ESA to capture large derelict satellite

The European Space Agency is moving forward with plans to capture and remove a large piece of space debris, in a mission called e.Deorbit, by 2023. European space ministers at the ESA's Ministerial Council gave the mission an initial go-ahead.

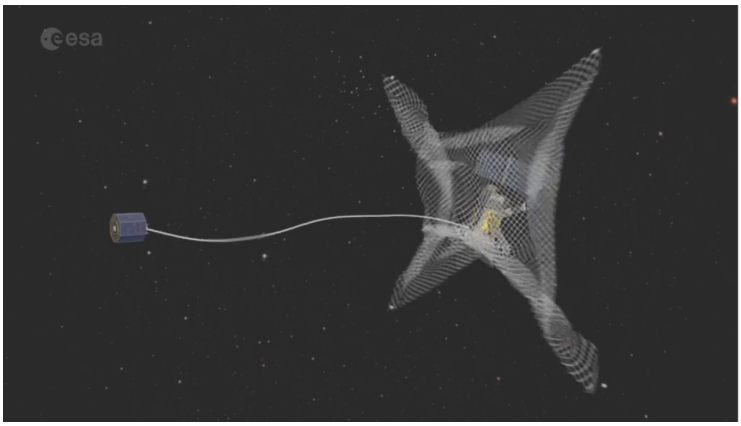
The mission – which is part of ESA's Clean Space initiative – hopes to capture an ESA-owned derelict satellite in low orbit in 2023, then move it to where it can safely burn it up in a controlled reentry to Earth's atmosphere.

ESA said that more than 75% of trackable space debris moves in low orbit, below about 2,000 km altitude.. Space debris can collide with working satellites, creating more debris and leading to a cascade of collisions. Even if all launches stopped tomorrow, the level of debris would go on rising, driven by continuing collisions. The only way to stabilize debris levels in the long run will be to remove entire large items.

Decades of launches have left Earth surrounded by a halo of space junk: More than 17 000 trackable objects larger than a coffee cup, which threaten working missions with catastrophic collision. Even a 1 cm nut could hit with the force of a hand grenade. The only way to control the debris population across key low orbits is to remove large items such as derelict satellites and launcher upper stages.

Such uncontrolled multi-ton items are not only collision risks, but also time bombs: They risk exploding due to leftover fuel or partially charged batteries heated up by orbital sunlight. The resulting debris clouds would make these vital orbits much more hazardous and expensive to use, and follow-on collisions may eventually trigger a chain reaction of break-ups.

While the concept itself is straightforward, the implementation is not – e.Deorbit will be like nothing ESA has ever attempted before. The chaser satellite requires extremely sophisticated guidance, navigation and control to synchronise motion and then capture its target, guided in turn by advanced image processing, blending inputs from optical and multispectral cameras as well as 'laser radar' lidar to derive a precise, reliable sense of the target and its motion. In addition, the project needs a reliable method of capturing its target. They are now looking at a net, harpoon or gripper as well as advanced robotics to secure the two satellites together. Finally, the satellite also requires a very high level of autonomy, because continuous realtime control from the ground will not be practical, especially during the crucial capture phase.



Artist's concept of derelict satellite capture by net.

The first technical challenge the mission will face is to capture a massive, drifting object left in an uncertain state, which may well be tumbling rapidly. Sophisticated imaging sensors and advanced autonomous control will be essential, first to assess its condition and then approach it. Making rendezvous and then steady station-keeping with the target is hard enough but then comes the really difficult part: how to secure it safely ahead of steering the combined satellite and salvage craft down for a controlled burn-up in the atmosphere?

Several capture mechanisms are being studied in parallel to minimise mission risk. Throw-nets have the advantage of scalability – a large enough net can capture anything, no matter its size and attitude. Tentacles, a clamping mechanism that builds on current berthing and docking mechanisms, could allow the capture of launch adapter rings of various different satellites

Strong drivers for the platform design are not only the large amount of propellant required, but also the possible rapid tumbling of the target – only so much spin can be absorbed without the catcher craft itself going out of control.

AK, with EarthSky Notes