



Space, the rules change: the Italian engine that pushes without exhaust fluid

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Traveling in space without a single drop of propellant. Until yesterday, it would have seemed like a science fiction theme. Today, however, in a laboratory a few steps from Lake Como, it is already an engineering reality: Genergo, an Italian deep-tech company based in the Como area, has designed and developed an electromagnetic space propulsion system without propellant, already successfully tested in orbit and protected by numerous international patents.

The company has developed a device capable of directly transforming electrical energy into thrust through controlled electromagnetic pulses. No gas to expel, no nozzle, no fuel tank: only electricity that becomes propulsion. A solution that goes beyond traditional electric-ion engines, long used on various space missions, and aims to redesign the way satellites move and maneuver in orbit.

Three space missions and over 700 hours in orbit

The new system was developed by Genergo and brought into orbit aboard the ION Satellite Carrier satellites of D-Orbit, another company from the Como area specializing in platforms for the transport and release of small satellites. The tests were conducted as part of SpaceX's rideshare missions, launched with the Falcon 9 rocket in the Transporter-5, Transporter-6, and Transporter-9 campaigns.

In these three missions, still operational, the propulsion system has exceeded 700 hours of operation in orbit, demonstrating a good level of technological maturity and reliability. For a technology that so radically breaks with the classic paradigms of space propulsion, the ability to validate its operation directly in the real scenario – space – is an essential step.

Controlled de-orbiting and Space sustainability

But what will a space engine without propellant be concretely used for?

«Genergo's vision is to make mobility in space safer, more sustainable, and reusable» explains Gabriele Zerbi, CEO of Genergo. «The first commercial use of the technology will initially be aimed at controlled de-orbiting activities, that is, the process of lowering the orbit of a satellite or a space object to guide its re-entry into the Earth's atmosphere and cause its destruction at the end of the mission».

A key piece in the fight against the problem of space debris: thousands of satellites and fragments orbit around the Earth, and having compact, reusable, and low-risk systems to bring them back into the atmosphere is one of the central objectives of space agencies and private operators.

The technology, Zerbi emphasizes, is not limited to end-of-life: «It is suitable for all types of satellites, subject to adequate characterization and engineering».

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Eliminating tanks, risks, and toxic materials

Today, satellites with propulsion must carry propellant to perform orbital maneuvers, maintain position, correct attitude, and sometimes re-enter the atmosphere. This involves a series of limits and complexities.

«Propellant occupies volume and adds mass, often increased by the hardware necessary to manage it – recalls Zerbi –: tanks, control valves, supply lines. It introduces operational risks, such as leaks or explosions, and is still a limited resource».

Genergo's system, on the other hand, focuses on intrinsic sustainability:

- no polluting or toxic materials;
- no pressurized components to store;
- no risk of contamination of the space environment or in case of atmospheric re-entry.

An architecture that promises to simplify satellite design, freeing up space and mass for payloads and scientific instruments, while simultaneously reducing operational risks.

From bench testing to missions with SpaceX

Reaching orbit, however, was not easy at all.

«The technology required numerous complex challenges» says Zerbi. «The first was to pass the bench test certification at the Politecnico di Milano».

Once the laboratory phase was overcome, the system was subjected to microgravity tests and a rigorous qualification process. «We designed and built from scratch a completely new propulsion system, which passed all the space qualification and acceptance tests required by SpaceX and D-Orbit on the first attempt. All this was achieved in just nine months».

A remarkable result, considering the high standards required to access commercial launches and operate on satellite platforms that must guarantee reliability for years.

«A significant result – continues Zerbi – was to find that the system operated at 100% after each launch, continuing to function correctly even years later. However, the greatest challenge was adapting our propellant-free technology to a real satellite and the ability to achieve repeatable results in space. A goal that, as far as we know, no one had managed to achieve before us».

Towards the highest level of technological maturity

The path now aims to consolidate and industrialize the technology. «We plan to expand the company and launch new space missions for further characterization and engineering of the technology» announces the CEO.

The declared goal is to reach the ninth level of technological maturity (TRL 9), the highest level: to achieve it, more successful missions are needed in which the system is used in real operational conditions and works as expected, repeatedly. Only then does the technology cease to be considered experimental and can be adopted on a large scale.

An Italian-made project, from research to orbit

The new propulsion system is entirely made in Italy. Genergo collaborated with the Department of Electronics, Information and Bioengineering of the Politecnico di Milano for bench measurement tests in the laboratory, and with the Department of Aerospace Science and Technology of the same university, which created the physical model of the satellite used for in-orbit analyses of the first mission and drafted the report on the electromagnetic emissions of the engine in the preliminary qualification phases.

From simulation to laboratory, from bench testing to Falcon 9, Genergo's story shows how an Italian deep-tech company can play a leading role in one of the most complex challenges of New Space: moving in space consuming fewer resources, reducing risks, and paving the way for truly sustainable orbital mobility.

News link: <https://www.excellencemagazine.luxury/genergo-presenta-un-sistema-innovativo-di-propulsione-spaziale/?lang=it>