

## HOW TO LAND ON A COMET

Generally speaking, space missions fall into one of three categories: **difficult, more difficult, and ridiculously difficult.**

**Flybys are difficult.** A spaceship travels hundreds of millions of miles through the dark void of space, pinpoints a distant planet or moon, and flies past it at 20 to 30 thousand mph, snapping pictures furiously during an achingly brief encounter.

**Going into orbit is more difficult.** Instead of flying past its target, the approaching spaceship brakes, changing its velocity by just the right amount to circle the planet. One wrong move and the spacecraft bounces off the atmosphere, becoming an unintended meteor.

**Landing is ridiculously difficult.** Remember NASA's "Seven Minutes of Terror" video. Since the Space Age began, the space agencies of Earth have succeeded in **landing on only six bodies: Venus, Mars, the Moon, Titan, and asteroids 433 Eros and Itokawa.**

In a move that could set a new standard for difficulty, the European Space Agency is about to add a seventh member to the list. On Nov. 12th ESA's Rosetta spacecraft will drop a lander named "Philae" onto the surface of Comet 67P/Churyumov-Gerasimenko.

**How hard is this landing?. Consider this: The comet will be moving 40 times faster than a speeding bullet,**

**spinning, shooting out gas and welcoming Rosetta on the surface with boulders, cracks, scarps and possibly metres of dust!** Rosetta will drop Philae from a height of 22 km as the comet rotates freely below. No active steering will take place during the slow descent. The comet's nucleus is strangely shaped, (one observer has likened it to a "freak-show mushroom") dominated by a pair of mile-wide "knobs" joined by a boulder-strewn "neck." Picking a landing site was not easy. None of the candidate landing sites met all of the operational criteria and Site J is clearly the best compromise. It is a relatively flat, boulder-free and gets plenty of sunlight for the lander's solar panels and has a line-of-sight communications with Rosetta orbiting overhead. The descent will take about 7 hours, a drawn-out process that could be enlivened by unpredictable jets of gas emerging from the comet's core. **This will be Seven Hours of Terror. "It will be the equivalent of transferring an object from one speeding bullet to another".**

Something that has only ever been done by the infamous Baron von Münchhausen as he rode a cannonball over the enemy camp to appraise the situation and caught a ride back on an enemy cannonball. The Rosetta mission's Philae lander is about the size of a washing machine. It has legs to cushion its impact, a thruster to push it down, and a harpoon that will act like an anchor on the comet's surface. The landing Site J has been given the name Agilkia (an island on the River Nile) in keeping with Rosetta's Egyptian theme. All the ancient buildings were relocated there after the island Philae was flooded.

**Philae can remain active on the surface for two-and-a-half days.** Its mothership, the Rosetta spacecraft, will remain in orbit around 67P through the comet's perihelion, or closest point to the sun, in July, 2015. Comets hold vital clues about our solar system's history. They are considered primitive building blocks of the solar system that are literally frozen in time, and they may have played a part in "seeding" Earth with water and, possibly, the basic ingredients for life. AK

