

National Aeronautics and Space Administration

NASA Helio Club

Capstone Project Mission Proposal

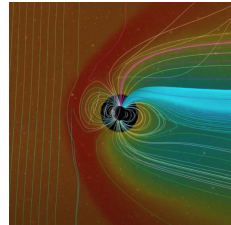
NASA Heliophysics Education Activation Team



Capstone Project: Mission Proposal



Session 1:
Heliophysics 101



Session 4:
Predicting Space
Weather



Session 2:
Observing the Sun



Session 5:
Aurora: The Beauty of
Space Weather



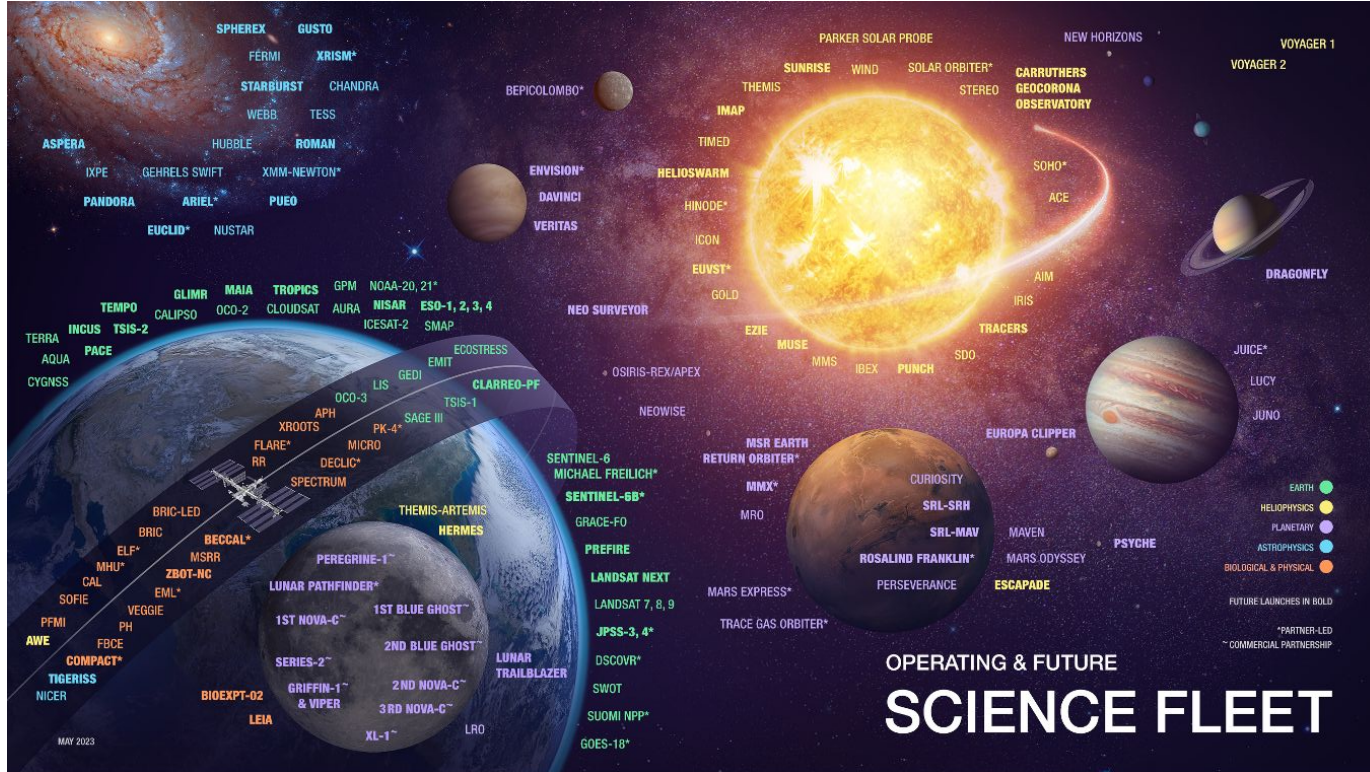
Session 3:
Parker Solar Probe
Engineering Challenge



Session 6:
Beyond the
Heliosphere



NASA's Science Fleet of Missions



Earth Science (E)
Heliophysics in
yellow (H)
Planetary Science (P)
Astrophysics (A)
Biological and
Physical Sciences
(BPS)



Missions Explored in this Club

Session 1

- IBEX (H)
- Voyager (H)

Session 2

- SDO (H)
- STEREO (H)
- Hubble (A)

Session 3

- Parker Solar Probe (PSP) (H)

Session 4

- Solar Orbiter (H)
- SOHO (H)
- MMS (H)
- Artemis (H)

Session 5

- ICON (H)
- ISS (BPS)

Session 6

- Chandra (A)
- TESS (A)
- Kepler (A)
- Spitzer (A)
- JWST (A)

NASA Mission Acronym Definitions:

Heliophysics:

IBEX: Interstellar Boundary Explorer

ICON: Ionospheric Connection Explorer

MMS: Magnetospheric Multiscale Mission

SDO: Solar Dynamics Observatory

SOHO: Solar and Heliospheric Observatory

STEREO: Solar Terrestrial Relations Observatory

Astrophysics:

TESS: Transiting Exoplanet Survey Satellite

JWST: James Webb Space Telescope

Biological and Physical Sciences:

ISS: International Space Station



Types of NASA Missions

● Missions with Physical Samples

- [OSIRIS-REx Mission](#) will return **Asteroid Bennu** samples to Earth in 2023. (P)
- The [Stardust Mission](#) was the first mission to return samples from a **comet** to Earth. (P)
- The [Genesis Mission](#) gathered samples of the **solar wind**. (H)

● Missions with Surface Exploration

- **Mars** rovers, including the current rovers; [Curiosity](#) and [Perseverance](#). (P)
- The [Huygens Mission](#) landed on Saturn's largest moon, **Titan**. (P)
- The [Apollo 11 Mission](#) was the first mission to send humans to the **Moon**. (P)
- NASA's upcoming [Artemis Mission](#) will send the next generation of astronauts to the **Moon**. (H)



Types of NASA Missions

● Orbiting Missions

- The [Solar Orbiter](#) orbits the **Sun**. (H)
- [Landsat](#) is one example of an **Earth** science mission. (E)
- [Mars Reconnaissance Orbiter \(MRO\)](#) orbits around **Mars**. (P)
- The [Juno Mission](#) orbits around **Jupiter**. (P)
- The [Messenger Mission](#) orbited **Mercury** for four years. (P)
- [Cassini](#) orbited **Saturn** for 13 years. (P)
- The [Galileo Mission](#) orbited **Jupiter** for 8 years. (P)
- The [Magellan Mission](#) orbited around **Venus**. (P)

● Flyby Missions

- [New Horizons](#) passed by **Pluto** and its moons in 2015. (P)
- The [Voyager Missions](#), launched in 1977, left our Solar System in 2012, gathering data from its flybys of the **Jupiter** and **Saturn** systems. (H)
- Launched in 1973, the [Mariner 10 Mission](#) had the first flybys of **Mercury** and **Venus**. (P)



Types of NASA Missions

- **Other Missions**

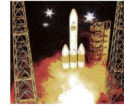
- [NASA Hubble Space Telescope](#). (A)
- [Kepler and K2 Missions](#). (A)
- [TESS Mission](#) (A)
- [International Space Station](#). (BPS)
- The [James Webb Space Telescope](#) (JWST) doesn't orbit Earth, but orbits a point out in space that experiences a gravitational equilibrium, about one million miles from Earth. (A)



Propose your own mission!

- What questions do you still have (about the Sun or the universe)?
- What places or phenomena would you like to learn more about?
- What measurements will you make that will address the science questions being investigated?

Mission Proposal Letter



Mission Name: _____

Mission Destination: _____

Lead Investigator: _____ (your name)

Mission Question: _____

Mission Concept: _____

Dear NASA:

Our team of scientists and engineers is very excited about the study of the Sun and the heliosphere. We have examined the data gathered from previous and existing missions to the Sun, missions that study magnetic fields around Earth, missions to the edge of the heliosphere, and missions that search for planets around other stars. But we believe that there is more to discover!

Mission Justification

We think this would be a good mission because...

Phase A: Project Plan:

The type of data that we will collect on this mission includes...



Mission Proposal Example

Proposed Mission Name: Parker Solar Probe

Proposed Mission Destination: The Sun

Lead Investigator: Dr. Justin Kasper

Mission Question: Where does the solar wind originate from, and how does it evolve?

Mission Concept: Parker Solar Probe will orbit the Sun and will use Venus' gravity as a sling during seven flybys over nearly seven years to gradually bring its orbit closer to the Sun.

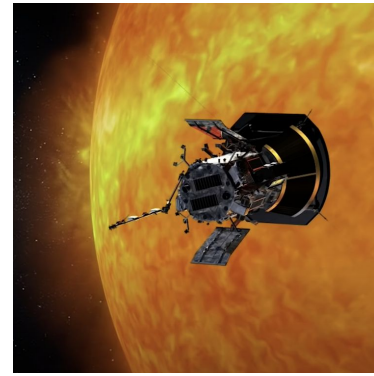


Illustration of PSP
Credit: NASA



Mission Proposal Example

Mission Justification: Parker Solar Probe makes critical contributions to our ability to forecast changes in Earth's space environment that affect life and technology on Earth.

Phase A: Science Data Collection: Parker Solar Probe carries four instrument suites designed to study magnetic fields, plasma, and energetic particles, and to image the solar wind. This data will help scientists predict space weather and keep humanity safe from the harmful effects of the Sun.

Phase B: Engineering Design: To perform investigations in the Sun's corona, the spacecraft and instruments are protected from the Sun's heat by a 4.5-inch-thick (11.43 cm) carbon-composite shield, and use water in a coolant system.



Criteria for Success

	Expert Design	Intermediate Design	Beginner Design
Mission Destination	Mission destination is unique and innovative with a strong science focus. Destination shows thoughtful consideration to current and past missions.	Mission destination is a popular hotspot for scientific exploration. However, this location has already been heavily explored.	Mission destination is not necessarily of scientific interest.
Phase A: Science Data Collection	Mission has a strong science goal and a clear plan for collecting data.	Mission has a valuable science goal.	Mission's science goal is unclear.
Phase B: Engineering Design	Mission has an efficient design that matches the challenges of the destination. Design provides details about how the spacecraft and its instruments will be protected from the specific space environment of the destination.	Mission has a thoughtful design that takes into consideration the general challenges of exploring the space environment.	Mission design doesn't directly address the challenges of exploring the general space environment.

Criteria for Success: Optional Points

	Expert Design (2)	Intermediate Design (1)	Beginner Design (0)
Mission Destination	Mission destination is unique and innovative with a strong science focus. Destination shows thoughtful consideration to current and past missions.	Mission destination is a popular hotspot for scientific exploration. However, this location has already been heavily explored.	Mission destination is not necessarily of scientific interest.
Phase A: Science Data Collection	Mission has a strong science goal and a clear plan for collecting data.	Mission has a valuable science goal.	Mission's science goal is unclear.
Phase B: Engineering Design	Mission has an efficient design that matches the challenges of the destination. Design provides details about how the spacecraft and its instruments will be protected from the specific space environment of the destination.	Mission has a thoughtful design that takes into consideration the general challenges of exploring the space environment.	Mission design doesn't directly address the challenges of exploring the general space environment.
Points (Optional)	A = 6–5	B = 4–3	C = 2–1
			Resubmit = 0