



Prismatic's PHASA-35, a high-altitude, long-endurance stratospheric UAS, is a fixed-wing aircraft with a 35-metre wingspan and a payload capacity of up to 15 kg. Its first stratospheric flight in 2023, reached an altitude of 66,386 feet and remained airborne for over 24 hours *PRISMATIC LTD*

A new frontier for aviation

Higher Airspace Operations opens new doors

Higher Airspace Operations (HAO) represent a new frontier for aviation that can provide significant societal benefits. For example, natural disasters can cause substantial damage to terrestrial telecommunications infrastructure, recovery can take weeks to months. However, in the case of critical communications infrastructure, users need service restored immediately. High Altitude Platform Systems (HAPS) can operate as part of a larger Non-Terrestrial Network (NTN) forming the critical near-space layer complementing terrestrial and Low Earth Orbit (LEO) and Geostationary Earth Orbit (GEO) constellations. HAO happens above the weather and airborne resources can be moved at will, enabling flexibility in the coverage area and providing network resilience.

Looking ahead at airspace access challenges

Demand for airspace access is expected to grow significantly in the next decade. The mix of aircraft types, performance characteristics and operational missions will be significant. This diverse collection of operations will present significant challenges to the systems and procedures used for traffic management as the operational scale increases and the diversity of vehicle performance grows.

Over the next twenty years, higher altitude operations will be a mix of civil and state aircraft conducting unmanned operations world-wide. These operations will have a diverse set of characteristics related to location and density of operations. The emergence of civil supersonic aircraft, combined with operations involving high-altitude balloons and ultra-long duration aircraft will add another dimension of diversity, namely vehicle performance. These unmanned and autonomous craft include lighter-than-air and fixed-wing aircraft that are hydrogen fueled or solar powered, as well as an evolving series of craft that do not fall neatly into one of those categories but combine aspects of both. They are safe, and environmentally friendly, floating above traditional passenger traffic and above traditional weather. However, they fly slowly and may have limited agility. Taken as a whole, this environment presents a challenge to safe and equitable management of air traffic, as well as a unique opportunity to gain experience on how managed autonomy can be adapted to greater aviation needs.

Activities are underway in regions across the globe with states developing their own approach to operations in higher altitude airspace. To effectively realise the economic and societal benefit of these operations, the stratospheric community needs a



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globally recognised concept of operations and an agreed approach to safety. The HAPS community is collaborating through the HAPS Alliance, and other mechanisms, to provide such a cohesive vision by working with key regulators as together they define an achievable concept of operations (CONOPS) that allows for full utility of today's autonomous aviation capabilities.

The HAPS Alliance

The HAPS Alliance's primary aim is the continuous improvement of aviation safety. HAPS vehicles are driven by automation performing fleet management and providing machine-to-machine communication enabling collaborative conflict detection and resolution based on commonly agreed "rules of the road". This very low-density environment provides an ideal environment for the aviation community to evolve new concepts of collaborative traffic management and understand the balance in human/machine teaming all while evolving the way we assess, measure, and mitigate risk.

In furtherance of these goals, the Alliance proposes a globally harmonised, cross-border, and integrated approach to HAO Traffic Management. This international vision for HAO, addresses the diverse needs of stakeholders across the globe including states, Air Navigation Service Providers (ANSPs), defence, industry, and new entrants. Solutions are capable of delivering global coverage and consistent capabilities, easily deployable to any world region without excessive delays or state-by-state duplication of investment.

Moving towards implementation

We envision an airspace structure and CONOPS that builds upon the FAA's Upper Class E Airspace Traffic Management (ETM) and EUROCONTROL's European Concept for Higher Airspace Operation (ECHO), while explicitly considering state sovereignty and national security. It introduces a standardised concept of "Cooperative Zones" (CZs) where operators cooperatively manage their operations. This federated architecture ensures system resiliency and allows for flexible and

scalable solutions to accommodate the diverse needs of HAO operations, including atypical intents, varying aircraft performance, and nuanced constraints.

The proposal also includes an interoperable framework of state-authorised Cooperative Zone publishing services supported by digital authentication, authorisation management, and authorisation verification. Also included are recommendations for a resilient and secure distributed architecture for safe and efficient integration of HAO into the global airspace.

Concepts introduced by the proposal have been recently evaluated in the NASA Ames Research Center Collaborative Environment (CE-1) simulation campaign successfully conducted in the summer of 2024. This test campaign demonstrated aspects of our proposed architecture as well as procedures and information exchange requirements for sharing vehicle telemetry and operational intent data for HAO. Future collaborative evaluations are planned to include a discovery and synchronisation service for HAO to enable shared situation awareness.

The HAPS community is global and diverse. The commonalities, however, offer an exclusive opportunity to reshape aviation's future, to design fully collaborative airspace in a new way, using higher levels of automation. The principles advocated allow regulators and operators to evaluate this approach in a low-density, lower-risk environment and rapidly adjust best practices from lessons learned.

HAPS Alliance

HIGH ALTITUDE PLATFORM STATION



The mission of the HAPS Alliance is to unlock the stratosphere to enhance connectivity and sensing services for civilian and government applications globally.

Since 2021, SCEYE has been achieving industry firsts related to internet connectivity from the stratosphere, high resolution mapping and renewable energy *SCEYE*

