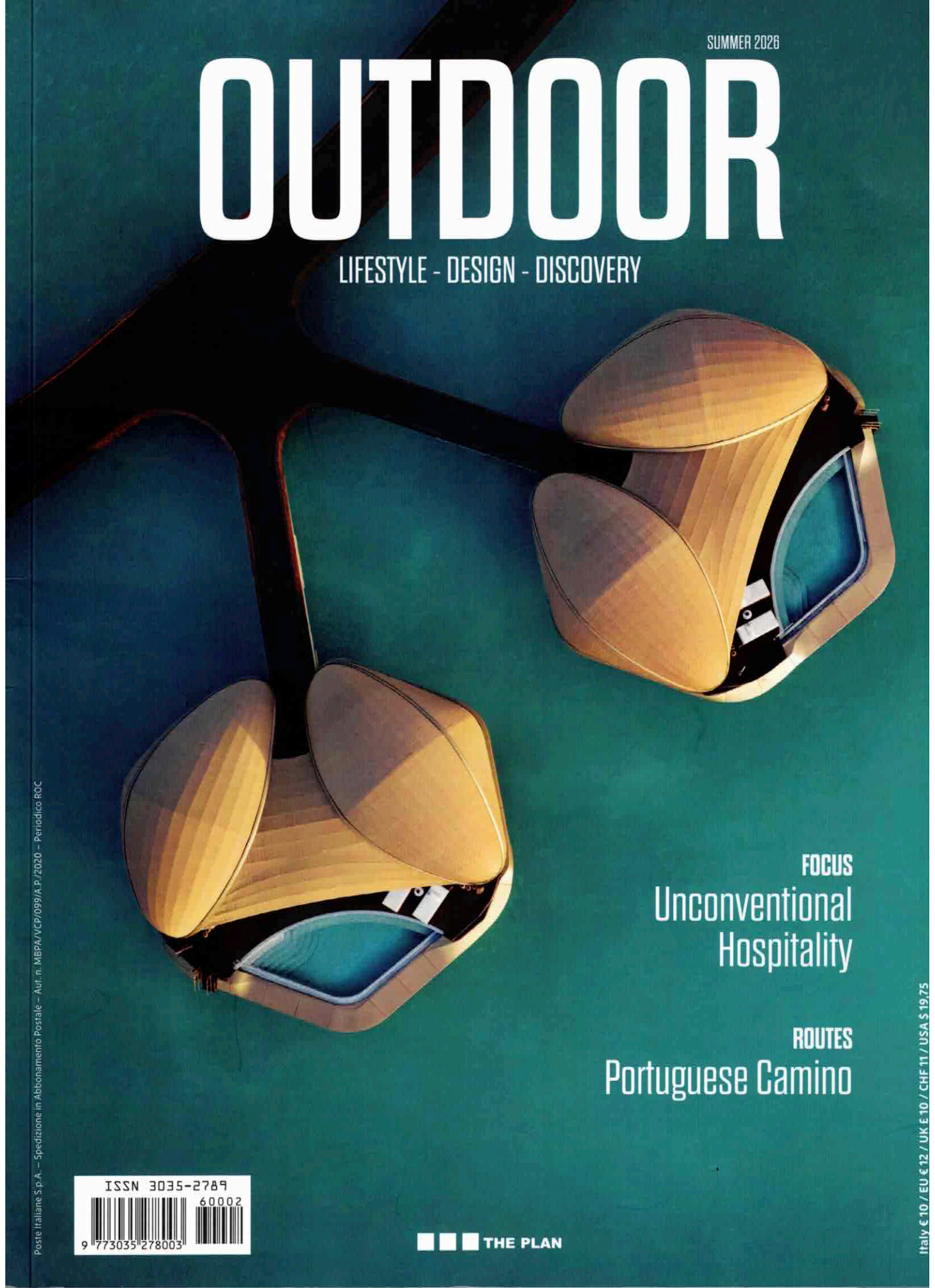
SUMMER 2026

OUTDOOR

LIFESTYLE - DESIGN - DISCOVERY



FOCUS

Unconventional Hospitality

ROUTES

Portuguese Camino

ISSN 3035-2789

THE PLAN

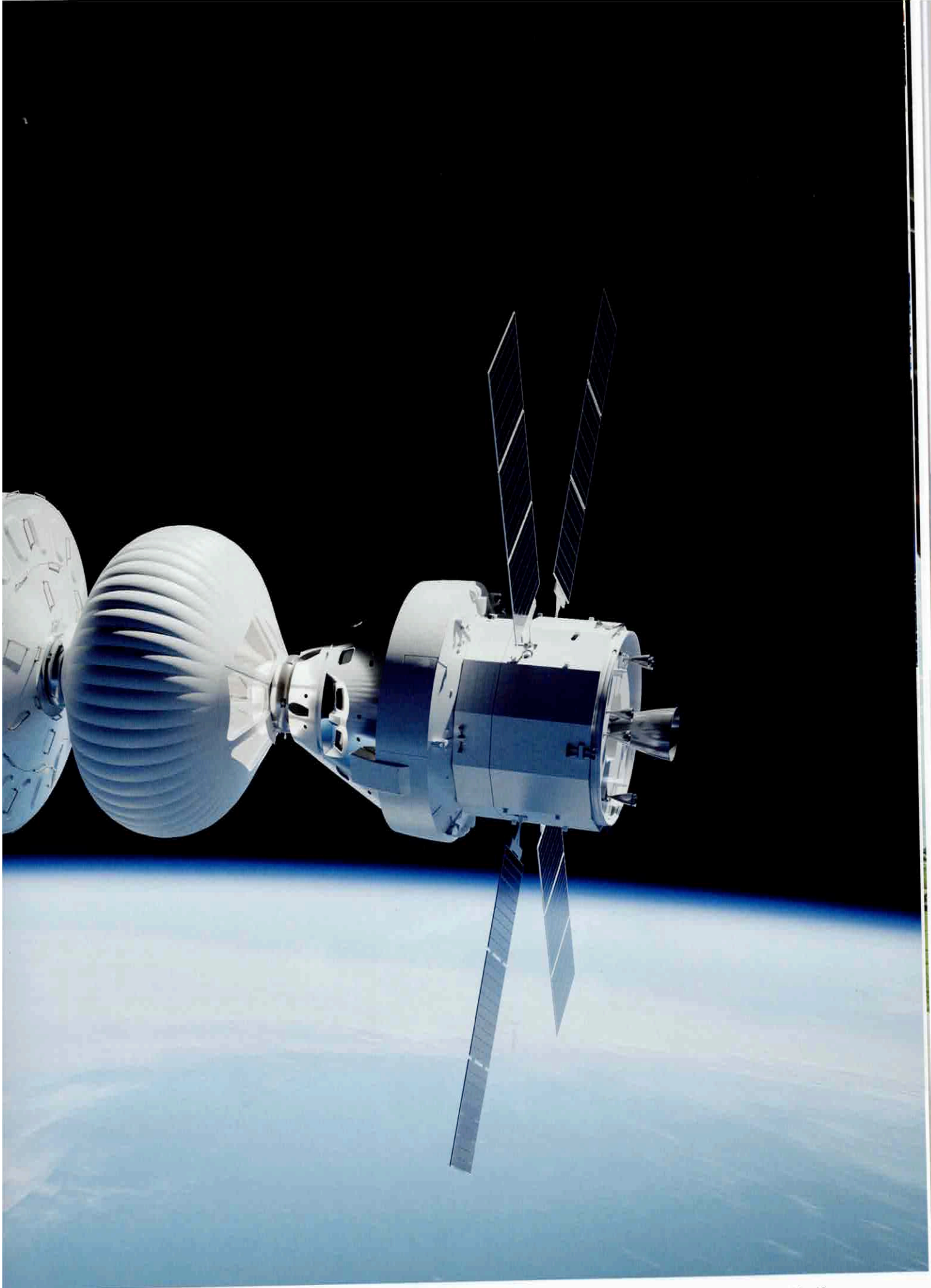
Poste Italiane S.p.A. – Spedizione in Abbonamento Postale – Aut. n. MBPA/VCP/099/A.P./2020 – Periodico ROC

Italy € 10 / EU € 12 / UK £ 10 / CHF 11 / USA $ 19,75

Space Architecture

Living in extreme environments

Nicolò Zennaro



Exterior rendering of Airbus LOOP, a multifunctional orbital module for a new space station. © Liquifer

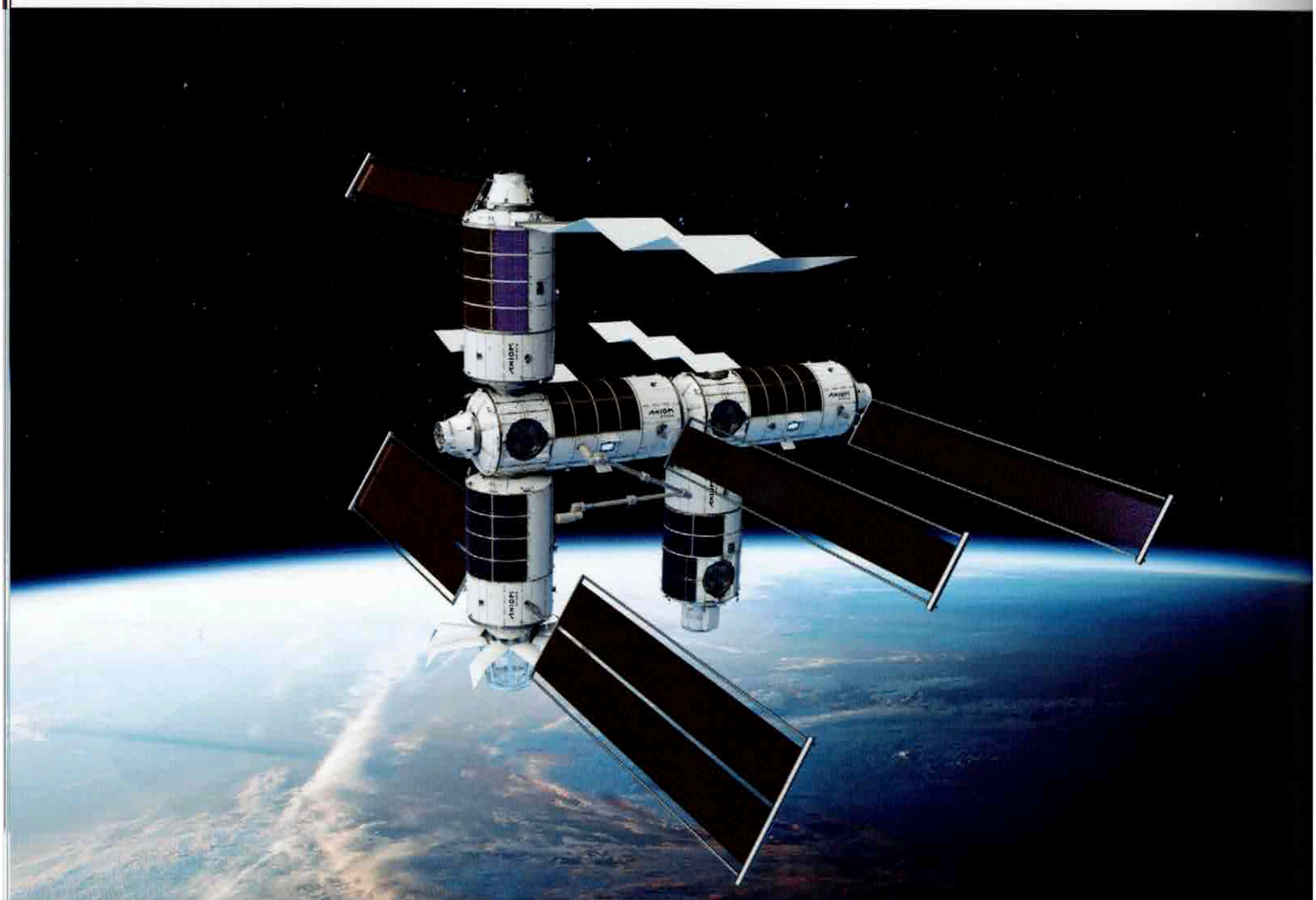
For many decades, film and literature have envisioned space as a man-made extension of Earth beyond the atmosphere. We have seen the elegant orbital station in *2001: A Space Odyssey*, Kim Stanley Robinson's geodesic domes on Mars, Asimov's Foundation, and the orbital architectures of *The Expanse*.

These narratives portray the void as a livable place where humanity thrives and expands as naturally as, in the past, voyagers crossed oceans and continents. And yet the physical reality of space is so radically different. A hostile environment, it lacks atmosphere and pressure, suffers extreme temperature swings, cosmic and solar radiation, orbital debris, and micrometeoroids in constant motion. Where science fiction imagines crowded, welcoming spaces, science fact reveals a merciless realm incompatible with human survival without full-spectrum technological mediation.

Space Architecture occupies the dichotomy and gap between imagination and physical reality. In space, architecture provides the essential shell that separates the outer void from inner life, leveraging technical solutions such as radiation shielding, environmental control within pressurized spaces, and integrated life-support systems. Architectural and design solutions cater to a crew's psychological needs, comfort and well-being, including the provision of social areas to maintain visual links with the outside. Despite the extreme conditions, the central theme of Space Architecture is, ultimately, hospitality. What was science fiction for many decades is now an established reality. The International Space Station (ISS) has accommodated orbiting humans continuously for over 25 years. Planned to cease operations in 2030, a new phase is coming into view: private initiatives are running alongside governmental efforts, redefining orbital habitats in terms of access and collaborative management.

One example of this transitional phase is **Axiom Station**, a project developed by Axiom Space and initially conceived as an extension for the ISS before becoming a standalone facility. As well as constructing orbital habitats, Axiom Space also trains commercial crews to conduct scientific research in microgravity conditions, pursuing goals set by governments, space agencies, and research institutions. Architecturally, the station is a modular design that exploits launch vehicle payload restrictions as a design opportunity. Every module is conceived as an independent, connectable unit, allowing for gradual in-orbit assembly and expansion through third-party components. **The station is not a finished object but an open platform capable of accommodating a range of functions**

Axiom Station. Composition combining architectural renderings with real Earth observation images captured by Marcus Wandt during the Ax3 mission. © Axiom Space



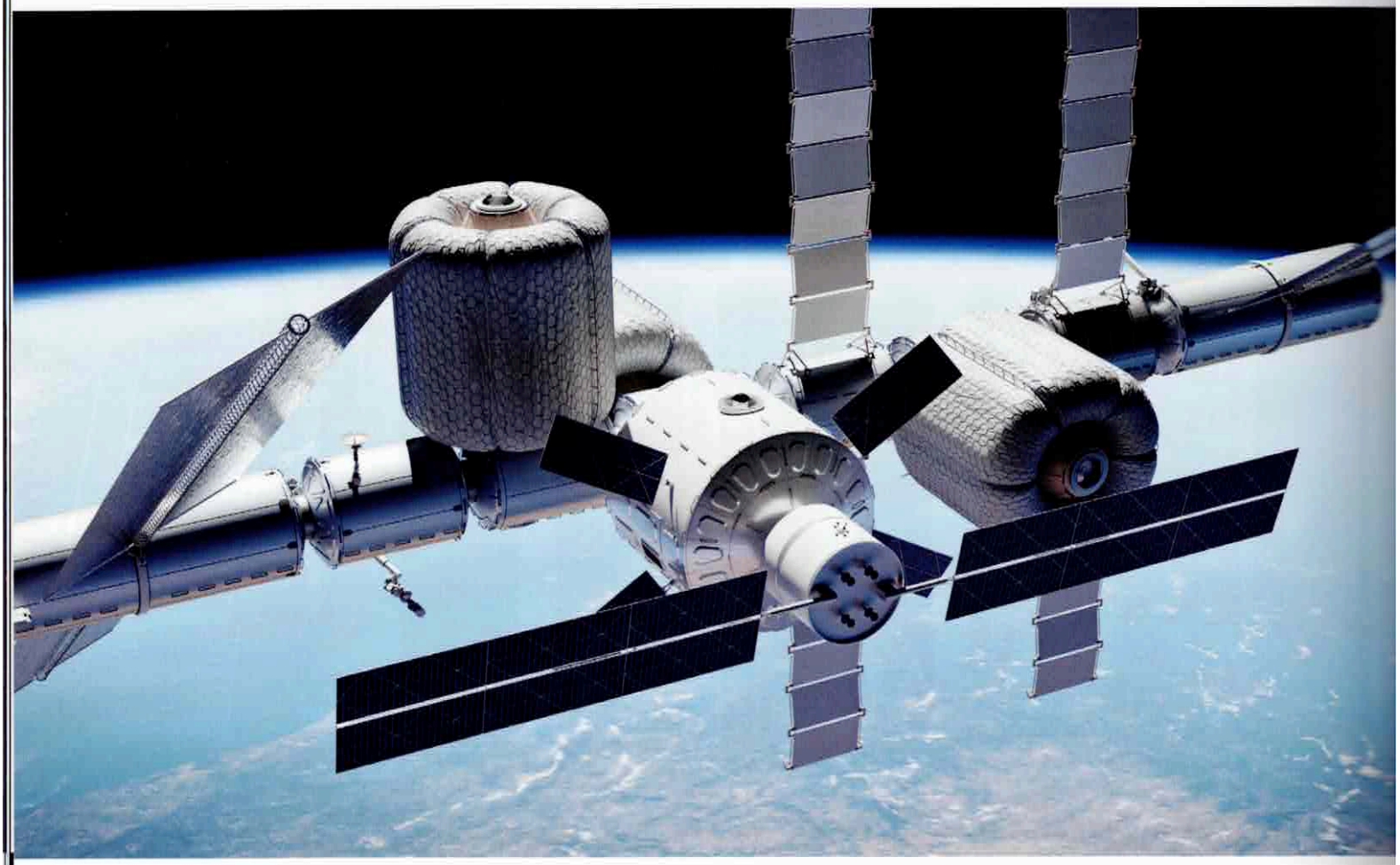
Structural components of the pressurized shell for the Axiom Station's Hab One (AxH1) module, prepared for welding operations at the Thales Alenia Space facility in Turin, Italy. © Axiom Space

As well as being a space operator, Axiom Space is a provider of cutting-edge infrastructure, extending opportunities to occupy, lease, and customize sections of the station to third-party partners.

Moving on to specifics, the private cabins in the habitation modules each have their own panoramic window, space for rest and daily life, and areas dedicated to scientific research and operational activities. While preserving visual connections with the outside via large windows, special attention was lavished on designing privacy and functional separation.

The interior embodies a truly significant departure from aerospace tradition, adopting a distinctly human-centered approach rather than a purely functionalist esthetic. In zero gravity, ideas like floor and ceiling lose all meaning. This space was therefore reimagined as a continuous, soft, enveloping volume. Padded surfaces, tactile materials, and fluid geometries address the specifics of safety and psychological well-being, transforming the orbital habitat from a hostile environment into a livable place. Storage systems are concealed behind modular walls, removing the visual clutter typical of the ISS. Lighting plays a key role in shaping the crew experience: dynamic systems reproduce Earth's circadian cycle, offsetting the 16 daily sunrises and sunsets characteristic of low-Earth orbit. Color and light intensity are tools for orientation, well-being, and the perception of time – all key elements within confined environments that lack natural points of reference.

Axiom Station will also feature an eight-person panoramic dome, the Earth Observatory, offering 360-degree views of the planet. This presented an intricate engineering challenge: the glazing must combine visibility and safety, withstand internal pressure caused by the vacuum of space, and at the same time protect against micrometeoroids and orbital debris.



Airbus LOOP. Design: Airbus DS, Liquifer. Exterior view of the space station concept. © Liquifer

Designed by Liquifer for Airbus Defence and Space, **Airbus LOOP** is a visionary concept for an orbital module and a new entrant to this evolving landscape. Liquifer's co-founders Barbara Imhof and René Waclavicek explain that their end-goal is not only to create a laboratory but **turn a "machine" into a place where human beings truly thrive**, applying the principles of hospitality and forward-thinking design to extreme environments.

Eight meters in diameter, the LOOP interior is unlike anything in a traditional space module. Designed to launch as a single unit aboard new heavy-lift rockets, it eliminates requirements for complex, in-orbit assembly. A rigid outer shell ensures protection against external hazards, allowing for the installation of windows, airlocks, docking hatches for visiting vehicles, and robotic interfaces. Conceived for a crew of four (and able to host up to eight on a temporary basis), all critical systems, from thermal control to life support and communications, are integrated into the structure.

And yet, as Imhof points out, the dimensions and technology do not tell the whole story. The design is all about anticipating the needs of daily life. Who is going to live here? What will their routine look like? Where will they keep their personal belongings? These may seem like simple questions, but in orbit they are pivotal design challenges.

To cater to these needs, LOOP is arranged over three distinct levels, linked by a central tunnel surrounded by a greenhouse. The living deck houses crew quarters and workout areas. The science deck is equipped with airlocks, payload space, and a rack system. A centrifuge simulates gravity to counter the effects of microgravity on the human body. The crew quarters play a special role within this structure. Far more than simple bedrooms, Waclavicek describes them as a shelter, workstation, storage space, and privacy zone: the specific needs of each activity are catered for. Sleeping or changing clothes calls for complete privacy. When working at a computer, someone might want visual contact with colleagues, but during family calls, acoustic isolation is essential. In an environment shared with strangers, a personal cabin is much like a truck driver's cab: the one, truly private space.

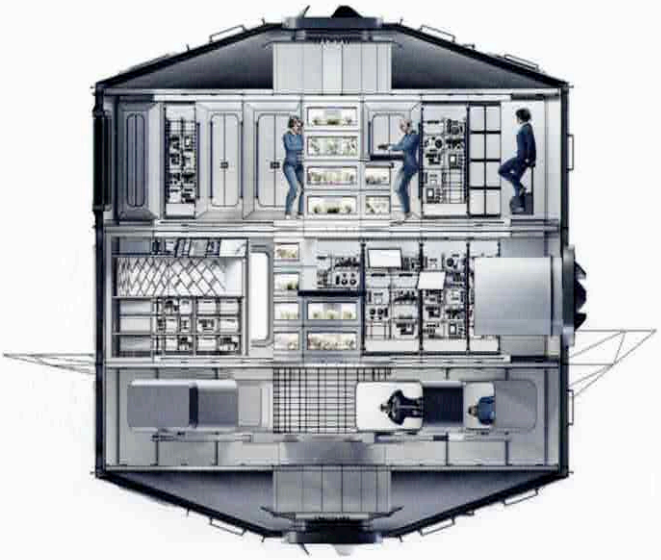
This human-centered approach extends to technical choices that may seem minor but, in orbit, are critical. Ventilation is a prime example. No natural convection occurs in microgravity; air has to be kept moving at all times to prevent buildup of potentially fatal pockets of CO_2.

Astronauts are trained to notice airflow, because it is a reassuring sign that the life-support systems are functioning as they should. A constant draft, something that on Earth would be undesirable, is vital to survival in space.

Lighting follows the same logic. Synchronizing color temperatures to circadian rhythms (cool light during working hours, warmer hues toward the end of the cycle) improves the crew's physical and psychological well-being without any extra mass. Lighting is an exceptionally efficient solution in an environment where every payload kilogram must be justified: it adds no weight, requires no structural alterations, and yet it redefines the identity of a space and the quality of life within.

The prospect of living in space is no longer science fiction; space architecture is turning it into applied engineering. Projects like Axiom Station and Airbus LOOP are concrete proof of this: as well as orbital laboratories, they are environments conceived to embrace human beings holistically, encompassing and catering to all physical, psychological, and social needs. Scientists, engineers, architects, and designers work together every day, pooling their efforts to understand how people are able to live in a place where life itself is not present. This experience, which cannot be replicated on Earth, underpins this achievement, supported by systems, materials, and technical solutions.

Barbara Imhof and René Waclavicek characterize the experience as floating within a panoramic dome, the Earth slowly rotating below, the absolute black of space stretching all around. It is in such moments, made of light, silence, and microgravity, that space-based hospitality reveals its most unique quality.



Vertical section showing the internal layout. © Liquifer

View of the interior spaces. © Liquifer