Zephyr

The world’s most advanced and only flight proven HAPS

ESA Φ Week, Frascati – 14 November 2018
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 world's most advanced and only HAPS to demonstrate day–night longevity
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 >74,000 ft.

• Payload operations: OPAZ 26cm resolution images, video and 3D mapping.

• BLOS: Whilst we remained in LOS of the local GCS at all times, we tested BLOS and commanded the aircraft from the GCS in Farnborough.

• The flight also proved a completely new battery technology which we have developed from concept to flight within a year and allowed us to operate with a dedicated flight ops crew for the first time.

• An application has been made to establish this as a new world record and we now move to operations from our new Australian permanent operating base to support our customers.

Zephyr flies for longer than any other aircraft during its successful maiden flight.

25 days, 23 hours, 57 minutes

#stratospheric
Proven System Performance

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• 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
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

SEE
Using platform to Look & Stare

SENSE
Using platform to listen
Passive receivers across the E/M spectrum

CONNECT
Connecting users individually or as part of a network

MILITARY
COMMERCIAL
See/Sense - surveillance can cover 40,000km² in 12 hours

Connect - Zephyr S provides 100s of Mbps covering 400km diameter / 125,000km² area per aircraft, or up to 1Gbps over 70km diameter

Connect - Zephyr T will provide multi-Gbps covering 125,000km² per aircraft

- Horizon scan: 400km range
- Comms horizon at 5° incidence: 200km = 125,000km²
- Radar utility at 15° incidence: 70km = 15,000km²
- Optical utility at 30° incidence: 35k = 3,800km²
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

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

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

More to come

25 days 23 hours 57 Mins
End of night altitude >60kft
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