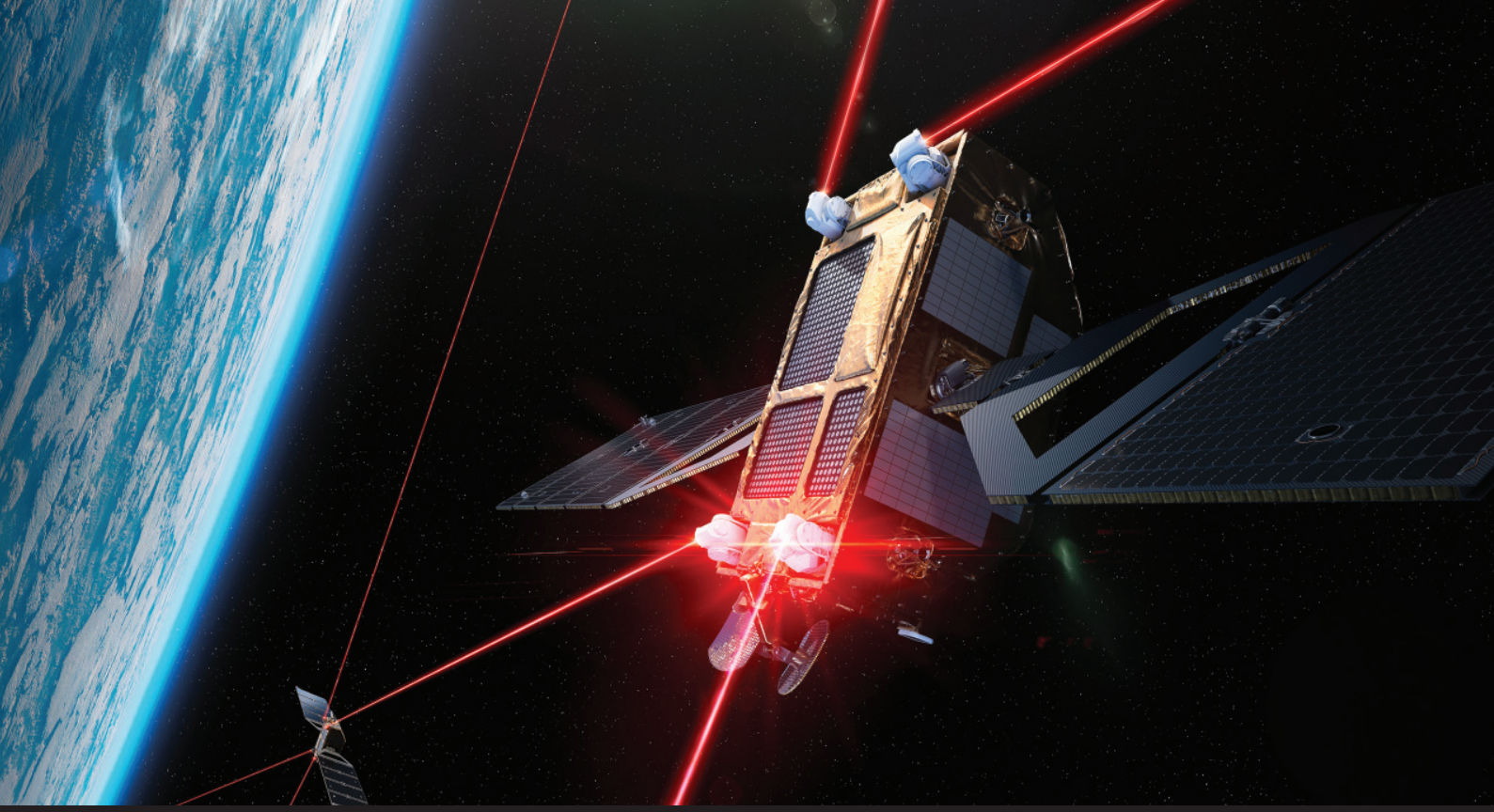


Artist's rendition of the UN:IO concept. Photo courtesy Mynaric & the UN:IO consortium

What the new UN:IO 400 laser constellation has learned from satellite fleets of the past

The recently announced European UN:IO 400 constellation claims it will serve as a powerful sovereign communications network for Europe by making use of dynamic optical technologies to laser-link its satellites together to reach newfound throughput. The news comes at a time when constellation strategy is being carefully interrogated for feasibility and the work of NewSpace pioneers is now informing newcomers.

By Laurence Russell, Assistant Editor, Satellite Evolution Group

In December of 2021, the 14 UN:IO consortium members, led by satellite manufacturer Reflex Aerospace, launch provider Isar Aerospace, and laser specialist Mynaric, began work on their euro1.4 million feasibility study. Prompted by the European Commission to create a sovereign communications network for Europe by 2025, the effort marks the first phase of the constellation which will eventually consist of over 400 laser-linked satellites and their associated ground stations, serving commercial and municipal channels. The constellation aims to enable superfast all-domain autonomous mobility, with special provision for defence and humanitarian operations.

Besides planning the operation, the feasibility study will also assess how UN:IO will meet the sustainability criteria of the EU's "Green Deal" plan and ensure an infrastructure that will be capable of serving well into our distant future, including preparation for emerging technologies such as quantum encryption. A demonstrator package is expected to begin operating in space as early as 2023.

We reached out to Walter Ballheimer, Managing Director of Reflex Aerospace, and a prominent member of the consortium, to discuss the project.

"Everyone in the consortium contributes their technology to UN:IO on a zero-profit arrangement because we understand that this constellation will generate revenue holistically," he explains. "We don't make our money out of invoicing the project for parts and services when it's an investment we all stand to benefit from."

CONSTELLATION STRATEGY: QUALITY OR QUANTITY?

UN:IO's model was constructed on the wisdom of the past. "Some of these business cases seek the cheapest, lowest-tech solutions, which possess few applications and short lifespans," notes Ballheimer. "In these cases, simpler satellites often require more complicated user terminals to pick up the slack, so the costs just fall to the user. These kinds of fleets usually scale with more and more units in an environment where quantity over quality creates more problems than it solves."

Walter Ballheimer, Managing Director of Reflex Aerospace

"I believe constellations can't be commercially sustainable if they're not penetrating a broad range of different markets," Ballheimer continues. "They need to serve mobile users, transportation players, enterprises, and defence assets. They must be able to adapt well at this crucial juncture of the space economy, because one-trick ponies won't last."

UN:IO doesn't only plan for modularity, it also aims to launch with future-proof technology. "Planning ahead is also crucial," Ballheimer states. "The inertia involved with bleeding-edge technology, like that in space, means providers must plan around the economy five years ahead of them." Suitably, the constellation is experimenting with obscure wavelengths like QB and W-bands, which aren't in express use today due to technological gaps. UN:IO, however, is betting those gaps will close by the time their satellites orbit. "It's certainly a gamble," Ballheimer conceded, "but a well-reasoned one, and when it pays off, we'll be sitting at the cutting-edge."

We also spoke with Paul Febvre, CTO of Satellite Applications Catapult Ltd, to obtain his impression of the modular satellite strategy. "In hardware terms, one size does not fit all. A one-stop-shop offering could be undercut by specialists who corner the market on which they focus," he cautions.

Whatever the case, at present the NewSpace economy remains a loosely understood one compared to traditional industries where great displays of business confidence can gain a lot of financial ground without concrete assurances. As many can attest, making money in the short term describes the economics of failure. Strong industries must be fiercely future-focused, not mere castles built upon sand.

SPACE SUSTAINABILITY BY DESIGN

UN:IO also intends to take orbital sustainability seriously by committing to cleaning up after itself through the disposal of its satellites. "We all must aim to leave no trace of our orbits in this market," Ballheimer notes. "When a

piece of our industry breaks, it's our responsibility to deal with it."

Febvre agrees. "Orbital sustainability is as much a selfish consideration as a critical concept," he adds. "This industry won't exist in an ecosystem we pollute. With a shared resource such as this, coexistence is a logical necessity."

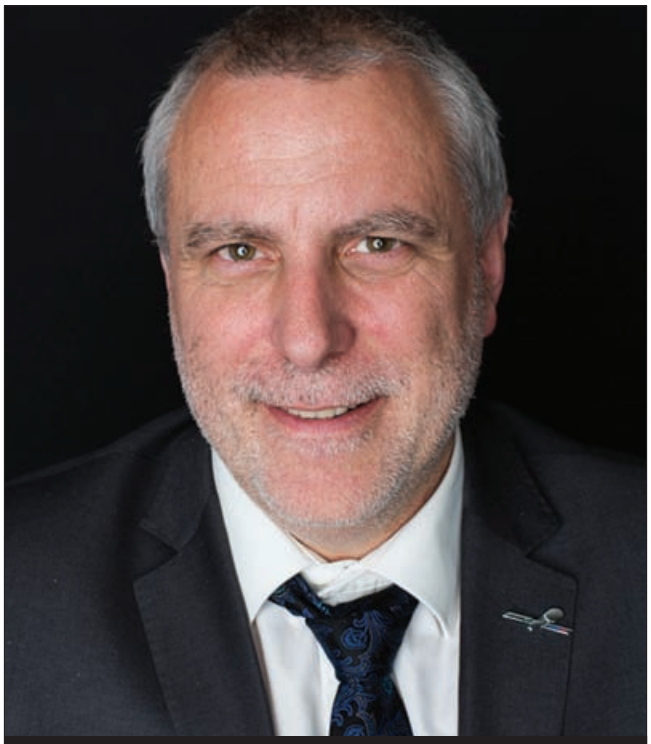
Each satellite of the UN:IO constellation is equipped with a passive de-orbiting sail which triggers automatically at the conclusion of the satellite's operational lifespan. The constellation even boasts a plan B by way of onboard propulsion systems but claims its sail has proven reliable enough not to require redundancies.

"We haven't been looking to cut our costs by neglecting sustainability," Ballheimer says. "We aim for 100 percent reliability and real efficiencies that stand the test of time."

Ballheimer goes on to explain that UN:IO will not be relying on what optimistic spokespeople of the orbital servicing market have promised. "As fascinating as it is, the servicing market we're seeing is more expensive than it's worth when the alternative is a simple, automated de-orbiting system."

Like most people, Ballheimer strongly advocates for a global regulatory standard when it comes to orbital sustainability like the one France has introduced at a national level. "This forces companies to play fair with orbital sustainability," he contends.

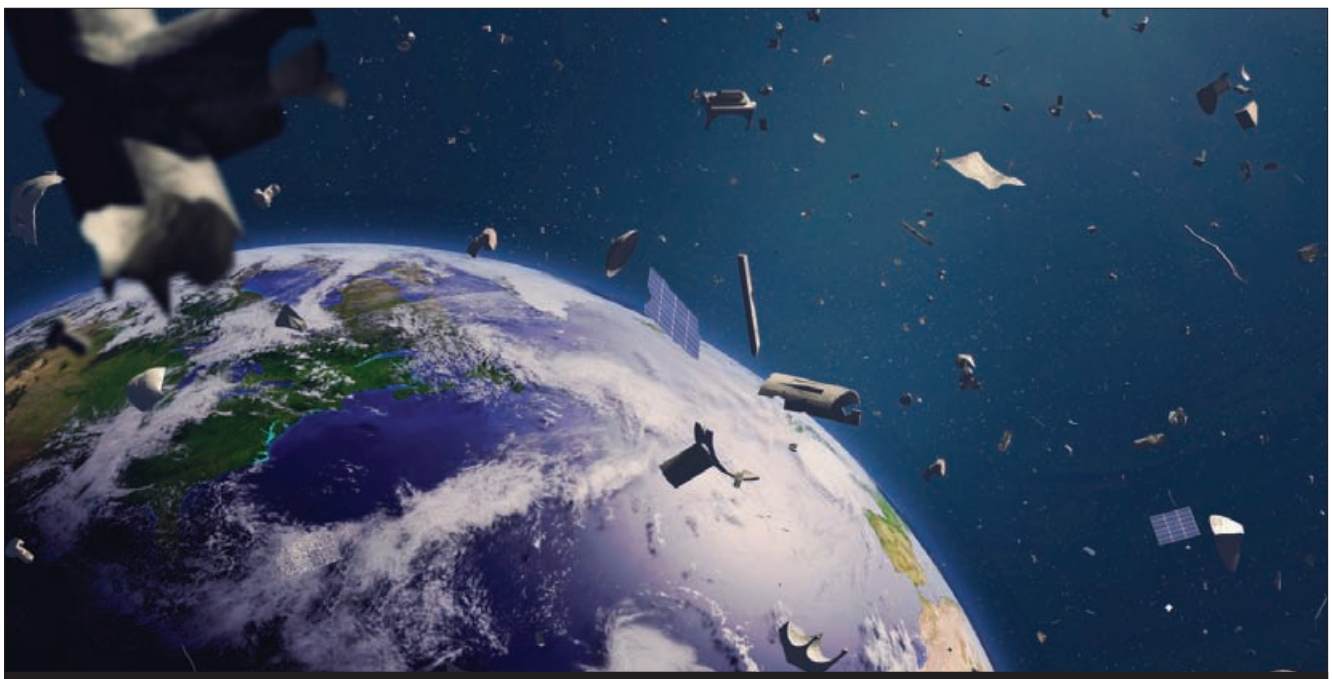
Openly pessimistic about international cooperation, Ballheimer favours the method of taxing a satellite's use of an orbit, meaning a company must continue paying for what is left in space. This, in turn, goes toward paying for the de-orbiting of the derelicts of bankrupt entities and Space Race era junk. As he acknowledges, such regulation is not commonly seen in the modern world, where international disputes seem to pepper our news on a weekly basis, and competition serves as the primary force of change in global economics.



Paul Febvre, CTO of Satellite Applications Catapult Ltd ●●●

"The space debris problem is a lot like dwindling bee populations," Ballheimer suggests. "To a layperson, it looks like an arbitrary issue, but if worse comes to worst, it represents an existential threat to mankind. Ecosystems can't exist without pollinators, and satellites can't function in a high-debris environment," he insists. "In both cases, unfortunately, it seems something needs to go very, very wrong for everyone to start recognizing the seriousness of the matter."

Even if half of what UN:IO promises is proven in practice, it could represent a solid alternative to common satellite constellation strategies with the potential to seriously influence the way we approach space in the 2020s. ●



Space debris. Photo courtesy Dotted Yeti/Shutterstock ●●●

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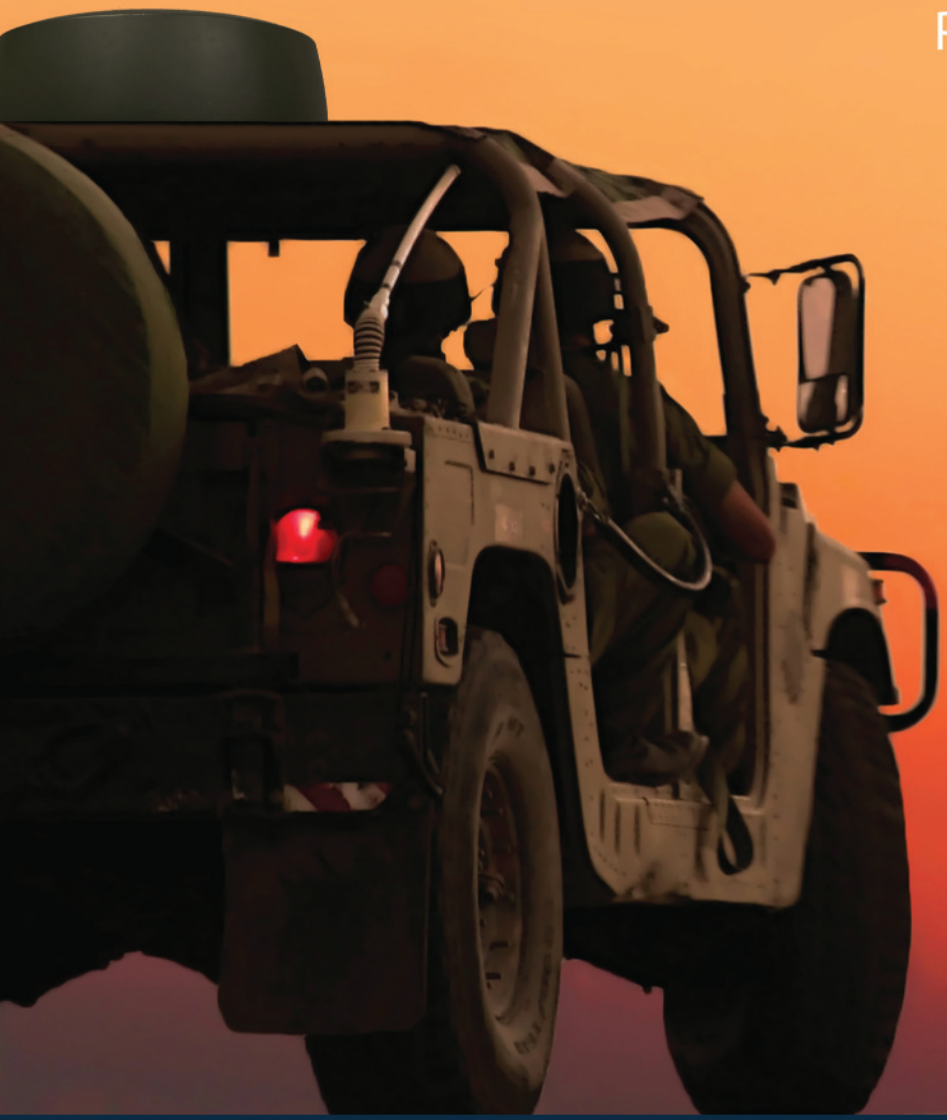

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