Pioneering the stratosphere:
The world’s most advanced and only flight proven HAPS
Zephyr is a flight proven solar powered platform acting as a ‘gap filler’

<table>
<thead>
<tr>
<th>Satellites</th>
<th>~ 200-36,000+ km LEO, MEO, GEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zephyr (HAPS)</td>
<td>~ 21 km</td>
</tr>
</tbody>
</table>

Both stationary and persistent

High-resolution images from stratosphere

Real-time video in HD

Low detectability

Note: Features depending on version, geography and payload

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Zephyr: Pioneering the stratosphere

The world’s leading solar-electric stratospheric unmanned aerial vehicle

**What is it?**
- Runs on sunshine in the stratosphere
- Weighs 75 kg
- Supports up to 5 times its own weight
- Manufactured from fibres no thicker than a human hair

**What will it do?**
- Zephyr: See clearly, Sense efficiently, Connect precisely
- Zephyr is able to revolutionise missions all over the world:
  - Defence
  - Humanitarian
  - Security
  - Environmental

**Powered by the sun**
- Zephyr uses solar energy, with secondary batteries charged in daylight to power overnight flight

**Zephyr flies for longer than any other aircraft**
- During its successful maiden flight: 25 days, 23 hours, 57 minutes

AIRBUS
**Zephyr Overview**

**Aircraft**
Zephyr S is the world’s leading solar-electric stratospheric UAV and Airbus has active launch and recovery site in Wyndham. In the future, incremental enhancements to Zephyr S will use the potential of the stratosphere even further.

**Flight approvals**
Flight approvals for mission geographies are obtained from relevant authorities. Currently, Zephyr can fly in a growing area in Australia.

**Spectrum allocation**
Spectrum allocations for UHF, S-Band and potential future will be secured for mission geographies and is in place in Australia for test flights.

**Analytics & Integration**
The payload data can be seamlessly integrated into existing Airbus analytics offerings and platforms (OneAtlas) to function together with other data.

**Payload**
Airbus or customer payloads can be fully integrated into Zephyr, the system is payload agnostic.

**Downlink**
BLOS and LOS options for command and control are in place for maximum mission flexibility.
For payloads, 10 Mbps S-Band (LOS) and 200kbps BLOS (Inmarsat) allow flexible data handling. Payload data can be completely independent from aircraft C&C if necessary.

**Payload Ground station**
Payload ground segments function autonomously and can be deployed in a shipping container.

**A/C Ground station and control**
The first launch and recovery site is in Australia which is a global operating base for Zephyr.
Zephyr Key Value Proposition

Persistence: Zephyr can persistently monitor or service a defined mission location over long periods of time

Accuracy: Operating at ~ 21 km, Zephyr payloads can offer high accuracy (e.g. high resolution for EO)

Latency: Zephyr is close enough to ground stations to have little latency and offer real-time services

Flexibility: Zephyr can switch from a swath to a stationary mode within the same mission and be re-tasked in minutes

Detectability: Flying in the stratosphere, Zephyr is almost undetectable with conventional methods

Discover Zephyr's value proposition in persistence, latency, detectability and flexibility
### Example Use Cases

<table>
<thead>
<tr>
<th>Earth Observation and Sensing</th>
<th>Institutional</th>
<th>Military</th>
<th>Commercial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildfire Monitoring</td>
<td>Maritime Security</td>
<td>Oil and Gas</td>
<td></td>
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<tr>
<td>Land Administration</td>
<td>Persistent ISR</td>
<td>Crop Monitoring</td>
<td></td>
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<tr>
<td>Environmental Monitoring</td>
<td>Land / Coastal Border Protection</td>
<td>High-res typography</td>
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<tr>
<td>Land Border Protection</td>
<td>Signal Intelligence</td>
<td>Smart Cities</td>
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<td></td>
<td>Carrier Strike Group</td>
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<tr>
<td><strong>Connectivity</strong></td>
<td><strong>V/UHF</strong></td>
<td><strong>Comm. LTE bubble</strong></td>
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<tr>
<td>Disaster recovery</td>
<td>Military LTE Bubble</td>
<td>Direct LTE</td>
<td></td>
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<tr>
<td>ADS-B + voice over ocean</td>
<td>Mobile COMs/MESH</td>
<td>Cellular backhauling</td>
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<td></td>
<td></td>
<td>Broadband services</td>
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</table>

As Zephyr capabilities are growing, more use cases are possible.
Wildfire Detection and Monitoring

Mission Objectives
• Tireless monitoring for early detection of wildfires across vast areas, using a standard multi-band visible & IR sensor package
• Zephyr can provide immediate situational awareness for responders in remote mission locations

Key Mission Requirements
• Day/Night imagery to assist fire fighters mission planning & monitoring real time
• Immediate voice communications for emergency responders

The Payload agnostic Design of Zephyr invites technology partners to develop, test and deploy innovative fire detection and monitoring sensors and communication payloads for national or export customers.
Reconnaissance Aircraft Tracking & Prediction

Mission Objectives
• Persistent monitoring and tracking of hurricanes, earthquakes, using a standard multi-band visible & IR sensor package
• Zephyr as a reconnaissance aircraft can provide immediate situational awareness for responders in high disaster locations

Key Mission Requirements
• Day/Night imagery to assist humanitarian relief
• Immediate voice communications for emergency responders

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Maritime Surveillance

Mission Objectives

- Detection, classification and tracking of maritime objects
- Provide continuous ISR support for strike groups and disaster relief

Key Mission Requirements

- Operate in remote locations, long distances from ground stations for long periods of time
- Real time data is critical for threat detection and comms for ISR purpose
Border Security

Mission Objectives
• Very high-resolution, real-time imagery for large border areas
• Immediate situational awareness for ground patrols to identify breaches

Key Mission Requirements
• Very high-resolution imagery with almost immediate change detection
• Day/night and all-weather situational awareness, quick switch hot-spot mode
Intelligence – See, Sense, Connect

Mission Objectives
• Scout a site, map its surroundings and automatically extract relevant features from accurate and current imagery

Key Mission Requirements
• High-resolution imagery
• Almost real-time data and analysis/processing
OPAZ

OPAZ is a new generation Earth observation system for images and video acquisition onboard Zephyr

Main Sensor
- 18cm GSD target in 2020, 26cm currently flying, at NADIR from 65,000ft (20km) distance
- High resolution RGB 1km² field of view video
- RGB 32 Megapixels ("8K")
- Frame rate 5fps 8K, or 20fps 4K

Field of Regard (FOR)
40km
40°/20° Pitch
+/- 45° Roll

Applications

Surveillance
- Persistent and very high resolution imagery and videos
- Real-time video transmission

Geo Information
- Mapping
- Crowd Monitoring
- Vehicles and Ship Detection

Analytics
- OneAtlas cloud based infrastructure
- Integrated and processed
Connectivity
A flexible alternative to providing connectivity

Military / Institutional Comms
- High availability service
- Resilience for secure networks
- Radio-relay

Cellular Backhaul
- Backhaul to rural/semi-urban regions
- Intermittent capacity provisioning

IoT/M2M Connectivity
- Low latency service
- Wide coverage low data rate service

LTE Applications
- Security for Enterprise
- High availability
- Direct to handset

Example Use Cases
- Public Protection
- Disaster Relief (PPDR)
- Emergency Communications
- Theatre Backhauling
- Cellular Backhauling
- 5G Connectivity
- Direct to device communication
- Direct to home services

Key Features
- High capacity backhaul services
- Complementary to existing network infrastructure
- Field of regard (FOR): ±/− 60° Azimuth, ±/− 60° Elevation
- Flexible service commitment
- Capable of 100 days continuous flight
- Operable as a constellation providing wide area coverage
- World's most advanced and only flight proven HAPS

Range of payload options inc. multi spot beam
Commercial Connectivity

Mission Objectives
• Persistent connectivity service in remote areas over long periods of time
• Supporting network to expand the reach of LTE services
• Nonstop communications amongst ground, air or sea-borne assets

Key Mission Requirements
• Station-keeping over mission area
• Supplement on-the-ground infrastructure to connect rural locations
• Encryption for secure communications across platforms

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<th>Zephyr Progression and track records</th>
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<tr>
<td>More than 10 Aircraft flight campaigns completed with more than 1000 hours total programme flight time</td>
</tr>
<tr>
<td>Current holder of 4 world records including 25 days endurance – this will increase beyond 30 days this year</td>
</tr>
<tr>
<td>Longest endurance flight without refuelling – 25days, 23 hours, 57 minutes in August 2018</td>
</tr>
<tr>
<td>Flight certifications in 5 countries: UAE, UK, USA, Belgium, Australia</td>
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<tr>
<td>Zephyr operates in the stratosphere, above weather and air traffic</td>
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<tr>
<td>The Kelleher facility in Farnborough UK is now operational. This facility is the production site for Zephyr aircraft and the first serial HAPS production site in the world</td>
</tr>
<tr>
<td>Wyndham in Western Australia is the first operational HAPS launch site and it is our gateway to the stratosphere</td>
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</tbody>
</table>
Thank You

Name: Ms. Davina Egbuna
Title: UAS Solution Engineer