**Efforts to clean-up Space**

The European Space Agency (ESA) is part of an international effort to monitor and – ultimately – tackle space debris. This junk – accumulated in orbit since the dawn of the space age sixty years ago – poses an increasing risk to operational spacecraft.

ESA is developing missions to tackle the problem to help prevent a serious collision in space. The Agency is also monitoring possible dangers caused by fragments of redundant spacecraft falling to Earth, such as China’s space station Tiangong-1 – due to enter the atmosphere in the coming months.

**A-roll**

**[Title Efforts to clean-up Space @ 10:00:00]**

**[10:00:10 Space Debris animation from ESA http://www.esa.int/esatv/Videos/2017/04/Space\_debris\_2017\_-\_a\_journey\_to\_Earth]**

Some 8,000 tonnes of space debris orbits the Earth – ranging from obsolete satellites to tiny flecks of paint. ESA tracks 29,000 objects over 10cm in size. But the greatest potential risk to operational spacecraft comes from the larger pieces.

**[10:00:30 Luisa Innocenti, Head of Clean Space Office, ESA]**

*The big ones are the ones that if they get impacted, will create a cloud of other smaller debris, which in turn could hit other debris and this could start what is called a Kessler syndrome, a chain reaction which is not controllable.*

**[Cutaway - animation of collisions from ESA]**

**[Luisa Innocenti]**

*The problem of space debris has to be fixed in two ways. The first, we need to stop polluting. And the second one, we have to remove the garbage, if you want, the debris.*

**[10:00:57 E-deorbit set-up shots]**

At ESA’s ESTEC Centre in the Netherlands, engineers are developing e.Deorbit – designed to capture an out of control satellite to remove it from harm’s way. It’s being tested using a robot and satellite model.

**[10:01:12 Jesus Gil Fernandez, Guidance, Navigation and Control Engineer, ESA]**

*We use the camera which is mounted on the smaller robot arm to mimic, to reproduce, the motion of the satellite around the target, the target satellite that we want to de-orbit, to capture.*

**[Cutaways of robot to cover internal edit]**

*Once we are sure we are moving like a single object, as if we were dancing, but without touching each other, we can move the robotic arms to grab the launcher adapter ring….So it makes it easy to bring it down to the Earth and destroy it in the re-entry or in the south Pacific Ocean.*

**[10:01:42 Set-up shots of Michèle Lavagna]**

Another approach involves using nets to capture space junk.

**[10:01:46 Michèle Lavagna, Professor in Flight Dynamics, Politecnico di Milano]**

*So, the concept is to mimic what the fishermen do on the sea. And so to have a very large net, to stay away from our debris and our mad satellites that are tumbling and moving freely.*

**[E-Deorbit net animation from:** [**http://www.esa.int/esatv/Videos/2016/11/Ministerial\_2016\_Operations/Animations\_e.DeOrbit\_mission**](http://www.esa.int/esatv/Videos/2016/11/Ministerial_2016_Operations/Animations_e.DeOrbit_mission) **]**

*And then from that distance to keep our net and you just try to wrap all over your satellite.*

**[10:02:08 Space Debris animation from ESA]**

Although e.Deorbit is still in development, ESA scientists will be closely watching a UK mission, RemoveDebris. This will trial the net concept in the coming months using a test satellite launched from the International Space Station.

**[Satellites in orbit animation from ESA]**

In the meantime, the priority is to make sure new satellites don’t add to the problem.

Ideally, at the end of their lives, satellites are either be parked in graveyard orbits or their course adjusted to re-enter the atmosphere…

**[10:02:37 Re-entry of ATV ex** <http://www.esa.int/spaceinvideos/Videos/2015/02/ATV-1_reentry> **]**

This is an ATV supply ship burning apart over a remote area of the Pacific Ocean…but even with planned re-entries like this, tough components in titanium and steel can survive to hit the Earth.

**[10:02:46 Set-up shots Benoit Bonvoisin]**

**[10:02:52 Benoit Bonvoisin, Materials Engineer, ESA]**

[**Includes cutaway animation from ESA to shorten]**

*Déjà on essaie de comprendre qu’est ce qui se passe avec les matériaux actuels, et ensuite on va voir comment on peut les améliorer, et comment on peut travailler au niveau design, au niveau conception du satellite, comment les différents éléments du satellite ils se cassent l’un contre les autres pendant la réentrée pour avoir un satellite qui soit plus sûr en fin de vie pour créer le moins de débris possible qui puissent retourner sur la terre.*

*[Translation:*

*Right now we're trying to understand what happens to the materials we use, and then we'll see how we can improve them, how we can work on the design and conception of the satellite, how the different parts of the satellite break up in relation to each other, in order to have a satellite which is safer at the end of its life and creates the smallest amount of debris on Earth.]*

**[10:03:13 Space debris animation ex-ESA]**

ESA supports and follows international guidelines to reduce space debris but it’s up to all countries to work together to combat the problem…with our increasing reliance on space, dealing with debris is in everyone’s interest.

**[10:03:29 ends]**

**B-roll**

**10:03:29**

Soundbites (English) X3

Luisa Innocenti, Head of Clean Space Office, ESA

**10:05:48**

Soundbites (English)

Jesus Gil Fernandez, Guidance, Navigation and Control Engineer, ESA

**10:07:20**

**Set-up shots demonstrating e.Deorbit with robot and satellite model at ESTEC**

**10:08:33**

Soundbites (English)

Michèle Lavagna, Professor in Flight Dynamics, Politecnico di Milano

**10:09:42**

Set-up shot of Michèle Lavagna

**10:10:18**

Soundbites (French) and cutaways

Benoit Bonvoisin, Materials Engineer, ESA

**10:12:47**

Set-up shots for Benoit Bonvoisin

END 14:05:20