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NASA's 22-Year-Old Swift Gamma-Ray Observatory Nears Atmospheric Re-Entry After Failed Orbital Rescue

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For nearly 22 years, NASA's Neil Gehrels Swift Observatory has acted as astronomy's fastest cosmic first responder. Launched on November 20, 2004, aboard a Delta II rocket, the 1,470-kilogram (1.5-ton) space telescope was designed for just a two-year primary mission to solve one of astrophysics' greatest mysteries: the origin of gamma-ray bursts (GRBs) , the most energetic explosions in the universe since the Big Bang. Instead, Swift operated for more than a decade-and-a-half past its warranty, detecting more than 1,600 gamma-ray bursts and capturing the ultraviolet and X-ray glow of colliding neutron stars. Now, after dropping to an altitude of just 275 kilometers (171 miles) in late October 2026, the unpropelled observatory has had its science instruments permanently powered down ahead of an uncontrolled fiery re-entry into Earth's atmosphere.

How Solar Activity Pulled Swift Down from Orbit

Even in low Earth orbit (LEO) hundreds of kilometers above the ground, space is not a perfect vacuum. Satellites orbit inside the thermosphere -- an ultra-thin upper layer of Earth's atmosphere where stray gas molecules constantly collide with spacecraft surfaces, creating aerodynamic drag that gradually slows them down and lowers their altitude.

Swift originally orbited at a safe altitude of roughly 595 to 600 kilometers (370 miles) inclined at 20.6 degrees to Earth's equator -- an orbit chosen to avoid the high-radiation South Atlantic Anomaly. However, because Swift was built without onboard thrusters or propellant tanks, it had no way to boost itself back up as drag slowly eroded its altitude. During the unexpectedly intense peak of Solar Cycle 25 between 2024 and 2026, frequent solar flares and extreme ultraviolet radiation heated Earth's upper atmosphere. Just as air expands when warmed, the thermosphere puffed outward, multiplying the density of gas molecules along Swift's orbital path and accelerating its rate of orbital decay far faster than mission planners had projected a decade ago.

Inside the $30 Million Robotic Rescue Attempt

As Swift's altitude dropped toward the critical 300-kilometer threshold where thickening air makes it impossible for reaction wheels (internal spinning flywheels used to point the telescope) to hold the spacecraft steady, NASA awarded a rapid $30 million contract to Arizona-based startup Katalyst Space Technologies for a first-of-its-kind commercial orbital salvage mission.

On July 3, 2026, Katalyst launched a robotic servicing spacecraft named Link , equipped with three mechanical capture arms designed to rendezvous with the uncooperative Swift satellite, grapple its launch adapter ring, and boost it back to a stable higher altitude. Although Link's mission was assembled in less than a year,

a faulty thruster valve shortly after launch knocked out key attitude-control reaction wheels and sent the robotic chaser into a rapid spin. Flight controllers stabilized Link and maneuvered it within 11 to 14 kilometers (7 to 9 miles) of Swift in August 2026, but the recovery burns consumed too much propellant to complete a safe capture. The rescue was scrubbed, and Link itself burned up in Earth's atmosphere in September 2026.

Mission Telemetry & Instrument Architecture

What made Swift irreplaceable for time-domain astronomy was its ability to spot a fleeting flash of high-energy gamma rays across a sixth of the sky and autonomously pivot its narrow-field telescopes toward the target within 20 to 75 seconds -- before the explosion's fading afterglow disappeared.

| Parameter / Instrument | | Specification | | Scientific Role & Re-Entry Status |

| Launch & Operational Span | | Nov 20, 2004 - Oct 20, 2026 (~22 years) | | Exceeded 2-year baseline design lifetime by 11x; science operations halted at 275 km altitude |

| Spacecraft Mass & Orbit | | 1,470 kg launch mass; 20.6 deg inclination | | Initial 600 km circular orbit decayed without onboard propulsion during Solar Cycle 25 |

| Burst Alert Telescope (BAT) | | 15-150 keV coded-aperture mask (2 sr FoV) | | Detected 1,600+ GRBs; heavy tungsten mask tiles (~5,200 cm^2 array) may partially survive re-entry |

| X-Ray Telescope (XRT) | | 0.2-10 keV Wolter-I grazing-incidence mirror | | Pinpointed GRB afterglows to arcsecond precision within seconds of autonomous spacecraft slew |

| UV/Optical Telescope (UVOT) | | 170-600 nm, 30 cm Ritchey-Chr tien mirror | | Measured optical light curves, supernovae, and cosmological redshifts; mirror core may survive |

| Katalyst Link Rescue Craft | | $30M robotic servicer (launched July 3, 2026) | | Reached within 11-14 km of Swift before valve/fuel anomalies forced August 2026 mission scrub |

What Happens During Atmospheric Re-Entry?

On October 20, 2026, as atmospheric torque overwhelmed Swift's pointing wheels at 275 kilometers altitude, mission controllers placed the observatory into safe mode and subsequently shut down its transmitters and electrical systems. Tracked by the U.S. Space Force, the 1.5-ton spacecraft is encountering exponentially denser air with each final orbit.

When Swift drops into the mesosphere around 80 to 100 kilometers (50 to 62 miles) above Earth at roughly 27,500 kilometers per hour (17,100 mph), extreme compression of the air ahead of the spacecraft will generate temperatures exceeding 1,600 deg C (2,900 deg F). Aluminum honeycomb panels, solar arrays, and electronic boxes will vaporize high above the ground. However, NASA reentry assessments note that a few ultra-dense or heat-resistant pieces -- specifically the tungsten tiles from the Burst Alert Telescope's coded mask (tungsten melts at 3,422 deg C) and segments of

the telescope mirror assembly -- could survive to reach the surface. Because Swift orbits at a 20.6-degree inclination, its ground track stays within the tropical and subtropical belt between 20.6 deg North and 20.6 deg South latitude, where oceans cover the vast majority of Earth's surface.

A Lasting Legacy in High-Energy Astrophysics

Even as its hardware burns up in the upper atmosphere, Swift leaves behind a two-decade public archive that transformed modern astrophysics. It proved that short gamma-ray bursts lasting less than two seconds are forged by colliding neutron stars, discovered the most distant cosmic explosions in the early universe over 13 billion light-years away, and demonstrated both the urgent promise and engineering challenges of robotic in-orbit satellite servicing.

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