NASAfacts

SWOT
Surface Water and Ocean Topography

Following the water

Life as we know it is tied to our access to water. But for all its importance, we have a surprisingly limited understanding of where Earth's water is today, where it's coming from, and where it will be tomorrow. Led by NASA and the French space agency Centre National d'Études Spatiales (CNES), the Surface Water and Ocean Topography (SWOT) mission will observe nearly all water on Earth's surface. The satellite will measure rivers, lakes, and reservoirs whose water volume and flow rate were previously unobserved, and will view ocean features, like currents and eddies, with unprecedented clarity.

This data will allow scientists to track the movement of water around the world, offering a better understanding of how the planet's water resources are changing and how those changes impact the environment. It will provide a better picture of how the ocean helps to mitigate climate change by absorbing heat and carbon dioxide from the atmosphere. And it will enhance scientists' ability to understand ocean warming, sea level rise, and how bodies of water respond to changing precipitation patterns.

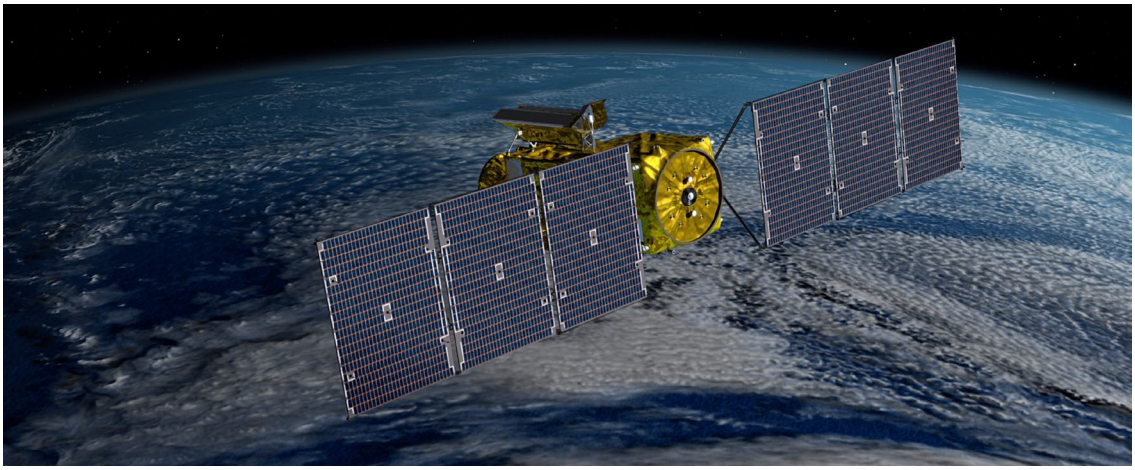
This information can inform decisions about our daily lives and address some of the most pressing climate change questions of our time.

Expected Mission Timeline

- **No earlier than Dec. 15, 2022:** SWOT launches from Vandenberg Space Force Base in central California aboard a SpaceX Falcon 9 rocket.
- **Three years:** Duration of the prime mission, when SWOT will survey the planet's surface at least once every 21 days. This starts after a six-month commissioning period.

Key Objectives

- Provide a global inventory of water resources, producing data on more than 95% of the world's lakes larger than 15 acres (62,500 square meters) and rivers wider than 330 feet (100 meters) across.
- Deepen understanding of where the water is, where it's coming from, and where it's going.
- Observe the fine details of the ocean's surface topography, enabling scientists



This illustration depicts the Surface Water and Ocean Topography satellite orbiting Earth. SWOT will survey the planet's surface at least once every 21 days. Credit: NASA/JPL-Caltech

to study currents and eddies smaller than 13 miles (20 kilometers) across – up to 10 times smaller than those that have been previously detectable with other sea level satellites.
- Improve understanding of the ocean's role in climate change.
- Measure ocean conditions near coastlines.

Science Instruments

- **Ka-band Radar Interferometer (KaRIn) instrument:** The scientific heart of the SWOT satellite, KaRIn will measure the height of water by transmitting radar pulses to Earth's surface and triangulating the return signals that bounce back using two antennas at the same time. The antennas are at either end of a boom that is 33 feet (10 meters) long.
- **Nadir altimeter:** Working with KaRin to measure the height of water on Earth's surface directly under the satellite's path, the altimeter will send radio signals to the water's surface and measure how long it takes the reflected signal to return to a receiver. This instrument, provided by CNES, builds upon the dual-frequency Poseidon family of altimeters that trace their roots to the TOPEX/Poseidon mission launched in 1992. The Poseidon family of altimeters was developed and built by Thales Alenia Space in Cannes, France.
- **Microwave radiometer:** Water vapor affects the radar signals from the KaRIn and nadir altimeter instruments, which can make the height of the water they're measuring appear higher or lower than it actually is. The radiometer measurements of water vapor between the satellite and Earth's surface correct for this effect.
- **Precise orbit determination package:** These three science instruments ascertain the position of the satellite in orbit. They include the Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS), the laser retroreflector array (LRA), and the global positioning system (GPS) receiver.

SWOT Spacecraft

The spacecraft bus and payload module that carries the science instruments is 16.4 feet (5 meters) tall with a mass of 4,850 pounds (2,200 kilograms). SWOT will be powered by the satellite's two solar arrays, which span 48.8 feet (14.9 meters) in length with an area of 335 square feet (31 square meters). SWOT's orbit will be adjusted when necessary by firing its onboard thrusters – small rocket engines used for in-flight corrections. This subsystem also includes a propellant tank.

Engineers successfully deployed one of two solar arrays installed on the SWOT satellite in January 2022 at the Thales Alenia Space clean room facility near Cannes, France. Courtesy: CNES/Thales Alenia Space

Mission Partners

SWOT is being jointly developed by NASA and CNES, with contributions from the CSA and the UK Space Agency. JPL, which is managed for NASA by Caltech in Pasadena, California, leads the U.S. component of the project. For the flight system payload, NASA is providing the Ka-band Radar Interferometer (KaRIn) instrument, a GPS science receiver, a laser retroreflector, a two-beam microwave radiometer, and NASA instrument operations. CNES is providing the Doppler Orbitography and Radioposition Integrated by Satellite (DORIS) system, the dual frequency Poseidon altimeter (developed by Thales Alenia Space), the KaRIn radio-frequency subsystem (together with Thales Alenia Space and with support from the UK Space Agency), the satellite platform, and ground control segment. CSA is providing the KaRIn high-power transmitter assembly. NASA is providing the launch vehicle and associated launch services.

Mission Websites

For more information about the SWOT mission, visit:

https://swot.jpl.nasa.gov/

https://swot.cnes.fr/fr/

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

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