HAPS Alliance
HIGH ALTITUDE PLATFORM STATION

Unlocking the potential of the stratosphere

Q3 2022

Nearly Half of World's Population Lacks Internet Access

2.9 BILLION PEOPLE

or ~40% of the world's population, don't have access to the internet

Source: ITU, Individuals Using the Internet, 2021

Each Layer Has Its Own Value Proposition for Connectivity

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

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

20km

150m

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

Monitoring and Detection

Mapping and Humanitarian Missions

Earth Observation

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

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

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

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

1 NO POVERTY	4 QUALITY EDUCATION	7 AFFORDABLE AND CLEAN ENERGY	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	10 REDUCED INEQUALITIES	13 CLIMATE ACTION
Fighting poverty with remote work thanks to connectivity	Realizing a connected society by bridging the digital divide	Sustainable system (zero CO_2 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 CO_2 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
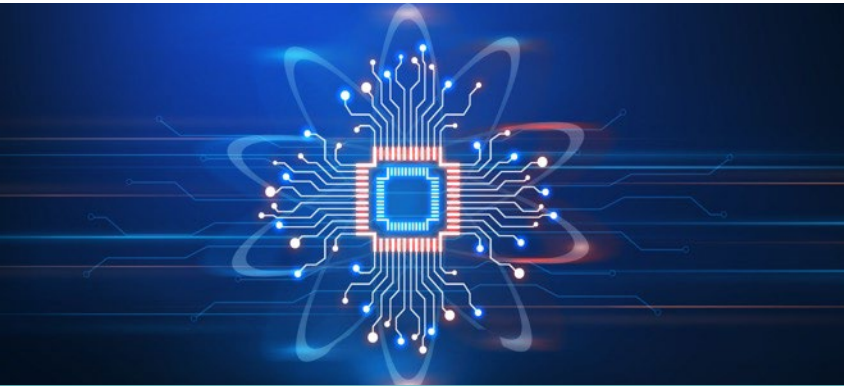
Jet stream winds exceeding 100km/hour and more
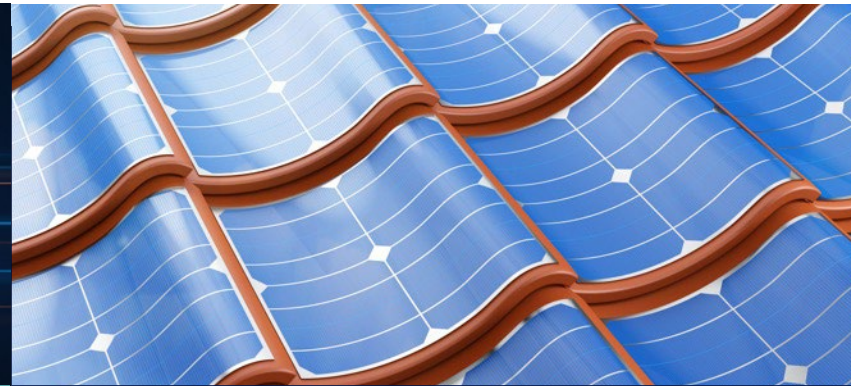
Wind speeds exceeding 40km/hour

Gravity waves and solar radiation at 20km above the earth

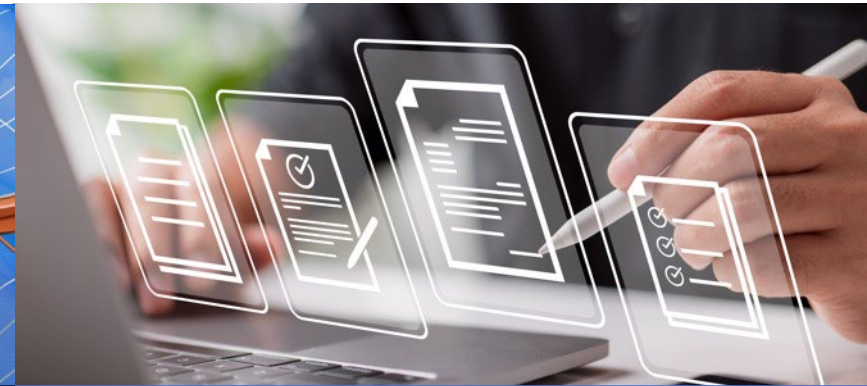HAPS Alliance
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The Latest Tech and Regulatory Advancements Have Paved The Way for HAPS
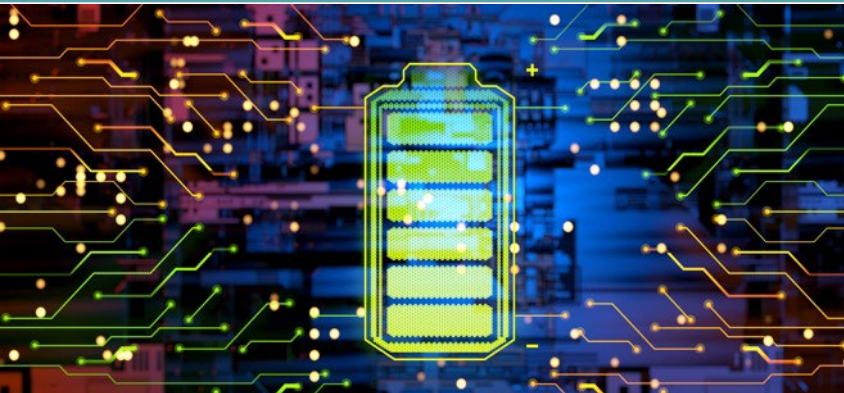

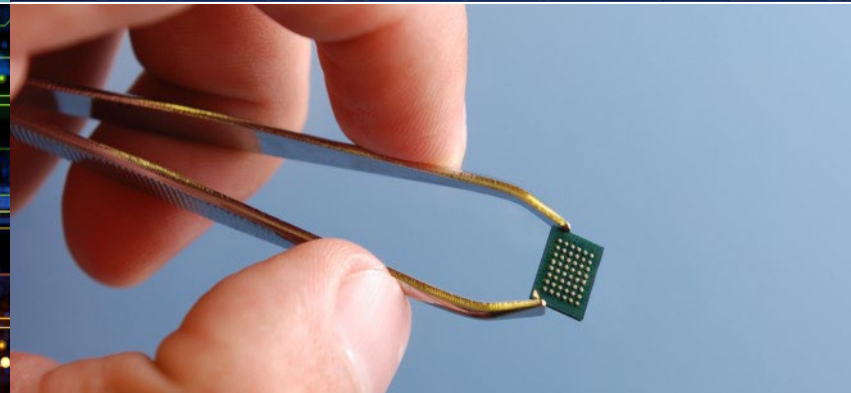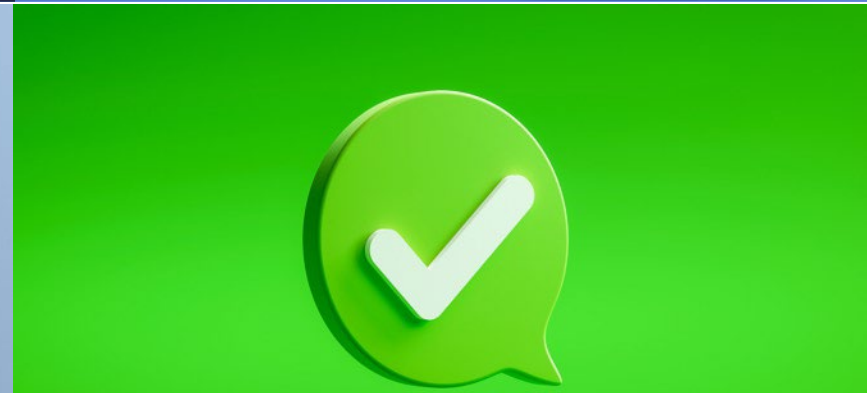Artificial Intelligence & Machine Learning

New Materials

Regulation Advancements

Batteries & Power Improvements

Instruments Miniaturization

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.

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:
- 36 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 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.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

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

SCEYE

SCEYE builds high-performance airships 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

Source:
https://www.sceye.com/
https://www.businesswire.com/news/home/20220614006039/en/Sceye-HAPS-Ascend-to-Stratosphere-Using-Renewable-Energy-Sources

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
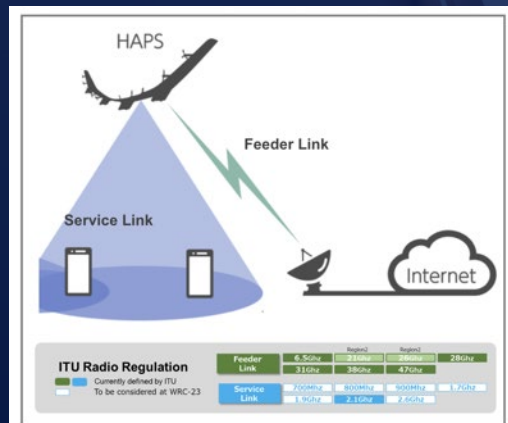
3GPP Standardization

- 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

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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

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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.

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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

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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

	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	**ITU-R** Joint proposal for studies on HAPS frequencies Proposed HAPS as one of the 6G concepts **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	**Thought Leadership on International Stage** • *"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 **Visionary White Papers Published** • Papers describing how we envision HAPS operations being managed at scale • HAPSMobile Flight/Comms Test experience	**Promotion / Education** • Hosted annual conferences: Member Meetings (Spring) and Summit (Fall) • Attended and promoted at various industry events **Supporting Alliance Presence** • Launched social media, LinkedIn • Shared industry news at regular basis • Created blog posts and articles **Publishing and Promoting White Papers** • Issued HAPS White Paper "*Driving the Potential of the Stratosphere*" • Promoted Telecom/Aviation WGs' papers
Plan	• Continue contributions towards international 6G standardization and expansion of HAPS frequency utilization (WRC-23 Agenda Item 1.4) • HAPS payload specification guidance	• 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	• 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

ITU-R: International Telecommunication Union Radiocommunication Sector
FCC: Federal Communication Commission (U.S.)

FAA: Federal Aviation Administration (U.S.)
EASA: European Union Aviation Safety Agency
NASA: National Aeronautics and Space Administration (U.S.)
JARUS: Joint Authorities for Rulemaking on Unmanned Systems

HAPS Alliance Publications

Member Spotlight Blogs

The HAPS Alliance showcases its members and their achievements through a Member Spotlight Blog Series.

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.

Creating an Enabling Regulatory Environment for HAPS Deployment

The Telecommunications WG published a Regulatory Positions Paper which offers a high-level overview of how HAPS provides regulatory recommendations to enable the stratospheric ecosystem.

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/

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HAPS Alliance Events

The second two-day Member Meeting was held online in April 2022. It included 24 member companies from over 14 different countries! The next one is scheduled to be announced shortly. Don't miss it!

The HAPS Alliance Inaugural Summit was held in November 2021. With over 250 attendees, representing 17 countries, sessions included networking, presentations by industry experts and much more! Check out the overview: https://hapsalliance.org/blog/summit-2021/

Bringing Together Telecom, Aviation and Technology Industries

Aerostar

AeroVironment, Inc.

Airbus Defense and Space GmbH

Airservices Australia

Amprius Technologies, Inc.

armasuisse Science & Technology

B2Space

Bharti Airtel Limited

Capgemini

Carleton University

Deutsche Telekom AG

Dhruva Space Private Limited

Digital Council Africa

Ericsson AB

ESEN, University of Manouba, Tunisia

Filtronic

Gilat Satellite Networks

GMV Aerospace and Defence S.A.U.

Hacettepe University

HAPSMobile Inc.

Intelsat US LLC

KDDI Corporation

KAUST

Kea Aerospace

Kratos

Kraus Hamdani Aerospace, Inc.

Liverpool Hope University

Luxon Consulting Group, LLC

MicroLink Devices

Mynaric AG

National Institute of Information and Communications Technology

NEAR SPACE CORPORATION

Nokia of America Corporation

Northern Territory Government of Australia

NTT DOCOMO, INC

Prismatic Limited

Sceye Inc.

SKY Perfect JSAT Corporation

SoftBank Corp.

Stratotegic Inc

STRATOSYST s.r.o.

TAO Trans Atmospheric Operations GmbH

Telecommunications Management Group, Inc.

Tonomus, A NEOM Company

The Regents of New Mexico State University

UAVOS Inc.

University of Applied Sciences and Arts Northwestern Switzerland

University of York

University of Washington

*Information current as of September 2022 and may be subject to change. For full list of active members, visit: https://hapsalliance.org/our-members/

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HAPS Alliance Membership Offers

Principal Member
$25,000 / per year

Same as general +

- 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/

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Thank You!

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