

HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

THE HAPS ALLIANCE

Unlocking the potential of the stratosphere

Roser ROCA TOHA

HAPS Alliance - Executive Board Member, for Airbus.

Living Planet symposium, Bonn, May 2022



STRATOSPHERE HASN'T RECEIVED MUCH COMMERCIAL ATTENTION UNTIL RECENTLY

Harsh conditions for long-duration flights:

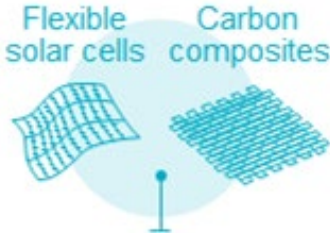
- Pressure and thermal conditions of -65°C
- Wind speeds exceeding 40 km/hour
- Gravity waves and solar radiation at 20 km above the earth



THE LATEST TECH AND REGULATORY ADVANCEMENTS HAVE PAVED THE WAY FOR HAPS



Artificial Intelligence
& Machine Learning



New
Materials



Regulation
Advancements

Batteries & Power
Improvements



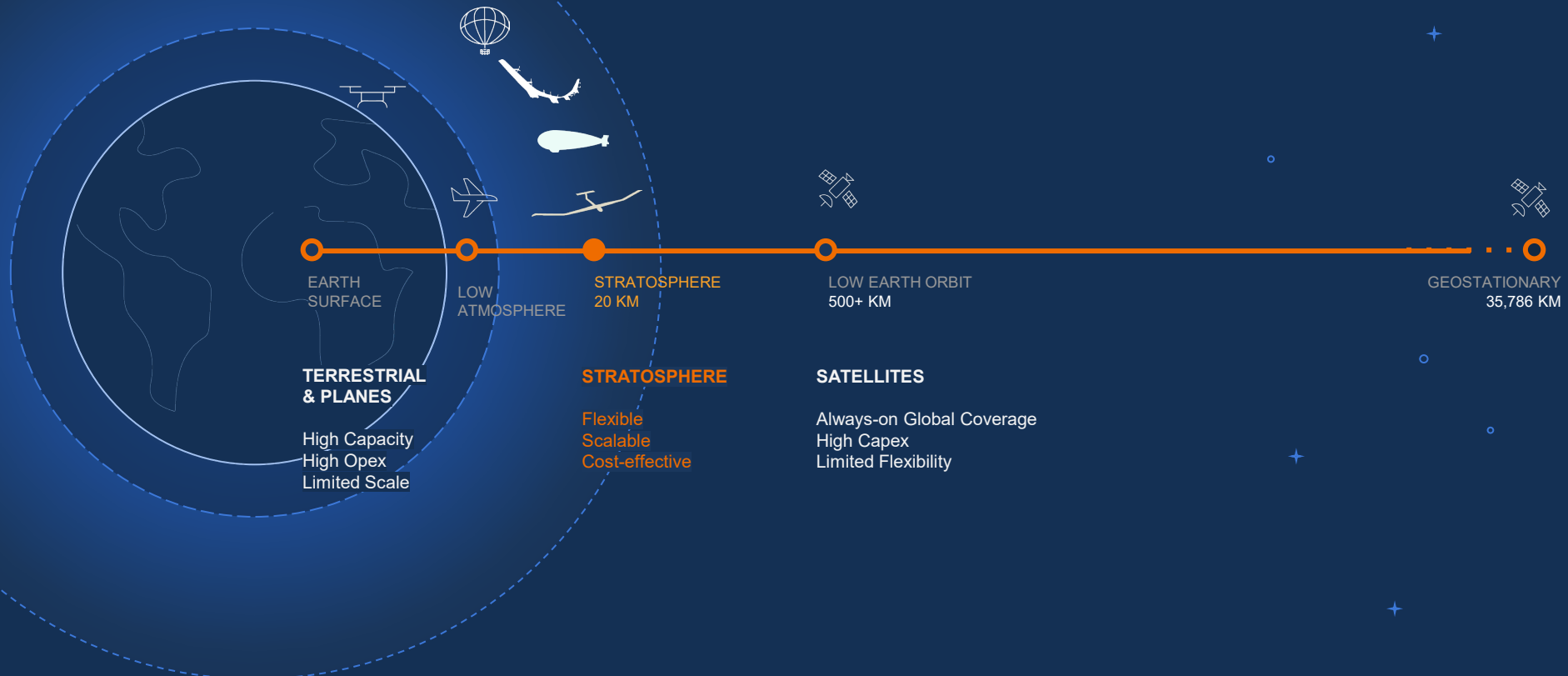
Instruments
Miniaturization



Public UAS
Acceptance



EACH LAYER HAS ITS OWN VALUE PROPOSITION FOR CONNECTIVITY & EO



EARTH SURFACE

TERRESTRIAL & PLANES

High Capacity
High Opex
Limited Scale

LOW ATMOSPHERE

STRATOSPHERE
20 KM

STRATOSPHERE

Flexible
Scalable
Cost-effective

LOW EARTH ORBIT
500+ KM

SATELLITES

Always-on Global Coverage
High Capex
Limited Flexibility

GEOSTATIONARY
35,786 KM

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.

CROSS-INDUSTRY COLLABORATION

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

HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

A COALITION OF THE LEADING VOICES IN THE HAPS INDUSTRY

SAFETY & REGULATORY ADVOCACY

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

THOUGHT LEADERSHIP & EDUCATION

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

BRINGING TOGETHER TELECOM, AVIATION AND TECHNOLOGY INDUSTRIES

AeroVironment Inc.

Airbus Defense and Space GmbH

Airservices Australia

Amprius Technologies, Inc.

Armasuisse Science & Technology

Auriga Aerospace Ltd.

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

Hacettepe University

HAPSMobile Inc.

Intelsat US LLC

KDDI Corporation

KAUST

Kea Aerospace Limited

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 / TILLAMOOK UAS TEST RANGE

Nokia of America Corporation

Northern Territory

Government of Australia

NTT DOCOMO, INC

Prismatic Limited

Radisys

Raven Aerostar

Sceye Inc.

SKY Perfect JSAT Corporation

SoftBank Corp.

Stratotegic Inc

STRATOSYST s.r.o.

TAO Trans Atmospheric Operations GmbH

Telecommunications Management Group, Inc.

The Regents of New Mexico State University

UAVOS Inc.

University of Applied Sciences and Arts

Northwestern Switzerland

University of York

University of Washington

STRATOSPHERE: ENABLING A WIDE RANGE OF APPLICATIONS



CONNECTIVITY



EARTH
OBSERVATION



NATURAL
RESOURCE
MGMT



DISASTER
MGMT



WEATHER



SECURITY
& DEFENSE



GOVERNMENT



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



HAPS can help us detect a fire earlier and extinguish it faster



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

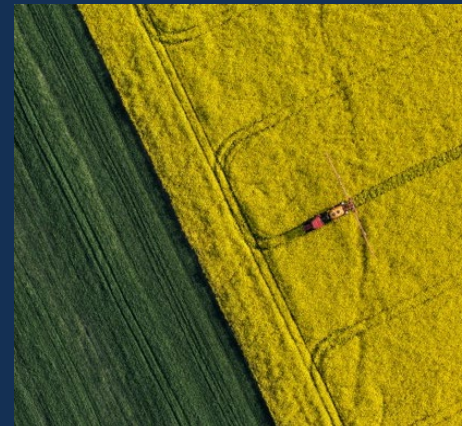
WHERE HAPS CAN HELP

Environmental

- Real-time climate change monitoring and transparent conservation
 - Civil society, Academia and Government
- Precise and persistent monitoring of
 - Methane and CO2 emissions
 - Ecosystems
 - Natural resources
- Early detection and prevention of
 - Forest fires, floods, storms
 - Oil spills and dumping
 - Illegal fishing and poaching – dark vessel identification
- Sustainable resource management
 - Water resources, usage, quality
 - Agriculture – yield optimization, drought and pest mitigation
 - Forest, vegetation, land, live-stock management

Humanitarian

- Human trafficking – detection and prevention
- Public health response – early detection and contact tracing
- Disaster relief response – protection of displaced populations
- Maritime – taking ‘search’ out of search and rescue



HAPS, AN ALLY WHEN IT MATTERS MOST

Natural disasters can cause massive damage to telecommunications infrastructure. Recovery takes weeks while users need immediate service

Weather Resilient



HAPS flying far above ground weather at 20km.

Ground equipment can be stored, moved, mounted.

Power Resilient



Each HAPS is independently solar-powered, with battery storage, and is not reliant on the local power grid.

Easy deployment & flexible



HAPS solutions require minimal deployment effort and ground logistics.

Adaptive, resilient fleet

Easily upgradable

Fast activation



When prepositioned in a region, HAPS can provide service quickly.

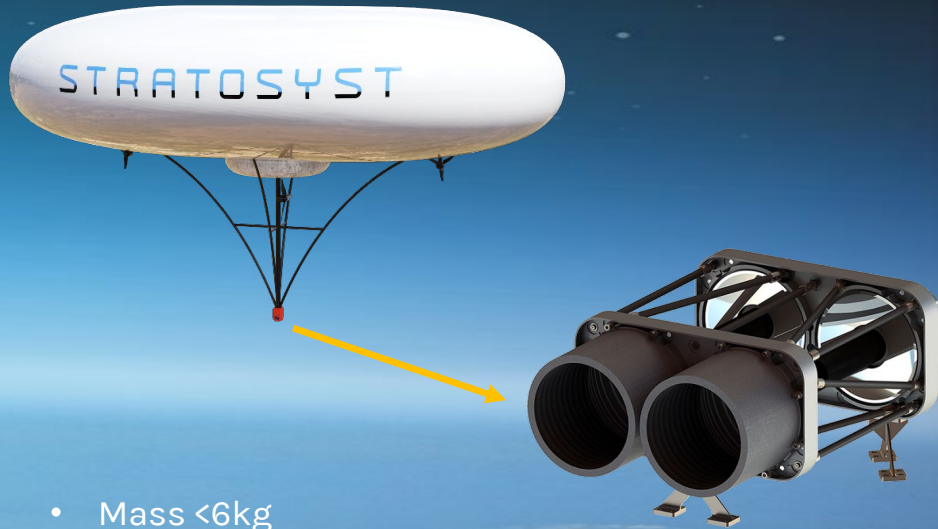
Complements terrestrial network

Movable fleet

**OUR MEMBERS
IN ACTION
for the planet**

STRATOSYST EARTH OBSERVATION

The global EO economy was estimated to be between EUR 9.6 and 9.8 billion and growing.....



- Mass <6kg
- GSD <15cm @ 20km
- Multi-Spectral Bands: Visible & Near Infra-Red

Use Cases:

- Natural disasters
- Agriculture
- Freshwater
- De-forestation
- Oil & Gas leakage
- Animal migration
- Polar caps monitoring

STRATOSYST EO FOR FIRE DETECTION



- Prevention of losses to environment, property, infrastructure and human lives
- Communication and situational awareness infrastructure for rescue operations
- LiveVideo Streaming for monitoring and rapid response

Duration: long-term operations (months)

Station-keeping: not required

Platform movement: circling above desired location(s)

Swarm operations: possible

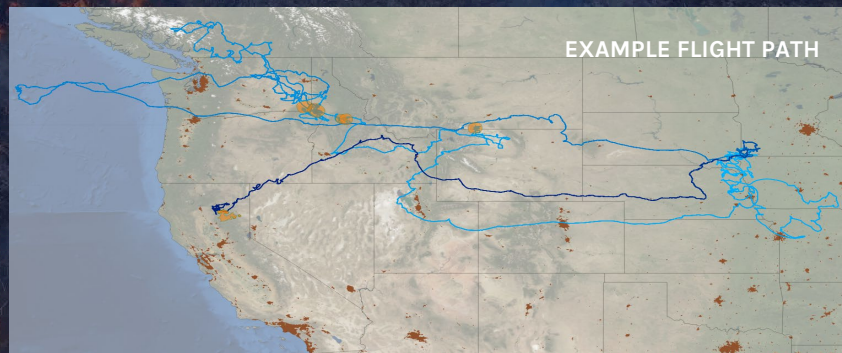
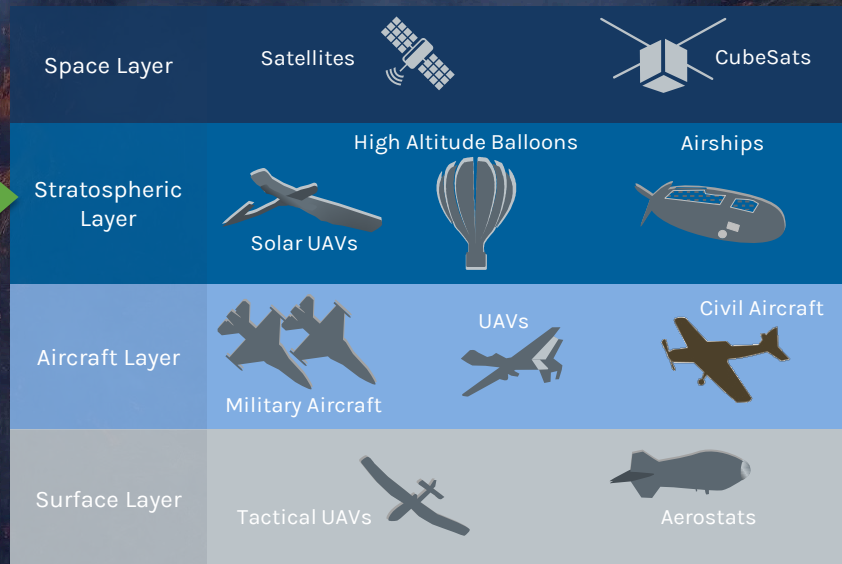
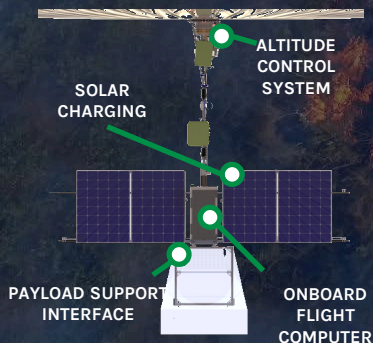
Data transmission: live

RAVEN AEROSTAR WILDFIRE SUPPORT

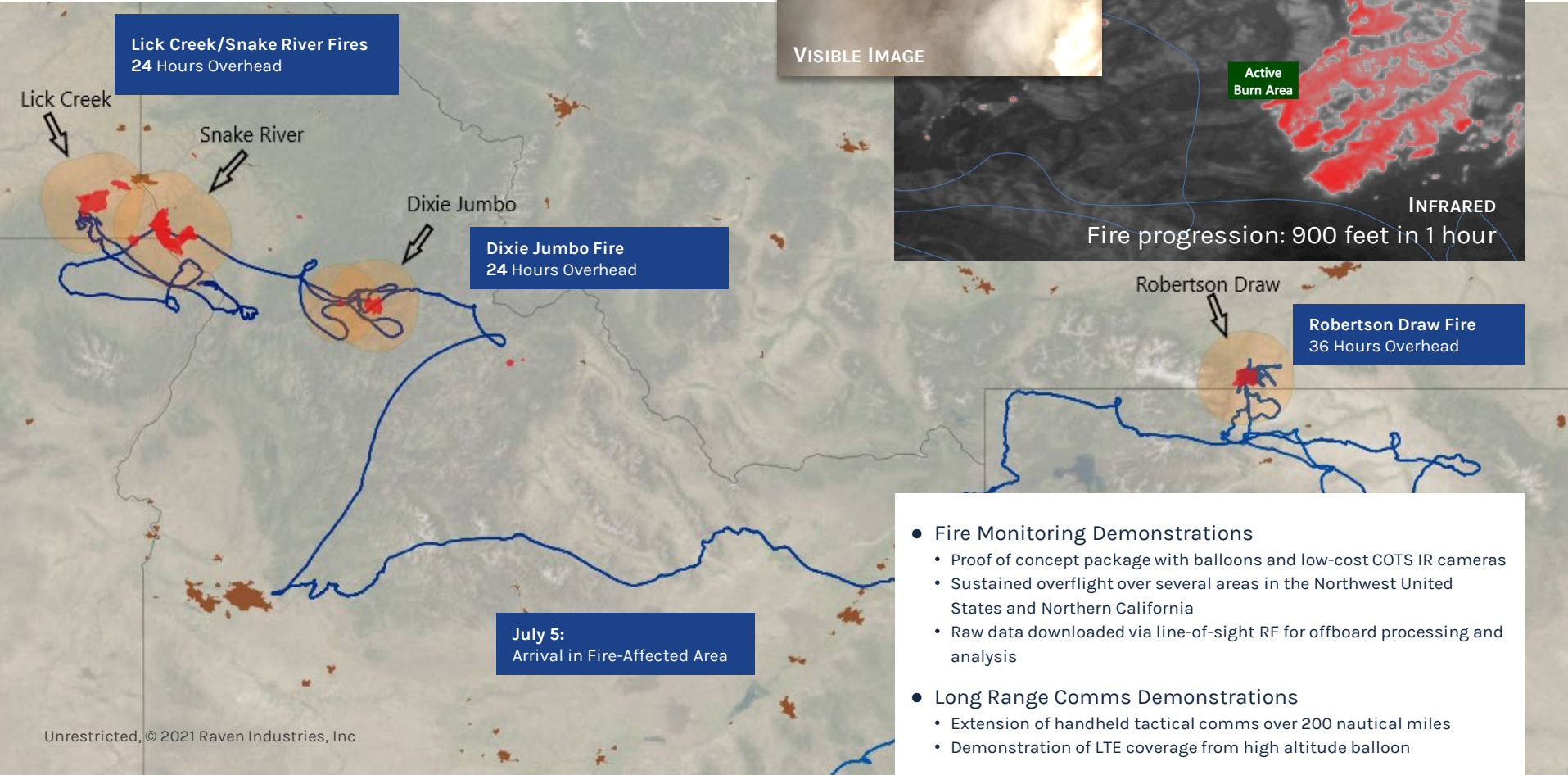
- **HAPS Layer Can Provide:**
 - Long Dwell Targeted Flight over Wildfire Events
 - Unique, High-Altitude Vantage Point for Remote Sensing and Communications
 - Persistence Coverage via Teamed Assets
- **High Altitude Balloons (HABs) Offer:**
 - Relatively Low Cost
 - Responsive Deployment
 - High Technical Readiness



THUNDERHEAD
BALLOON



RAVEN AEROSTAR RECENT PROGRESS



- **Fire Monitoring Demonstrations**
 - Proof of concept package with balloons and low-cost COTS IR cameras
 - Sustained overflight over several areas in the Northwest United States and Northern California
 - Raw data downloaded via line-of-sight RF for offboard processing and analysis
- **Long Range Comms Demonstrations**
 - Extension of handheld tactical comms over 200 nautical miles
 - Demonstration of LTE coverage from high altitude balloon

SCEYE INVOLVEMENT IN HAPSVIEW PROJECT

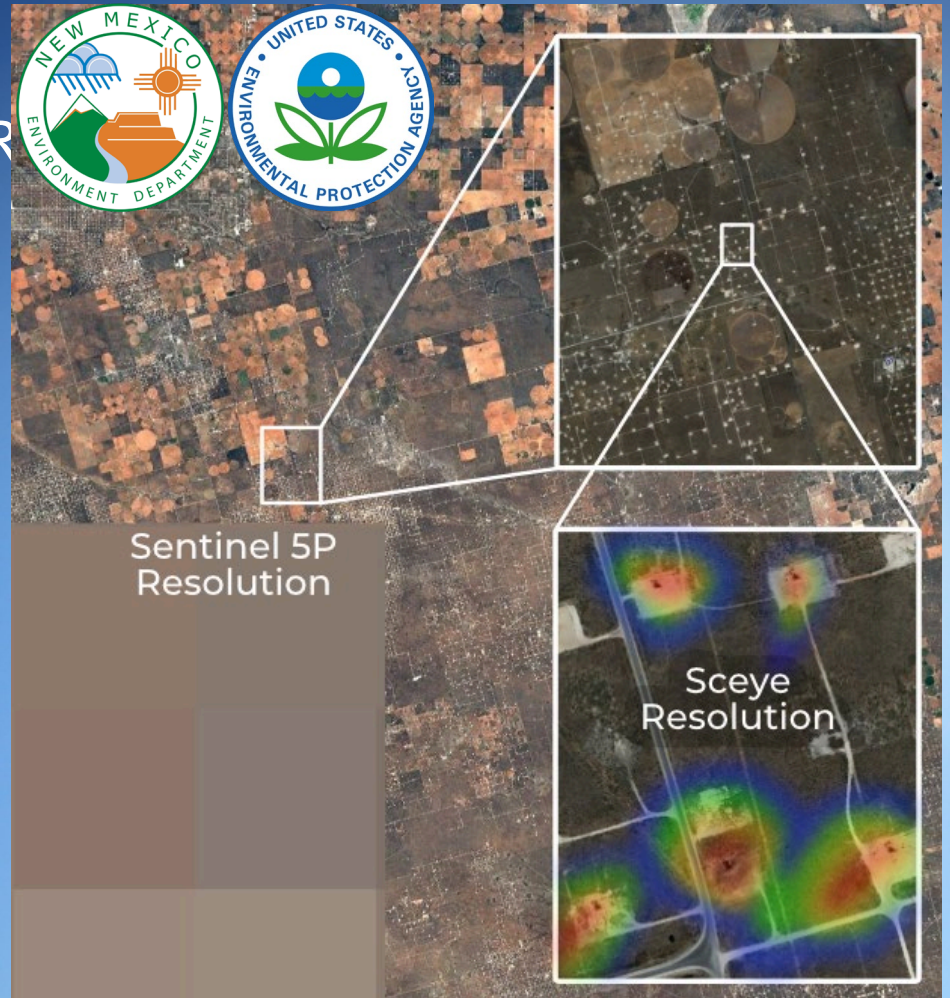
- Today's standard platform for GHG globally detection is ESA's Sentinel 5P which provides a resolution of 7km x 7km (MORE)
- HAPSVIEW is a feasibility study commissioned by the European Space Agency (ESA) and completed by GMV, Sceye, ABB and KNMI
- It supports formulation of the Paris Agreement Monitoring (PAM) and Metropolitan Surface Air Quality (MSAQ) missions
- Study shows there are both wide range of sensors for pollution, GHG and CH4 monitoring, that meet requirements, and airships are the platform of choice for persistent data required to enable policy
- Few of the total surveyed platforms were compatible with the off-the-shelf sensors due to SWaP
- Most modifications (yellow) relates to the inclusion of scanning mirrors for Sceye HAPS.

Platforms / Instruments	Sceye	HTA
O ₃	→	△
CH ₄	△	▼
CO	→	▼
SO ₂	△	▼
NO ₂	→	▼
Aerosols	→	▼

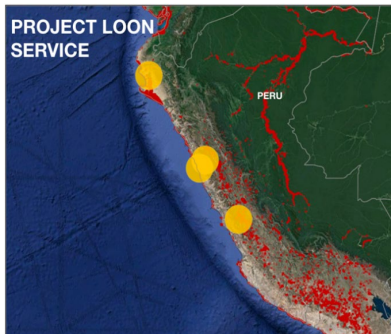
△	Compatible: The instrument architecture is compatible with the HAPS with only minor modifications that do not change its overall concept.
▼	Not Compatible: The instrument cannot be on the HAPS
□	Compatible with modifications: the instrument architecture has to be modified to be used on that HAPS. Examples: addition of a scanning mirror, extension of the angular range of its scanning mirror, etc.

SCEYE EMISSIONS MONITOR

- New Mexico Environmental Department has signed MOU with EPA to use Sceye HAPS for monitoring significant emissions sources, state-wide air quality levels and cross-state traffic for wide awareness
- Sceye can deliver **sub-1 meter** resolution
- The short distance to ground ensures accuracy in attributing gas releases versus the far distance to satellites
- The resolution is enabled by the ability to carry several hundred kg of payload without sacrificing station-keeping capabilities

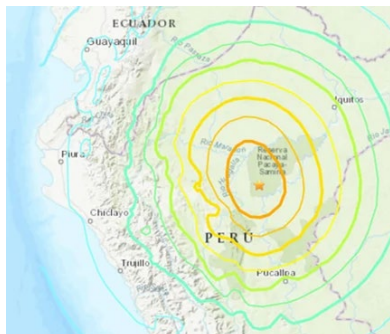


LOON: HAPS POST-DISASTER SOLUTION ALREADY SUCCESSFULLY DEPLOYED



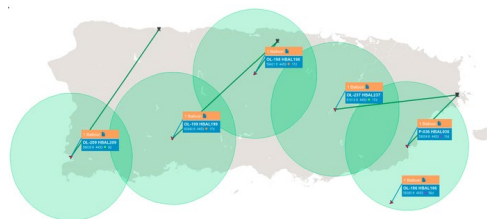
2017: Peru

Reconnected 100,000+ Telefonica users post El-Nino floods



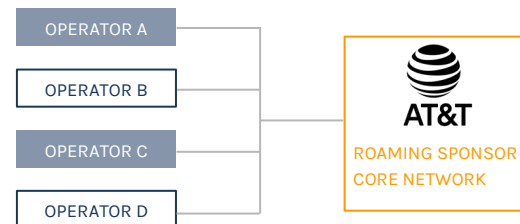
2019: Peru

Reconnected 20,000+ users in Amazon within 48 hrs of earthquake



2017: Puerto Rico

Loon provided internet to 250,000+ Puerto Ricans after Hurricane Maria



2020

Enabling scaled service across all AT&T LTE International roaming partners

HAPS ALLIANCE WORKING GROUPS

Telecommunication W G

Aviation W G

Marketing & Communication W G

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, 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

HAPS ALLIANCE AVIATION WORKING GROUP

ACHIEVEMENTS

- World ATM Congress Presentation, 27 October 2021
 - *“From the Stratosphere and Beyond – the HAPS Alliance is Connecting the Unconnected”*
 - Introduced HAPS Alliance and presented our vision for Operations at Scale in the stratosphere
- HAPS Terminology Discussed, Debated, and Written Down – Approved and in use
 - The words we use to describe ourselves are important – they define who we are!
 - Even the words we avoid when talking about ourselves can be just as important – i.e. who we aren’t!
- CONOPs for managed autonomy in accessing Higher Airspace Operations – Published
 - Share the vision with Regulators in order to help steer shorter-term regulatory decisions and positions
 - Start changing the legacy Pilot In Command paradigm to one of “management by exception”
- HAPSMobile Flight & Communications Test Experience – Published
 - Important to show global Regulators the tangible progress being made by the HAPS Alliance members

GOALS

- Work with Researchers, Air Services Australia, and other ANSPs to develop Community Operating Principles for the upper airspace collaborative traffic management system
- Draft Circular for ICAO to define HAPS and supplant RPAS Manual treatment of autonomous fleet systems – not “remotely piloted” but instead “managed” –Terminology!



JOIN HAPS ALLIANCE

INFORMATION & EDUCATION

Collectively advocate the advantages of HAPS with relevant authorities

STANDARDIZATION & INTEROPERABILITY

Develop common product specifications and standards for HAPS interoperability

CREATE A HAPS ECOSYSTEM

Build a viable, cooperative and safe HAPS ecosystem

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



THANK YOU