Artist's concept of Tiangong-1 in orbit. Image courtesy China National Space Administration (CNSA).

TIANGONG-1

The Chinese Space Station Tiangong-1 is decaying and expected to make an uncontrolled reentry to Earth in early April 2018. The spacecraft will burn up upon reentry, but some space debris may survive. Odds are slim that the debris will land in populated areas.

The Heavenly Palace

China's first space station, Tiangong-1, or "Heavenly Palace," was launched aboard a Long March 2F/G rocket from the Jiuquan Satellite Launch Center on Sept. 30, 2011. The prototype for China's ambitious space program, Tiangong-1 weighed 18,740 pounds at launch, measures 34 feet long and 11 feet in diameter, and has solar panels on either side. Tiangong-1 was unmanned at launch, but was designed to be a habitable lab for docking and orbital experiments and eventually become the larger, multiple-module Tiangong station. Tiangong-1 has an internal area of 15 cubic meters and two sleep stations for astronauts.

Two manned missions to Tiangong-1 were completed. Shenzhou 9 launched on June 16, 2012, with three astronauts, including China's first female astronaut, fighter pilot Liu Yang. On this mission, the crew spent 11 days at the station and completed two dockings—one computer-controlled and one crew-guided. Shenzhou 10, the second mission to the station, launched on June 11, 2013, with three astronauts aboard. On this mission, the crew spent 13 days at the station, completed the first orbital maintenance, and performed additional docking tests.

The first of two manned missions was completed to Tiangong-1: Shenzhou-9, launched on June 16, 2012. Photo courtesy Reuters.

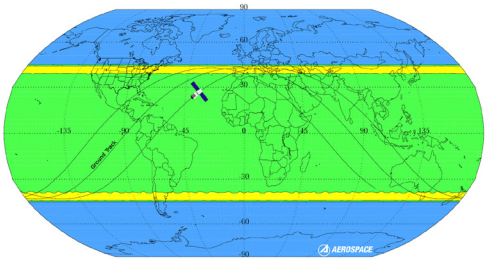
For Tiangong-1's reentry into Earth's atmosphere, China's original plan was to control its descent using thruster burn. However, on March 16, 2016, China reported to the United Nations that telemetry services with Tiangong-1 had "ceased functioning." Based on The Aerospace Corporation's analyses, Tiangong-1 is now on a decaying orbit as its altitude slowly decreses while its descent toward Earth rapidly increases. When the station reaches Earth's upper atmosphere, the space station will make an uncontrolled reentry.

Tiangong-1 facts

- Tiangong-1 is predicted to reenter Earth's atmosphere around April 1, 2018 ± 2 days
- Tiangong-1 will likely reenter somewhere between the latitudes of 43° north and south
- Any debris surviving reentry will most likely fall into an ocean
- The odds of space debris hitting you are less than one in 1,000,000,000,000
- Hydrazine, a highly toxic and corrosive substance, may survive reentry on pieces of space debris

Tiangong-1 Reentry Details

Tiangong-1's reentry is being closely monitored by The Aerospace Corporation's Center for Orbital and Debris Reentry Studies (CORDS). Established in 1997, CORDS focuses on Aerospace's research and technology applications in the areas of space debris, collision avoidance, and reentry breakup, providing a single point of contact for debris reporting information.

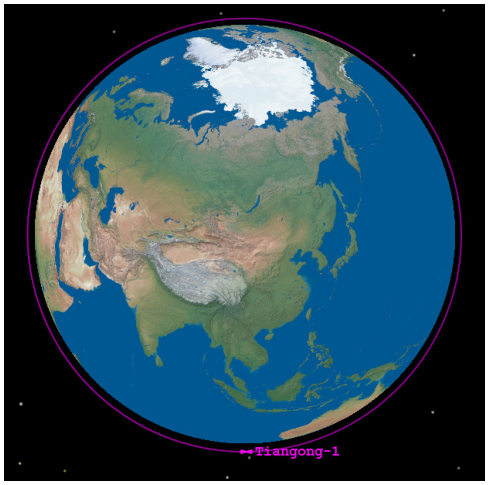


The map above shows the relative probabilities of debris landing within a given region. Yellow indicates locations that have a higher probability, while green indicates areas of lower probability. Blue areas have zero probability of debris reentry since Tiangong-1 does not fly over these areas (north of latitude 42.7° north or south of latitude 42.7° south). These zero probability areas constitute about a third of Earth's total surface area.

For Tiangong-1, CORDS is continuously monitoring the timing and location of the space station's reentry. Currently, the space station is predicted to reenter Earth's atmosphere around April 1, 2018 ± 2 days. Due to the uncertainties involved, it is very difficult to predict the exact timing of any space object reentry.
Sources of uncertainty include:

- significant variation in the density of the upper layers of the atmosphere
- orientation of the spacecraft over time
- physical properties of the spacecraft, including the exact mass and material composition
- exact location and speed of the space station

When aggregated, these factors translate into a reentry timing uncertainty that is roughly 20 percent of the "time to go"—the time remaining between the date of the prediction and the predicted date of reentry. Aerospace estimates that Tiangong-1 will reenter somewhere between the latitudes of 43° north and south, and any surviving reentry debris will most likely fall into an ocean. The odds of space debris hitting you are less than one in 1 trillion. Surviving debris from Tiangong-1 might be carrying or be comprised of toxic materials. CORDS experts advise that it is best to not touch any space debris or breathe in any vapors it may release.



Orbit of Tiangong-1 as of March 13, 2018 @ 00:00:00.000 UTC. The apogee (highest point in the orbit) = 259 km, while the perigee (lowest point in the orbit) = 231 km. For reference, the International Space Station is in a 400 km circular orbit.

Incandescent objects during this reentry may be visible and will likely last up to a minute or more, depending on time of day, visibility conditions, and the observer's location. Aerospace will continue to provide updated reentry predictions and more details of the predicted reentry region a few days prior to the reentry time frame. For updates about Tiangong-1 or information about CORDS, please visit aerospace.org/cords.

The Center for Orbital and Reentry Debris Studies

Since 1997, CORDS research has established Aerospace as a world authority on space debris, reentry breakup, satellite conjunction assessment, launch collision avoidance, and space situational awareness. CORDS provides technical support to virtually all launch vehicle and satellite programs related to national defense, developing state-of-the-art expertise used both nationally and internationally.

The Aerospace Corporation

Aerospace is a nonprofit corporation that operates a federally funded research and development center (FFRDC) for the United States Air Force. This FFRDC spans the entire space domain for government as well as civil space and other federal agencies. With a world class workforce of roughly 3,000 engineers and scientists, Aerospace is able respond with agility to the unique challenges posed by national security space requirements, delivering well-defined, innovative solutions that assure mission success.

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