HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

Unlocking the Potential of the Stratosphere

2024

Each Layer Has Its Own Value Proposition

EARTH SURFACE

LOW ATMOSPHERE

STRATOSPHERE 20 KM

LOW EARTH ORBIT 500+ KM

MEDIUM EARTH ORBIT 2,000 – 35,000 KM

GEOSTATIONARY 35,786 KM

TERRESTRIAL & PLANES

- Limited Scale
- High Capacity
- High OpEx
- Local Coverage

HAPS

- Flexible
- Scalable
- Cost effective
- Wide coverage
- Direct to cellphone

SATELLITES

- Limited Flexibility
- High CapEx
- Global and persistent coverage

Enabling a Wide Range of Applications

Connectivity

HAPS can close the digital divide and connect under-connected and unconnected areas

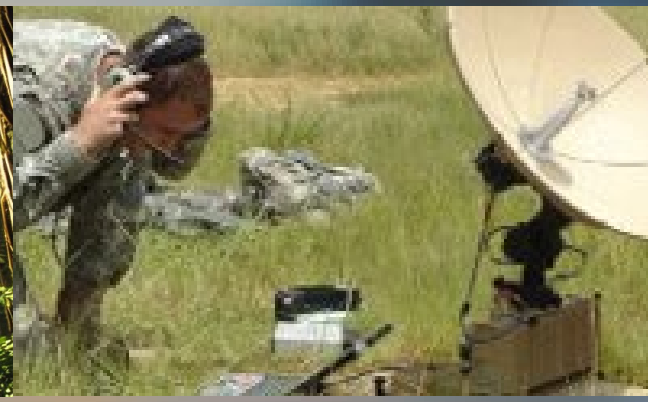
Disaster Response

In an emergency situation, HAPS can be retasked on short notice to assess damage, restore infrastructure connectivity, and direct assistance to those in need faster.

Earth Observation

HAPS enable real-time monitoring with high resolution images and sensors for wildfire monitoring, atmospheric testing, and crop health assessment.

Defense



*HAPS provides persistent intelligence, surveillance, and reconnaissance, and long-range communications for operations in austere environments or for border protection.

*The HAPS Alliance supports the promotion of HAPS capabilities within defense sectors but acknowledges that defense applications are unsuitable for all members, and the HAPS Alliance will be sensitive to individual member preferences

Tackling the Global Digital Divide

2.6
BILLION PEOPLE

or ~35% of the world's population don't have access to the internet

Source: ITU, Individuals Using the Internet, 2022

HAPS are important layers in modern 3D telecommunication infrastructure, together with satellite constellations and terrestrial networks.

HAPS can offer wide coverage and low latency and act as a bridge between the ground and the orbit, reducing the power requirements of small devices.

HAPS Connectivity

Network coverage from the stratosphere

Connect the unconnected

High-speed Low latency

Power resilient

Direct connection with devices

Cost reduction

Weather resilient

IoT connectivity

Disaster recovery

Flexible Fast activation

HAPS D2D Communications

Each communication layer has its own connectivity value proposition and use cases.

In comparison to satellite-based direct-to-device (D2D) communications, HAPS-based solutions provide:

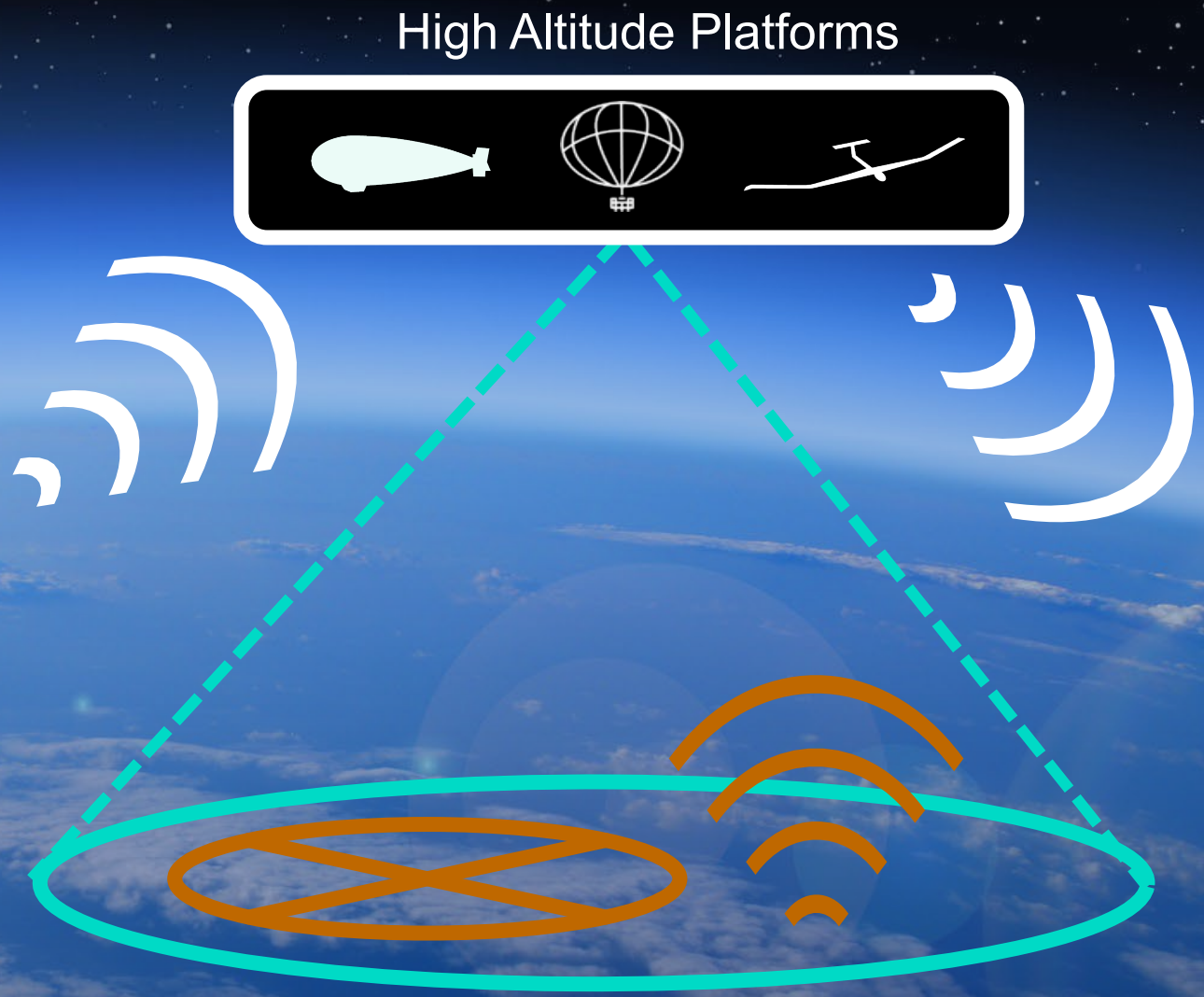
- Faster connection speeds with lower latency
- An “industrial strength” 4G/5G user experience
- Better indoor penetration/connectivity
- Higher network capacity

Disaster Response Use Cases

- **Rapid Network Restoration:** HAPs can swiftly re-establish cellular connectivity after natural disasters, facilitating emergency response.
- **Persistent Aerial Surveillance:** With their long-duration flight capabilities, HAPs offer continuous observation over vast geographical areas, aiding in the assessment of disaster zones.
- **Connectivity in Remote Areas:** HAPs can extend communication networks to remote environments like mountainous regions, enabling efficient post-disaster search & rescue operations.

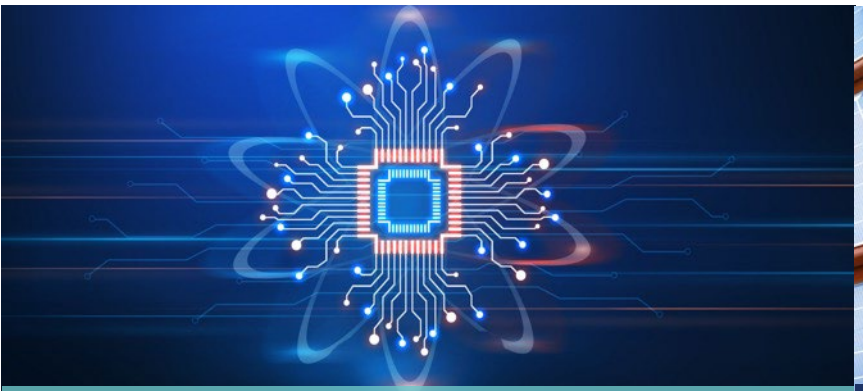
Defense Applications Use Cases

- Persistent monitoring over a large geographic area
- Extension of communications beyond-line-of-site
- Command and Control operations from any location
- Distributed network sensors
- Autonomous flight over contested environments



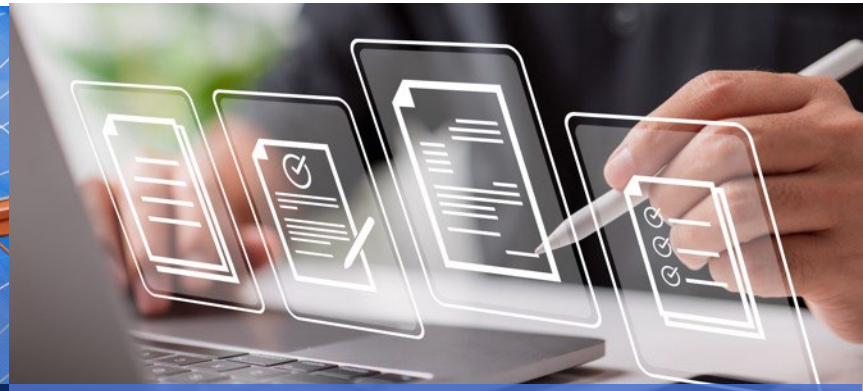
Development in the HAPS Industry

The Latest Tech and Regulatory Advancements Have Paved The Way for HAPS

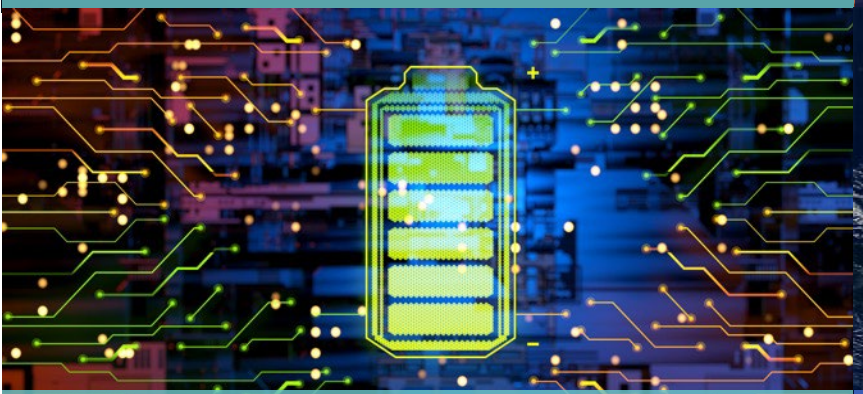


Artificial Intelligence & Machine Learning

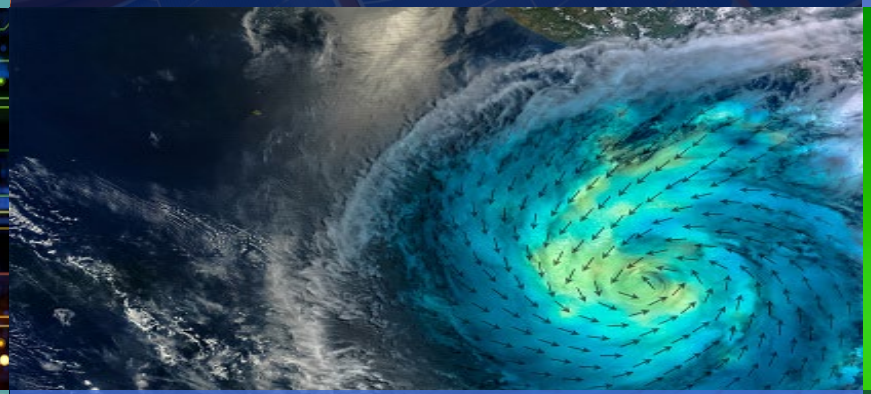
New Materials



Regulation Advancements



Batteries & Hydrogen Power Improvements



Weather Models & Forecast

Public UAS Acceptance

Technological Progress

Solar Cells

The power and weight of solar cells are critical parameters for solar-powered HAPS. The development of high-efficiency, lightweight and flexible solar cells has been significantly improved, resulting in a lighter HAPS aircraft.

Next-Generation Batteries

Batteries with higher capacity have heavier batteries, which in turn means that flying heavier HAPS aircraft requires more energy. There has been significant progress in the development of lightweight and high energy density (above 400Wh/kg) next-generation batteries which can enable HAPS to fly in the stratosphere for longer hours.

Hydrogen storage & power

Recent advances in hydrogen combustion, fuel cells and stratospheric storage have heralded a new era in high-power solutions for HAP platforms, enabling long-endurance flights, eliminating carbon emissions, and paving the way for high-power and weight payloads.

Motor & Propellers

A highly efficient motor is necessary for HAPS, which is used to convert solar energy into propulsive power. Significant progress has been made in the development of a lightweight, high-efficiency, and high-reliability motor for HAPS, which enables HAPS to endure continuous long flight times and maintain stable performance in the stratosphere's hypobaric environment.

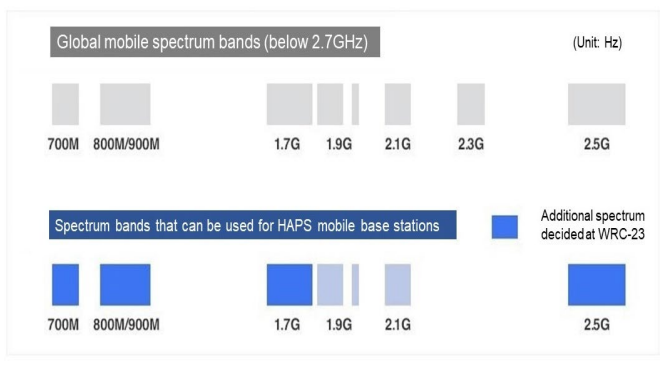
Improved Weather Models

Advancements in historical weather data, faster computers, improved satellite data, and increased ground stations worldwide, along with recent progress in machine learning, have significantly improved the precision and adaptability of stratospheric weather models. This enhanced information allows for more precise flight planning and navigation in the stratosphere.

Regulation Progress

Frequency Band Expansion

- 3 additional frequency bands were approved for HAPS feeder link at ITU WRC-19
- Expansion of HAPS spectrum were approved for HAPS service link at ITU WRC-23. Please see our blog post for more details.



3GPP Standardization

- HAPS operating band and base station class are successfully included in Release-17 specifications. HAPS is approved to be used in 3GPP specifications.


3GPP TS 38.104 V17.5.0 (2022-03)

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
NR;
Base Station (BS) radio transmission and reception
(Release 17)

Aviation Regulations & Standards

- The Federal Aviation Administration (FAA) releases the ETM Concept of Operations to support traffic management in the Upper Class E airspace, which is crucial for future HAPS operations.
- The European Concept for Higher Airspace Operation (ECHO) is currently developing a Concept of Operations (ConOps) for the use of higher airspace, including HAPS operations.

ITU: International Telecommunication Union
WRC-19: World Radiocommunication Conference 2019
WRC-23: World Radiocommunication Conference 2023

3GPP: Third Generation Partnership Project
FAA: Federal Aviation Administration (U.S.)
ETM: Upper Class E Traffic Management

Types of HAPS

Heavier-than-Air HAPS

Fixed Wing

- High maneuverability
- Wider operational envelope
- Endurance, with flight duration months at a time
- Greater flexibility in operation - enabling persistent coverage or readily re-tasked

Lighter-than-Air HAPS

Balloon

- Long duration – capabilities to stay afloat for months at a time
- Rapid deployment
- Wide area coverage
- Large payload capacity
- Low-cost stratospheric access

Airship Form Factor

- High maneuverability
- Large payload capacity
- Capability to stay over an area of operation, remaining in the stratosphere for months at a time
- Rely on buoyancy (helium, hydrogen) and not on lift by cruising
- Large solar cell surface area and structure

Technological Progress: Heavier-than-Air HAPS

Airbus/AALTO HAPS

Airbus' Zephyr achieved:

- 64 days of stratospheric flight, across two 2022 flights, proving Zephyr can operationalize the stratosphere
- 4,000+ total flight hours and demonstrating precise stratospheric maneuverability and station-keeping over points on the ground

Source: https://www.aaltohaps.com/zephyr

Kraus Hamdani Aerospace

Kraus Hamdani Aerospace developed:

- HAPS which achieved 26 hours and 10 minutes airborne with the K1000P (group-2 fully electric UAS) running high power mil spec radios and a highly capable EO/IR ISR FMV payload

Source: https://krausaerospace.com/

Technological Progress: Heavier-than-Air HAPS (cont'd)

Prismatic

Prismatic's PHASA-35:

- Maiden flight completed in 2020.
- First stratospheric flight achieved in 2023, reaching an altitude of 66,386 feet, with a total mission duration of over 24 hours.

Source: https://www.prismaticltd.co.uk/

SoftBank/AeroVironment

SoftBank's Sunglider:

- Succeeded in a stratospheric test flight in 2020 that lasted 20 hours and 16 minutes, with 5 hours and 38 minutes in the Stratosphere
- Demonstrated its high-performance capabilities under demanding conditions and strong wind
- Successfully completed multiple previous test flights

Source: https://www.softbank.jp/en/corp/philosophy/technology/special/ntn-solution/haps/

Stratospheric Platforms Limited

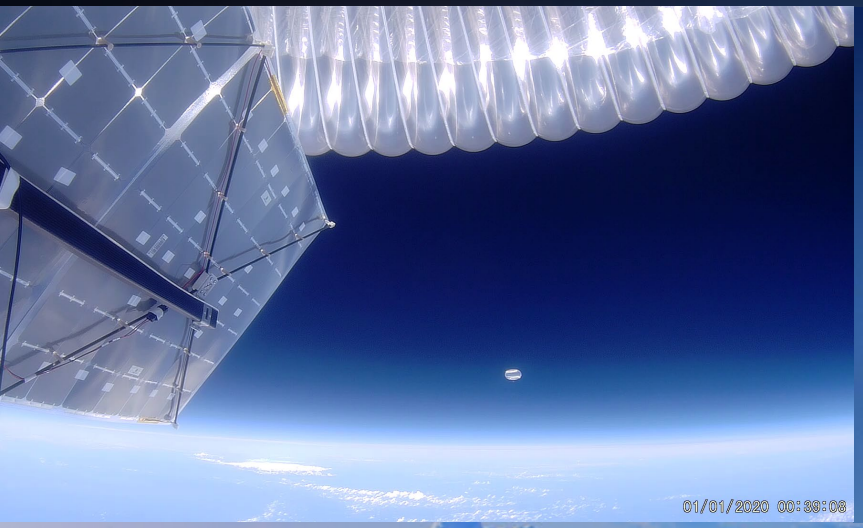
Stratospheric Platforms Limited's STRATOMAST:

- The platform is powered by a hydrogen fuel system.
- Direct to user handset 5G connectivity / 6ms latency providing speeds of 200Mbps.
- The antenna enables broad area coverage equivalent to around 500 terrestrial masts, or 15,000 km^2.

Source: https://www.stratosphericplatforms.com/technology/

Technological Progress: Lighter-than-Air-HAPS

Aerostar



Aerostar develops stratospheric balloons that:

- Successfully delivered LTE networks connections from an altitude of 20km in 2022
- Demonstrated linger over a certain area for weeks to months by using solar power
- More than 10,000 operational flights, 500 consecutive days presence, and 2 million flight hours in the stratosphere

Source: https://aerostar.com/news

SCEYE

SCEYE builds high-performance HAPS for stratospheric infrastructure that:

- Successfully provided an internet connection from stratosphere to the ground in 2021
- Demonstrated the ability of the HAPS to stay over a designated area for operation for months by using renewable energy in 2022
- Demonstrated high-resolution environmental mapping in 2023
- Completed full diurnal flight in the stratosphere and closed the power-loop in August 2024

Source: https://www.sceye.com/sceye-media/

Stratosyst

Stratosyst develops SkyRider as their stratospheric platform:

- To provide long-term commercial flights in order to provide connectivity, earth observation, natural disaster monitoring and more
- Designed for smaller payloads and global operation

Source: https://www.stratosyst.com/#press-and-news

Academia & Research Progress

Universities

- Collaboration on modern technologies
- Diploma thesis
- Hands-on experience
- Applied Research

Stratospheric Research

- Pollution
- Temperature, wind speed
- Chemical composition
- Long-term changes – climate change

HAPS Alliance

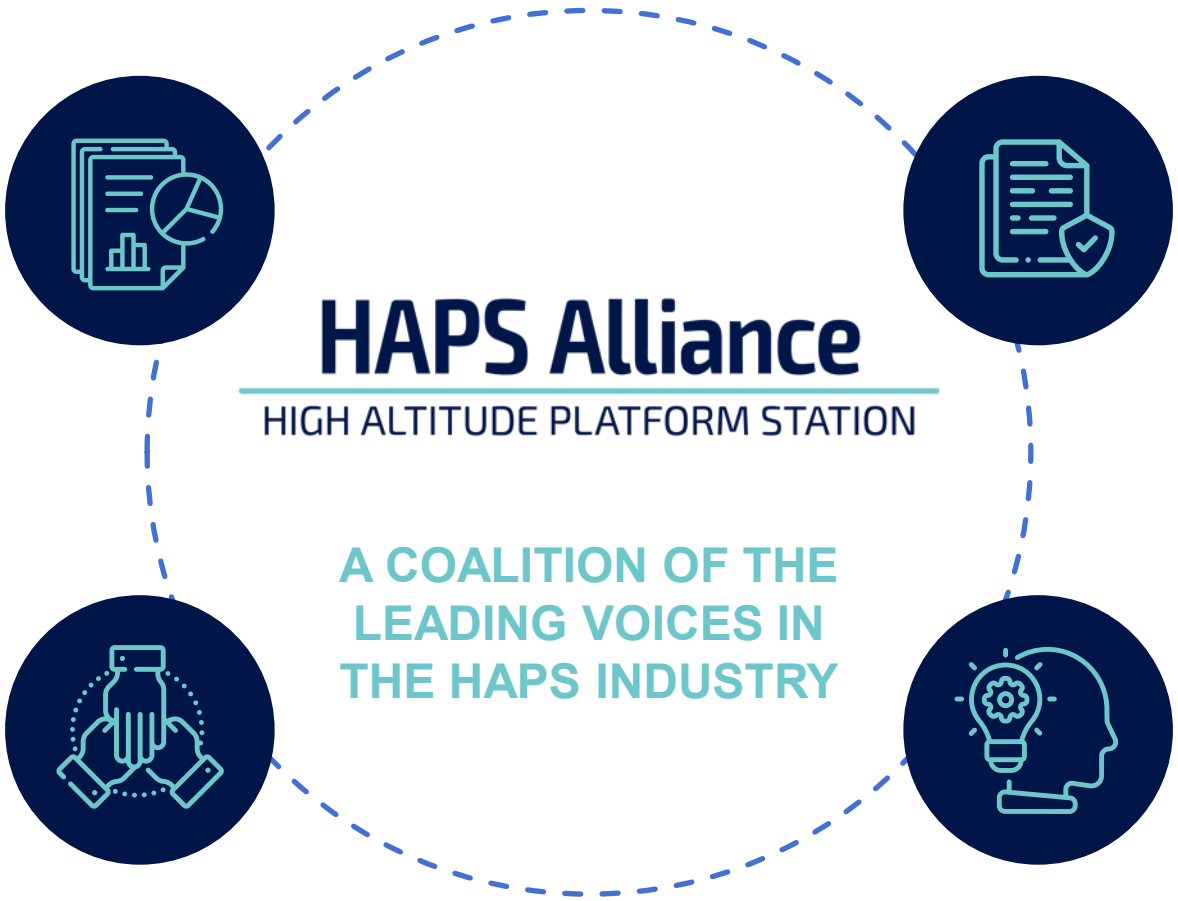
A Consortium of Leading Companies Catalyzing the HAPS Ecosystem

ACCELERATE HAPS ADOPTION

Identify commercial and defense use cases and business models and build industry-wide standards and interoperability guidelines.

SAFETY & REGULATORY ADVOCACY

Build the HAPS ecosystem in a safe and non-discriminatory way, in collaboration with both telecom and aviation regulators.



CROSS-INDUSTRY COLLABORATION

Liaise with industry organizations by delivering focused and pertinent guidance relating to HAPS technology and market opportunities.

THOUGHT LEADERSHIP & EDUCATION

Coalesce the voices of HAPS industry leaders into a compelling message for partners, regulators, and the public.

Complementing the Work of Other Leading Organizations

TELECOM

3GPP
Technical requirements & recommendations

ITU & National Regulators
Spectrum studies & recommendations

GSMA
Business case & market studies

HAPS Alliance
HIGH ALTITUDE PLATFORM STATION

AEROSPACE

Aerospace Industries Association
Regulatory policy alignment

ICAO & National Regulators
ATC & safety policies

GSMA: Global System for Mobile Communication Association
ICAO: International Civil Aviation Organization
ATC: Air traffic control

HAPS Alliance Working Groups

Aviation	Advance aviation regulations, concept of operations, technologies, and standards to foster the HAPS industry
Defense Applications	Promote collaboration and innovation within the defense sector for the utilization of HAPS technology
Marketing & Communications	Solidify HAPS Alliance as a leading industry organization for the HAPS technology, fostering collaboration, accelerating market adoption, and driving membership growth and revenue.
Telecommunications	Advance the global HAPS ecosystem for telecommunications use cases through education, research, regulatory advocacy, and technical standards.

Achievements of the HAPS Alliance

Regulations

- **3GPP**
  - Completed Release-17 specifications including HAPS operating band and base station class
- **Public Consultations**
  - Radio Spectrum Policy Group, Asia-Pacific Telecommunity Wireless Group, FCC
- **Technical Studies**
  - Viability of HAPS: Feeder-link capacity, coexistence, payload specification guidance
- **Aviation**
  - Contributed to the advancement of aviation regulations by developing papers and guidance on HAPS operations, safety frameworks and certification
  - Cooperated with key regulators such as ICAO, FAA, NASA, and JARUS
- **ITU-R**
  - Contributed to the expansion of HAPS spectrum bands at WRC-23 by providing technical studies and leading workshops
  - Proposed HAPS as one of 6G concepts

Publications

- Integration and environmental guidelines for potential payload providers
- How experts in the field of HAPS have reimagined traditional aviation safety metrics
- Unique issues to be considered when regulating HAPS
- Attended Autonomous Fleet Systems and the use of Collaborative Traffic Management for the Stratosphere

Visit:
https://hapsalliance.org/publications/

HAPS Alliance Publications (Highlights)

HAPS Operation Using Attended Autonomous Fleet Systems

The Marketing & Communications WG published a white paper that explains the concept of Attended Autonomous Fleet Systems and the use of Collaborative Traffic Management for the Stratosphere (CTMS).

Guidelines for Payload Operation in the Stratosphere

The Telecommunications WG published white paper that provides integration and environmental guidelines for potential payload providers to consider when developing a payload for operation on a flight vehicle in the stratosphere.

Acceptable Levels of Risk for HAPS

The Aviation WG published an authoritative white paper that highlights how leading experts in the field of HAPS have reimagined the traditional safety metrics used in aviation and introduced new approaches to setting acceptable levels of risk for this emerging technology.

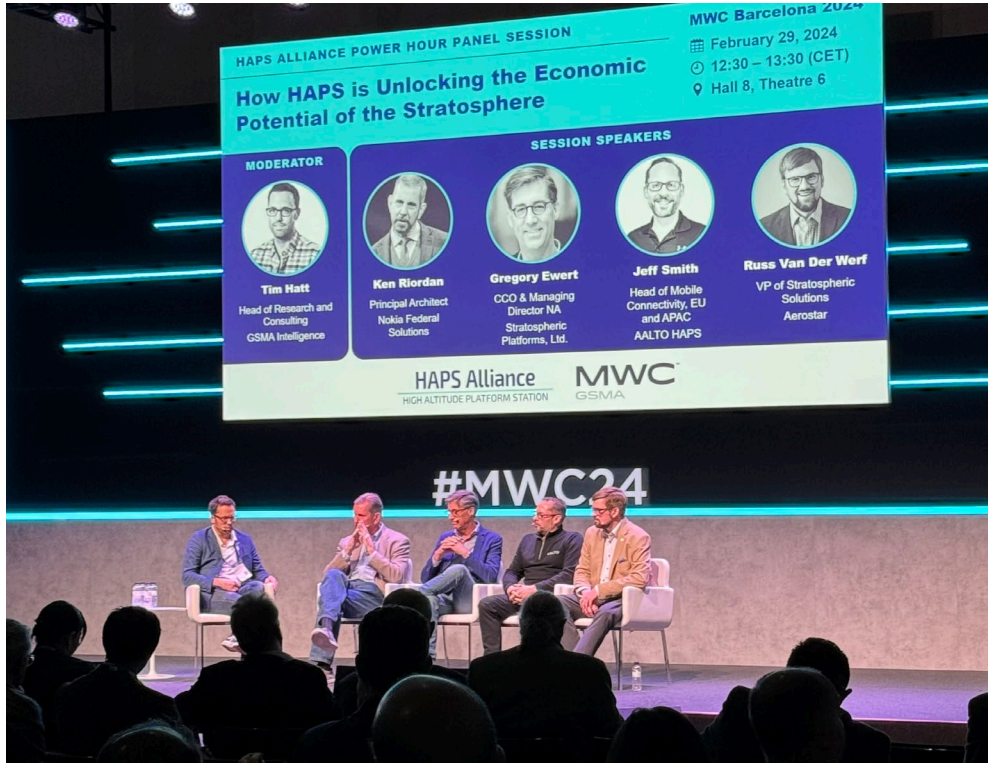
HAPS Certification Pathways

The Aviation WG published a white paper that provides valuable insights into the unique issues that must be considered when regulating High Altitude Platforms Systems (HAPS). And recommends a series of actions to facilitate their safe and efficient operation.

Visit: https://hapsalliance.org/publications/

HAPS Alliance Events

The HAPS Alliance convenes annually, hosting both virtual and in-person Member Meetings. In 2023, members gathered virtually in June and November in-person at Capgemini: Applied Innovation Exchange in San Francisco, California.



The HAPS Alliance actively participates in a variety of industry events throughout the calendar year, such as International Civil Aviation Organization, Mobile World Congress, World Satellite Business Week, and various other events.

Recap blog: https://hapsalliance.org/blog/haps-alliance-brings-stratospheric-innovation-to-light-at-mwc-2024/

HAPS Alliance Podcast

Teaser Episode: Introducing “The Race to Near Space:” the HAPS Alliance Podcast

Episode 1: Skydiving from 135,000 feet with Alan Eustace

Episode 2: Exploring the Skies: The Evolution of Stratospheric Ballooning with Aerostar

Episode 3: Samer Halawi on the race to commercialize the Stratosphere

HAPS Alliance Members

Aeroprobe Corporation
Aeropuerto de Teruel, PLATA
Aerostar
AeroVironment, Inc.
Airbus Defense and Space GmbH
Airbus US Space and Defense
Airspan
American Lithium Energy
Amprius Technologies, Inc.
armasuisse Science & Technology
AT&T
Aurora Flight Sciences
Avient Corporation
B2Space
Bharti Airtel Limited
BIANOR SERVICES EOOD
CACI, Inc.
Cambridge Consultants
Capgemini
Carleton University
CELESTE AIRSHIPS
Clay County Economic Development Corporation
Cligent Technologies
Comfone AG
Dashagriv Aerospace Technology
Deutsche Telekom AG
Digital Council Africa
EANT GmbH
Embention Sistemas Inteligentes S.A
Enchampion Comany
Ericsson AB
ESEN, University of Manouba, Tunisia
Filtronic
Flight Next
Geoinformation Unmanned Aerial Systems Ltd 'GeinUAS'
Gilat Satellite Networks
Hacettepe University
HEMERIA
Icarus
Indonesia-ITU Concern Forum (IICF)
Involve Group S.R.L.
KDDI Corporation
Kea Aerospace Limited
King Abdullah University of Science and Technology (KAUST)
Kratos
Kraus Hamdani Aerospace, Inc.
KT Corporation
Lekha Wireless Solutions Private Limited
Leonardo Electronics US Inc.
Liverpool Hope University
Luman Aerospace
Luxon Consulting Group, LLC
MEISEI ELECTRIC CO, LTD.
Meteomatics
Montavista Energy Technologies Corporation(Anhui)
MSB Technologies
NAL Research Group
National Institute of Information and Communications Technology
NEAR SPACE CORPORATION / TILLAMOOK UAS TEST RANGE
Near Space Labs
Newspace Research and Technologies Pvt Ltd
Northrop Grumman
NTT DOCOMO, INC
Orbit Communications
picoNETS
PowerLight Technologies
Prismatic Limited
Radical
Range and Bearing Corporation
Royal Air Force
Sagetech Avionics Inc
San Jose University Research Foundation/NASA
Satraka Ltd
Sceye Inc.
Sierra Nevada Corporation (SNC)
Siradel
SoftBank Corp
Space Compass Corporation
Space Data Corporation
Stratodynamics Aviation Inc.
Stratolia
Stratoship
Stratospheric Platforms Limited
STRATOSYST s.r.o.
Stratotegic Inc
Swift Engineering
Syncrosis
Technology Park of Fuerteventura
Telecom Technology Center
Teledyne Brown Engineering, Inc.
The MITRE Corporation
The Regents of New Mexico State University
The WX Company
TURKCELL ILETISIM HIZMETLERI A.S.
Ulak Haberlesme AS
University of Applied Sciences and Arts Northwestern Switzerland
University of North Dakota-John D Odegard School of Aerospace Sciences
University of York
Virtual Inc
Voltitude Ltd
Volz Servos
World Mobile Group Ltd

*Information current as of 19 May 2025 and may be subject to change. For full list of active members, visit: https://hapsalliance.org/our-members/

HAPS Alliance Member Achievements

Through innovative technologies and collaborative efforts, HAPS Alliance members have achieved groundbreaking milestones across a spectrum of industries and applications.

For a deeper dive into these achievements, please visit https://bit.ly/46tfUbT or scan the QR code below!

HAPS Alliance Membership Offers

Principal Member
$30,000 / per year

***Same as General Member, plus*:**

- Eligible to be elected to Executive Board*
- Voting rights for Alliance documents (Executive Board members)
- May chair working groups and committees
- May propose new work items
- May participate and vote in working groups and committees

*Additional $10,000 annual Director Fee if elected to the Executive Board

General Member
$1,000 - $12,500 / per year*

- May participate and vote in working groups
- May attend committee meetings as an observer, where applicable
- Invited to attend virtual and face-to-face events
- Access to work products in process
- Early access to published work products
- May participate in co-marketing opportunities
- Will receive member mailings and announcements
- Company logo & link on HAPS Alliance public website
- Dedicated Member Spotlight blog posts
- Promotion of member company media coverage, speaking engagements, and news

*Fee varies based on company size (# of employees)

Join Now/More Info

https://hapsalliance.org/membership/

Thank You!