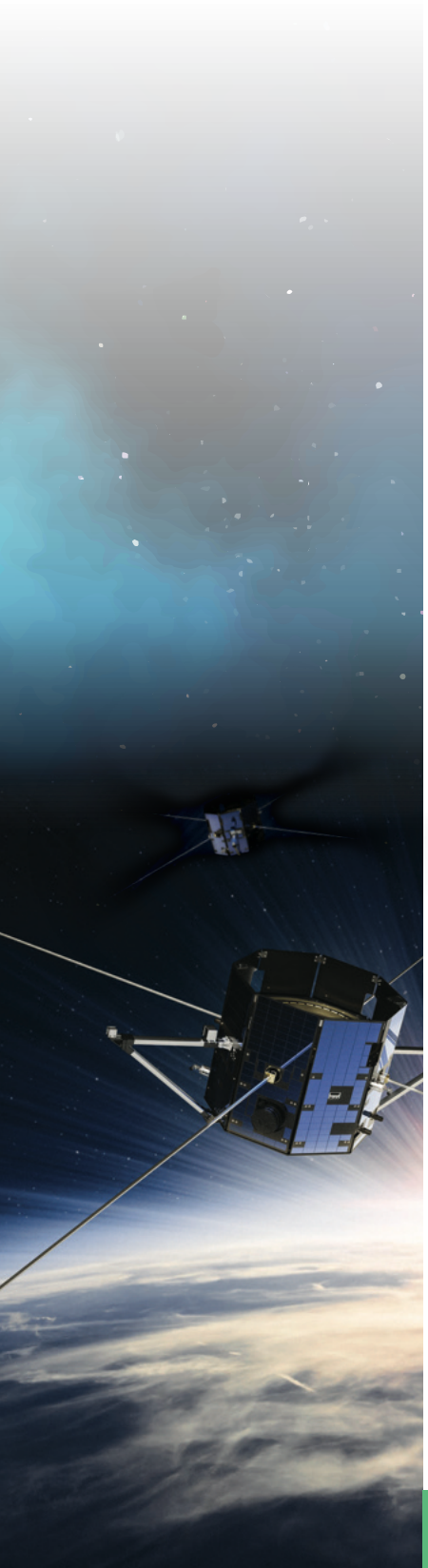
National Aeronautics and Space Administration

TRACERS Launch Press Kit

Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites



Introduction

NASA's TRACERS mission will study how the solar wind — the continuous stream of ionized particles escaping the Sun and pouring out into space — interacts with Earth's magnetosphere. The magnetosphere is the region around Earth dominated by our planet's magnetic field. This mission will help answer key questions about how the Sun influences Earth and ultimately drives space weather that impacts technology and communications.

The TRACERS mission will measure magnetic reconnection, an explosive event driven by tangled magnetic field lines. Magnetic reconnection frequently occurs in Earth's magnetosphere when particles and magnetic fields from the Sun interact with Earth's magnetic field, and it is a precursor for space weather effects like auroras. The mission will primarily study magnetic reconnection in a narrow region in Earth's magnetosphere known as the polar cusps, where solar wind particles funnel into Earth's atmosphere. By better understanding magnetic reconnection, scientists will be able to better prepare for impacts of solar activity on Earth. These insights into space weather will not only help us predict impacts to technology, power, and communications infrastructure on the ground and on satellites enabling our daily lives, but also to keep our astronauts safe as they go to the Moon, Mars, and beyond.

3 Things to Know About TRACERS

1. Understanding Magnetic Reconnection

   TRACERS will help scientists understand a process known as magnetic reconnection and its effects in Earth's atmosphere. Magnetic reconnection happens all across the universe but is of special relevance where the solar wind first meets Earth's magnetosphere, a region known as the magnetopause. A reconnection event there can shoot solar wind particles — normally diverted around our planet — directly into our atmosphere at high speeds. This process can trigger the beautiful northern and southern lights but also create potentially hazardous conditions for astronauts and satellites. TRACERS will help answer long-standing questions that are key to understanding magnetic reconnection and space weather, especially how the Sun transfers energy, mass, and momentum to near-Earth space.

2. Into the Cusps

   To study magnetic reconnection at Earth's magnetopause, TRACERS' twin satellites will fly in tandem, one behind the other, through the polar cusps, which are funnel-shaped regions where Earth's magnetic field opens over the North and South Poles. There, Earth's magnetic field dips down toward the ground, funneling and concentrating particles into one part of our atmosphere. By studying this region, TRACERS will allow scientists to observe how quickly reconnection changes and evolves by comparing data collected by each satellite.

3. Working Together

   TRACERS will work with other NASA missions to give scientists a holistic understanding of the causes of space weather from the Sun to Earth.

   Two recently launched missions, NASA's PUNCH (Polarimeter to Unify the Corona and Heliosphere) and EZIE (Electrojet Zeeman Imaging Explorer) are also in low Earth orbit, studying the solar wind and interactions in Earth's atmosphere. By combining observations from PUNCH, EZIE, and TRACERS, scientists will be able to get a more complete understanding of how and when Earth's protective magnetic shield can suddenly connect to the solar wind and let outside particles in.

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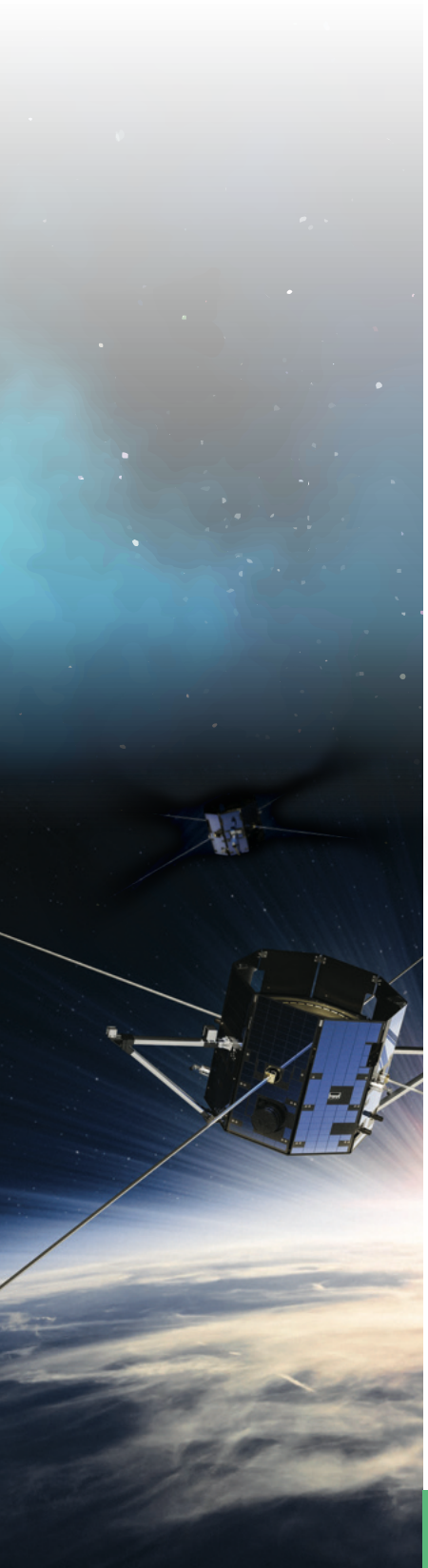

Details of the Mission

Name

Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites

Objectives

The TRACERS mission aims to connect activity in the polar cusp to the magnetopause to discover how variations in magnetic reconnection drive dynamics in the cusp. The mission asks:

1. Whether differences seen in reconnection is driven by changes in the solar wind over time or by location.
2. How the rate of reconnection changes for reconnections that vary in time.
3. To what extent dynamic structures in the cusp are due to reconnection that varies over space or over time.

Partners

The TRACERS mission is led by David Miles at the University of Iowa with support from the Southwest Research Institute in San Antonio, Texas.

NASA's Heliophysics Explorers Program Office at NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the mission for the agency's Heliophysics Division at NASA Headquarters in Washington.

NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, in partnership with NASA's Science Mission Directorate is providing the launch service as part of the agency's VADR (Venture-class Acquisition of Dedicated and Rideshare) contract.

The University of Iowa, the University of California, Los Angeles, the University of California, Berkely, and Southwest Research Institute lead instruments on TRACERS that study changes in the Earth's magnetic field, electric field, and plasma environment.

Millennium Space Systems built the spacecraft and is responsible for data operations.

Launch Details

The TRACERS mission is launching on a commercial rideshare mission along with the NASA or NASA-Sponsored small satellites Athena EPIC, PExt and REAL.

Date: No earlier than late July 2025
Launch Site: Space Launch Complex 4E, Vandenberg Space Force Base, California
Vehicle: SpaceX Falcon 9 rocket

Spacecraft

Dimensions

The TRACERS mission uses two nearly identical octagonal satellites, T1 and T2, each 37 inches (0.95 meters) high and 52 inches (1.32 meters) across. The satellites weigh less than 440 pounds (200 kilograms) each.

Duration

The TRACERS mission is scheduled to conduct science for at least one year, following a one-month commissioning period after launch.

Orbit

The two TRACERS spacecraft will be in a Sun-synchronous, low Earth orbit, flying just 367 miles (590 kilometers) above the ground. The orbit will take the satellites repeatedly through the polar cusps to study where and how often reconnection happens at the outer edges of Earth's magnetic field. The two satellites will follow one behind the other in close separation. By passing through regions at least 10 seconds apart, the two spacecraft will provide multiple "snapshots" and give scientists a better understanding of how particles and electromagnetic fields change in the region due to magnetic reconnection. The satellites will fly through the cusps several times each day, totaling more than 3,000 passes in the first year.

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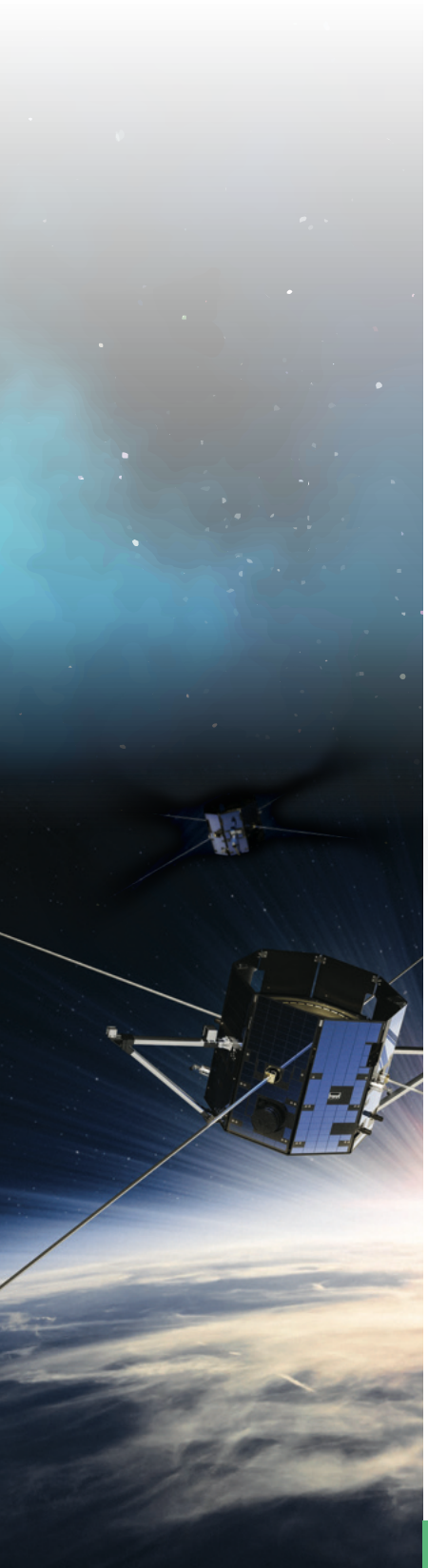

Instruments

Each of the two TRACERS satellites will host six instruments, including one technology demonstration.

- ACE: Analyzer for Cusp Electrons
  - This instrument measures the energy of electrons in plasma around the spacecraft and how they move in relation to the background magnetic field, a measurement known as energy-pitch angle distribution.
- ACI: Analyzer for Cusp Ions
  - This instrument measures the energy of ions in plasma around the spacecraft and how they move in relation to the background magnetic field, a measurement known as energy-pitch angle distribution.
- EFI: Electric Field Instrument
  - The Electric Field Instrument measures the electric field along two axes perpendicular to the background magnetic field, which is used to compute the plasma flow. It also measures high-frequency plasma waves.
- MAG: Fluxgate MAGnetometer
  - The Fluxgate MAGnetometer measures the background magnetic field of plasma along three axes. It can also be used to infer the presence of electrical currents and low-frequency plasma waves.
- MSC: Magnetic Search Coil
  - The Magnetic Search Coil measures high-frequency magnetic waves along three axes.
- MAGIC: MAGnetometers for Innovation and Capability
  - This instrument is a fluxgate magnetometer that measures the local magnetic field. As a technology demonstration, MAGIC will test a modern manufacturing process that could enable smaller magnetometers that produce less noise for future space missions.

The Data

The instruments aboard TRACERS will take approximately seven minutes of high speed measurements per orbit as the spacecraft pass through the polar cusp and low speed data in the remainder of the orbit. After downlinking, the TRACERS data will be sent to the mission operations center at Millennium Space Systems in California, which will share it with the science operations center at the University of Iowa. The data will be available to the public around four months after it is available to the science team. All TRACERS data will be published through the Space Physics Data Facility, ensuring open access to the scientific community and public.

Connections to Other Missions

The TRACERS mission builds upon and contributes to NASA's Heliophysics fleet, which studies a vast, interconnected system from the Sun to the space surrounding Earth and other planets, to the farthest limits of the Sun's constantly outflowing streams of solar wind. TRACERS will provide key information about magnetic reconnection at Earth's magnetospheric cusps and will work with other NASA missions to give scientists a holistic understanding of the causes of space weather from the Sun to Earth. Combining observations from missions in multiple locations provides important context for the entire heliophysics system.

PUNCH

The Polarimeter to Unify the Corona and Heliosphere (PUNCH) mission makes global, 3D observations of the Sun's outer atmosphere, the corona, to learn how particles and energy from the Sun become the solar wind. PUNCH's observations, when combined with those from TRACERS, will help scientists get a more complete understanding of how energy from the Sun's atmosphere flows through Earth's magnetosphere.

EZIE

The Electrojet Zeeman Imaging Explorer (EZIE) mission is a set of three SmallSats that are studying auroral electrojets, which are electrical currents flowing about 60 to 90 miles above Earth's poles that link the aurora to Earth's magnetosphere. By combining observations from PUNCH, EZIE, and TRACERS, scientists will be able to get a more complete understanding of how energy from the Sun's atmosphere flows through Earth's magnetosphere and atmosphere.

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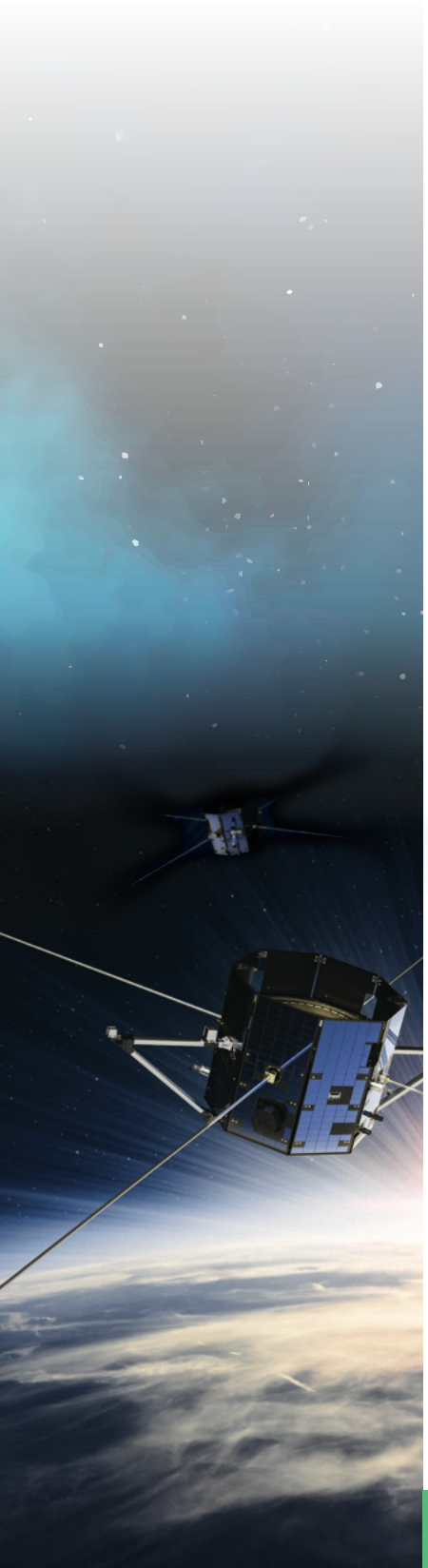

TRACERS Team

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- David Carter, NASA Explorers Mission Manager
  • Goddard Space Flight Center
- Richard Prasad, TRACERS Satellite Manager,
  • Millenium Space Systems

Important Links

News Releases, Features, Advisories, and Blog

Progress reports on TRACERS' road to launch, including the latest information on launch dates, can be found at science.nasa.gov/blogs/tracers/.

News, updates, and feature stories about the TRACERS mission are available at science.nasa.gov/mission/tracers.

Video and Images

B-roll and animations for media and public use are available at: https://svs.gsfc.nasa.gov/gallery/tracers/
Read NASA's image use policy: https://www.nasa.gov/nasa-brand-center/images-and-media/

How to Watch

Live Launch Feed

A live video feed of key launch activities and commentary will be broadcast on X by @SpaceX.

Additional Resources on the Web

A PDF version of this press kit is available at science.nasa.gov/mission/tracers.
Find additional information about the TRACERS mission at tracers.physics.uiowa.edu.
Learn more about NASA Heliophysics at science.nasa.gov/heliophysics and the Sun at science.nasa.gov/sun.

Social Media

General Updates

Join the conversation and get updates from these accounts:
X: @NASASolarSystem, @NASA
Facebook: NASA Solar System, NASA
Instagram: @NASA Solar System, @NASA

Launch Day Updates

Updates on launch day will also be available from:
X: @NASAKennedy
Facebook: @NASAKennedy