



# Terrestrial Planet Finder Interferometer

## Exploring Habitable Worlds and Revealing Signs of Life

### Mission Science

The Terrestrial Planet Finder Interferometer (TPF-I) will search for habitable worlds around nearby stars and look for indicators of the presence of life. Working with infrared wavelengths, TPF-I complements the search made by the Terrestrial Planet Finder Coronagraph (TPF-C) in visible wavelengths. This combination provides the strongest possible confirmation of the presence of indicators of habitable worlds.

A habitable world is one that has environmental conditions that could support life. The most reasonable home for life elsewhere in the universe would be a terrestrial planet, rocky, roughly Earth-size, with an atmosphere, and located in its star's habitable zone — at such a distance from the star that liquid water can exist on the planet's surface. TPF-I will look for the presence of water vapor, ozone, methane, and carbon dioxide to determine if the balance of these gases could provide a habitable environment — one that would support life.

Astronomers will combine the discoveries by TPF-I with data from SIM PlanetQuest and TPF-C. SIM PlanetQuest measures the planet mass and distance from the parent star, which determines whether the planet can support an atmosphere. Spectral data from

TPF-I and TPF-C will allow astronomers to measure the temperature and composition of planetary atmospheres — and habitability.

### Mission Summary

TPF-I is in the pre-formulation phase of its development. The observatory mission concept includes five formation-flying spacecraft: four 4-meter-class mid-infrared telescopes and one combiner spacecraft to which the light from the four telescopes is relayed to be combined and detected. The observatory will be deployed beyond the Moon's orbit for a mission life of five to 10 years.

### Mission Technology

New technologies are being developed to allow spectroscopic measurements of light from extrasolar planets, including (1) formation-flying telescopes to work together as one extended observatory, providing unprecedented angular detail and sensitivity that no telescope on the ground could ever achieve; (2) starlight-suppression technology so that the light from a planet's star will be dimmed by a factor of a million, making the planet's light visible; and (3) new cryogenic coolers, making it possible for a new generation of detectors to find Earth-like planets.

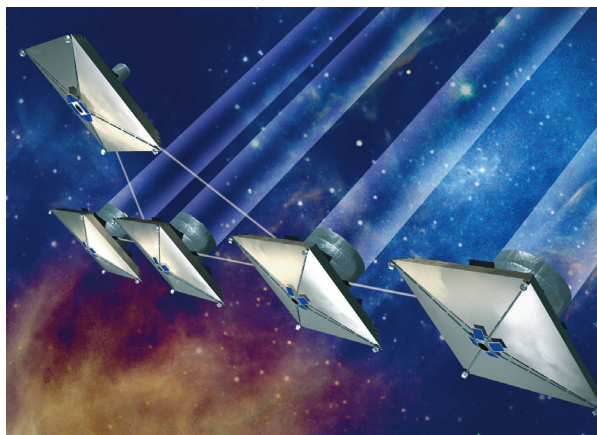
**Terrestrial Planet Finder Interferometer is managed by the Jet Propulsion Laboratory, California Institute of Technology.**

**Project Manager:** Daniel Coulter, Jet Propulsion Laboratory, California Institute of Technology

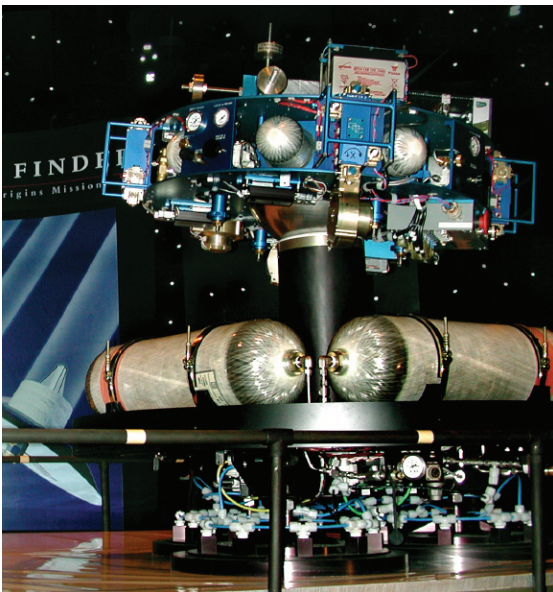
**Project Scientist:** Charles Beichman, Jet Propulsion Laboratory, California Institute of Technology

**Project Website:** <http://tpf.jpl.nasa.gov>

Terrestrial Planet Finder Interferometer is a part of NASA's Navigator Program.



# NASA Facts



The first formation-flying robot, built by Guidance Dynamics Corporation, shown here in maneuvers at the Jet Propulsion Laboratory.

### Heritage

TPF-I builds on technology and expertise developed for the Palomar Testbed Interferometer and the Keck Interferometer. TPF-I will benefit from technology developed for SIM PlanetQuest, the Large Binocular Telescope Interferometer, the James Webb Space Telescope, and TPF-C.

### National Endorsements

In 2001 the National Academy of Sciences published its Decadal Report, which strongly endorsed Terrestrial Planet Finder, emphasizing that “NASA should pursue a vigorous program of technology to enable the construction of TPF to begin in this decade.”

### Accomplishments

Cryocooler technology, required to cool the detectors on the TPF-I collector spacecraft, was demonstrated for the first time in 2005 by Lockheed Martin through a competitive contract that also included Ball Aerospace

and Northrop Grumman Space Technology. The two robots required for ground-based demonstrations of formation-flying maneuvers were built by Guidance Dynamics Corporation and commissioned at the Jet Propulsion Laboratory in 2005 and 2006. New milestones have also been reached in laboratory starlight suppression with the assistance of the University of Arizona and the U.S. Naval Research Laboratory.

### Partners

Listed below are the partners and technology suppliers for TPF-I, including members of the Science Working Group, the TPF Technology Advisory Committee, industrial contractors, NASA Centers, optics and high-technology providers, and investigators of ongoing TPF Foundation Science awards.

**Alabama:** NASA Marshall Space Flight Center. **Arizona:** Lowell Observatory, Planetary Science Institute, University of Arizona. **California:** Automated Controlled Environments Inc., California Institute of Technology, Guidance Dynamics Corporation, Jet Propulsion Laboratory, Lawrence Livermore National Laboratory, Lockheed Martin, Newport Corporation, Northrop Grumman Space Technology, San Francisco State University, UC Berkeley, UCLA, UC Santa Cruz. **Colorado:** Ball Aerospace, National Center for Atmospheric Research, University of Colorado at Boulder. **Hawaii:** University of Hawaii at Manoa. **Maryland:** NASA Goddard Space Flight Center, Seabrook Engineering, Space Telescope Science Institute. **Massachusetts:** Harvard-Smithsonian Center for Astrophysics, Massachusetts Institute of Technology; **Michigan:** University of Michigan. **New Hampshire:** Creare Inc. **New Jersey:** DRS Data and Imaging Systems Inc., Princeton University, Rutgers—the State University of New Jersey. **New Mexico:** Boeing, SVS, CVI Laser LLC. **New York:** University of Rochester. **Ohio:** Ohio State University. **Pennsylvania:** Pennsylvania State University, University of Pittsburgh. **Texas:** Texas A&M University, Southwest Research Institute, University of Texas at Austin. **Washington, D.C.:** Carnegie Institution of Washington, Naval Research Laboratory, U.S. Naval Observatory.

NEW TECHNOLOGIES ARE BEING DEVELOPED TO ALLOW SPECTROSCOPIC MEASUREMENTS OF LIGHT FROM EXTRASOLAR PLANETS.

National Aeronautics and Space Administration

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