Earth Observation, Navigation and Science

SPIDER (SHIP POSITION AND DETECTION RADAR)

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AIRBUS

Maritime Security

DEFENCE AND SPACE

The problem

- >90% of world trade goods and > 70% of global crude oil are transported by sea
- Growth in shipping increases likelihood of accidents and environmental damage
- Shipping increasingly a target for piracy, organised crime and terrorism
- Illegal maritime activities such as illegal fishing, drug trafficking, weapon movement/proliferation and illegal immigration/human trafficking are constantly on the rise

The monitoring requirement

- Maritime monitoring and tracking services
- Vessel detection capabilities, operating in conjunction with AIS
- Augmenting or replacing HF radar systems providing coastal ship tracking
- Identification and discrimination of civilian and military vessels
- All weather day/night capability
- Low data latency – typically less than 1h
- Revisit time – typically less than 2h

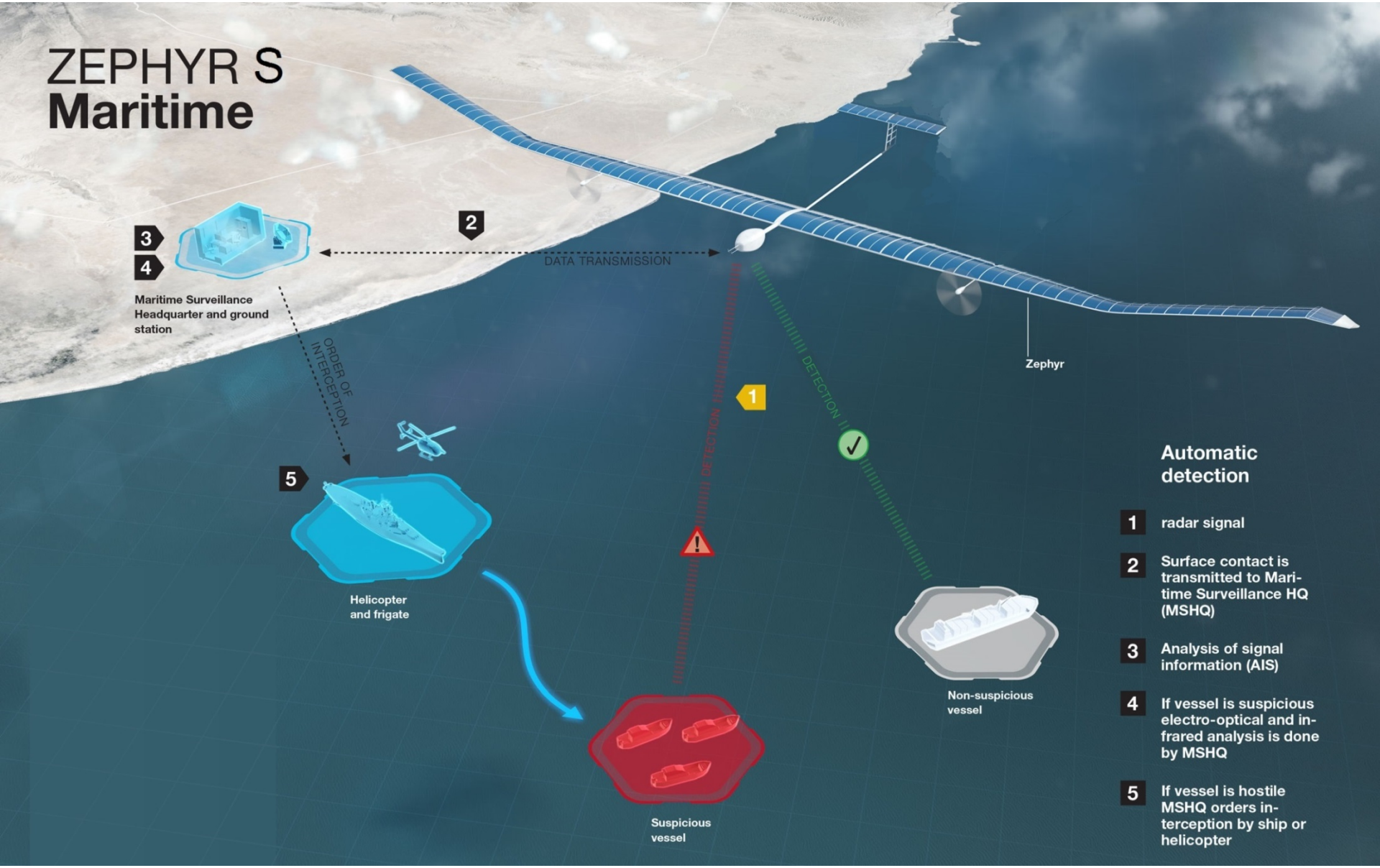
The solution

- Low-cost, persistent and reliable maritime security and surveillance from HAPS
- Novel low SWaP payload suitable for Zephyr S
- Specifically designed for ship position, detection, and tracking
- COTS components
- Complementary to and can provide cueing to other maritime sensors
- Potential progression to low-cost spaceborne SPIDER

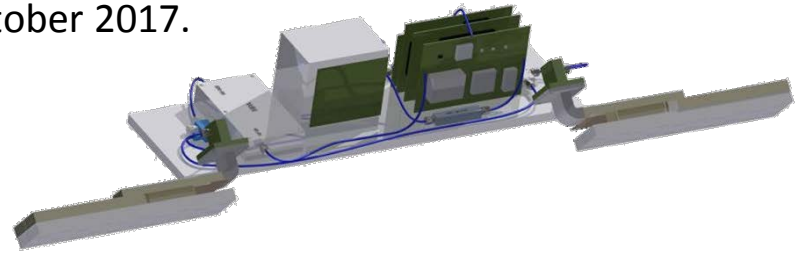
Payload Characteristics	Payload Performance	
• Total mass < 5kg • Power consumption < 30W (avg.) • Centre frequency: X-Band • Bandwidth: up to 500 MHz • CW Operation: PRN and Chirp pulses • Antenna size < 0.2 m x 0.2 m • Beam Scanning capabilities for extended coverage	Resolution	• Maritime: 0.5 m x 100 m • SAR†: 2 m x 2 m
	Access	• Maritime: 50 km* • SAR†: 10 km (single-beam)
	Swath	• Right/Left side operation • Incidence angle: 20° - 55° • Azimuth angle: ± 20°
	Performance	• Prob. of detection > 0.9 • Prob. False alarm < 10^{-6}

*Combines several elevation beams † SAR processing on-the-ground

- Zephyr S transits ~2000km/day
- If ship detected, cell ID sent to GCS (1-2 bytes/ship).
- Targets are geo-located using Zephyr location and heading information (on-ground).
- Ship tracking (heading/velocity) processed on-ground from several observations.
- The predicted performance of the SPIDER ZS Radar will detect fishing trawlers and also larger ships with a probability of detection (Pd) >0.9 and a probability of false alarm (Pfa) <10-6, covering swaths from 26km to 70km even in very rough conditions, such as sea state 6.


ZEPHYR S
Maritime
3
4
Maritime Surveillance Headquarter and ground station
2
DATA TRANSMISSION
Zephyr
ORDER OF INTERCEPTION
1
DETECTION
DETECTION
5
Helicopter and frigate
Non-suspicious vessel
Suspicious vessel
Automatic detection
1 radar signal
2 Surface contact is transmitted to Maritime Surveillance HQ (MSHQ)
3 Analysis of signal information (AIS)
4 If vessel is suspicious electro-optical and infrared analysis is done by MSHQ
5 If vessel is hostile MSHQ orders interception by ship or helicopter

- Implementation, validation, and verification of a SPIDER PoCC demonstrator.
- Demonstration of SPIDER radar concept on an airplane (“controlled” environment).
- Demonstration of processing principle and radar operation for maritime surveillance.
- CEOI Program with 50% Airbus DS co-funding.
- Zephyr’s radar design with mostly the same COTS components but without PCB integration.
- Instrument integration and testing complete end October 2017.
- Flight trials planned for November 2017.



Payload accommodation on Zephyr S

Two options depending on detailed mass budget:

- Whole payload in nose housing (only if <3kg feasible after optimisation).
- Backend in main wing (<1.5kg) and rest in nose pod (<3kg).