Zephyr

The world's most advanced and only flight proven HAPS

ESA Φ Week, Frascati – 14 November 2018

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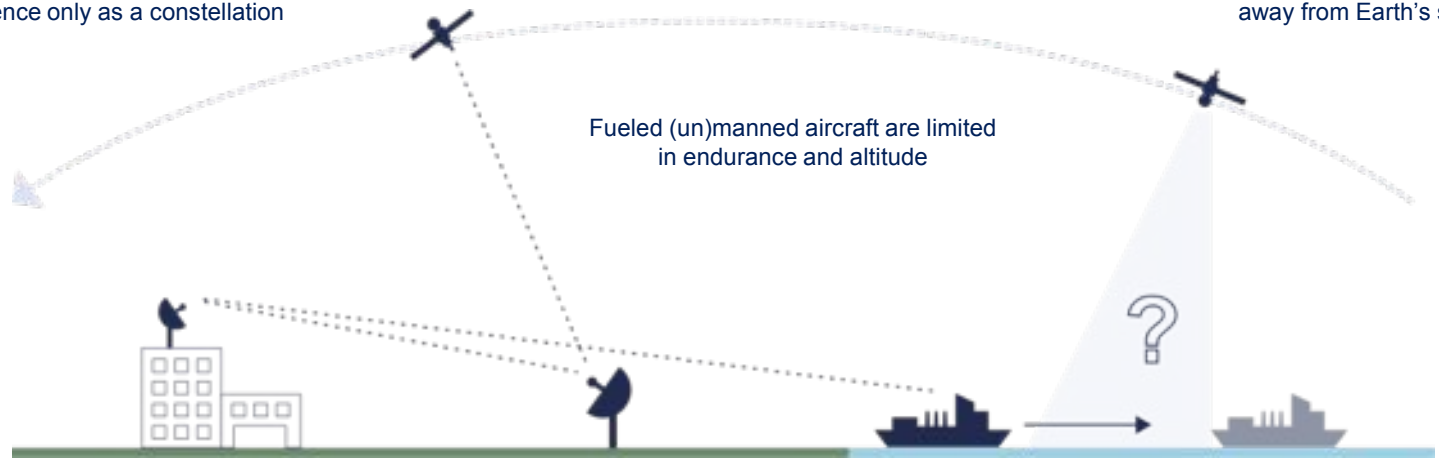
The Challenge of Local Persistence

Reaction time: a few hours

LEO/MEO satellites can offer persistence only as a constellation

GEO satellites are 36,000km away from Earth's surface

Fueled (un)manned aircraft are limited in endurance and altitude



The Solution – Zephyr

- Zephyr S is a solar electric unmanned High Altitude Pseudo-Satellite
- 25m wingspan
- Lightweight composite structure
- Powered by solar array and rechargeable batteries
- Beyond Line of Sight (BLOS) command and control
- Payload agnostic
- Offers EO Missions a new capability which:
    - Offers permanent real-time satellite-like capabilities focused on a specific area of interest
    - Complements and extends both satellite networks and services and conventional manned aircraft and UAVs

Maiden Flight – August 2018

The worlds most advanced and only HAPS to demonstrate day–night longevity

Zephyr

Pioneering the stratosphere

Zephyr flies for longer than any other aircraft

during its successful maiden flight

25 days, 23 hours, 57 minutes

#stratospheric

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Proven System Performance

- After taking off on 11th July in Arizona, USA, Zephyr S logged a maiden flight of over 25 days, the longest duration flight ever made.
- Consistently achieved dawn altitudes of c60,000 ft throughout the flight, and achieved an ultimate altitude record of >74,000ft.
- Zephyr S maiden test flight was also an opportunity to test an Airbus in-house developed prototype optical payload, designed for civilian and security applications
- BLOS: Whilst Zephyr remained in LOS of the local GCS at all times, BLOS was tested and commanded the aircraft from the GCS in Farnborough
- The flight also proved a completely new battery technology which was developed from concept to flight within a year and allowed operation with a dedicated flight ops crew for the first time
- An application has been made to establish this as a new world record and operations are now moving to a new Australian permanent operating base to support customers

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Operations

- Zephyr is designed to be operated from a small number of strategic, routine launch and recovery sites selected for:
  - Benign, year round weather conditions to allow regular, low risk launch and recovery
  - Avoiding congested air traffic routes
- Operation is BLOS from multiple command and control centres anywhere in the world
- Typically an aircraft will be already airborne and simply tasked to a new mission
- Following tasking or launch, aircraft transits to the area of interest, flying in the stratosphere for 1,000+ nautical miles per day for typical mission durations of up to 100 days
- At the end of the mission Zephyr can either fly to the next mission location or be returned and re-equipped with a different payload

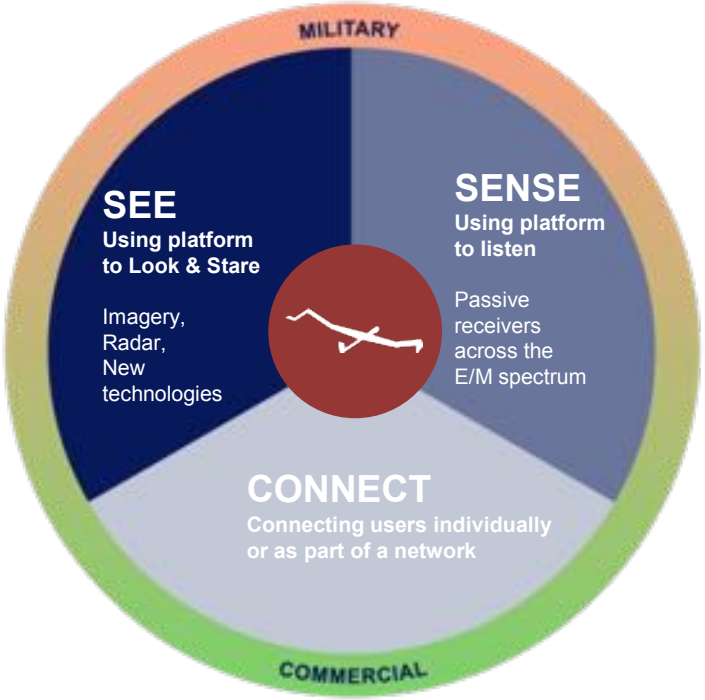
Zephyr Capabilities

Capability is determined by payload

Zephyr can support a variety of sensor payloads including:

- Surveillance
  - High resolution EO
  - SW / MW / LWIR
  - LiDAR
  - Hyperspectral
  - SAR
  - Air Quality
  - Scientific Missions
  - GPS replacement

- Comms
  - LTE
  - Handset to Handset relay – 300km range using standard issue handsets with no modification
  - EM survey instrumentation



Zephyr payload coverage

See/Sense - surveillance can cover 40,000km^2 in 12 hours

Connect - Zephyr S provides 100s of Mbps covering 400km diameter / 125,000km^2 area per aircraft, or up to 1Gbps over 70km diameter

Connect - Zephyr T will provide multi-Gbps covering 125,000km^2 per aircraft

Horizon scan: 400km range

Comms horizon at 5^o incidence:
200km = 125,000km^2

Radar utility at 15^o incidence:
70km = 15,000km^2

Optical utility at 30^o
incidence: 35k = 3,800km^2

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HAPS-enabled Service Opportunities

Forest Fire Management, Maritime Surveillance and Border Surveillance each create challenges for local and national agencies to monitor and manage

The flexibility and persistence of HAPS has significant potential to offer valuable services that complement and augment existing services

As part of an ESA-funded HAPS study, a high level of coherence between requirements from different end users and application

For example:

- Near or real time data
- A flexible and controllable platform
- 24/7 (day and night, all-weather) capability
- Endurance to operate for multiple months
- The ability to cover a large area (e.g. sea basin) but at the same time focus on specific detail
- To provide VHR optical, IR, and SAR data
- Operate safely and within EU regulations

These requirements fall within the key capabilities of HAPS platforms

Zephyr S – 2018 a year of milestones achievements

Dedicated Launch Facility
- Wyndham Airfield
- Dedicated Infrastructure for Zephyr
- Team on site
- Preparing aircraft for flights in 2018 and beyond

Zephyr S Maiden Flight
- Successful flight campaign
- Over 25 days
- Minimum altitude >60kft
- BLOS operation

Kelleher Building Farnborough
- Dedicated production Facility Opened
- Scale to 30 A/c per year

25 days 23 hours 57 Mins

End of night altitude >60kft

More to come

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For further information contact:
Alexandra Barker, alexandra.barker@airbus.com
Dr Roger Tidswell, roger.tidswell.external@airbus.com