HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

STRATOSPHERIC PLATFORMS In the GOLDEN DOME and LAYERED DEFENSIVE ARCHITECTURES

2026 HAPS Alliance Defense Round Table Event: July 23, 2026

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Welcome – HAPS Alliance and DAWG Introduction

- *HAPS Alliance President (Russ VanDerWerff), Defense Working Group Chair (Kyle Doverspike)*

HAPS and The Golden Dome – White Paper and Topic Review and Q&A

- *Defense Working Group Chair (Kyle Doverspike)*

Member Spotlights – Defense Technology and Capabilities

- *Aerostar, Involve Space, Space Data, Stratosyst, Swift Engineering, TMYTEK, Voltitude, Wren Aerospace*

Q & A – White Paper and Spotlight Questions from Audience (via chat)

- *Defense Applications Working Group Members*

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.

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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.

Each Layer Has Its Own Value Proposition

Unlocking the Potential of the Stratosphere

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

Airship Form Factor

- High maneuverability and payload capacity
- Capability to stay over an AO, 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

Balloon

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







Enabling a Wide Range of Applications

Connectivity

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

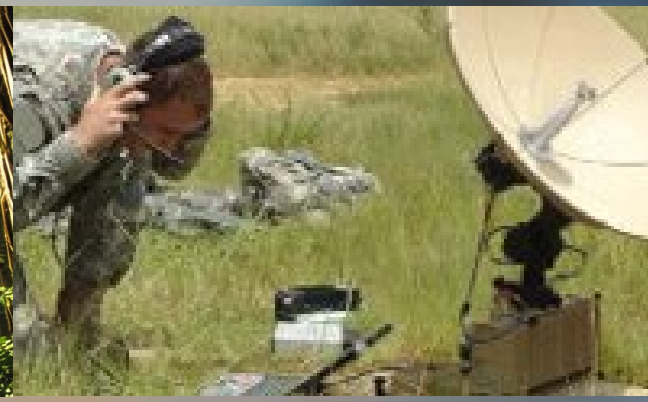
Disaster Response

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

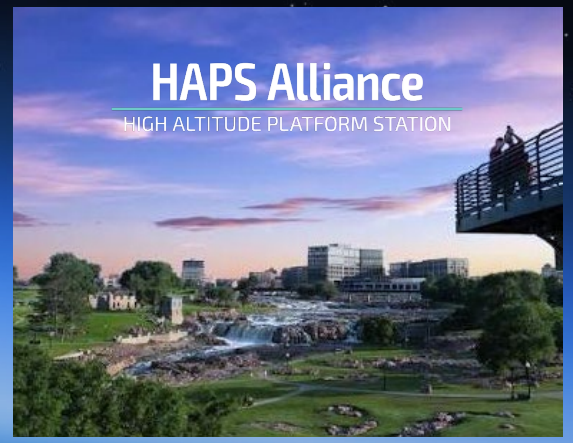
HAPS enable real-time monitoring with high resolution images and sensors for wildfire monitoring, atmospheric testing, and crop health assessment.

Defense



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

HAPS Alliance Member Meeting

2023	2024	2025	2026
			
San Francisco, California	Bonn, Germany	New York, New York	Sioux Falls, South Dakota

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- Hosted by Aerostar in Sioux Falls, SD
- Two-day event: 30 Sep – 1 Oct, 2026
- Live Stratospheric Balloon Launch On-site
- Working Group In-person Breakouts
- Stratosphere Manufacturing Facility Tour
- No Host Social Networking Event

HAPS at Work: Powering Open Skies

- The Latest In Everything HAPS
- Annual HAPS Alliance Updates
- Keynote Speakers & Panels – Government, Industry, Military, Users, and Vendors
- Member Briefings on recent achievements, demonstrations, opportunities, and research

HAPS Alliance Working Groups

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

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What does the DAWG Do?

What Does the DAWG Do For Members?

An environment for collaboration and engagement with the defense sector

Opportunities to engage and network with the defense sector representatives, including government, military, and non-Alliance contractors

Opportunities to participate in or represent the HAPS Alliance at defense sector conferences and events

Advocacy for HAPS Alliance ideals and positions within the defense sector for the use of HAPS in defensive

Advocacy of DAWG goals and defense-based stratospheric strategies within the HAPS Alliance

What Does the DAWG Do For Defense?

Opportunities to engage with the HAPS Alliance, the forefront of stratospheric capabilities

Educational materials, white papers, and resources on the maturity and application of stratospheric capabilities for defensive applications

Opportunities to be exposed to emerging and developing stratospheric capabilities

Stratospheric capability representation at defense industry conferences

An established stratospheric industry-based group for collaboration, media, inquiries, etc.

Defense HAPS In The News

TESTING AND EMPLOYMENT

CONCEPTS AND OPERATIONS

U.S. ARMY

3d MDTF demonstrates ability to operate in the Indo-Pacific

By Major Stephen Page June 21, 2024

FORT SHAFTER, HAWAII – 3d Multi-Domain Task Force (3MDTF) continued to demonstrate its ability to operate in the INDOPACOM theater through its participation, experimentation, and innovation in Valiant Shield 24. 3MDTF deployed teams of soldiers across the Pacific while executing distributed command and control and employing emerging concepts and capabilities partnered with Department of Defense agencies and commercial industry.

Teams operating out of Japan, Guam, and Palau integrated extended range sensing, long range communication, effects, and fires to contribute to accomplishing training objectives.

US Army conducts high-altitude experiments with Zephyr UAS

Est. reading time: 1:30

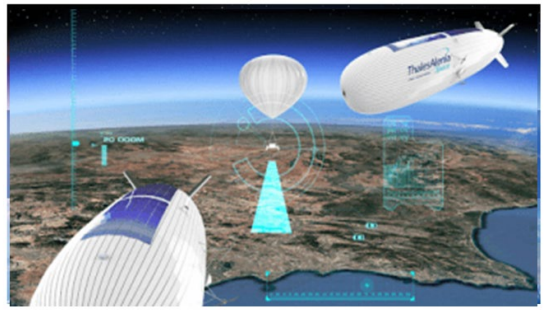
July 25, 2022 - By Tracy Cozzens

Zephyr is prepared for a flight test. (Photo: Airbus)

Dubai Startup Pitches Tethered-Rotor Platform For Stratosphere Use

Thierry Dubois August 20, 2025

Credit: X721



Stratobus: A Feature Hybrid of Unmanned Air Vehicles for the European Air Defence Structure

Finabel - 5 February 2020 - Info Flash

dvids

HOME FEATURES CONTENT STORIES

Above the Clouds and in the Atmosphere Over NE21

PALMER, ALASKA, UNITED STATES
05.10.2021
Video by Petty Officer 3rd Class Omar N Rubi
Pacific Air Forces

Subscribe 41

BREAKING DEFENSE

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AIR LAND NAVAL SPACE NETWORKS MULTI-DOMAIN BUSINESS CONGRESS PENTAGON GLOBAL

FEATURED: Defense Budget 2026 » News Video: The Weekly Break Out »

AIR WARFARE, LAND WARFARE

Army about to formalize 'micro-high altitude balloons' as a new requirement for surveillance ops

The new effort for microHABs is being led by the Army's Program Executive Office for Aviation, Andrew Evans, director of the Army's ISR Task Force, told Breaking Defense, which for the moment is the primary acquisition shop overseeing the service's pursuit of systems that can operate at the upper edges of the stratosphere — roughly between 60,000 and 100,000 feet, and just below orbital space.

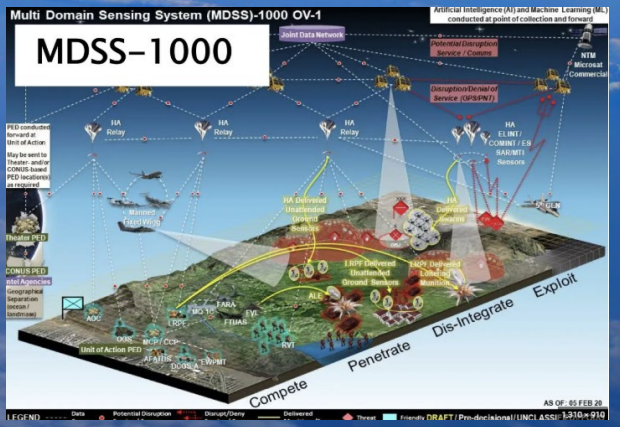
By THERESA HITCHENS on October 16, 2024 at 5:05 PM

The Army said micro-High-Altitude Balloons (microHABs) completed a Continuous Uninterrupted Relay Transmission Aerial Intelligence Network over a large distance as part of the Vanguard 24 exercise in September 2024. (PEO IEWS via LinkedIn)

THESE U.S. MILITARY DRONES ARE BREAKING RECORDS - HERE'S WHAT MAKES THEM SO SPECIAL

BY JONATHAN H. KANTOR // NOV. 15, 2024 10:15 PM EST

Airbus



HAPS Alliance DAWG: *Technology Readiness Framework for Stratospheric Industry and Defense*

- HAPS In Defense Applications
- TRL Purpose and Function In Defense
  - Analysis of TRL Approach and Policy
- HAPS TRL Scale
  - Hardware
  - Software
  - Modeling and Simulation
- HAPS Critical Technology Element (CTE)
  - Aviation Systems
  - Service Systems
- Unique HAPS CTE And Considerations
  - Representative Environments
  - Integrating Technologies of Various TRL
  - Managing Risk in Test Conditions
  - Specialized Modeling and Simulation
  - Global Navigation and Prediction

Published Nov 2025

HAPS DAWG Defense Applications Framework

From: *Technology Readiness Framework for Stratospheric Industry and Defense*

Command, Control, Communications (C3) *Use of HAPS system to transmit and receive signals for the purposes of communications*				**Intelligence, Surveillance, & Reconnaissance (ISR)** *Use of HAPS system to collect and derive information*			
Network Extension	**Tactical / Mesh**	**BLOS**	**Fires Support**	**SIGINT**	**MASINT / RADAR**	**Optical**	**Open Source**
Strategic network of platforms and assets for common operating picture (COP), situational awareness (SA), or information sharing	Dynamic C3 network of localized, tactical nodes with disadvantaged LOS for COP, SA, or cross-node meshing	Utilization of C3 over beyond line of sight (BLOS) platforms in space, stratosphere or air allowing long distance comms over long distances	Relay of C3 signal for targeting, maneuvering, or C3 direct to munitions items or unmanned friendly assets performing offensive action	ISR derived from electronic systems and signals to ascertain information about the source, location, or data within the signal	ISR derived from capturing and measuring the intrinsic characteristics and components of the source	ISR derived to create and validate a picture via optical sensor, still or full motion, to include infrared to ultraviolet spectra	ISR derived from signals purposefully emitted by sources for tracking, safety, and deconfliction of commercial and private activities
Example: Blue Force Comms, Secure Comms	**Examples: MANET, LTE, UHF, VHF**	**Examples: LOE / GEO Satellite, HAPS Relay**	**Examples: LRF Support, Dynamic Retasking**	**Examples: ELINT, COMINT**	**Examples: GMTI, SAR, Infrasound**	**Examples: EO, IR, Hyperspectral**	**Examples: AIS RX, ADS-B RX**
Electronic Warfare (EW) *Use of HAPS system to transmit signals for the purpose of defeat or confusion*		**Air Launched Effects (ALE)** *Use of HAPS system to deploy secondary platform or effect*		**Other Effects** *Use of HAPS system to perform other effects and functions*			
Electronic Attack	**Disrupt or Decoy**	**Direct**	**Indirect**	**Recovery**	**Safety / FOS**	**Wind / Weather**	**APNT**
EW signals emitted or altered as electronic attack (EA) to spoof, jam, confuse, simulate, or disable adversarial systems	EW signals emitted to disrupt or decoy (D2) by simulating the signature of unfriendly or friendly platforms to confuse adversarial systems	ALE deployment of secondary platform or material with kinetic or mass derived payload capable of colliding with intended target or performing effect	ALE deployment of secondary platform with ability to independently provide effects using payload and C3 capability	ALE deployment of secondary platform for the purpose of precision recovery of valued or sensitive HAPS components at an advantageous location	Systems that collect or produce signatures establishing the presence of the HAPS for safety or open-source safety and freedom of Sky (FOS) observation	Systems that collect or produce signatures for the purpose of characterizing weather or environmental factors	Systems that collect or produce signatures for the purpose of deriving assured position, navigation, and timing (APNT) for use by HAPS or distribution
Counter-UAS, Radar jamming	**Spoofed ADS-B, non-HAPS C3 transmit**	**Glide Munition, Chaff, Kinetic UAS**	**ISR Glider, Jammer UAS, Other HAPS**	**Glider, UAS, Parafoil**	**ADS-B, Strobe**	**Barometer, LIDAR, Thermometer**	**Star-tracker, Sun-tracker, Geo-mapping**

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			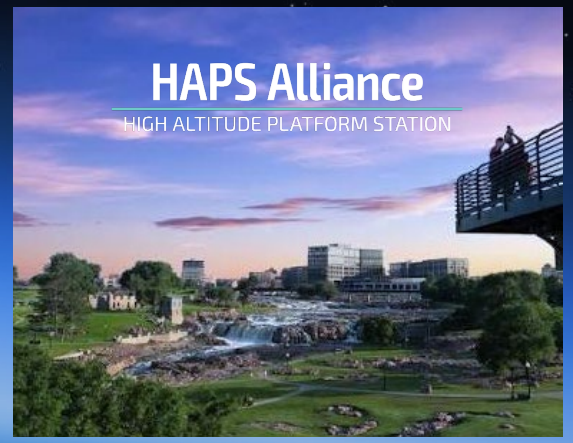
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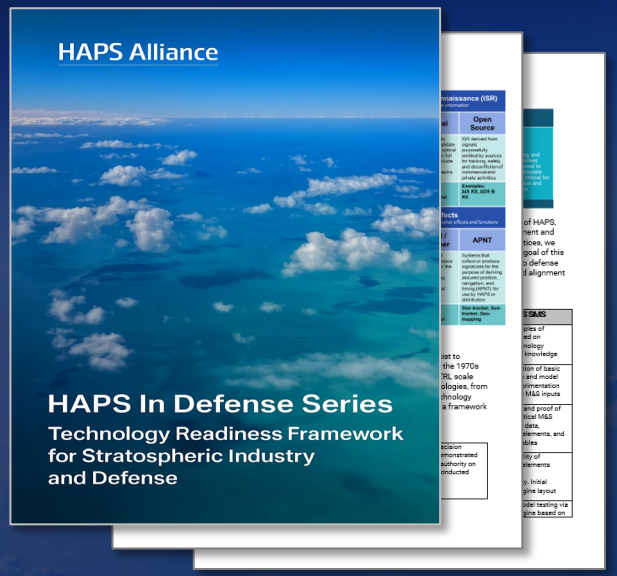
Defense Industry and Gov Benefits

- DAWG In-Person WG and Gov Round Table
- Defense Panel – Multi-national Gov & Military
- Military & Federal Program presentations
- Defense Industry Vendor Briefings – Users, demonstrations, & new capabilities
- Stratospheric Defense Industry Engagement

HAPS Alliance DAWG: *Future White Papers and Events*

Publish ~Fall 2026

HAPS Modeling & Simulation for Defense



- Overview for Gov and Defense Approach to stratospheric platform M&S
- Guidelines for CTE and use of AI
- Representative datasets for Gov testing

Other Future DAWG Whitepaper Topics

- **Export Control Framework**
  - Provide recommendations and guidance on stratospheric technology export compliance considerations and existing precedents
- **Payload SWAP Standardization**
  - Provide a review, summary, and recommendations for existing and plausible standardization approaches for stratospheric payloads and platforms
- **Stratospheric Layer Deconfliction**
  - A continuation of the HAPS Alliance Aviation WG's published civil stratospheric platform deconfliction with approaches for defense organizations to participate and leverage

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Need:

As missiles, hypersonic objects, cruise missiles, and UAS threats continue to evolve, defense leaders are seeking architectures that improve early detection, tracking, command-and-control, and response timelines across multiple domains.

Opportunity:

HAPS technologies represent a significant opportunity to strengthen emerging layered defense architectures, including the U.S. “Golden Dome”, by opening a new layer of the battlespace

Impact:

By operating closer to the battlespace than orbital systems while maintaining longer endurance than conventional aircraft, HAPS can support earlier warning, better cueing, more resilient communications, and greater flexibility in how layered defense systems are deployed and sustained.

Focus:

Why HAPS are critical to Golden Dome success

Six Golden Dome foundational risks served uniquely by HAPS

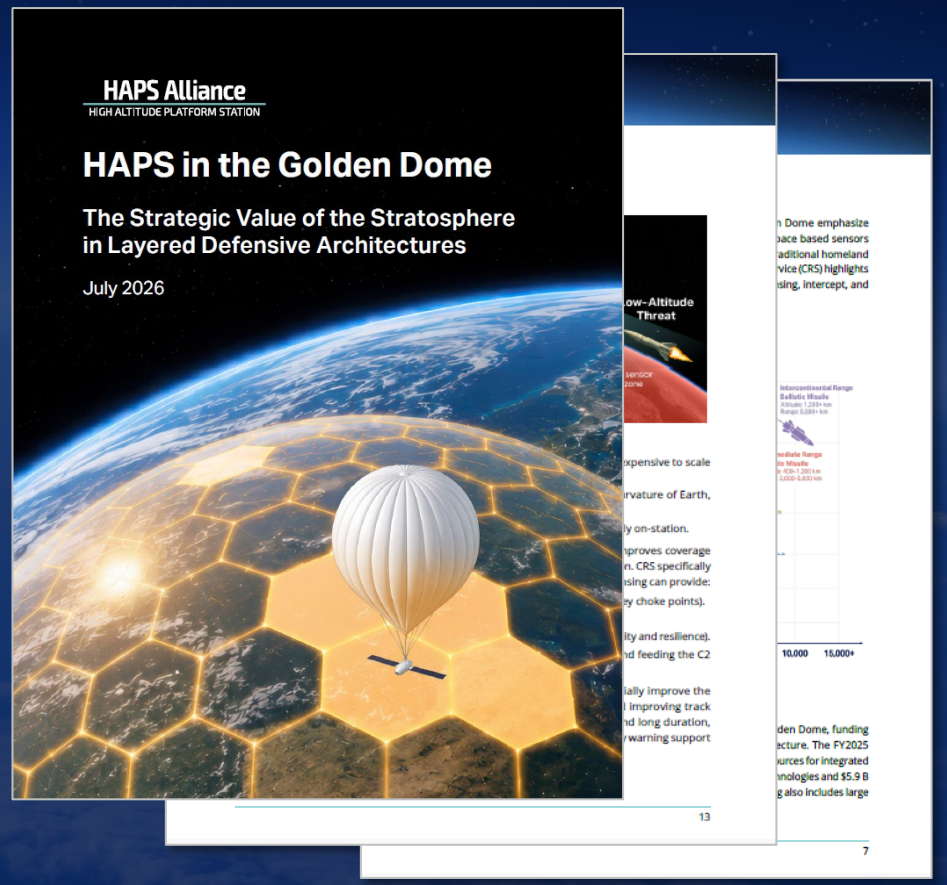
A look at international policy & treaties for HAPS in defense

Recommendations: near term & long term integration of HAPS

HAPS Alliance DAWG: *HAPS In The Golden Dome: The Strategic Value Of The Stratosphere in Layered Defensive Architectures*

- Golden Dome Strategies and Policies
  - Golden Dome Competencies
  - International Dome Defense Initiatives
  - Relevant International Policies
- HAPS Capabilities in Defense
  - HAPS Entering Defense
  - HAPS In Layered Architectures
- HAPS In the Golden Dome
  - Persistent Mid-Layer Sensing
  - Communications Extension and Relay
  - Contested Electronics Warfare Support
  - Left of Launch Force Projection
  - MDA and Gap Filling
  - Rapid Test and Training
- Recommendations

Published Jul 2026



Golden Dome Strategies and Policies

Global Impact

Many countries and international partnerships with layered architecture initiatives. Similarities include:

- Defense against missiles and hypersonics
- Wide area coverage and monitoring
- Low-cost innovations and development
- Integrated C2 and communication
- Multi-layer cross support between platforms
- Desire rapid testing and employment

Policy and Precedent

No modern multilateral defense treaty has explicitly considered HAPS capabilities

1899 and 1907 - Hague Conferences discussed applications of tethered balloon systems but have since been superseded by other treaties

1967 - Outer Space Treaty was signed as the foundation of all modern international space law, does not address military operations in space or define the altitudes of "space"

2023 – United States INDOPACOM J06/SJA published a legal position on overflight controversy by the PRC over US airspace, determination is HABs and HAPS operate in airspace and not "outer space" or "near space" and are within sovereign territory

HAPS Capabilities in the Golden Dome

Golden Dome Areas of Need ▪ **Layered Architecture Functionality** ▪ **HAPS Commercially Proven Capability**

Cost Effective	Task-able Flexibility	Dynamic Resilience	Capable Platforms	Proven Technology
Persistence and coverage density at comparatively lower cost HAPS platform companies have demonstrated low-cost flight ability for 20 - 300+ days	**Repositionability and rapid re-tasking** HAPS have demonstrated the ability to maneuver and navigate across and between continents using global C2 networks	**Layered resilience against single-point failures** HAPS have demonstrated mesh communications and the ability to relay for other platforms in commercial applications	**High SWAP with improved geometry for low-flying threats.** HAPS have demonstrated payload SWAP to enable sophisticated monitoring at lower-than-space altitudes	**A practical bridge between commercial innovation and defense integration** Many HAPS have already proven utility and value in commercial applications

HAPS Capabilities in the Golden Dome

1. Persistent Mid-layer Sensing	2. Comms Extension & Relay	3. Contested EW Support	4. Left of Launch Force Projection	5. MDA and Gap Filling	6. Rapid Test and Training

Persistent Mid-Layer Sensing

Layered Architectures require multiple vantage points and overlapping effects

Satellites: Global coverage, but expensive to scale and susceptible
Ground Radars: High power/aperture, limited by line-of-sight and terrain
Traditional Aircraft: Flexible but limited endurance and costly

HAPS can act as a persistent, repositionable "mid-layer" sensor node that improves coverage geometry — especially for cruise missiles and UAS that stay low

Persistent ISR: Wide area monitoring of critical corridors
Gap filling: Where terrain and curvature limit ground-based radar
Multi-static: Distributed nodes improve track quality and resilience
Cueing: Handing off detections to higher fidelity radars / interceptors and feeding the C2 "glue layer"

Left of Launch Force Projection

Left of Launch components are sensitive, but messaging indicates an intention to leverage space-based capabilities to project force, with several hurdles

Schedule: Current capabilities are immature and require development
Cost: Space development is costly & high risk, particularly at speed
Policy: Changes in policy needed to leverage space layer

HAPS present an economical near-term alternative to space-based capabilities in force projection

Coastal and Terrestrial: Wide FOV enables HAPS to project sensing from safe international waters and friendly airspace in target areas
Maritime: HAPS excel in maritime due to persistence and navigation
Interdiction: During conflict escalation, HAPS with ALE enable effects and distraction over exceptionally long distances

HAPS Capabilities in the Golden Dome

1. Persistent Mid-layer Sensing
2. Comms Extension & Relay
3. Contested EW Support
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Comms Extension and Relay

Golden Dome messaging is near-term focus on communications and integrated C2 systems

C3 Glue layer: Nearest term goal to establish C3 as other tech matures
Data Fusion: Leveraging AI and other SW programs to exploit streams
Multi-agency: Distributing to partners, inter-agency, and others

A leading use case for commercial HAPS is communications and data distribution, this process is easily adapted into layered defense

Austere: Line-of-Sight over wide areas over poor and difficult terrain
Redundant: Backup to space and aircraft when degraded or jammed
Mesh: Comms node with multi-path to other platforms in the dome
Edge Data: Host edge data processing, reduce backhaul and bandwidth

MDA and Gap Filling

Maritime and coastal defense present unique homeland defense challenges difficult for traditional platforms

Pattern of Life: Evasive transshipment, dark ships, unusual loitering
Anomalous: Drug running, military buildups, non-cooperative vessels
Sensor Density: Critical corridors, distributed islands, wide seas & gulfs

Through persistence and wide field of view, HAPS enable new methods of maritime domain awareness and dominance

ISR: High SWAP enables multi-int collection with a single HAPS
Picket Line: Station keeping in “string of pearls” of persistent sensors
Blue Force Support: In a response scenario HAPS can provide Blue Force comms and ocean state / weather monitoring support

HAPS Capabilities in the Golden Dome

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Contested EW Support

Electronic Warfare is a critical risk in every modern engagement, defense architectures will face diverse challenges

Jamming: Overwhelming RF preventing C3 and effectiveness
Spoofing: Deceptive signals to confuse C3 and degrade cohesion
Decoy: Deceptive signals to distract sensors and responses

HAPS are uniquely resilient to EW risks due to several factors inherent to where and how they operate in the stratosphere

Altitude: EW TX struggles to affect HAPS at operating altitude distances
Encryption: High SWAP enables onboard data security modules
Counter-Jam: Wide FOV spectrum monitoring and local EW response
A-PNT: HAPS can provide A-PNT to Blue Forces in A2AD zones

Rapid Test and Training

Golden Dome and Layer Architecture objectives are far reaching, requiring systems to test and evaluate immediately

Mission Ready: Desire for systems proven in commercial environment
High Quantity: Rapid manufacturing and scale acquisitions
Flexible: Adaptable multi-function systems ready to plug-and-play
Low PAX: Unmanned system with low staffing to maintain and use

HAPS represent an opportunity to accelerate dynamic testing in critical ways at low cost compared to space-based or manned systems

Components: Satellite components tested prior to space deployment
Communications: Radios, waveforms, and relays tested in wide areas
Targeting: HAPS signatures used to test and train blue forces
Drops: From space and high altitude drop systems with precision

HAPS Capabilities in the Golden Dome

Recommendations

Prioritize engagement with the HAPS industry and experts to cultivate opportunities for rapid collaboration and partnership

Engage: Include HAPS and the stratosphere in upcoming conferences solicitations, planning events, and wargames
Attend: HAPS Alliance and DAWG Events intended to increase engagement

Leverage existing demonstrations and investments already underway

Requirements: Provide Golden Dome supporting requirements for HAPS technologies to existing HAPS development programs

Accelerate resources in the form of dedicated funding and supporting programs for the purpose of rapidly testing, validating, and employing HAPS technologies

Employ: Many high TRL HAPS are proven and ready for employment
Advance: Many low TRL HAPS technologies are primed for rapid advancement

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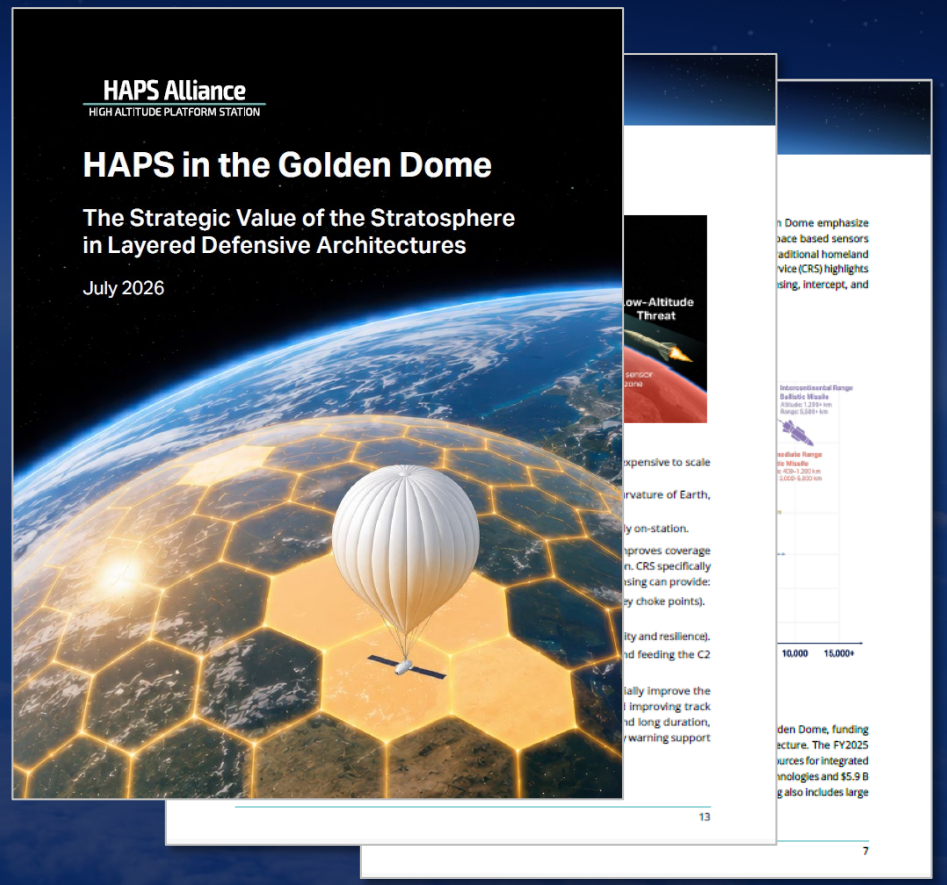

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Member Spotlight

Defense Industry Members Presenting

- Stratosyst
- Space Data
- Aerostar
- Voltitude
- Windborne
- TMYTEK
- Swift Engineering
- Wren Aerospace

For Company Contact Information, Please Reach Out Directly or Submit Inquiries to DefenseWG@HAPSAlliance.org

Aerostar: Layered Defensive Architectures with HABs

HAPS Alliance DAWG Roundtable Session

23 July 2026

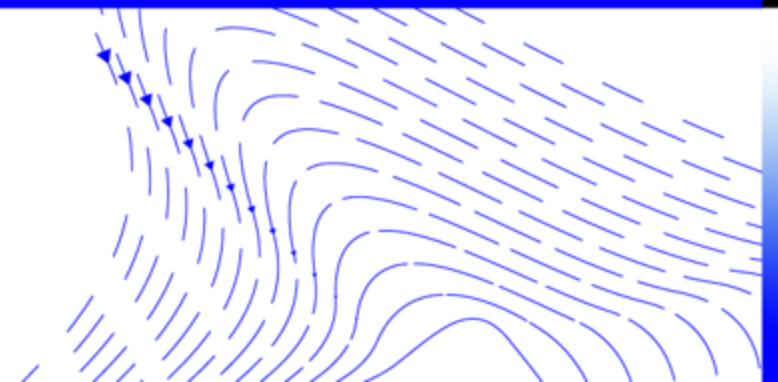
Virtual

Mark Ketcham
Principal Solutions Engineer

(605) 789-3575
Mark.Ketcham@aerostar.com

Caleb Turner
Senior Solutions Engineer

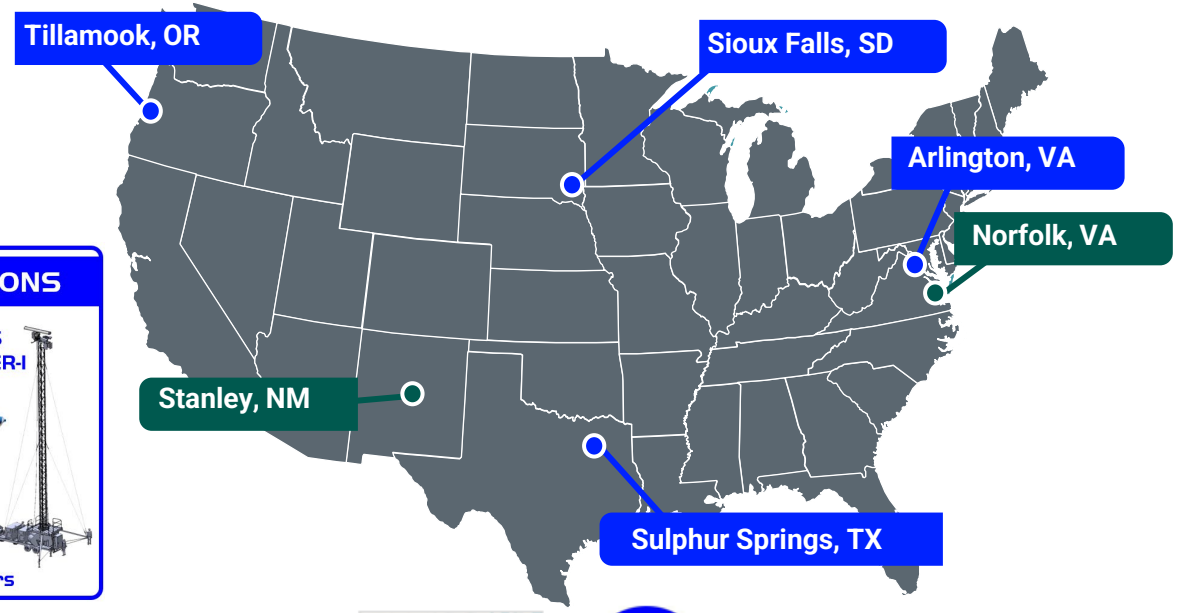
(503) 842-1990
Caleb.Turner@aerostar.com



AEROSTAR: Company Overview

With 70 years of lighter-than-air innovation and expertise, we're dedicated to solving challenges in Aerospace and Defense

- **>2 Million** Flights Hours in Stratosphere
- **>10,000** Operational Flights
- **>200** Technology Patents
- **70 yrs** Years Designing Balloon Systems
- **>200,000 sqft** Manufacturing and Lab Space
- **200** Employees
- **336 days** World Record Balloon Flight Days
- **>1,200 days** Consecutive days of balloon flight



STRATO SOLUTIONS


Thunderhead


Thunderstorm


Lightning


Cyclone

RESEARCH BALLOONS


Launch Services


NASA Large Super Pressure Balloon Program


Large Zero Pressure Balloons

SPACE INFLATABLES


Habitat Interiors


Materials Testing


Uprighting Bags


Planetary Balloons

RADAR SOLUTIONS

HiPointer 100
HiPointer 150

Vista F25
Vista F50 ER-I

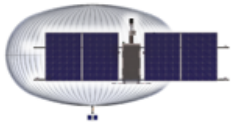
HiPointer 250

Multi-INT Mobile Towers

RAVEN

RAVEN AEROSTAR

Google LOON



NASA

AEROSTAR

NSC

1956 Raven founded as manufacturer of high-altitude research balloons

1956 USAF projects Manhigh and Excelsior utilize balloon systems for space and high-altitude flight tests

1986 Aerostar International founded as a subsidiary of Raven

2010 Hi Sentinel Successful sustained, powered stratospheric airship flight

2012 Project Loon initiated with Google X to provide high-speed Internet to Rural Areas using balloons

2018 DARPA ALTA program selects Thunderhead system as sole platform

2018 Aerostar Cyclone Balloon System selected for NASA "Flight Opportunities" program

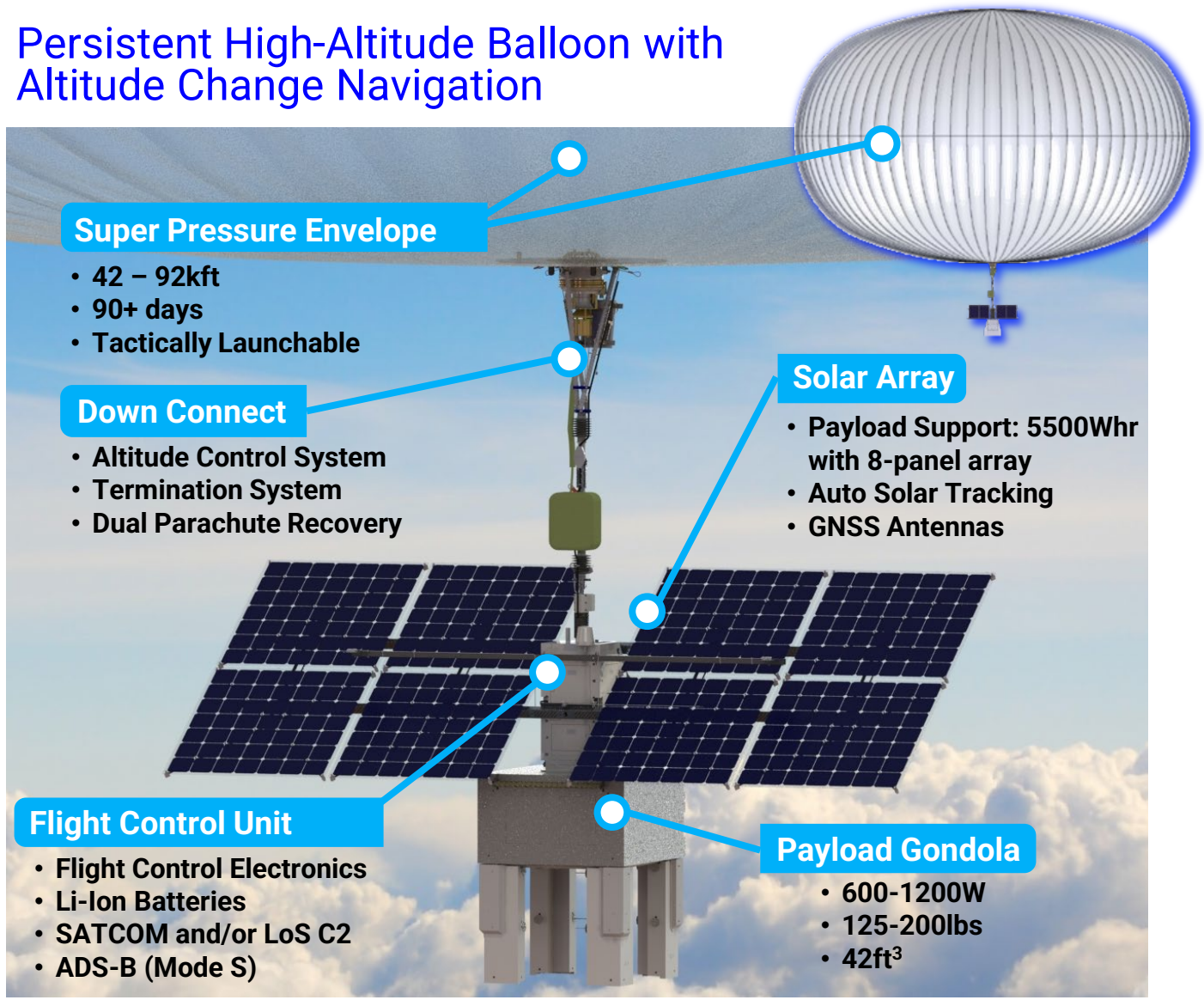
2021 Aerostar Launches 18 flights across 6 sites for 5 programs in 2 weeks.

2022 Aerostar separates from Raven, becomes stand-alone entity held by TCOM Holdings

2024 Aerostar acquires Near Space Corporation

High Altitude Platform: Aerostar Thunderhead

Persistent High-Altitude Balloon with Altitude Change Navigation



Modular Thunderhead System Architecture

- Modular balloon envelopes for tailored altitude ranges for maximizing wind diversity seasonally and regionally
- Scalable recovery and power systems for tailored payload SWAP

		Payload SWaP	
Payload Weight		125lb	200lb
Max Payload Energy		2400Whr/day	5500Whr/day
Max Payload Power		600W	1200W
Altitude	72 - 92kft	TH0400	TH1400
	62 - 82kft	TH0300	TH1300
	52 - 72kft	TH0200	TH1200
	42 - 62kft	TH0100	TH1100
Common Feature and Interface Support			
	Power Rails	Multiple +28VDC, 12VDC, 5VDC Rails	
	BLoS/LoS Comms	Iridium, Optional High Bandwidth IP LoS Mesh Radio or Satellite Comms	
	Payload Data Svc	Real-time GNSS/INS Data via Ethernet	

Available
Qualification required
Previously Flown; Long Lead Time
Design is required

Demonstrated Security and Defense Payloads

Thunderhead SWAP supports multi-INT payload employment with wide area persistent effects

SIGINT (passive RF)

TDOA/FDOA

Angle of Arrival

BLOS Comms

Iridium

Inmarsat

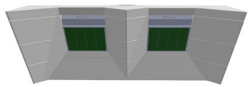
Starlink

Starshield

IMINT (Imagery)

StratoCam EO/IR

SAR + MTI

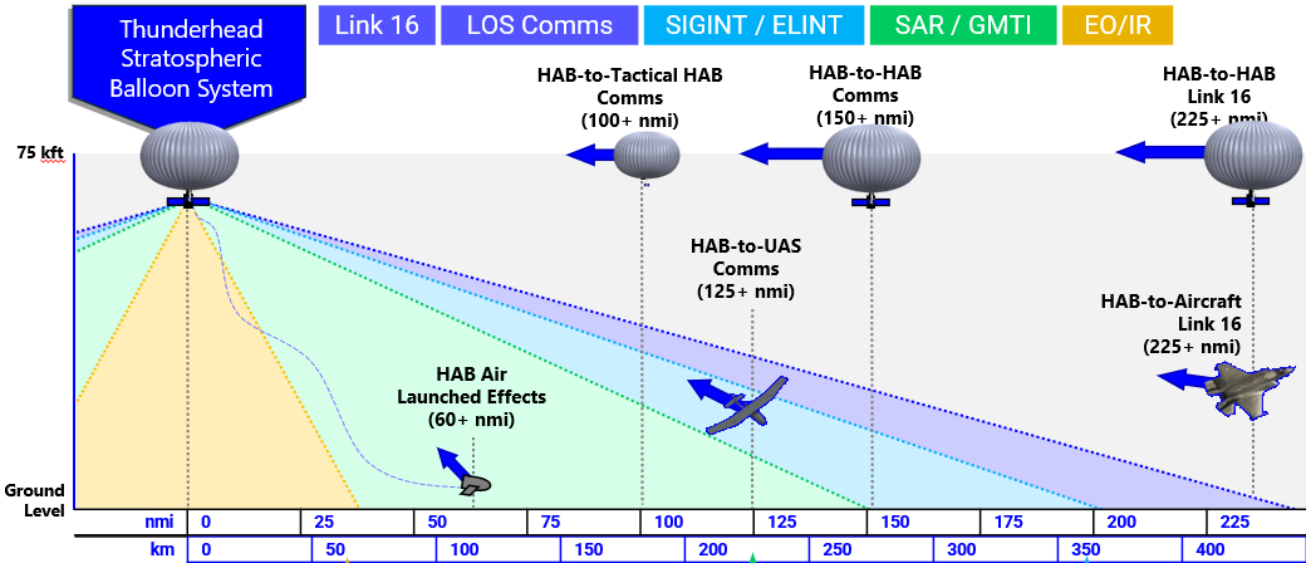


LOS Comms

Mesh Radio

Tactical Data Link

4G LTE



Demonstrated Effects and Ranges from 70kft

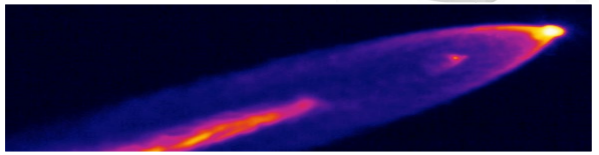
Aerostar StratoCam: Modular EO/IR Imagery Sensor

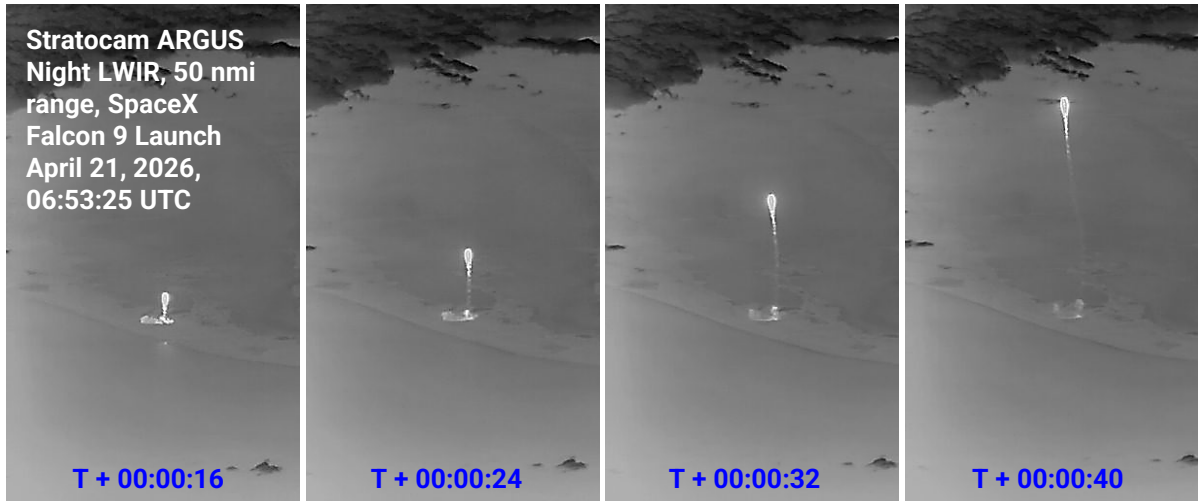
Argus: MIL-Grade ISR **2026**

Max value EO/IR sensors for day/night detection and monitoring of terrestrial and maritime CONOPS.

Ares: Missile Detect/Track **2027**

Optical Package: UV, Vis, NIR, SWIR, MWIR, and LWIR sensors for body plume detection of fast moving AV's.

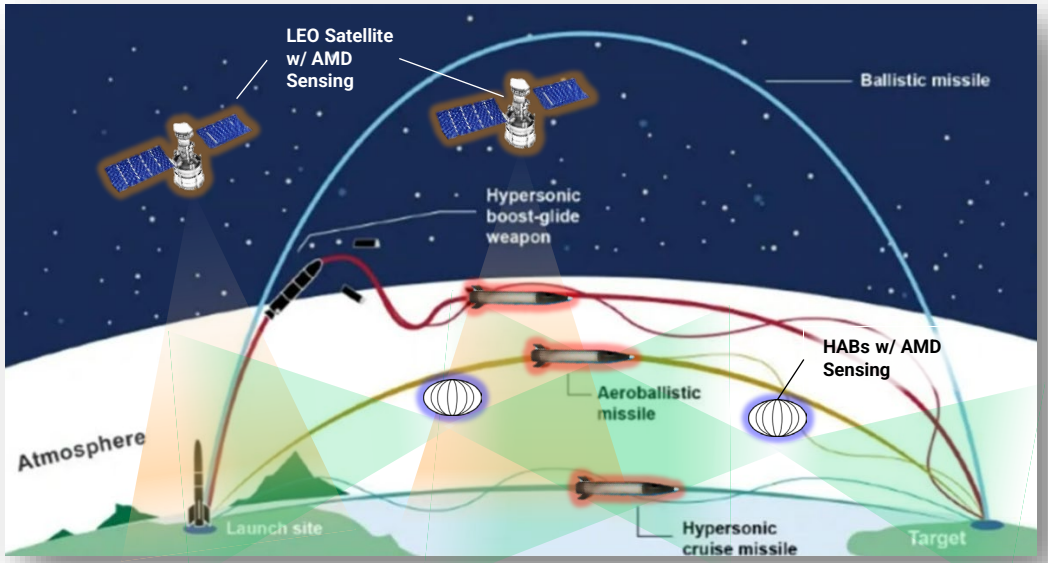




Example CONOP: HAB augmented IAMD

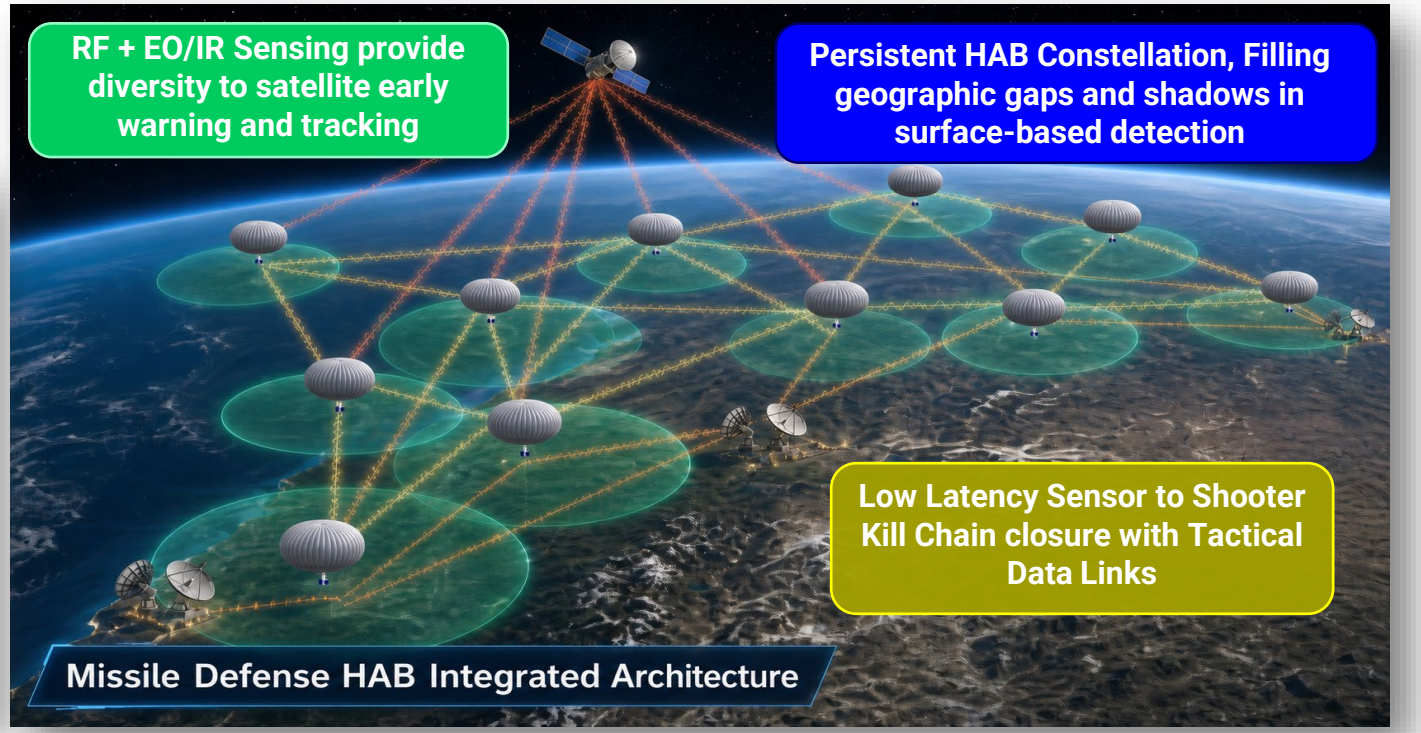
Wide-area Multi-mode Sensing

- HABs deploy in constellations for persistent wide area Early AMD Threat Warning Sensing including RF Detection and IR Tracking
- Favorable view shed for HGV and other similar new High Speed Low Altitude airborne threats Lower background clutter than space-based sensors
- Adds new geometric sensing vector (perspective diversity) providing to improve tracking solution



Networked Communications

- HABs have integrated into organic tactical data links (TDL) for C2 backhaul and track/target data networking
- HABs provide low-latency threat track information to tip and queue targeting assets and provide COP situational awareness
- HAB TDLs have demonstrated link ranges beyond air to ground RF LOS ranges.



Swift Engineering

Swift Ultra Long Endurance (SULE)

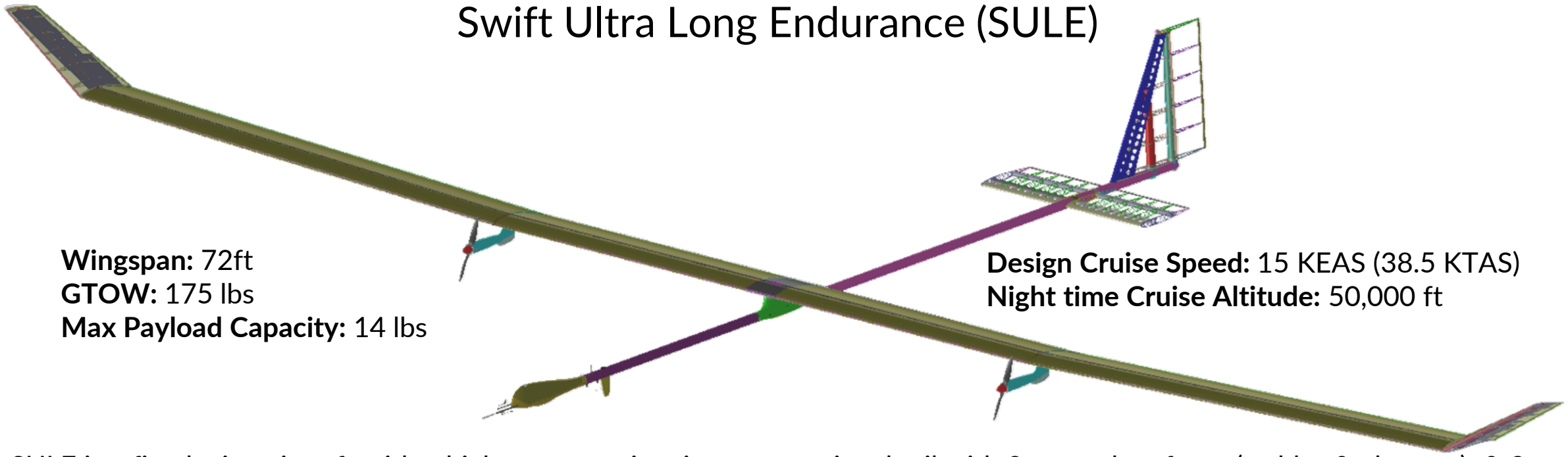
Persistent Intelligence at the Edge of the Atmosphere

Daniela Bublik
General Manager, R&D

Hamed Khalkhali, Ph.D.
President

SULE Overview

Swift Ultra Long Endurance (SULE)



Wingspan: 72ft
GTOW: 175 lbs
Max Payload Capacity: 14 lbs

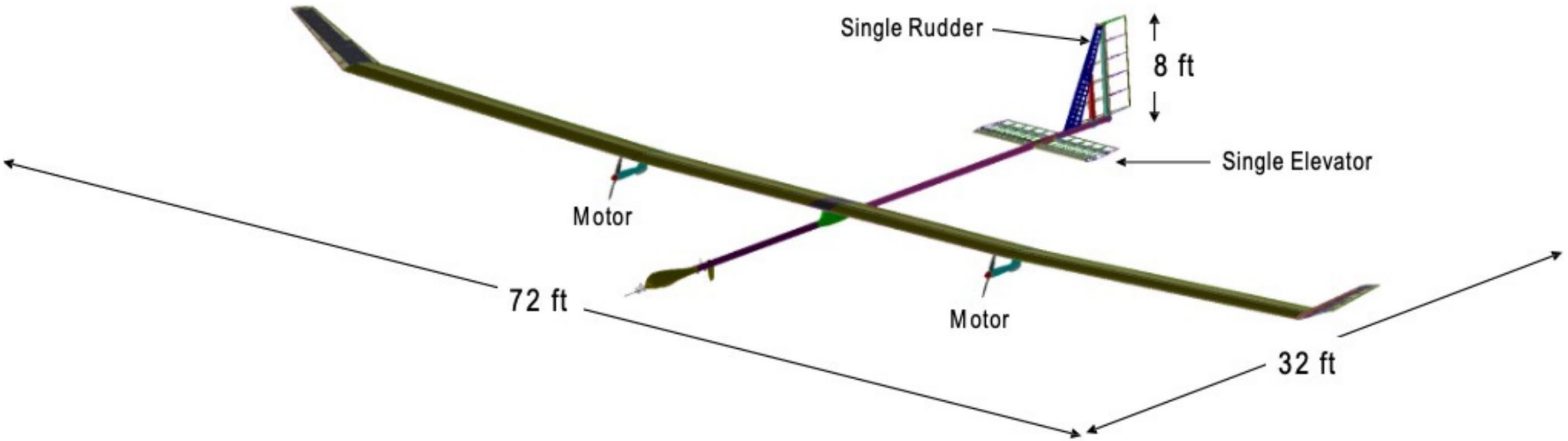
Design Cruise Speed: 15 KEAS (38.5 KTAS)
Night time Cruise Altitude: 50,000 ft

SULE is a fixed wing aircraft with a high-aspect ratio wing, conventional tail with 2 control surfaces (rudder & elevator), & 2 electric thrust motors slightly below the main wing. The aircraft is lightweight and has a composite primary structure

Energy: Harvested from a large solar array on the top surface on the main wings, which is stored in batteries that are distributed along the main spar.

Designed to operate at 65k+ ft in collaboration with NASA. Currently being flown for NASA and US Forest Service. Continued funding from NASA recently awarded.

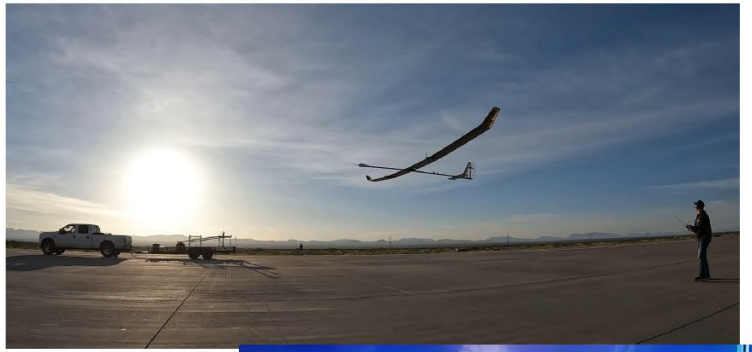
SULE Design Layout



Recent SULE Flights

10,000 feet Flight – June 9th 2023

- Launched at 6:51am from SPA
- Reached 10,000 feet MSL
- Successfully recovered at 10:06am

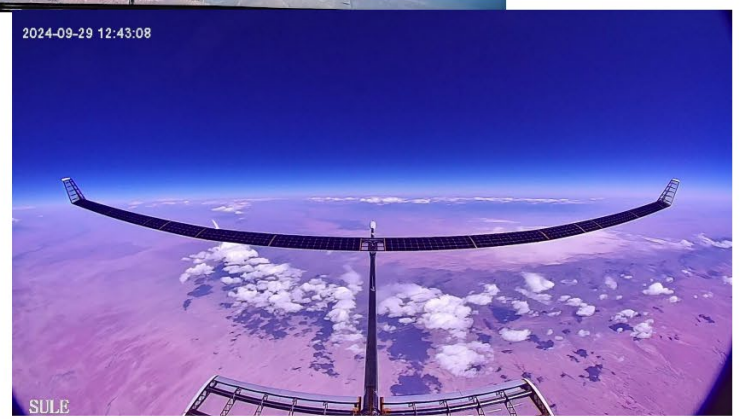


25,000 feet Flight – July 28th 2023

- Launched at 6:51am from SPA
- Reached 25,100 feet MSL at 2:00pm

54,000 feet Flight – September 29th 2024

- Launched at 6:51am from SPA
- Reached 54,000 feet MSL at 5:00pm
- Total flight time at 25 hours



67,000 feet Flight – June 9th 2025

MYTEK

The Architect of End-to-End Connectivity

Transforming Complex mmWave Innovation into Commercial Reality from Ground to Space

Industry Standard

Establishing the de facto standard for 6G and multi-orbit satellite communications

Deep Integration

Integrating phased array technology with a software-defined radio architecture

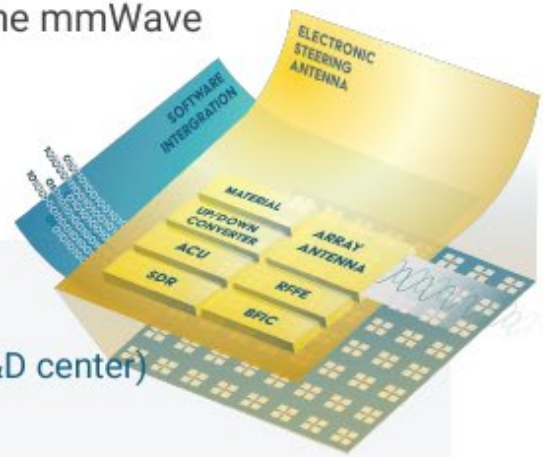
Commercialization

Accelerating the commercialization of mmWave technology from laboratory to MP

Jackrose Kuo, Solution Architect & Business Development

TMYTEK Specializes in Millimeter Wave Technology

TMYTEK is a world leading mmWave phased-array solution provider capable of design, manufacturing, and testing. We dedicate to solving all the mmWave challenges in the 5G, 6G, Satellite, Radar Defense era.



2014 Founded
Founder：Su-Wei Chang & Ethan Lin

Office
Taipei HQ、Hsinchu (R&D center)

100+ Team Members
50% R&D、30% Sales & Marketing

Patent granted
Granted 127+ global patents、60+ pre-grant

Funding to date $53M
Debuted on the TPEx in 2025
Listing process of TIB

Shareholders
NDF、EZconn 6442、KENMEC 6125、Amazing IC 6411、Inventec 2356

EMERSON · KEYSIGHT TECHNOLOGIES · Celanese · ROHDE&SCHWARZ Make ideas real · Nitto · Anritsu · EZconn

Mass Production Revolution: "LEGO" Phased Arrays via Next-Gen Packaging

AiP of Semiconductor Industry

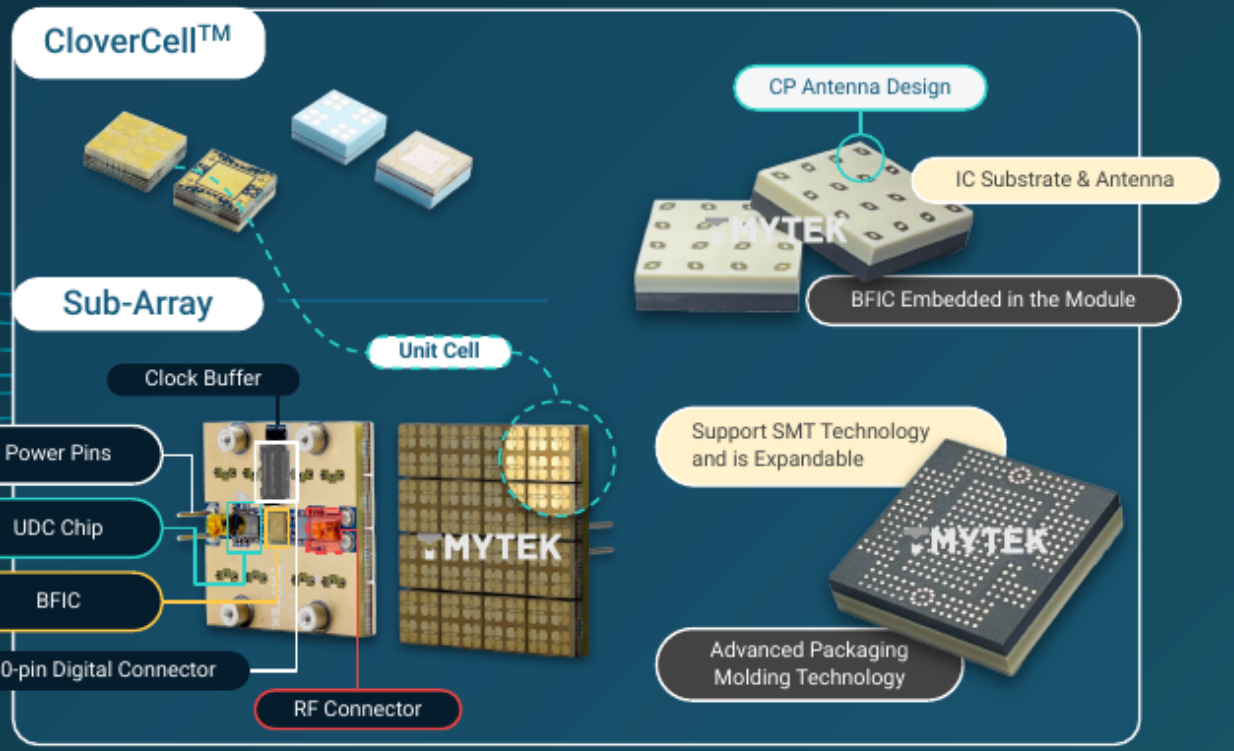
National IC Vendors

ANALOG DEVICES · QORVO · LATTICE · Infineon · AMD · RENESAS · SKYWORKS · Texas Instruments

\+ MYTEK Intelligent RF System

\+ USI Semiconductor Packaging

LEGO Modular mmWave Array

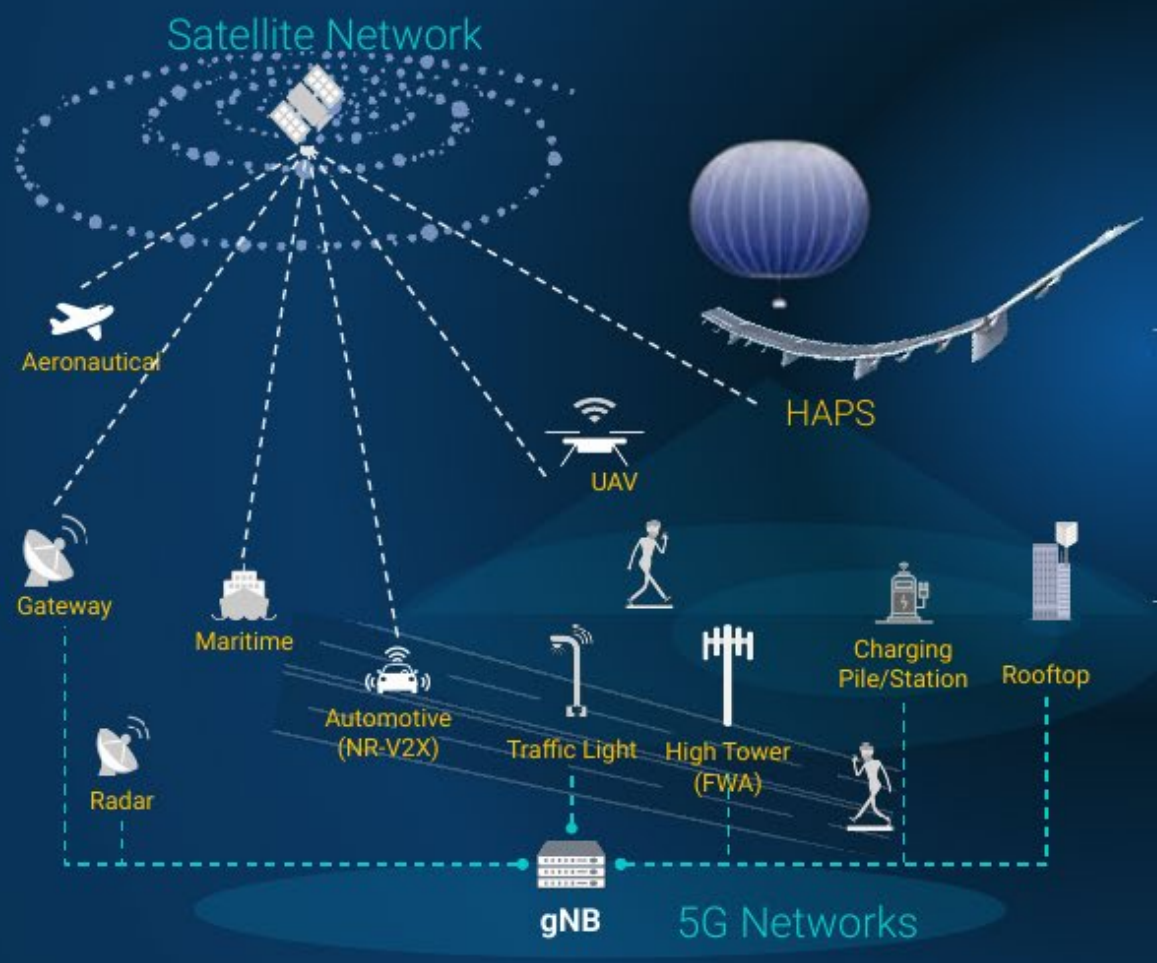


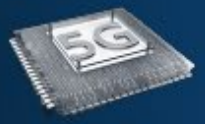
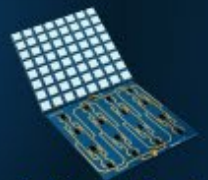
Military-Grade Antennas at Consumer-Level Cost

Enabling Mass Adoption of 6G and Satellite Terminals

From Module Expertise to Market Impact

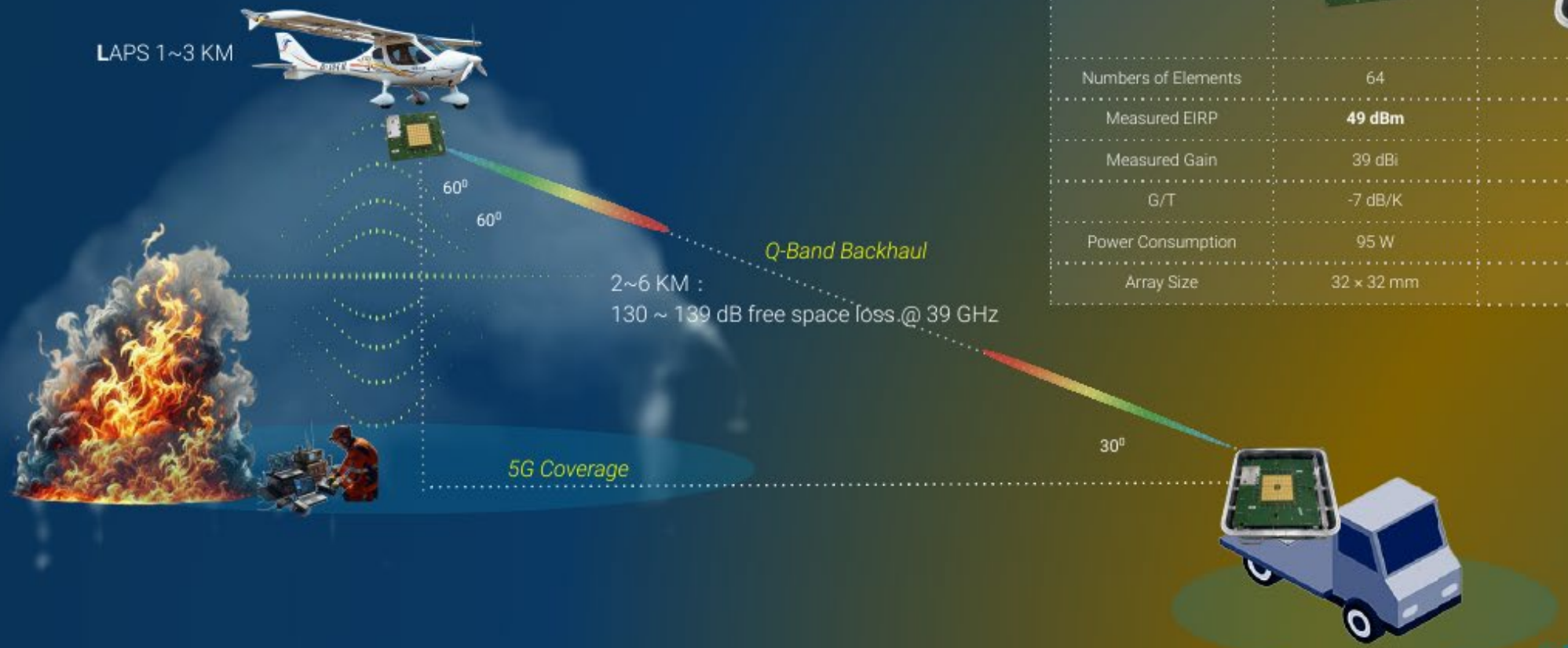
Collaboration with Ecosystem Partners

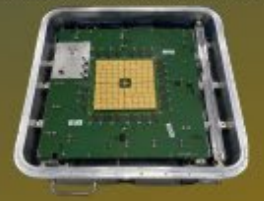


	TMY Antenna Offering	Platform Partnership	Application
5G / 6G	 n257/n258/n260	 5G Baseband/PHY	 5G mmWave RU/ Small Cell/CPE
SATCOM	 Ku/Ka/Q Band	 SATCOM Modem	 User Terminal
RADAR	 X/Ku/Ka Band	 Radar DSP	 Anti-Drone Radar

Emergency, Disaster Rescue

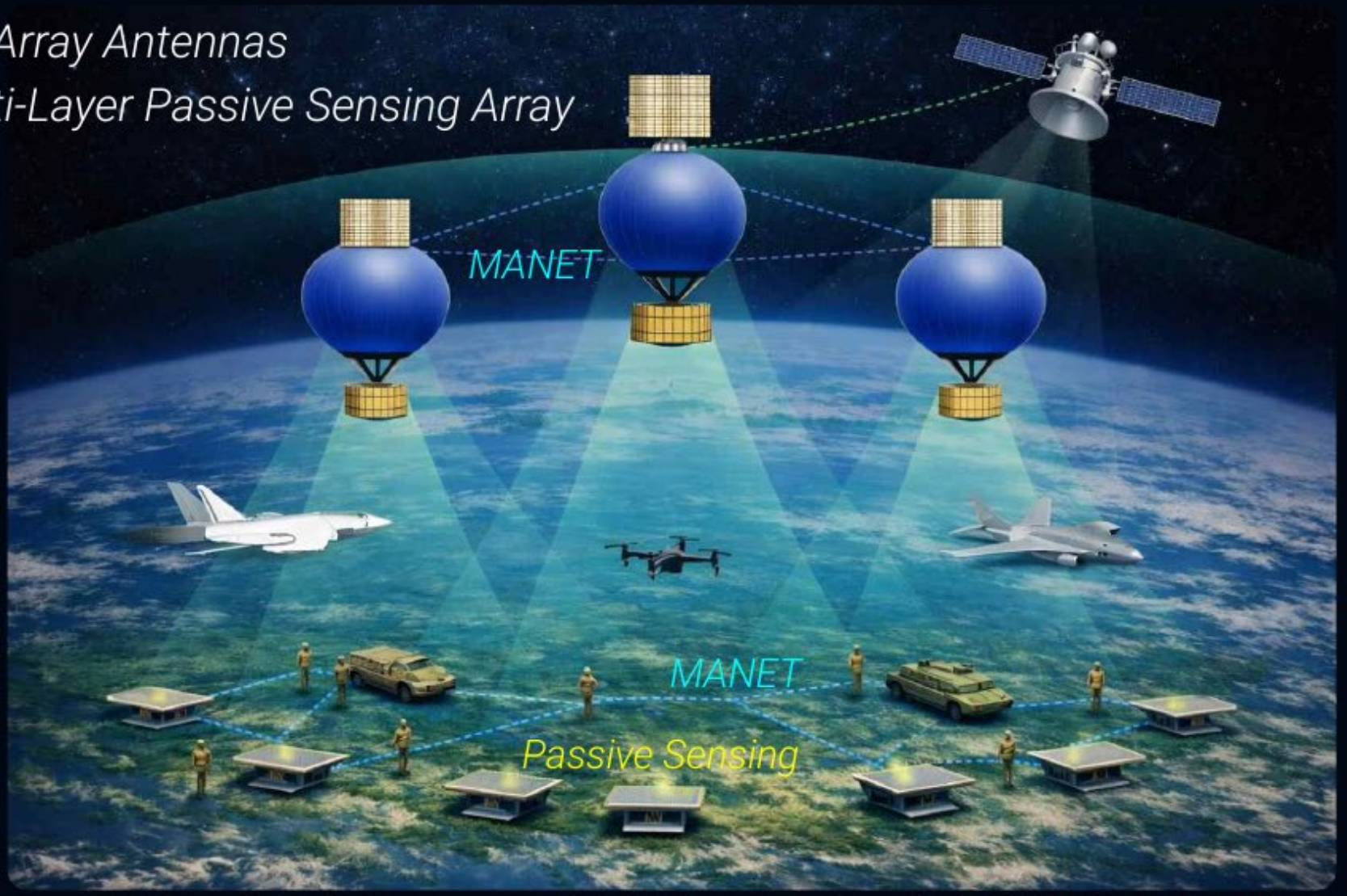
Rapid Mobility & High-Speed Backhaul for Real-Time Disaster Intelligence by Q-Band Backhaul Adoption



Backhaul Solution 37~43.5 GHz	Aircraft Backhaul 8×8 Array	Ground Backhaul Station 16×16 Array
Array Configuration		
Numbers of Elements	64	256
Measured EIRP	**49 dBm**	**61.0 dBm**
Measured Gain	39 dBi	47.5 dBi
G/T	-7 dB/K	-1 dB/K
Power Consumption	95 W	320 W
Array Size	32 × 32 mm	64 × 64 mm

Ultimate Stealth: Invisible Sensing with Resilient Tactical Mesh

Decentralized MANET with 5G Array Antennas
Integrated SATCOM-HAPS Multi-Layer Passive Sensing Array



01.Ground Passive Reception
Frontline satellite antennas passively receive signals from satellites and HAPS, ensuring stealth and survivability.

02.Signal Exploitation
Local decryption and analysis transform raw signals into actionable intelligence for target detection and tracking.

03.HAPS Relay & MANET
HAPS array antennas relay satellite data and create resilient **MANET** links with ground units.

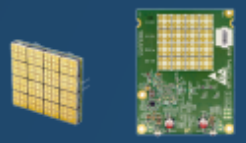
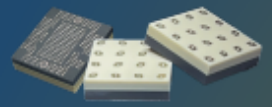
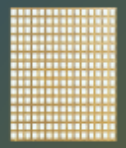
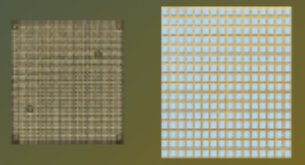
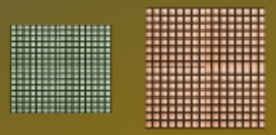
04.Rapid Dissemination
MANET enables fast, decentralized sharing of situational awareness across dispersed forces.

05.Wartime Sensing & Monitoring
Integrated architecture supports sensing, monitoring, and tracking under contested conditions, forming a "space-to-earth net."

06.Satellite Antenna Backbone
Satellite array antennas are the critical enabler, ensuring persistent coverage and reliable links that turn passive sensing into operational awareness.

Driving the Future of Connectivity

Modular Tile Architecture -
Transforming Advanced R&D into Scalable, Field-Proven Commercial Solutions

Antenna in Package Electric Steering Antenna Solution	***5G KA (28 GHz) TDD*** 	***Q Band (39 GHz) TDD*** 	***SATCOM KU FDD*** *TR Shared Aperture* 	***SATCOM KU FDD*** 		***SATCOM KA FDD*** 	
Applications	*Communication & Sensing 5/6G/MANET/RADAR*		*SATCOM*				
Array Element	*8 x 8*	4 × 4	*TRX 16x16*	*TX 16x16*	*RX 16x16*	*TX 16x16*	*RX 16x16*
EIRP & G/T @ Boresight	*47 dBm*	41 dBm	*28 dBW; -0.7 dB/K*	*31 dBW*	*1.6 dB/K*	*26 dBW*	*1.5 dB/K*
Power Consumption (W) (BFIC Only)	*33 (module)*	15	*60*	*29*	*23*	*30.2*	*18.1*
AiP Array Size (CM)	*4 x 4*	1.6 × 1.6	*20 x 30*	*17 x 17*	*23 x 23*	*8.6 x 8.6*	*12.7 x 12.7*

TMYTEK

THANK YOU !

sales@tmytek.com

TMYTEK.com

TMY Youtube

Jackrose LinkedIn

/TMYTEK /TMY Technology /TMYTEK /TMYTEK

Introducing Voltitude Ltd

Unlocking the Stratosphere®

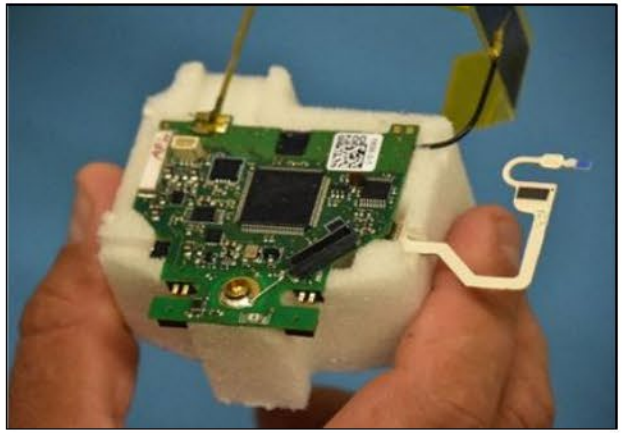
Fixed wing HAPS and mHAB

Steve Doughty – COO

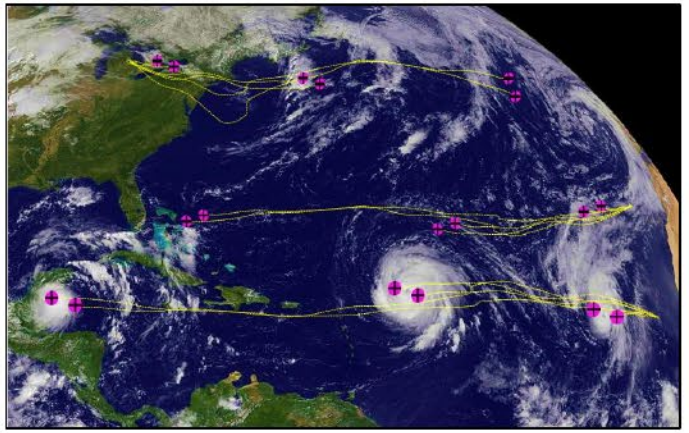
VOLTITUDE

Fixed wing HAPS

Stratospheric Balloons

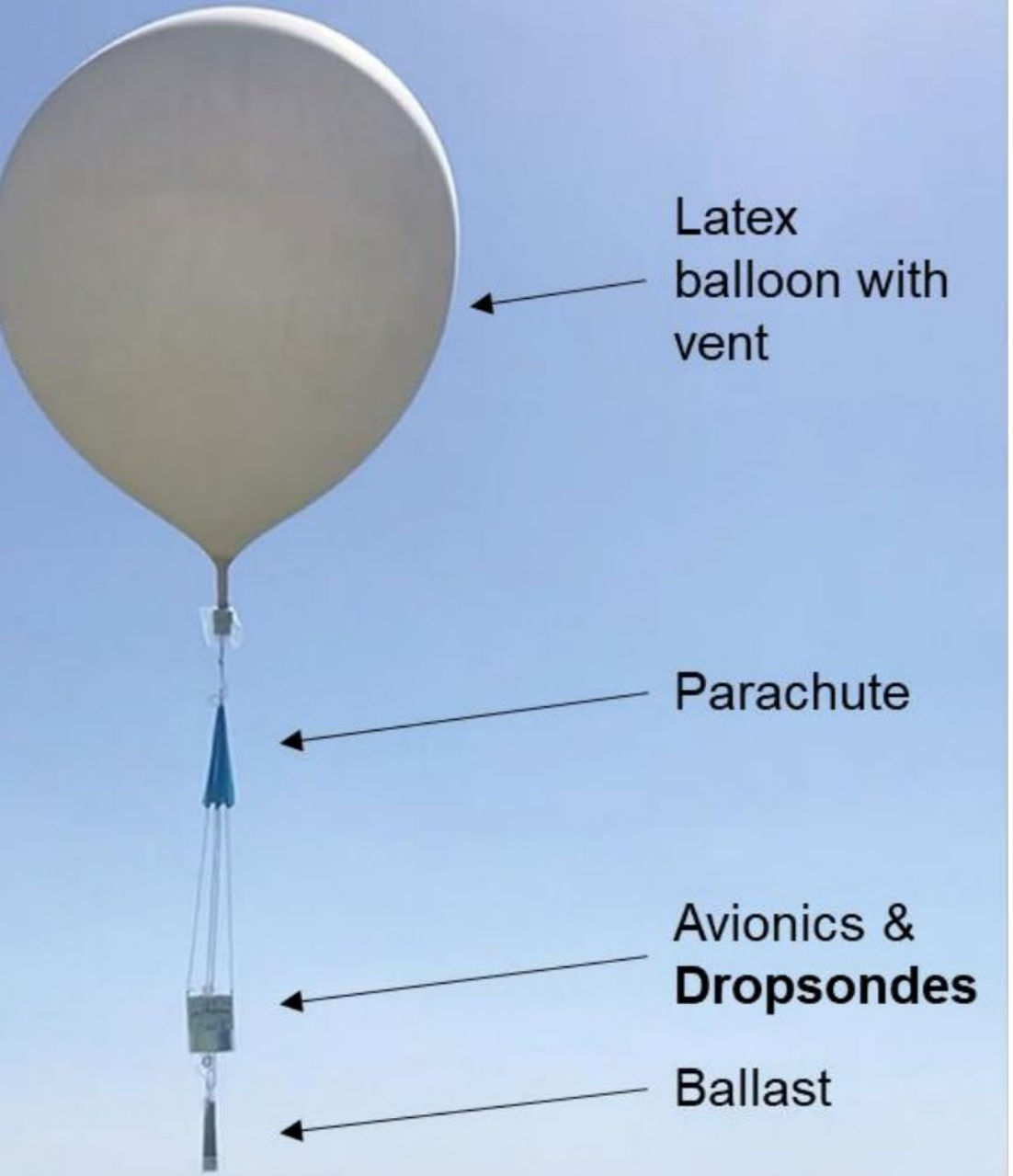


Micro-dropsondes

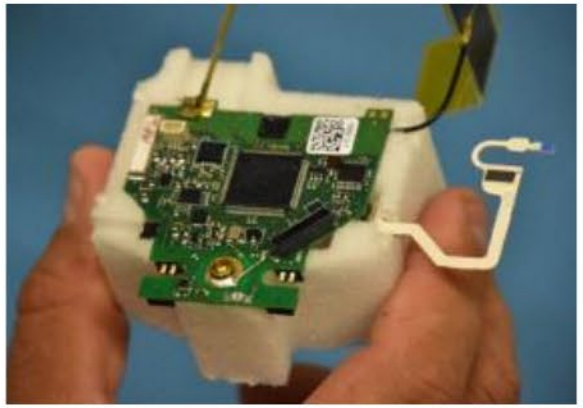


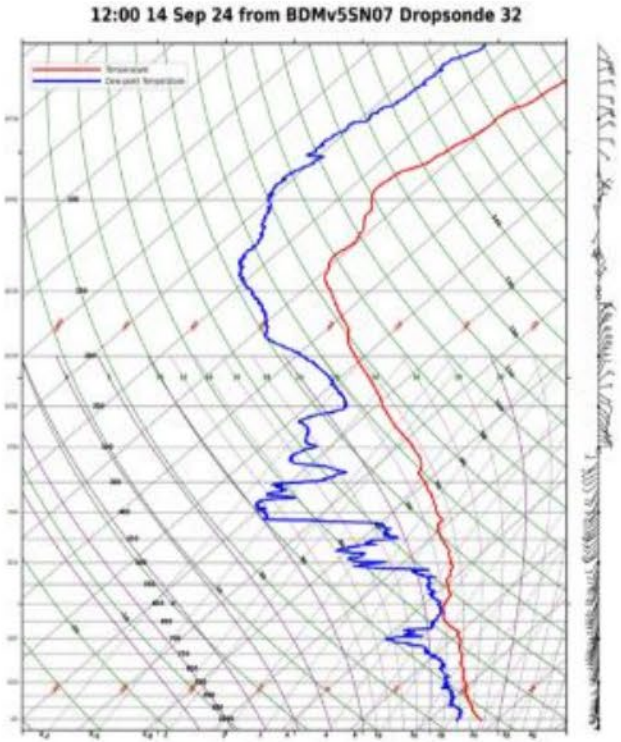
Targeted Observations

HAPS Alliance
HIGH ALTITUDE PLATFORM STATION



StratoSonde® mHAB





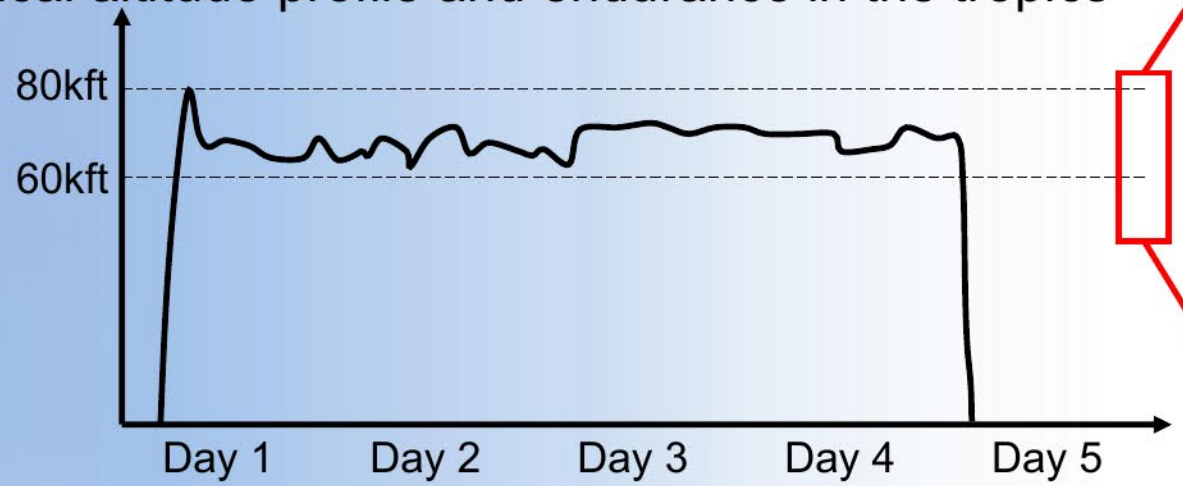
Each mHAB supports up to 16 dropsondes.

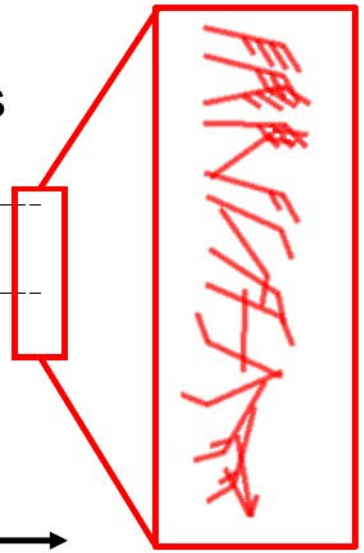
- Typically, 1200 data levels per drop.
- Data all the way to sea-level.

UK Patent no. GB2601245
US Patent no. US12392926B2

mHAB Navigation

Typical altitude profile and endurance in the tropics

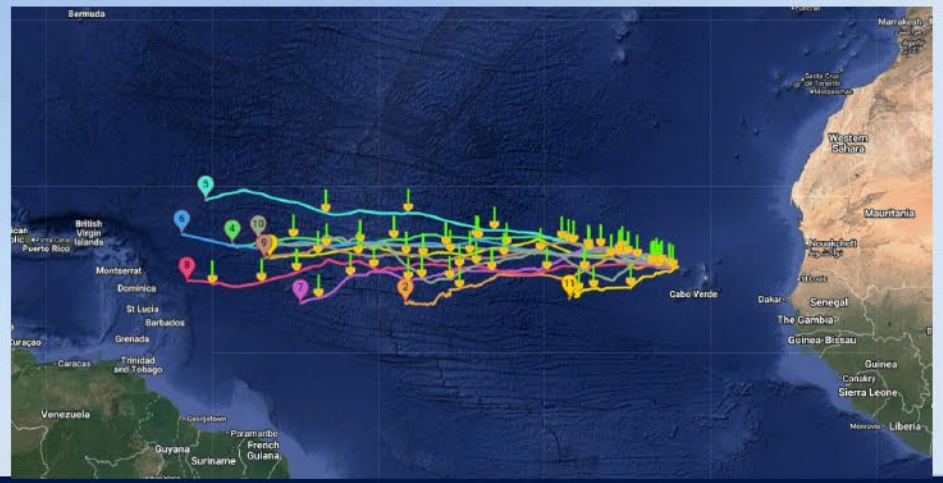




Strong Easterly

Light and variable winds just above the tropopause

Tropospheric winds



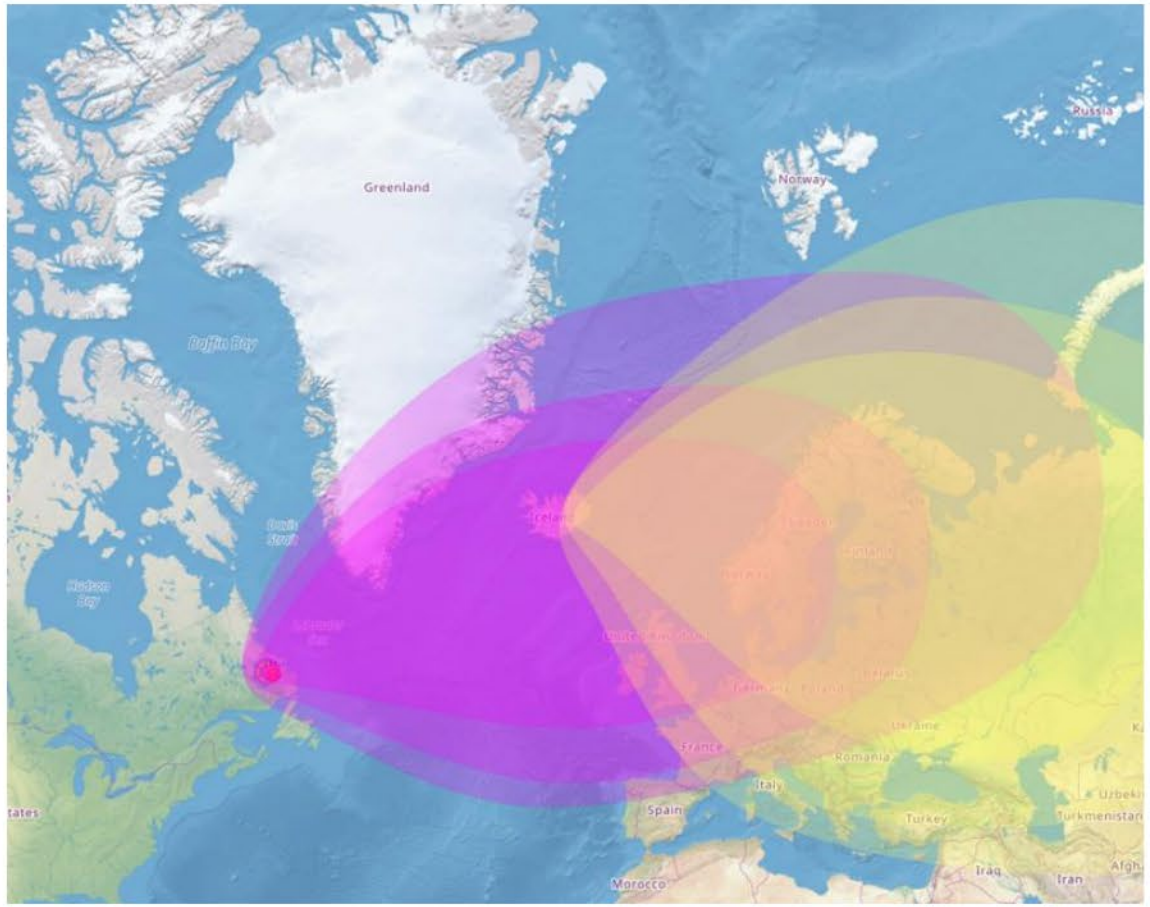
Winter Arctic Missions

mHAB Gap-Filling Concept

Greenland-Iceland-Norway Gap

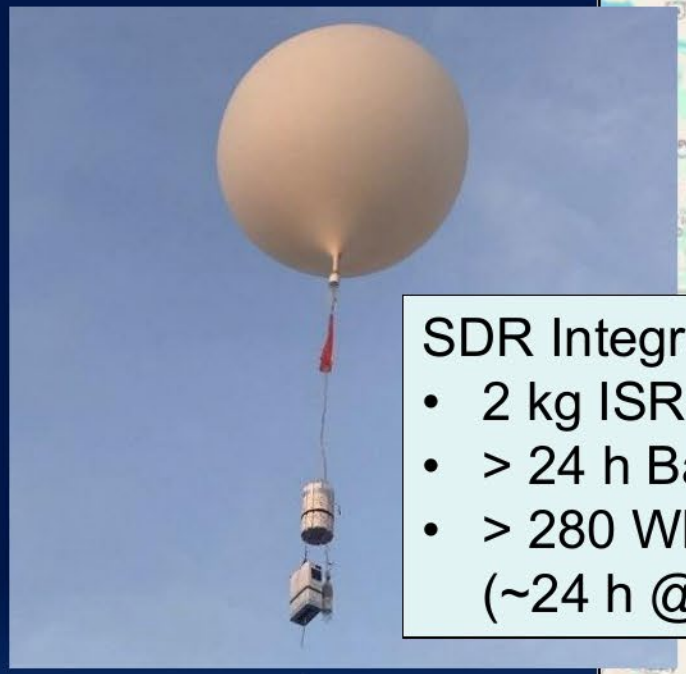
~500 km coverage per balloon
~1000 km between mHAB

Constellation fed with new systems with launches every 6 h



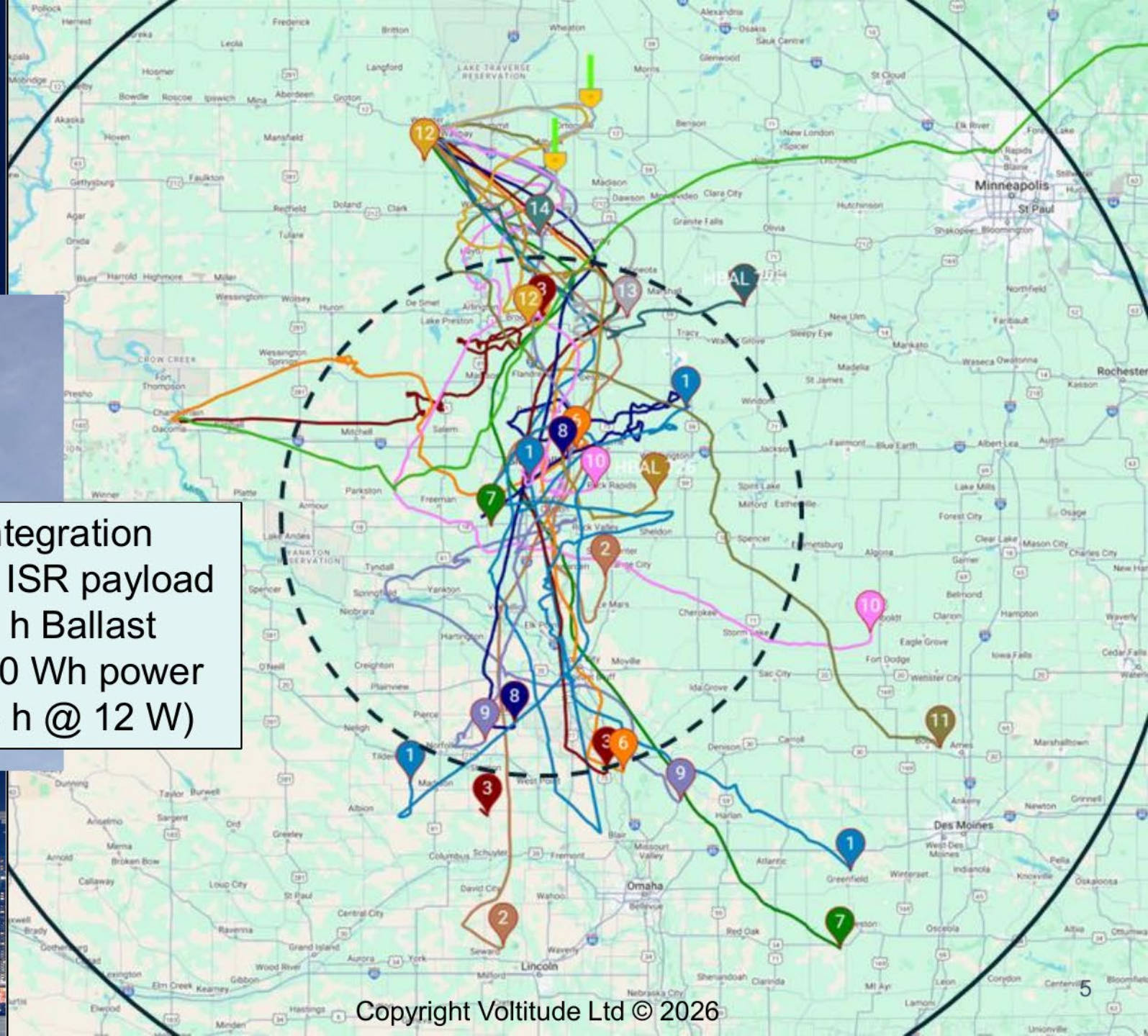
Balloons have a high probability of navigating into high North Atlantic and Arctic regions

ISR HAB Gap Filling Demo



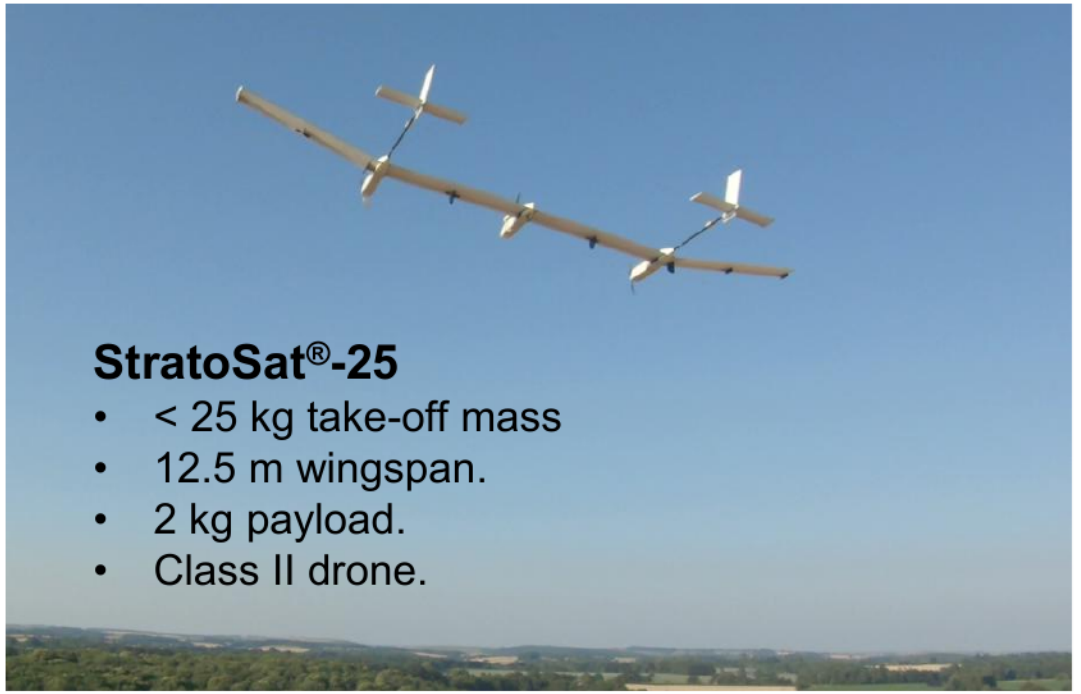
SDR Integration

- 2 kg ISR payload
- > 24 h Ballast
- > 280 Wh power (~24 h @ 12 W)



StratoSat®-25
Fixed-Wing Attritable HAPS

Featuring Voltitude's proprietary **gust alleviation technology**, StratoSat HAPS can take-off and land over a much wider operating envelope, overcoming the main barrier to commercial services from the stratosphere and reducing operating costs.

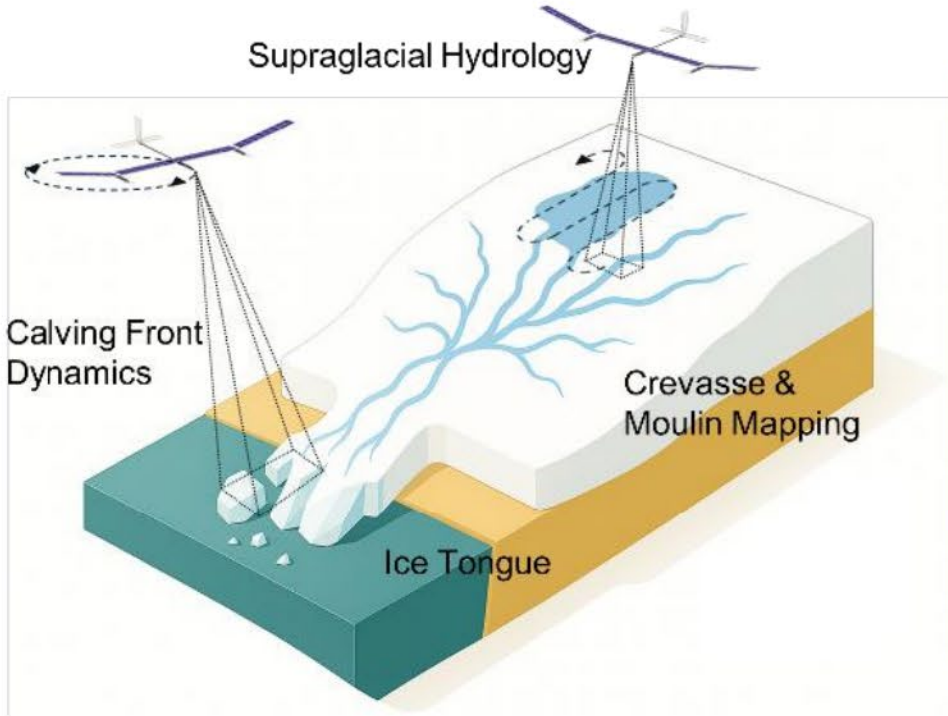


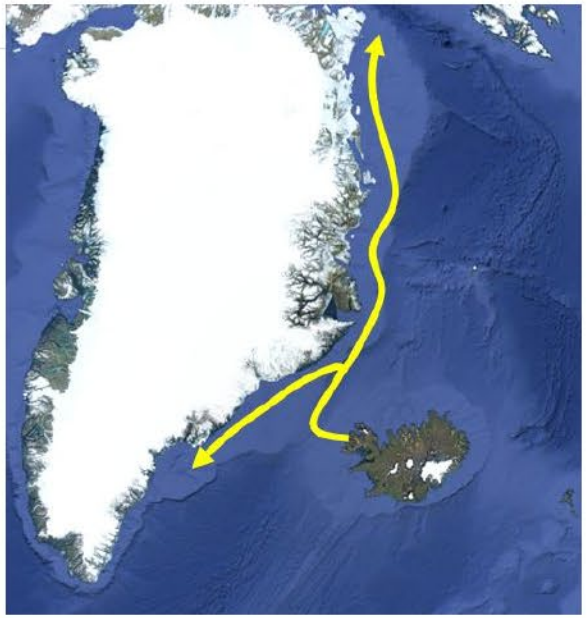
UK Patent no. GB2618301
US Patent no. US012583583B2

CryoWatch

Advanced Research + Invention Agency ARIA

Project CryoWatch will use ultra-persistent, solar electric, HAPS, stationed in the stratosphere, to present a scientific and technological breakthrough in climate monitoring and research capability.





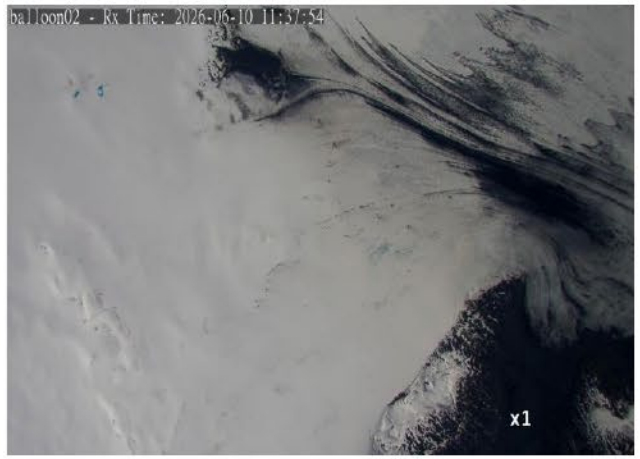
HAPS enable high-resolution monitoring for high-frequency processes, over long-time periods, with dynamic flexibility to monitor more than one large scale region of interest.

HAPS Alliance
HIGH ALTITUDE PLATFORM STATION

CryoWatch

Advanced Research + Invention Agency ARIA

Project CryoWatch will use ultra-persistent, solar electric, HAPS, stationed in the stratosphere, to present a scientific and technological breakthrough in climate monitoring and research capability.



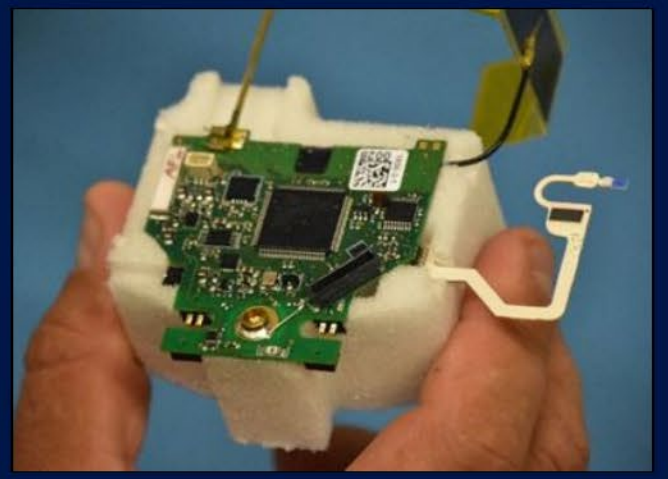
20 km

400m

HAPS enable high-resolution monitoring for high-frequency processes, over long-time periods, with dynamic flexibility to monitor more than one large scale region of interest.

HAPS Alliance
HIGH ALTITUDE PLATFORM STATION

Thank You



WWW.VOLTITUDE.CO.UK

✉ info@voltitude.co.uk

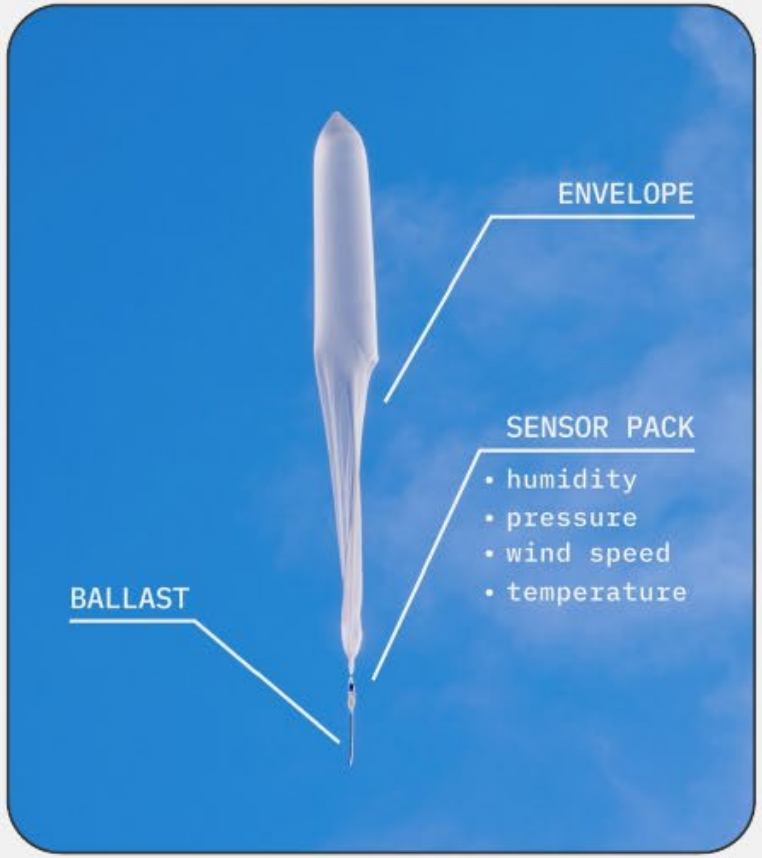
HAPS Alliance
HIGH ALTITUDE PLATFORM STATION

WindBorne Atlas

The Largest Balloon Constellation in the World

Atlas & the Global Sounding Balloon (GSB)

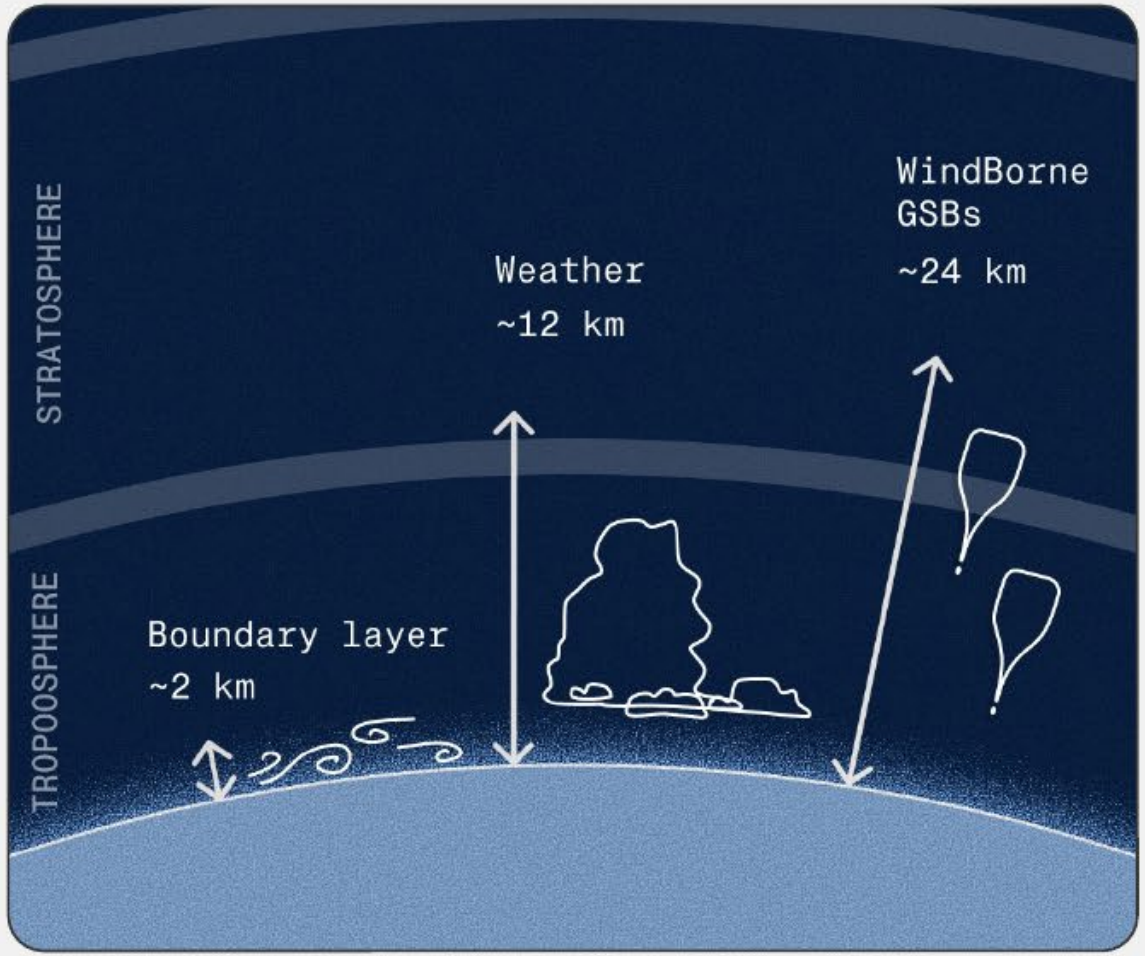
- Longest single HAB flight: 345 days (world record holder)
- Average duration 27 days
- Dozens of vertical soundings per flight
- Current: ~650 GSBs aloft
- Observations from 90°S to 90°N — pole to pole
- 23 active launch sites across 6 continents



Left: WindBorne Atlas global constellation with a single flight path highlighted
Above: An aloft WindBorne GSB

WindBorne Atlas Golden Dome Utility

Persistent Multi-Layer Sensing // Maritime Domain Awareness & Gap Filling



Persistent Multi-Layer Sensing

WindBorne Atlas provides remote worldwide sensing 24/7/365, and the constellation is constantly replenished with hundreds of launches per week to ensure persistent coverage.

GSBs collect direct in-situ measurements from ground/sea level through the stratosphere, delivering persistent multi-layer sensing anytime, anywhere.

Maritime Domain Awareness

The WindBorne GSB Buoy is the first-ever balloon-to-buoy platform, providing real-time ocean sensing in austere environments without the need for local deployment, asset allocation, or warfighter risk.

A buoy can remotely deploy anywhere a GSB can fly, collecting wave height and period, salinity, water temperature, surface winds, and more.

WREN AEROSPACE

WREN AEROSPACE

HAPS Alliance Defence Roundtable: Stratospheric Platforms in the Golden Dome and Layered Defensive Architectures

Incubated at esa BUSINESS INCUBATION CENTRE NOORDWIJK

The need for resilient, affordable data and connectivity solutions is greater than ever

Natural disasters are becoming more frequent and severe

Global geopolitical tensions are rising

2.2 billion people remain offline

Our approach to HAPS

HAPS still struggle with

- Operational flexibility
- Durability to deal with turbulence
- Reliable station-keeping in all weather conditions

Our approach to HAPS

HAPS still struggle with

Operational flexibility	Durability to deal with turbulence	Reliable station-keeping in all weather conditions
Operation in any season & latitude thanks to hydrogen propulsion	Patent-pending durable yet lightweight airframe	Greater airspeed and full redundancy

Our approach to HAPS

HAPS still struggle with

Operational flexibility	Durability to deal with turbulence	Reliable station-keeping in all weather conditions
Operation in any season & latitude thanks to hydrogen propulsion	Patent-pending durable yet lightweight airframe	Greater airspeed and full redundancy

We have successfully flown multiple sub-scale prototypes and proven our unconventional design

HAPS for defence

What we will offer defence stakeholders

A durable, fly anywhere, any time aircraft

Sustained operational capability at a brigade or divisional level

Significantly lower costs than HALE UAVs and satellites

Sovereignty from foreign satellite constellations

HAPS for defence

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Golden Dome WP topics of interest

1 Communications Extension and Relay

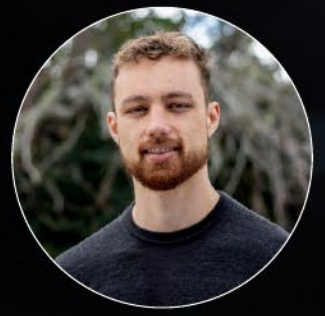
2 Persistent Multi-layer sensing

3 Contested EW Support

Our winning management team

Julius Jördens
Co-founder & CEO

STARBURST
Airborne



Michael Daly
Co-founder & CTO

ROCKETLAB

Max Garber
Lead Engineer

ROCKETLAB

Advisory Board Member

Samer Halawi

- Former CEO of AALTO HAPS (Airbus subsidiary)
- Former CEO of Thuraya
- Former CCO of Intelsat & OneWeb

AALTO THURAYA

Strategic advisor

Firas Arab

- Director of Strategic Accounts for Commercial Aviation

eutelsat ONEWEB
eutelsat GROUP

Supported by

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Co-funded by the European Union

WREN AEROSPACE

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Stay tuned for big updates soon

Please reach out if you are interested in our developments

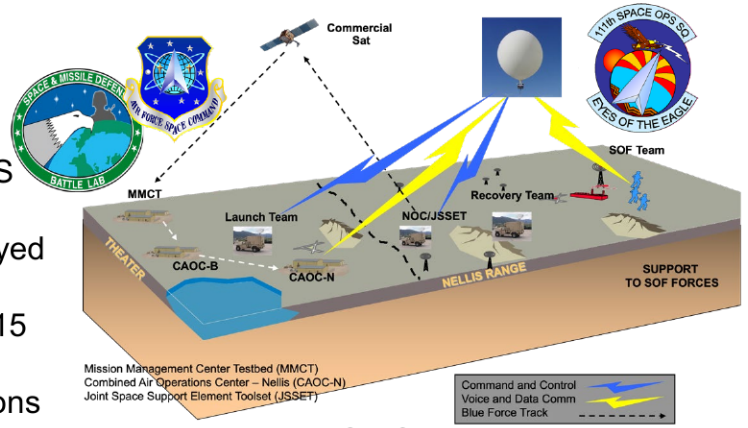
www.wrenaerospace.com

Space Data Corporation History

Space Data®
TAKING INGENUITY TO NEW HEIGHTS

- Founded in 1997, Space Data Corporation has been producing and flying its high-altitude stratospheric vehicles since April 2004 to provide commercial communication

- Space Data operates in ***industrial communications and spectrum markets***
  - Developed Stratospheric vehicles to use of the corporation's 2 MHz of nationwide, licensed spectrum in the 900 MHz band
  - Commercial oil/gas monitoring and operates & supplies spectrum to utilities
- Space Data has ***produced over 4,000 SkySite™ Platforms and conducted well over 30,000 high altitude flights***, accounting for well over 300,000 hours of level float above 65,000 feet.
- In 2005, Space Data received its ***first Department of Defense contract***, supporting the US Air Force Space Command in testing and evaluating high altitude capabilities to augment satellite systems
  - Participated in numerous demos & operational exercises with the US military and IC demonstrating communication & ISR capabilities using SkySat™ Systems
- In 2007, ***delivered first production SkySat™ Platforms***, military UHF variant of the 900 MHz commercial SkySite™
  - Over 2,000 SkySat™ Platforms manufactured and sold to the US military and Canadian Forces
  - Combat SkySat became the first TRL9 HAPS system when deployed by USAF in 2008 for a classified mission
  - SkySat™ was communications system for recovery of downed F-15 Pilot in Libya
  - SkySat™ vehicles have been used for a variety operational missions with IndoPACOM, CENTCOM, and SOUTHCOM

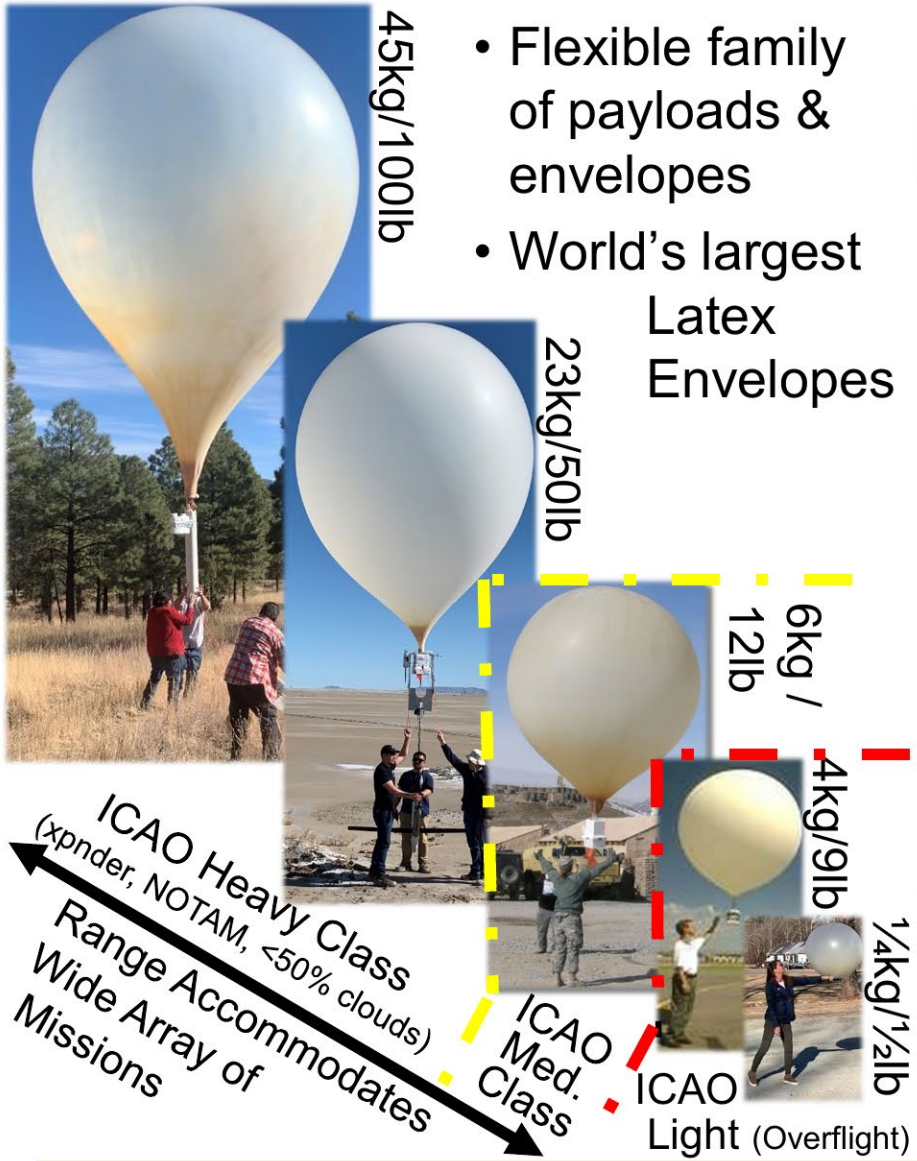


JEFX 06 JWS - OV-1

For over two decades, Space Data's innovative stratospheric systems have successfully supported operational ground and maritime defense and national security missions around the world

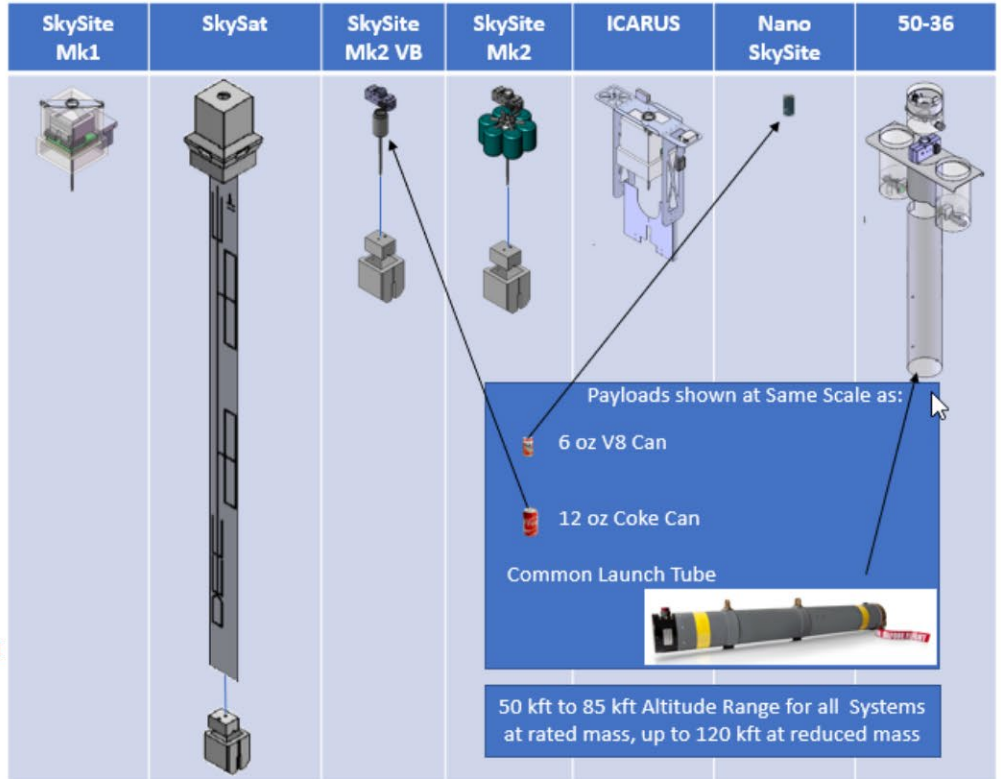
Full-Line of microHAB Systems

Space Data®
TAKING INGENUITY TO NEW HEIGHTS



- Flexible family of payloads & envelopes
- World's largest Latex Envelopes

25 yr Timeline of Platform Development



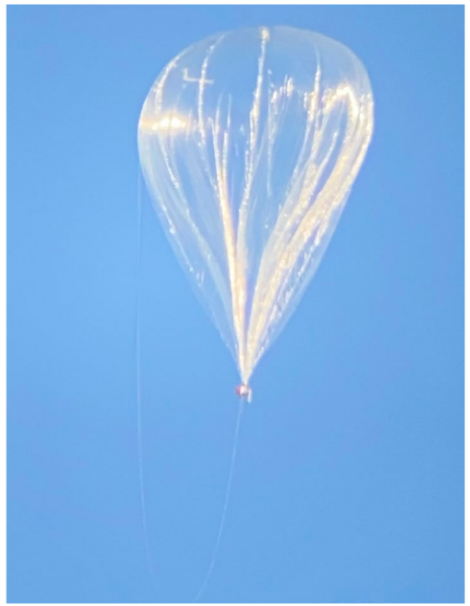
SkySite Mk1	SkySat	SkySite Mk2 VB	SkySite Mk2	ICARUS	Nano SkySite	50-36
2004	2006	2010	2012	2016	2020	2021
IoT 900 MHz	BLOS Relay 225-375 MHz	IoT 900 MHz	IoT 900 MHz	Air Launch Effects	IoT 900 MHz	Air Launch Effects
6 lb	12 lb	7 lb	12 lb	50 lb	0.5 lb	100 lb
24 hr	36 hr	48 hr	84 hr	Ascent Only	24 hr	36 hr

Expeditionary Launch with 1-2 person crews in 30+ Knot Surface Winds from a single Pickup Truck

Now Offering Polyethylene Envelopes

Space Data®
TAKING INGENUITY TO NEW HEIGHTS

- While Space Data traditionally offered Latex extensible envelopes, it now is developing a line of Polyethylene Envelopes for longer life missions
- Space Data acquired Loon's balloon film cutting / seaming equipment along with its stock of PE01 balloon film at Google Loon's liquidation auctions
  - Acquired 80' flatbed scanner for inspecting plastic balloons & other test equipment/payload elements



PE Envelopes along with Latex Envelopes for expeditionary launch, provides a full spectrum of microHABs to meet varying mission needs (hours to weeks, grams to 50 kg)

DAWG Member Q&A

HAPS In the Golden Dome

- Persistent Mid-Layer Sensing
- Communications Extension and Relay
- Contested Electronics Warfare Support
- Left of Launch Force Projection
- MDA and Gap Filling
- Rapid Test and Training

Submit Questions
Via The
Meeting Chat

HAPS Alliance

HIGH ALTITUDE PLATFORM STATION

Thank you!