

# Magnetic space tug could target dead satellites

June 20 2017

---



  
2016

Derelict satellites could in future be grappled and removed from key orbits around Earth with a space tug using magnetic forces. Researcher Emilien Fabacher of the Institut Supérieur de l'Aéronautique et de l'Espace, part of the University of Toulouse in France, is studying magnetic grappling as a method of space debris removal, as well as examining the technique's potential for satellite formation flying. Credit: Philippe Ogaki

Derelict satellites could in future be grappled and removed from key orbits around Earth with a space tug using magnetic forces.

This same [magnetic attraction](#) or repulsion is also being considered as a safe method for multiple satellites to maintain close formations in [space](#).

Such satellite swarms are being considered for future astronomy or Earth-observing missions – if their relative positions can stay stable they could act as a single giant telescope.

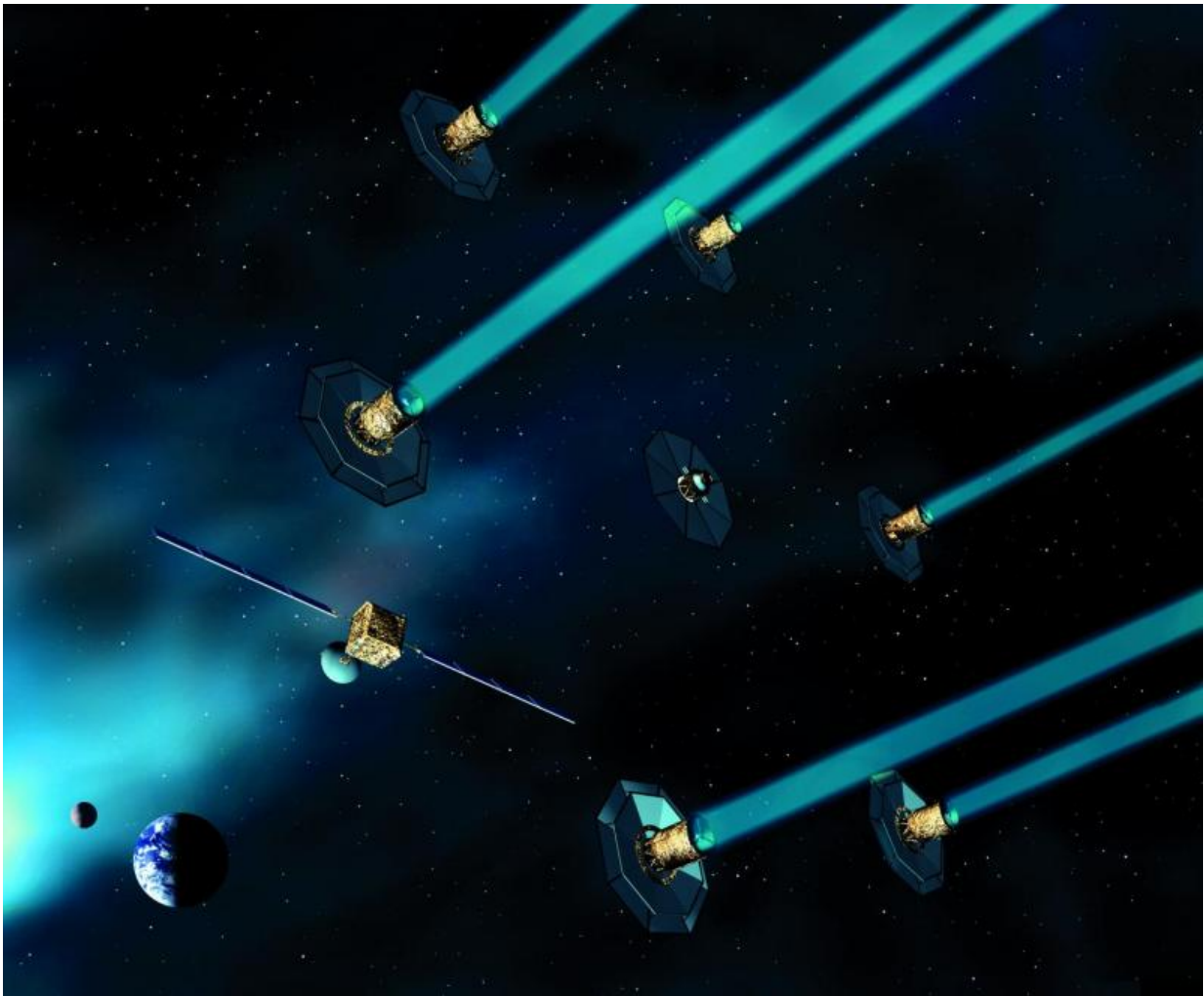
To combat space debris, interest is growing in plucking entire satellites from space. The biggest challenge is to grapple and secure such uncontrolled, rapidly tumbling objects, typically of several tonnes.

Multiple techniques are being investigated, including robotic arms, nets and harpoons.

Now researcher Emilien Fabacher of the Institut Supérieur de l'Aéronautique et de l'Espace, part of the University of Toulouse in France, has added another method to the list: magnetic grappling.

"With a satellite you want to deorbit, it's much better if you can stay at a

safe distance, without needing to come into direct contact and risking damage to both chaser and target satellites," explains Emilien.



Darwin's formation-flying flotilla of six telescopes and communication satellites would have looked at light from space to analyse the atmospheres of Earth-like planets. This proposed ESA mission was to look for faint extrasolar planets. The concept was studied but not pursued. Credit: ESA 2002; Illustration by Medialab

"So the idea I'm investigating is to apply [magnetic forces](#) either to attract

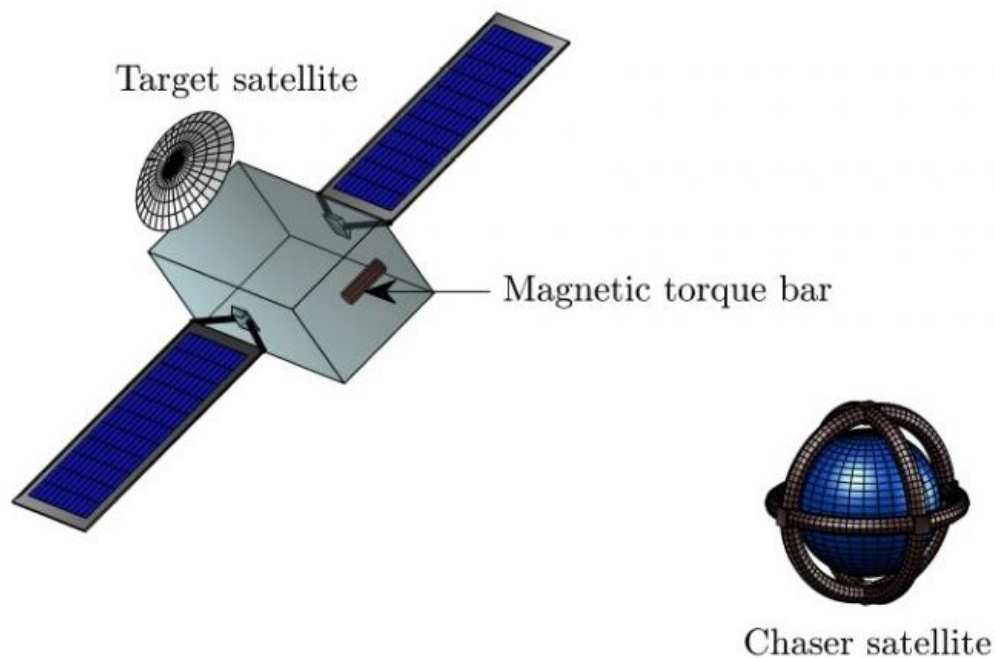
or repel the target satellite, to shift its orbit or deorbit it entirely."

Such target satellites would not need to be specially equipped in advance. Instead, such a tug would influence target satellites using their 'magnetorquers': reliable electromagnets already carried to adjust orientation using Earth's magnetic field.

"These are standard issue aboard many low-orbiting satellites," adds Emilien.

The [strong magnetic field](#) required by the chaser [satellite](#) would be generated using superconducting wires cooled to cryogenic temperatures.

Similarly satellites could also keep multiple satellites flying in precise formation, comments Finn Ankersen, an ESA expert in rendezvous and docking, formation flight.



Derelict satellites could in future be grappled and removed from key orbits around Earth with a space tug using magnetic forces. Such a tug would influence target satellites using their ‘magnetorquers’: reliable electromagnets already carried to adjust orientation using Earth’s magnetic field. Credit: Emilien Fabacher/ISAE-Supaero

"This kind of contactless magnetic influence would work from about 10–15 m out, offering positioning precision within 10 cm with attitude precision 1–2°."

For his PhD research, Emilien has been researching how the resulting guidance, navigation and control techniques would work in practice, combining a rendezvous simulator with magnetic interaction models, while also taking account of the ever-changing state of Earth's own magnetosphere.

His research has been supported through ESA's Networking/Partnering Initiative, which supports work carried out by universities and research institutes on advanced technologies with potential space applications. Emilien also visited ESA's technical centre in the Netherlands, to consult with Agency experts.

Emilien recalls that the concept originally came out of discussion with ESA experts, and he was lucky enough to be in the right place at the right time to explore its feasibility: "The first surprise was that it was indeed possible, theoretically – initially we couldn't be sure, but it turns out that the physics works fine."

Provided by European Space Agency

Citation: Magnetic space tug could target dead satellites (2017, June 20) retrieved 23 April 2024 from <https://phys.org/news/2017-06-magnetic-space-dead-satellites.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.