



HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

Unlocking the potential of the stratosphere

Q3 2023

Tackling the Global Digital Divide

2.7
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, low latency, and can act as a bridge between the ground and the orbit, reducing the power requirements of small devices.



Each Layer Has Its Own Value Proposition for Connectivity



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

- High maneuverability
- Large payload capacity
- Station keeping abilities, remain in the Stratosphere for months at a time
- Rely on buoyancy (Helium, Hydrogen) and not on lift by cruising
- Large solar cell surface area – structure



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

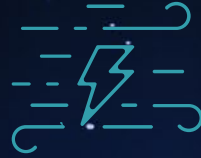
Stratosphere: Enabling a Wide Range of Applications



Connectivity



Earth
Observation



Disaster
Management



Security
and Defense



Maritime



Surveillance



Monitoring
and Detection



Critical
Infrastructure
Inspections



Government



Mapping and
Humanitarian
Missions

Enabling a Wide Range of Applications

Connectivity



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

Monitoring and Detection



HAPS can help us detect natural disasters earlier and take action faster

Mapping and Humanitarian Missions



In an emergency situation, HAPS can be retasked on short notice to assist those in need faster

Earth Observation



HAPS enable real-time monitoring with high resolution images and sensors to identify the location of smoke generation

HAPS & Sustainable Development Goals

SUSTAINABLE DEVELOPMENT GOALS



Fighting poverty with remote work thanks to connectivity



Realizing a connected society by bridging the digital divide



Sustainable system (zero CO2 emissions during flights)



Connecting societies around the world
New communication system that uses the stratosphere
Wide-area coverage



Connecting societies around the world
Realizing a connected society by bridging the digital divide



Sustainable system (zero CO2 emissions during flights)

Development in HAPS Industry

Stratosphere Hasn't Received Much Commercial Attention Until Recently

Harsh conditions for long-duration flights



Low pressure and thermal conditions of -65°C in average



Jet stream winds exceeding 100km/hour and more

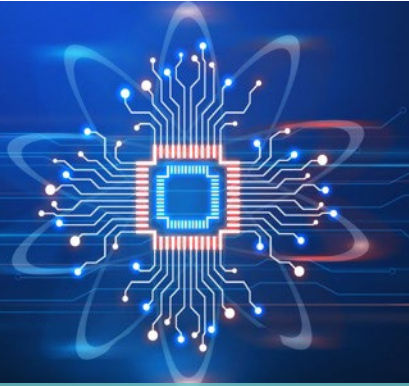


Wind speeds exceeding 40km/hour

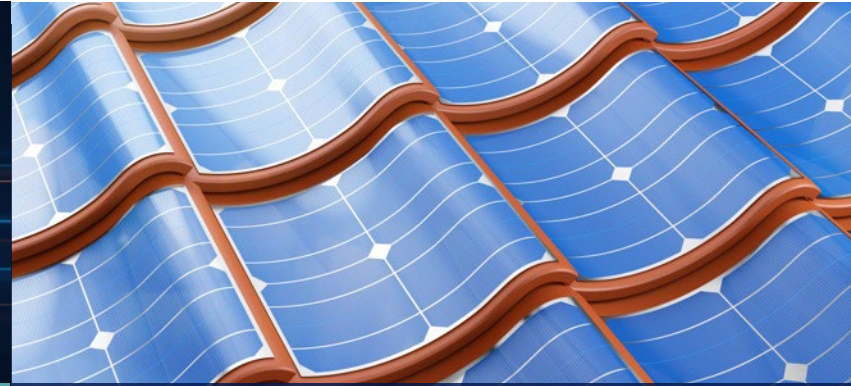


Gravity waves and solar radiation at 20km above the earth

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



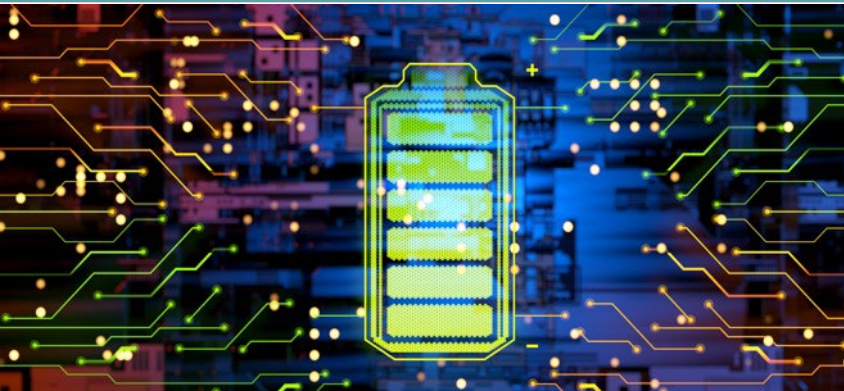
Artificial Intelligence &
Machine Learning



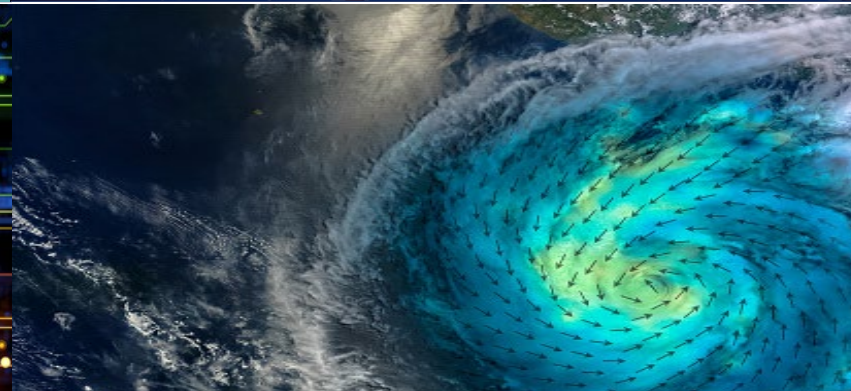
New Materials



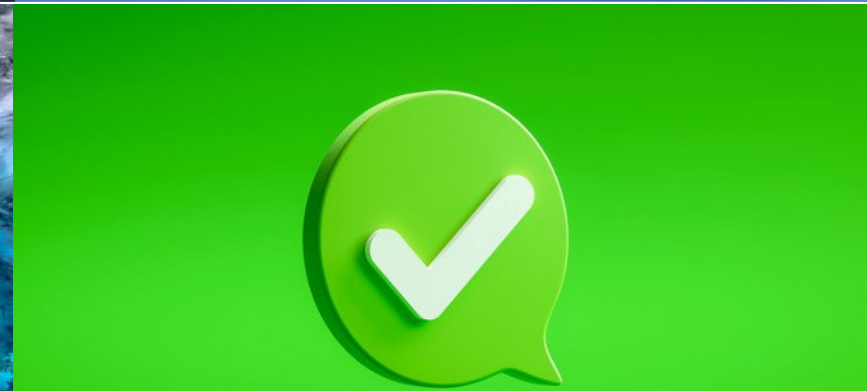
Regulation Advancements



Batteries & Power
Improvements



Weather Models & Forecast



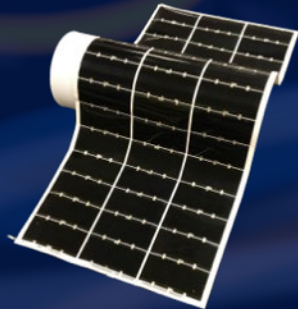
Public UAS Acceptance

Technological Progress

Solar Cells

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 and resulted in lighter HAPS aircrafts.

Microlink Devices' 150mm diameter ELO foil
Foil is <30 μm thick and flexible



Next-Generation Batteries

Batteries with higher capacity have heavier batteries, which in turn means that flying heavier HAPS aircrafts require 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.

Motor & Propellers

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

Lightweight Aircrafts

Development and advancement of solar, battery, payload and aircraft structure and design technologies has led to the design of improved lightweight stratospheric vehicles. Lightweight aircrafts enables overnight flights and maximum capacity of payload which makes HAPS services stable and sustainable.

Technological Progress: Heavier-than-Air HAPS

Airbus



Airbus' Zephyr achieved:

- 64 days of stratospheric flight, across two 2021 flights, proving Zephyr can operationalize the stratosphere
- 2,435 total flight hours and demonstrating precise stratospheric maneuverability and station-keeping over points on the ground

Source: <https://www.airbus.com/en/newsroom/press-releases/2021-10-airbus-zephyr-solar-high-altitude-platform-system-haps-reaches-new>

HAPSMobile



HAPSMobile's Sun glider:

- 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.hapsmobile.com/en/>

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: 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 in the stratosphere and 2 million flight hours

Source: <https://aerostar.com/news/raven-provides-cellular-connectivity-from-the-stratosphere-via-thunderhead-balloon-system>

SCEYE



SCEYE builds high-performance HAPS for stratospheric infrastructure that:

- Successfully provided an internet connection from stratosphere to the ground in 2021, and
- Demonstrated the airship's ability to stay over a designated area for operation for months by using renewable energy in 2022
- Demonstrated high-resolution environmental mapping in 2023

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

Stratosyst



Stratosyst develops SkyRider as their stratospheric platform:

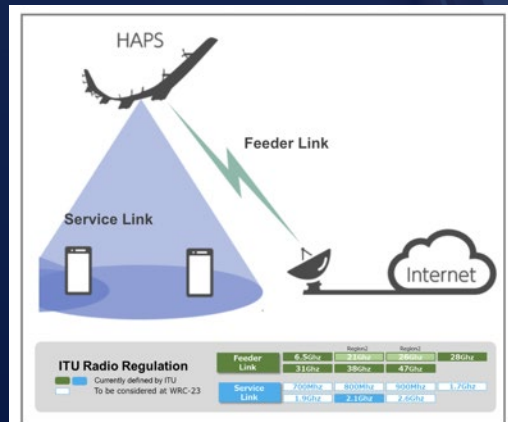
- To provide long-term commercial flights in order to provide connectivity, earth observation, natural disaster monitoring and more
- Designed for smaller payloads and global operation

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

Regulation Progress

Frequency Band Expansion

- 3 additional frequency bands were approved for HAPS feeder link at ITU WRC-19
- An agenda item for WRC-23 to expand additional frequency bands for HAPS service link were approved at WRC-19



3GPP Standardization

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



Aviation Regulations & Standards

- FAA releases ETM Concept of Operations to support traffic management in Upper Class E airspace, which is crucial for future HAPS operations
- European concept for higher airspace operation (ECHO) is currently developing a Concept of Operations for the use of higher airspace, including HAPS operations

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 COMMERCIAL ADOPTION

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



SAFETY & REGULATORY ADVOCACY

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



HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

A COALITION OF THE LEADING VOICES IN THE HAPS INDUSTRY

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

HAPS Alliance Working Groups

	Telecommunications WG	Aviation WG	Marketing & Communications WG
Goals	Advance the global HAPS ecosystem for telecommunications use cases	Advance aviation regulations, concept of operations, technologies, and standards to foster the HAPS industry	Driving awareness, safety and regulatory alignment and commercial adoption
Achievements	<p>ITU-R Joint proposal for studies on HAPS frequencies Proposed HAPS as one of the 6G concepts</p> <p>3GPP Completed Release-17 specifications including HAPS operating band and base station class</p> <p>Public Consultations Radio Spectrum Policy Group, Asia-Pacific Telecommunity Wireless Group, FCC</p> <p>Technical Studies Viability of HAPS: Feeder-link capacity, coexistence, payload specification guidance</p>	<p>Thought Leadership on International Stage</p> <ul style="list-style-type: none"> • “From the Stratosphere and Beyond – the HAPS Alliance is Connecting the Unconnected” at 2021 World ATM Congress • HAPS Alliance vision for operations at scale • HAPS appropriate risk assessment process • Introduced vision for Cooperative Traffic Management in the Stratosphere (CTMS) philosophy and work in progress <p>Visionary White Papers Published</p> <ul style="list-style-type: none"> • Papers describing how we envision HAPS operations being managed at scale • HAPSMobile Flight/Comms Test experience 	<p>Promotion / Education</p> <ul style="list-style-type: none"> • Hosted annual conferences: Member Meetings (Spring) and Summit (Fall) • Attended and promoted at various industry events <p>Supporting Alliance Presence</p> <ul style="list-style-type: none"> • Launched social media, LinkedIn • Shared industry news at regular basis • Created blog posts and articles <p>Publishing and Promoting White Papers</p> <ul style="list-style-type: none"> • Issued HAPS White Paper “Driving the Potential of the Stratosphere” • Promoted Telecom/Aviation WGs’ papers
Plan	<ul style="list-style-type: none"> • Continue contributions towards international 6G standardization and expansion of HAPS frequency utilization (WRC-23 Agenda Item 1.4) • HAPS payload specification guidance 	<ul style="list-style-type: none"> • Develop and promote guidance for upper airspace through cooperation with Global Community – FAA, ICAO, EASA, NASA, JARUS, etc. • Participation in global events - ICAO Drone Enable, World ATM Congress, ATCA Technical Symposium • Continue thought leading white papers 	<ul style="list-style-type: none"> • Increased awareness of HAPS and developed presence of HAPS Alliance by hosting and attending events • Educate globally by publishing White Papers, blogs, social media and more

HAPS Alliance Publications (Highlights)

Creating and Enabling Regulatory Environment for HAPS Deployment



The Telecommunications WG published its first Regulatory Positions white paper, highlighting the regulatory environment for HAPS deployment.

HAPS Operation Using Attended Autonomous Fleet Systems



The Aviation WG published a white paper which explains the Collaborative Traffic Management for the Stratosphere as an operational end-state that enables safe and scalable operations of HAPS.

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.

Driving the Potential of the Stratosphere



The Marketing & Communications WG published a white paper which highlights the stratosphere's potential to offer greater connectivity and support a wide range of applications.

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

HAPS Alliance Events



The first in-person Member Meeting was held in November 2022 at the Intelsat offices in McLean, VA. It included 30+ member companies from around the world. The next one is scheduled to be announced shortly. Don't miss it!

Recap blog: <https://hapsalliance.org/blog/haps-members-meet-to-share-a-year-of-successes/>



The HAPS Alliance held a panel session at Mobile World Congress in February 2023 in Barcelona, Spain. Panel representatives included member companies Airbus, Deutsche Telekom AG, Intelsat and TMG.

Recap blog: <https://hapsalliance.org/blog/haps-alliance-soars-at-mwc-2023/>

Bringing Together Telecom, Aviation and Technology Industries

Aeropuerto de Teruel, PLATA

Aerostar

Aerovironment, Inc.

Airbus Defense and Space GmbH

Airservices Australia

Ampruis Technologies, Inc.

armasuisse Science & Technology

Aurora Flight Sciences

B2Space

Bharti Airtel Limited

CACI, Inc.

Capgemini

Carleton University

Deutsche Telekom AG

Dhruva Space Private Limited

Digital Council Africa

EANT GmbH

Ericsson AB

ESEN, University of Manouba,
Tunisia

Filtronic

Florida Atlantic University Harbor
Branch Oceanographic Institute

Geoinformation Unmanned Aerial
Systems Ltd 'GeinUAS'

Gilat Satellite Networks

GMV Aerospace and Defence
S.A.U.

Hacettepe University

HAPSMobile Inc.

Indonesia-ITU Concern Forum
(IICF)

Intelsat US LLC

KDDI Corporation

Kea Aerospace Limited

King Abdullah University of Science
and Technology (KAUST)

Kratos

Kraus Hamdani Aerospace, Inc.

Liverpool Hope University

Luxon Consulting Group, LLC

MicroLink Devices

Mynaric

National Institute of Information
and Communications Technology

NEAR SPACE CORPORATION

Near Space Labs

Newspace Research and Technologies Pvt Ltd

Nokia of America Corporation

Northern Territory Government of Australia

NTT DOCOMO, INC

picoNETS

Prismatic Limited

Radical

Sceye Inc.

SKY Perfect JSAT Corporation

SoftBank Corp.

Space Data Corporation

Stratospheric Platforms Limited

STRATOSYST s.r.o.

Stratologic Inc

TAO Trans Atmospheric Operations
GmbH

Technology Park of Fuerteventura

Telecommunications Management Group,
Inc

The MITRE Corporation

The Regents of New Mexico State
University

The WX Company

TJ Innovation

Tonomus

TURKCELL ILETISIM HIZMETLERI A.S.

Ulak Haberlesme AS

University of Applied Sciences and Arts
Northwestern Switzerland

University of Washington

University of York

World Mobile Group, Ltd

*Information current as of August 2023 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 \$25,000 / per year

- Same as General Member
- 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 - \$10,000 / 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)

Supporter Member \$0 / per year

- Participate in select co-marketing opportunities
- Receive member mailings and announcements
- Have your company name listed on the HAPS Alliance public website
- Become an informed member of the HAPS Alliance community
- Access to select member meeting sessions and events
- Early access/discounts to published work products

Join Now/More Info ▶

<https://hapsalliance.org/membership/>



The background of the slide is a high-altitude aerial view of Earth. It shows a vast expanse of white, fluffy clouds below a clear, deep blue sky. The horizon line is visible, curving across the middle of the frame. The top of the image transitions into a dark, starry space. The text 'Thank You!' is centered in the upper half of the image.

Thank You!