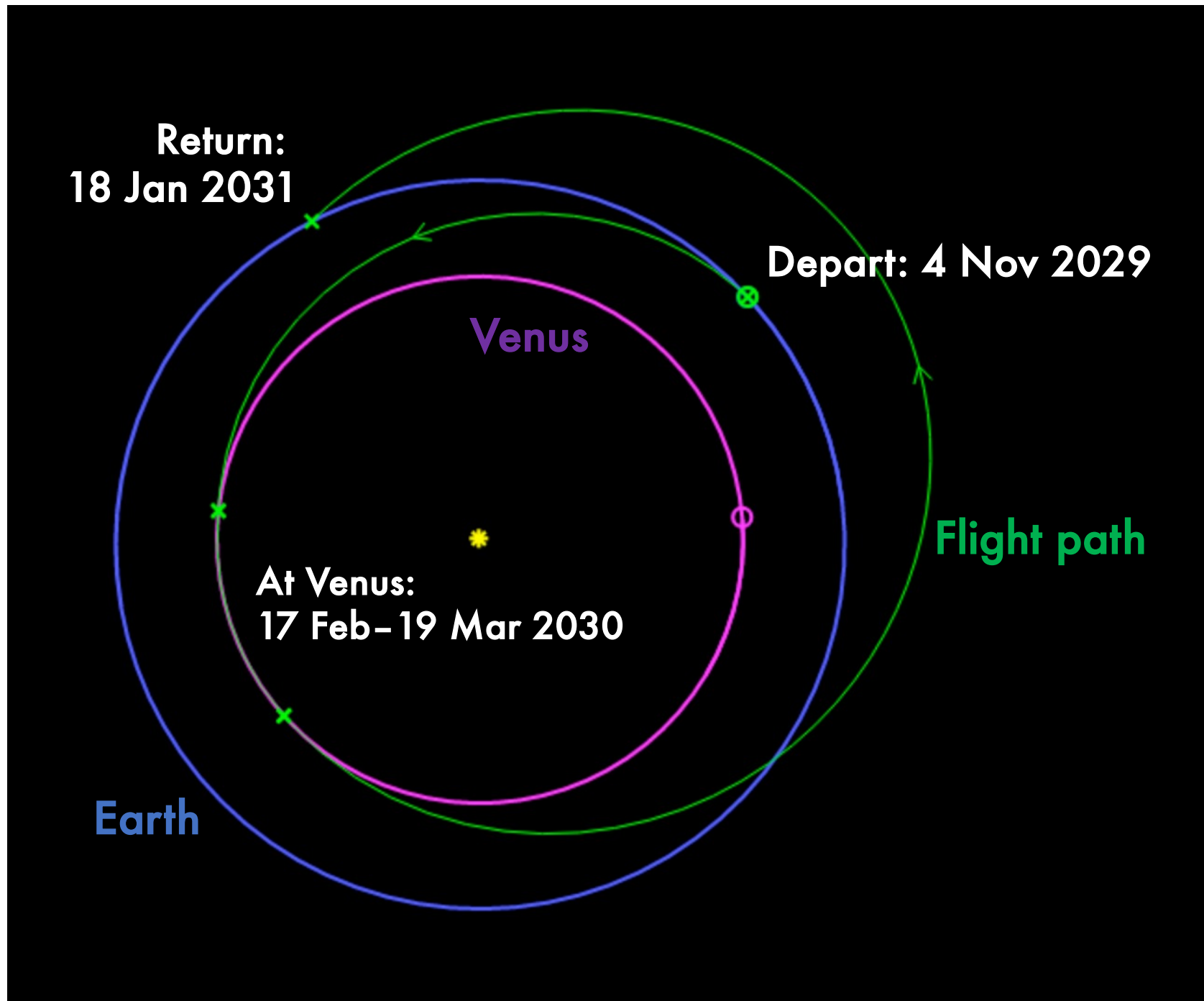
II. Advances human exploration



Venus-Mars
double flyby
(19-months)

100% more planets for
around 50% more travel time!

II. Advances human exploration

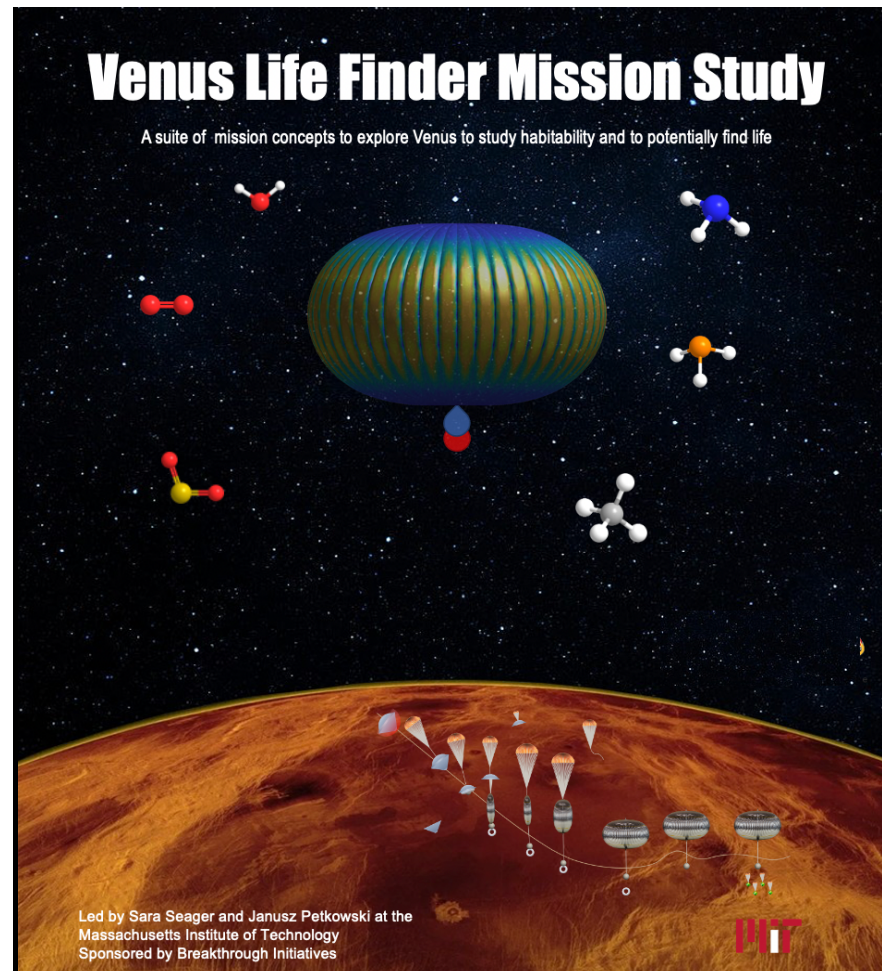


1-Month Stay at Venus
(1.2-year total mission)

1-year stay also possible

Image and trajectory created using
NASA Ames Trajectory Browser:
trajbrowser.arc.nasa.gov
a tool created for NASA by Cyrus Foster

III. Advances science



Search for Life

ASTROBIOLOGY
Volume 21, Number 10, 2021
Mary Ann Liebert, Inc.
DOI: 10.1089/ast.2020.2244

The Venusian Lower Atmosphere Haze as a Depot for Desiccated Microbial Life: A Proposed Life Cycle for Persistence of the Venusian Aerial Biosphere

Sara Seager,¹⁻³ Janusz J. Petkowski,¹ Peter Gao,⁴ William Bains,¹ Noelle C. Bryan,¹
Sukrit Ranjan,¹ and Jane Greaves^{5,6}

III. Advances science

Ability to contribute to the search for life without crewed landings

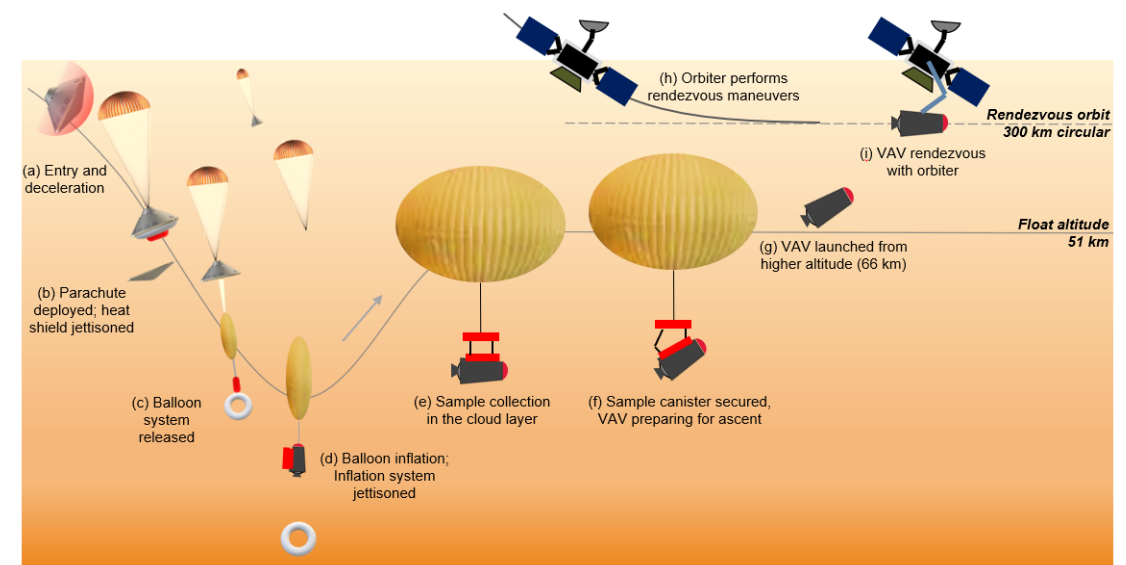
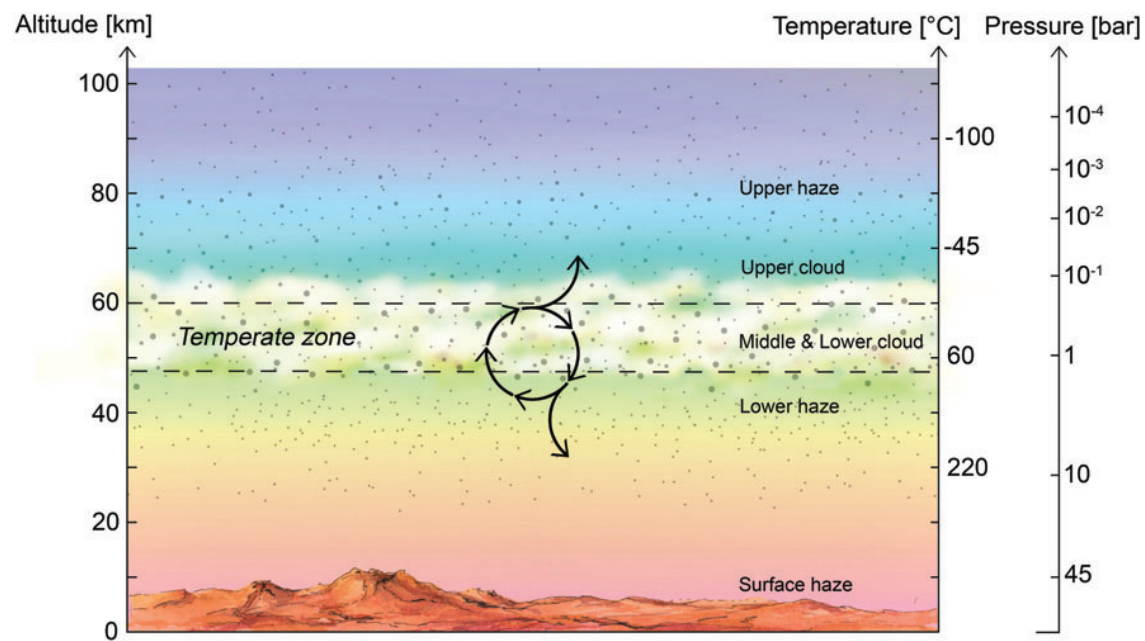
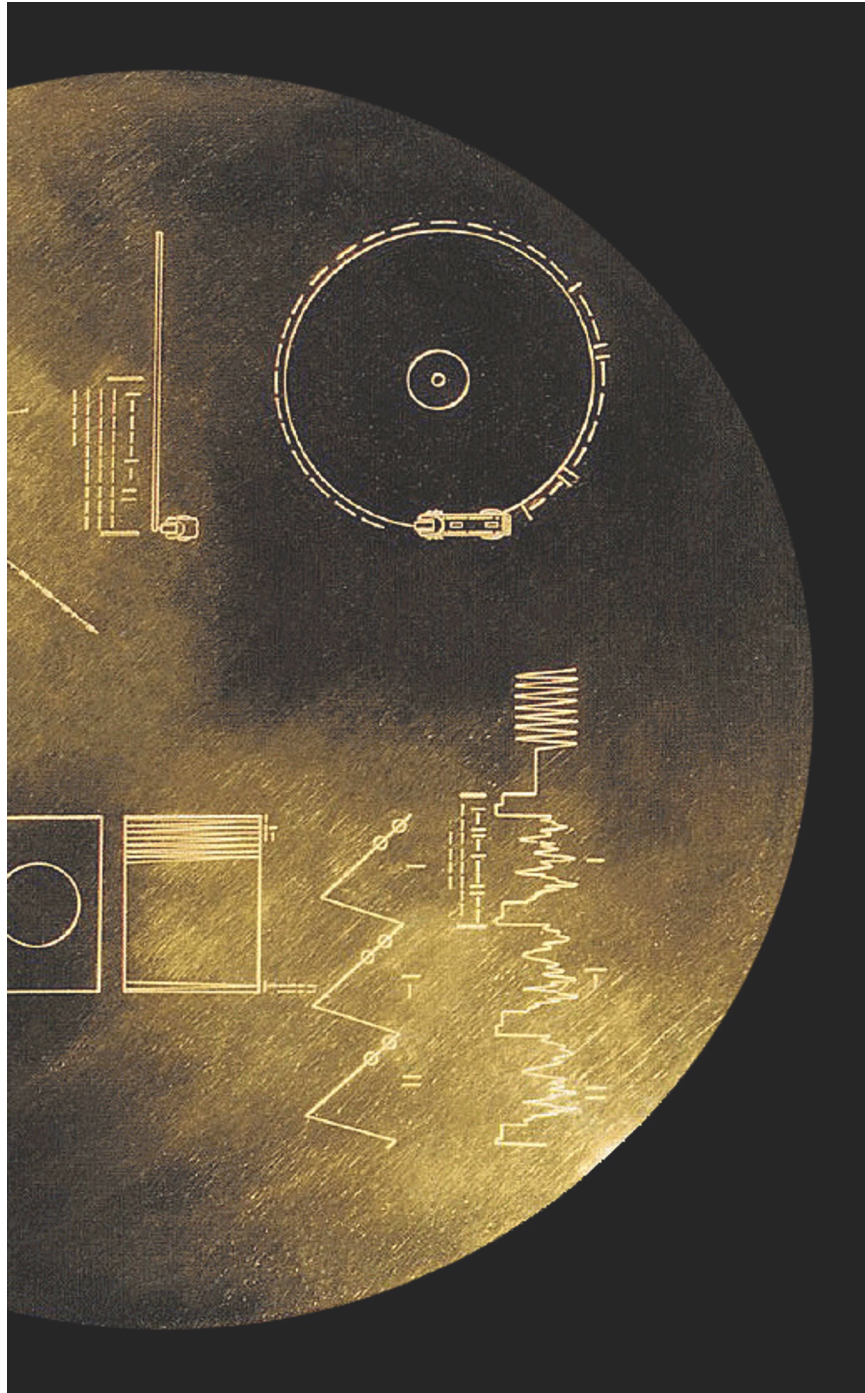


Figure 6-7. Concept of operations for the atmospheric phase of the Venus atmosphere sample return mission.

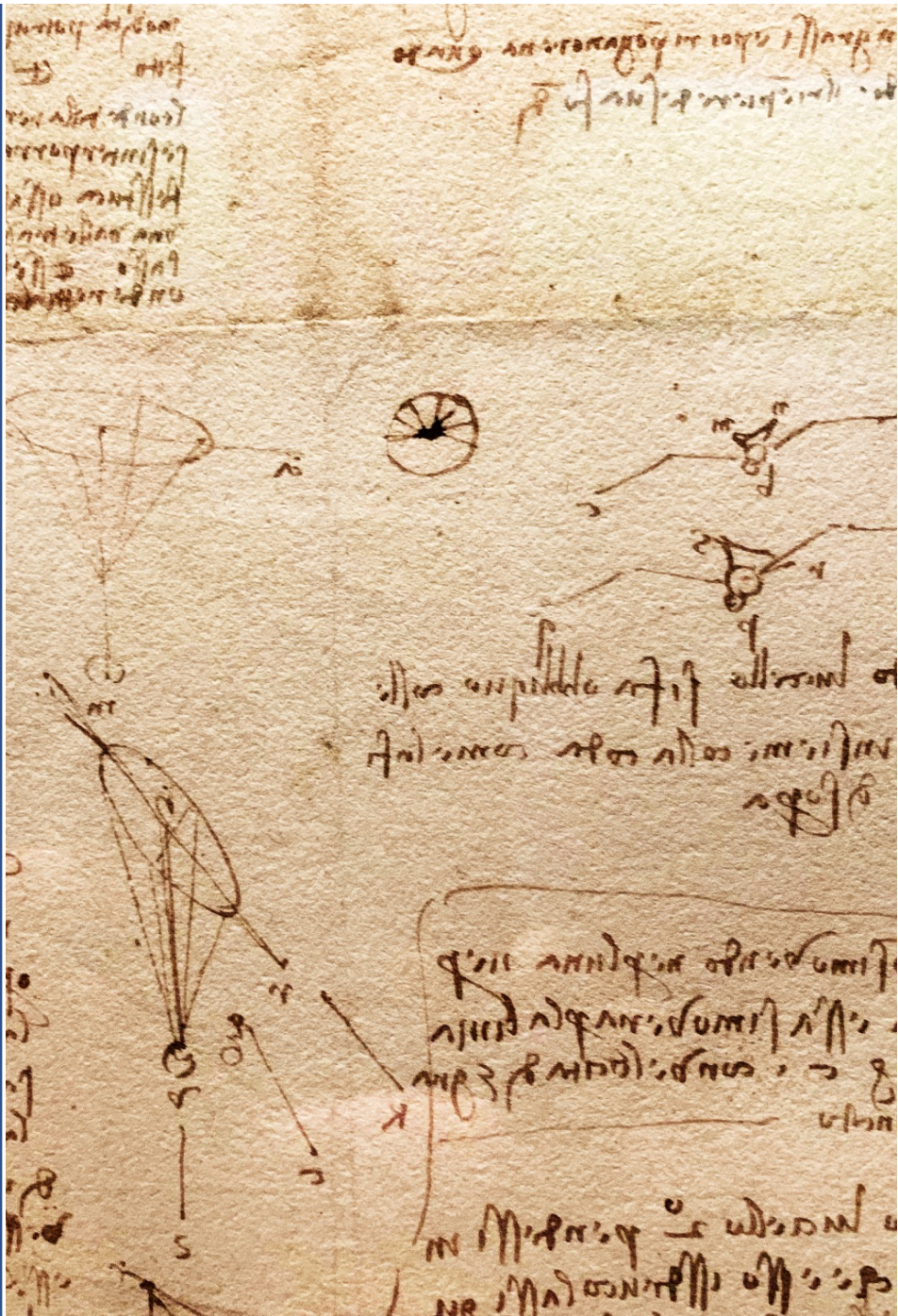
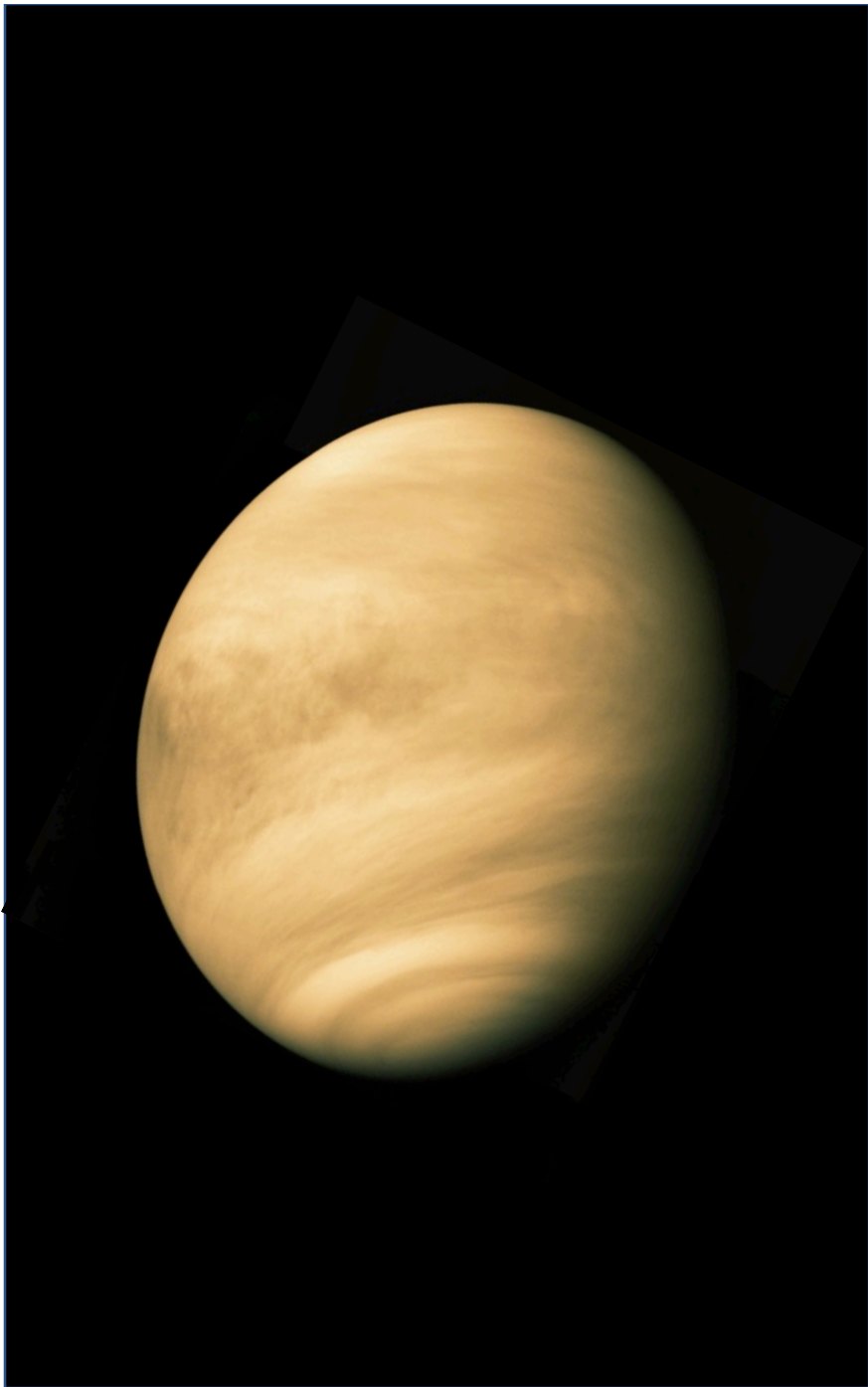


Crewed expeditions to Venus can be good for:

- Scientific exploration
- Expanding humans into the solar system
- National interests of the U.S. (see Webb-McNamara)

Entwining these is not necessarily bad, and raises questions about how we improve our society and human civilization over time.

Seeing into
the deep



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