

Applications Development using Low Cost SAR

Owen Hawkins

SSTL – The Company

UK satellite manufacturer is owned by 99% Airbus
Defence & Space 1% University of Surrey

Since 1985, employing ~600 staff Facilities in
Surrey, Kent, Hampshire & Colorado



International presence



Major contracts : platforms, payloads or complete missions





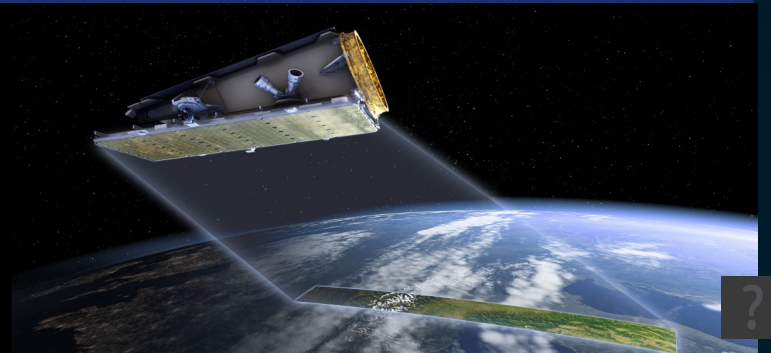
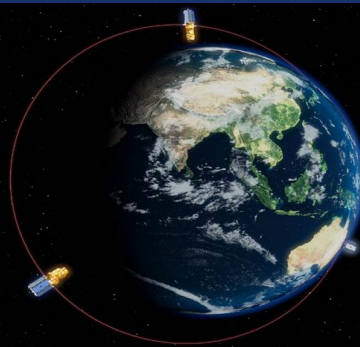
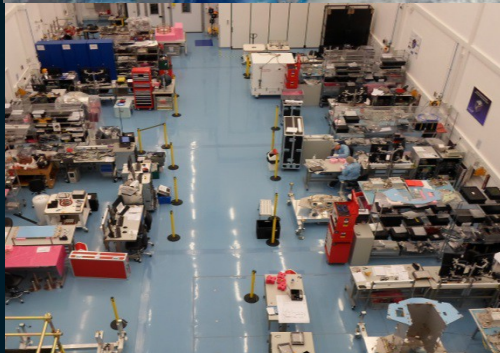
Missions in Manufacture

Galileo (22 payloads)

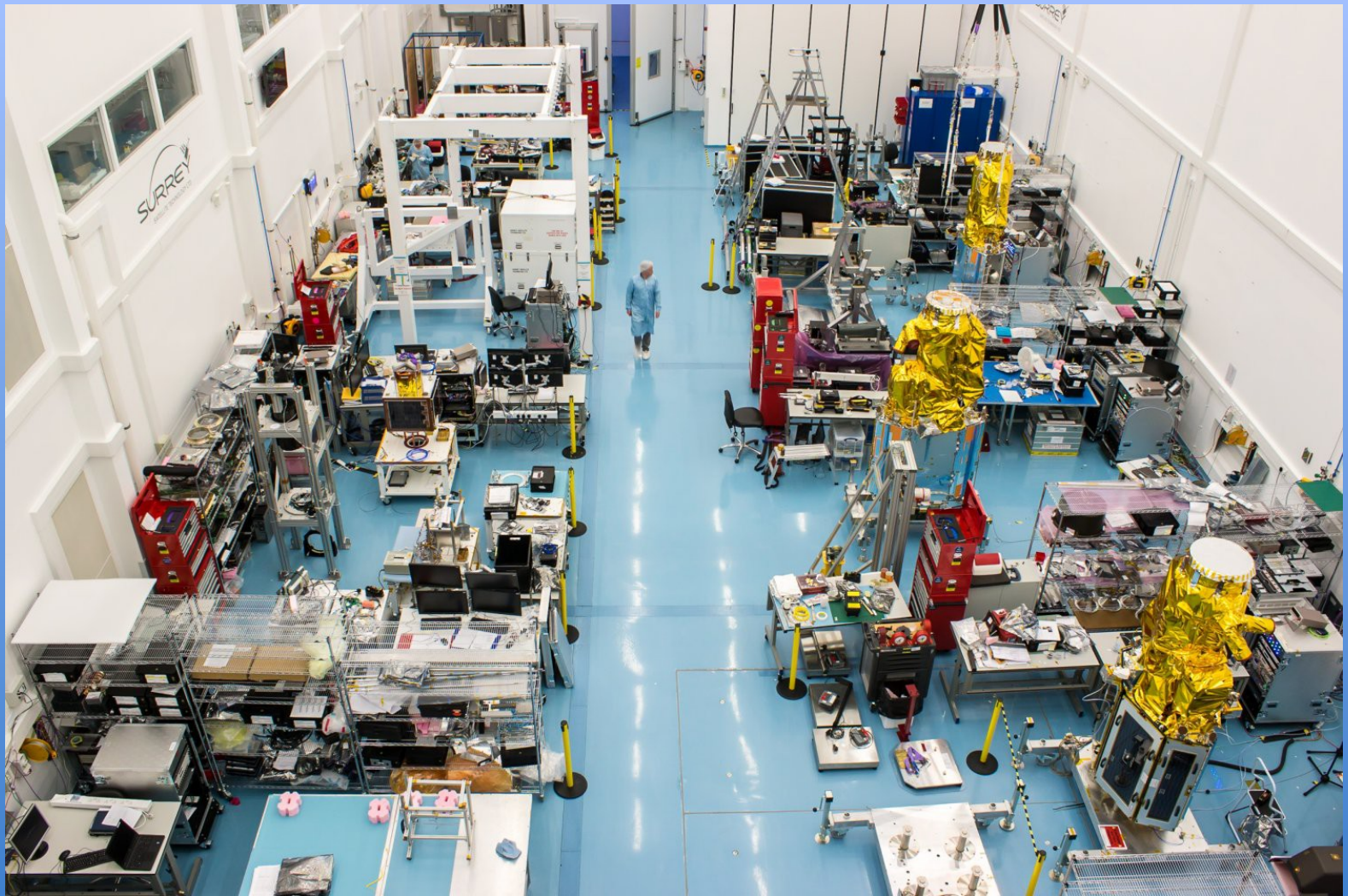
EarthCARE

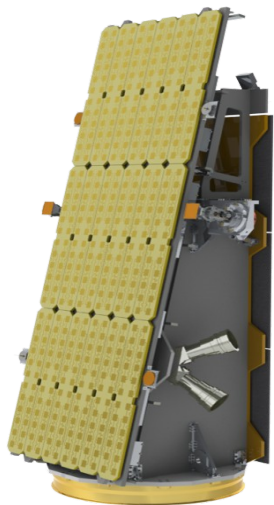
Lomonosov

DMC3 (3 satellites)



AISet 1B





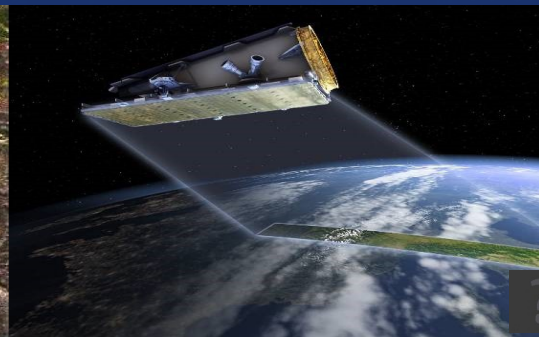
Radar - NovaSAR

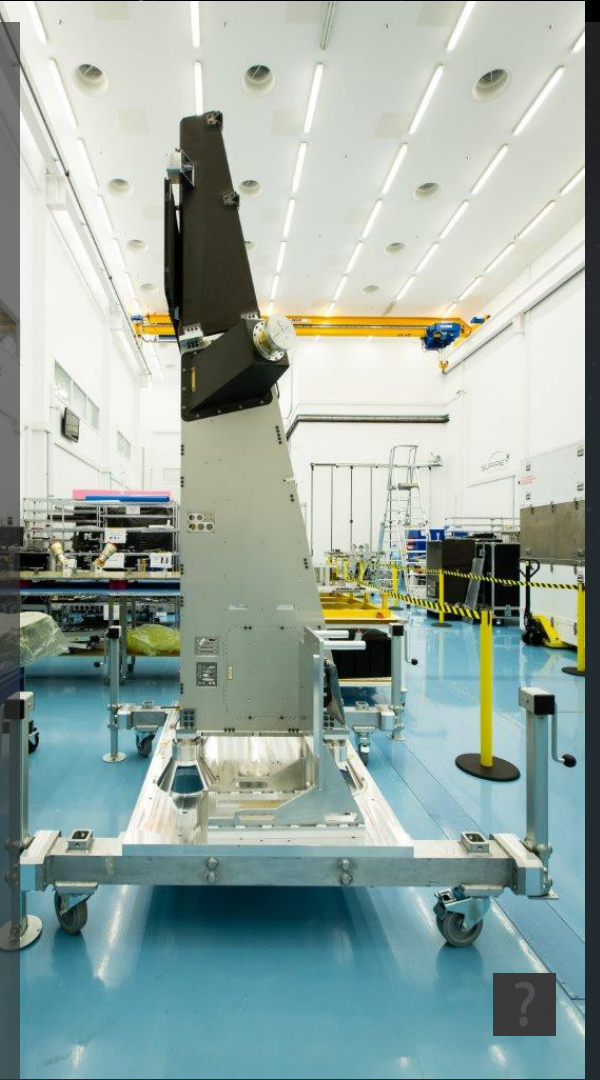
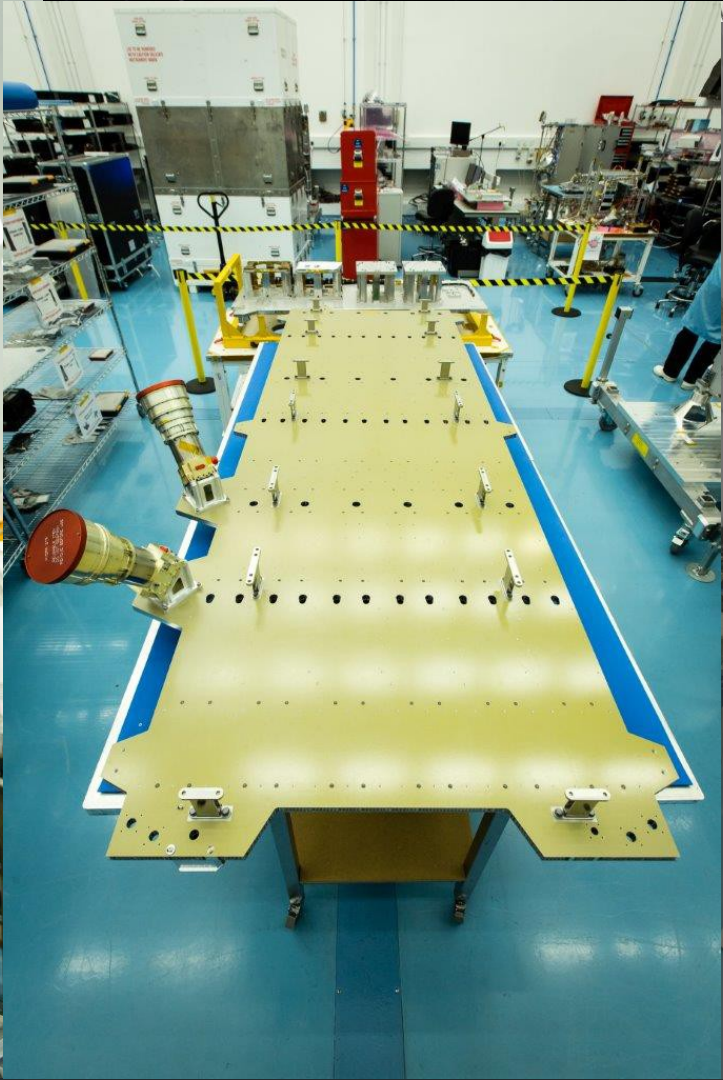
Low-cost SAR Satellite

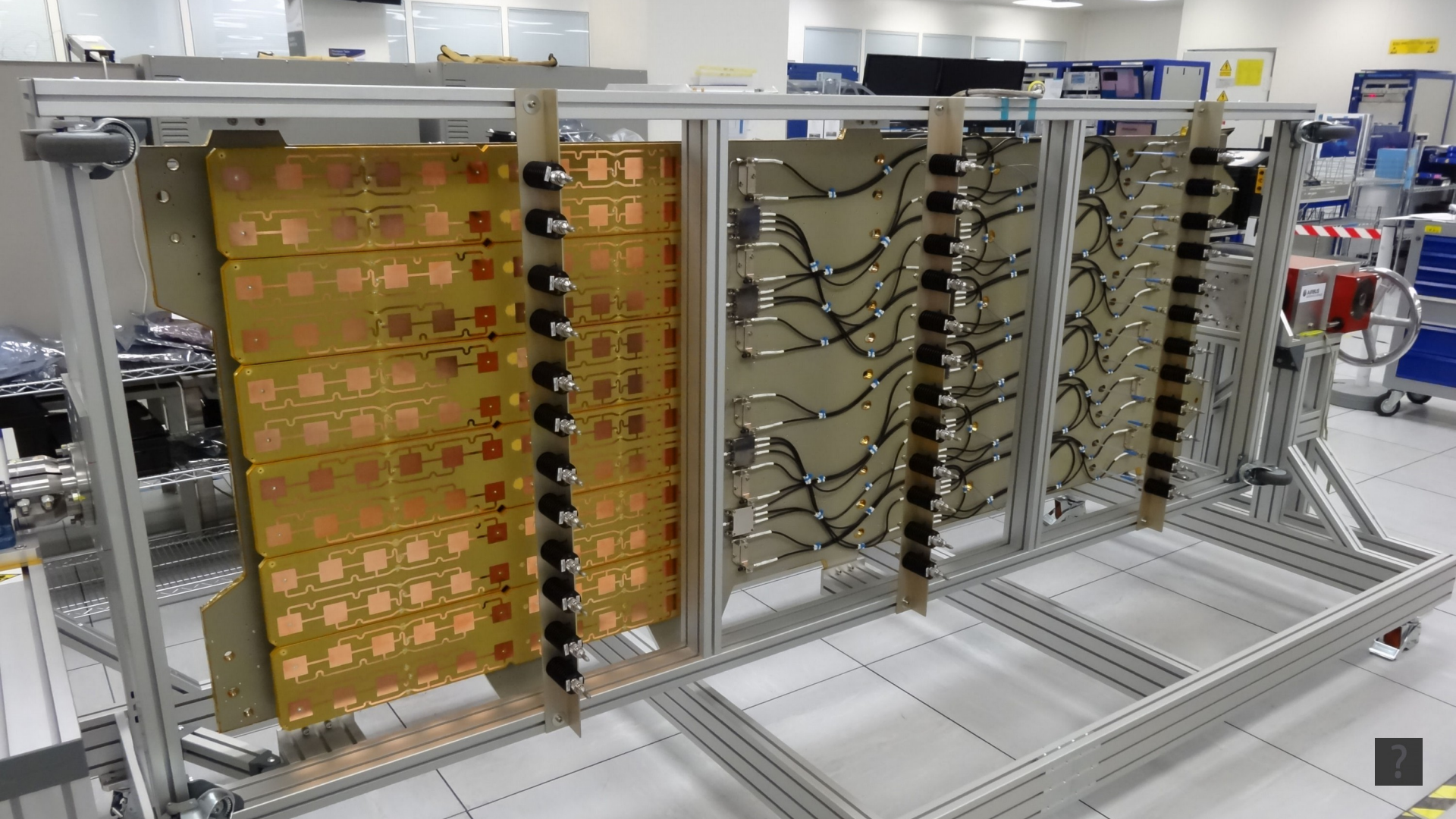
SSTL-Airbus (D&S) Joint Programme

4 Modes: 6-30m Resolution

HMG £21m investment in first satellite



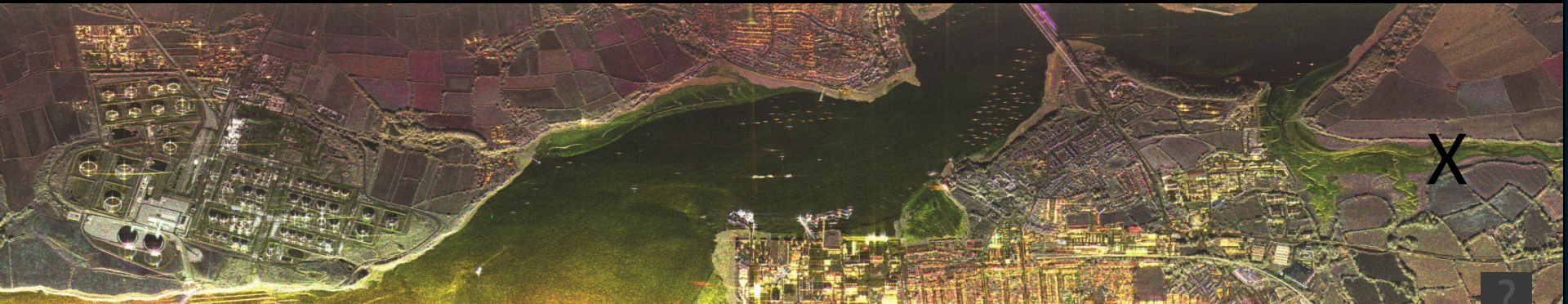
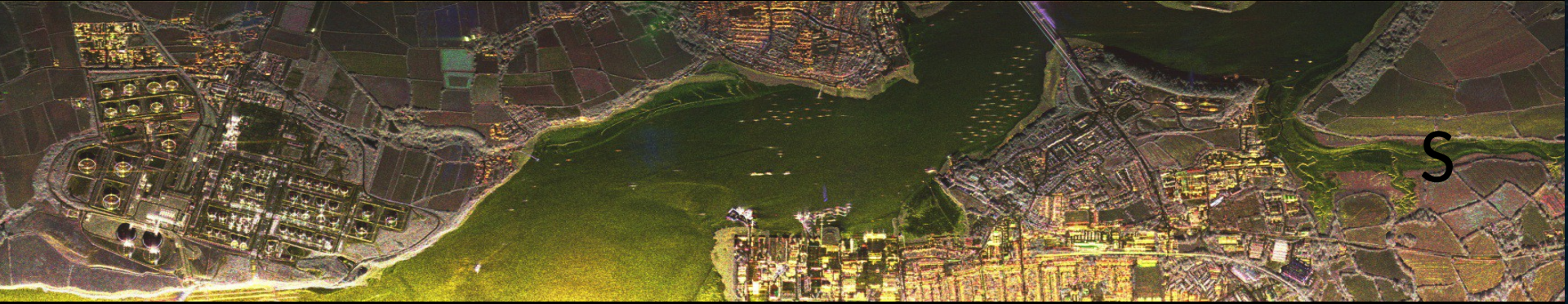




SAR data acquisition in S- and X-Band in HH, VV, HV and VH polarisation Numerous flights since 2000

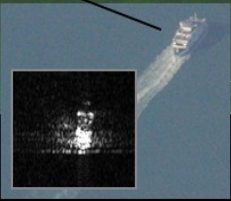
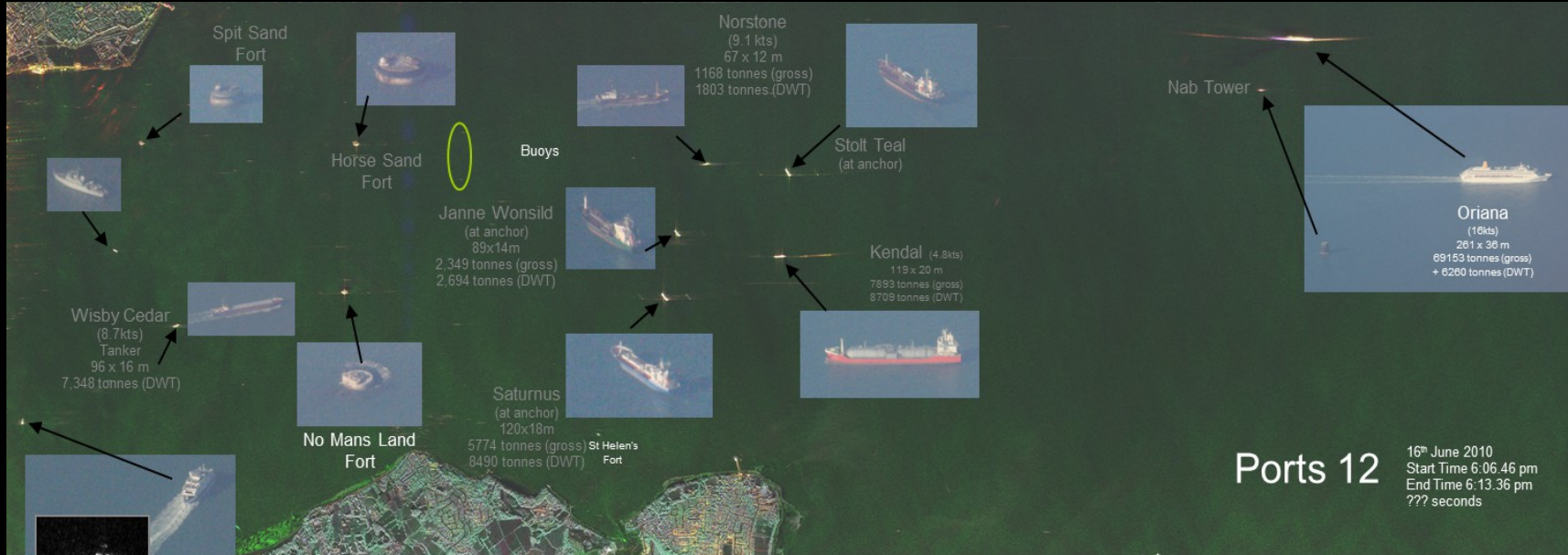


SAR antenna



Ship Detection plus AIS

Airbus Portsmouth – Geoff Burbidge



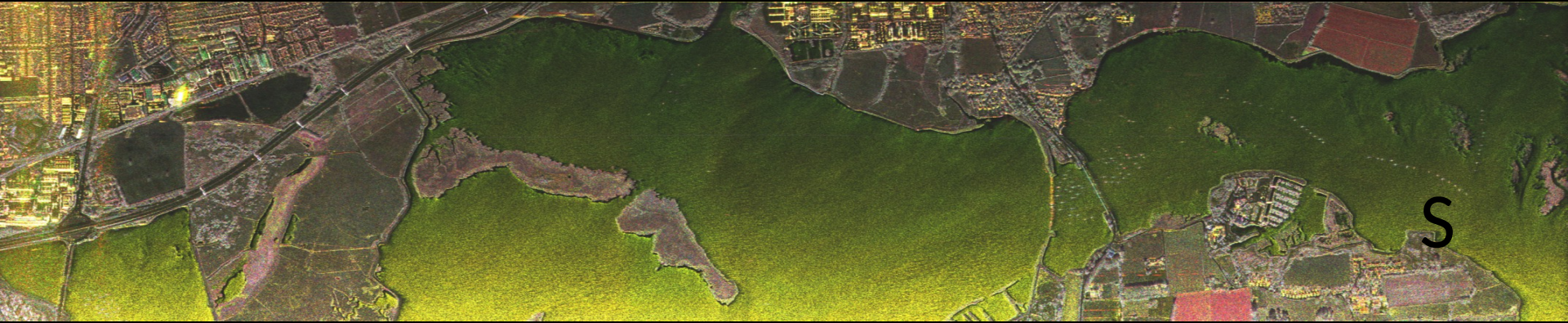
St Clare
(10.6kts)
81x81 x 18 m
5359 tonnes (gross)
6128 (DWT)

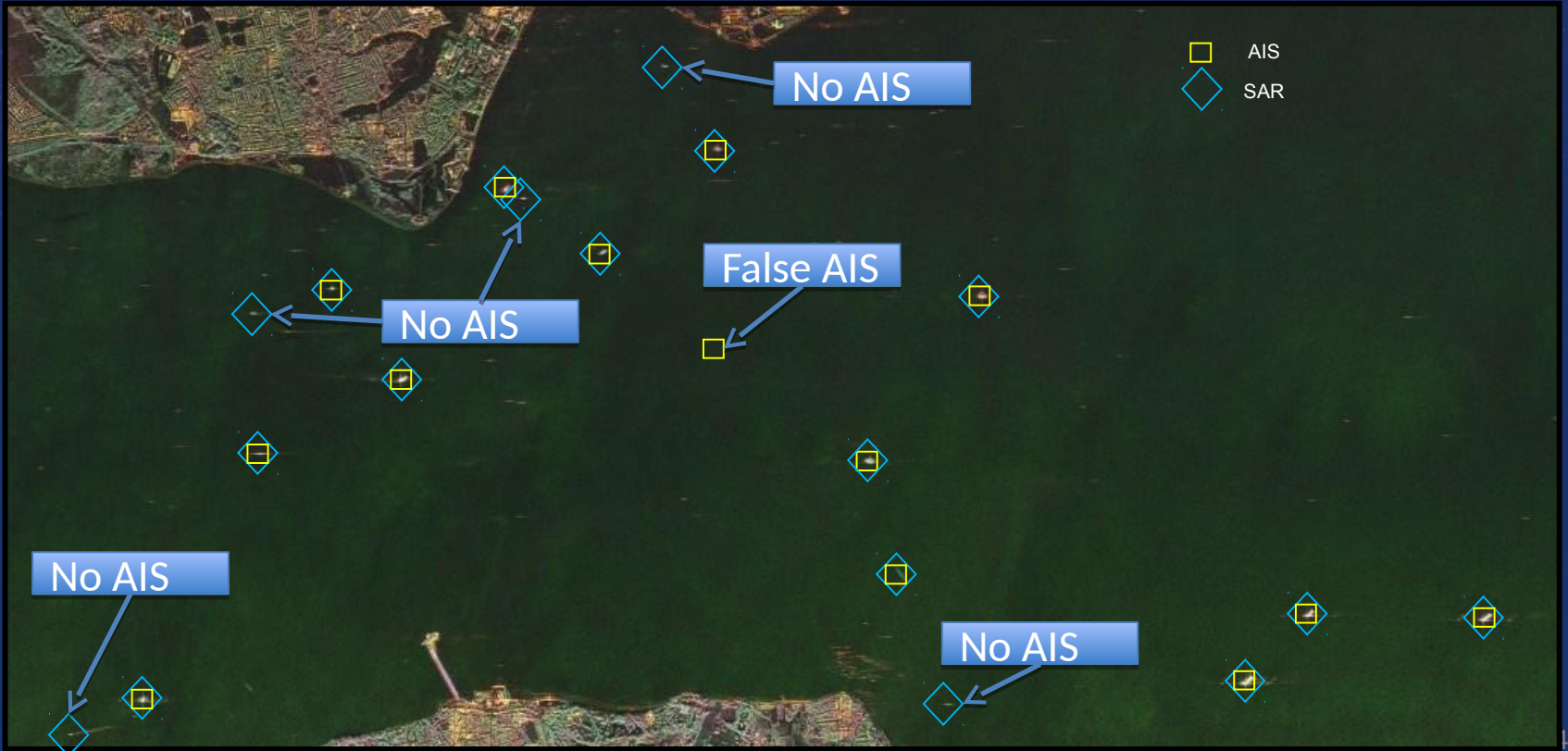
Quad Polar Image + Ground Truth (names & speeds from www.shipais.com, photos from aircraft window)

Ports 12

16th June 2010
Start Time 6:06.46 pm
End Time 6:13.36 pm
??? seconds



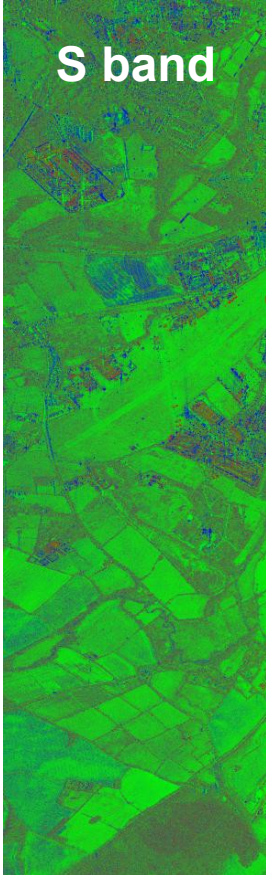




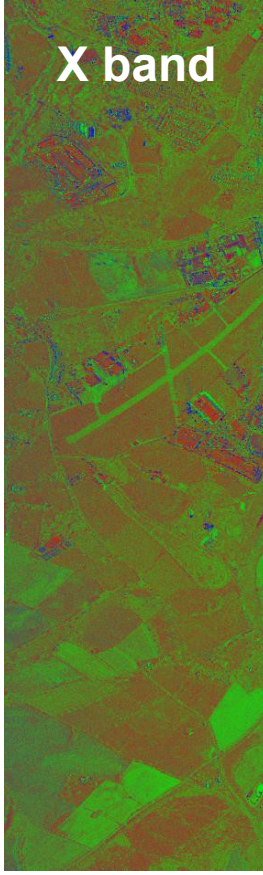
Polarimetry, Land

Surrey Space Centre – Rafella Guida

S band



X band



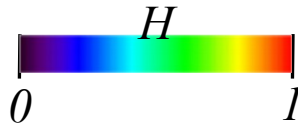
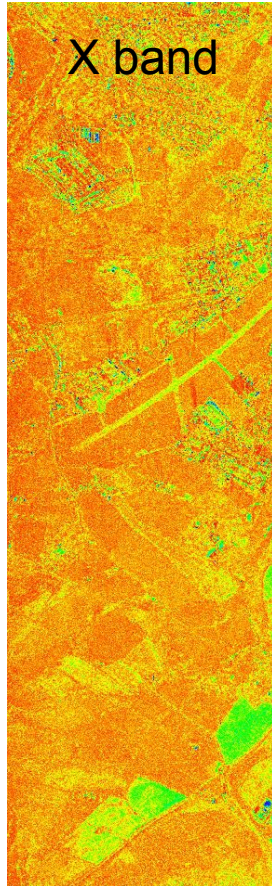
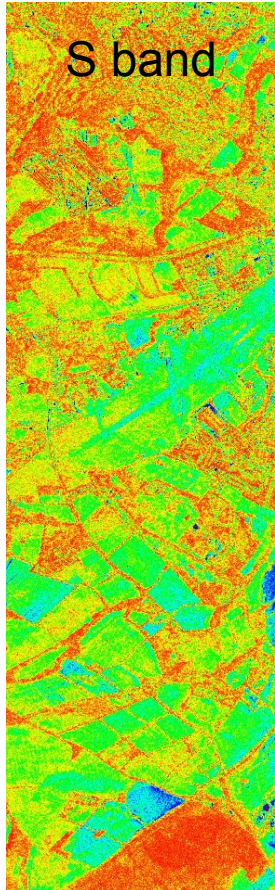
R: volume

G: surface

B: double-bounce

At X band, an increased amount of the received power is due to the volume scattering contribution (in red)

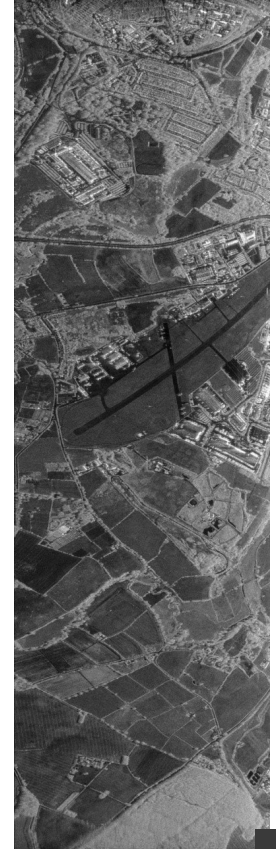




At S band, the polarimetric entropy approaches 1 in presence of some vegetated areas and forests in particular.

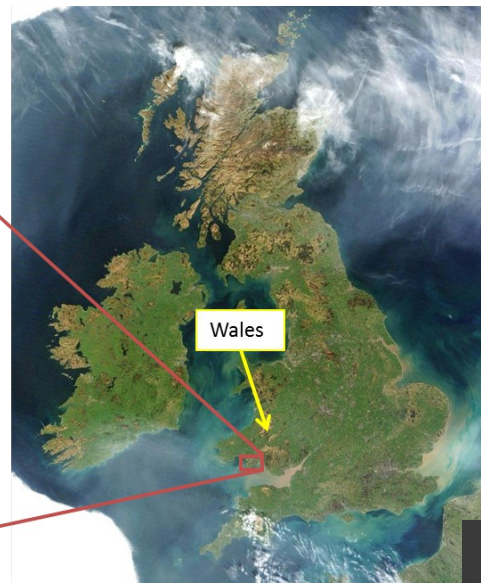
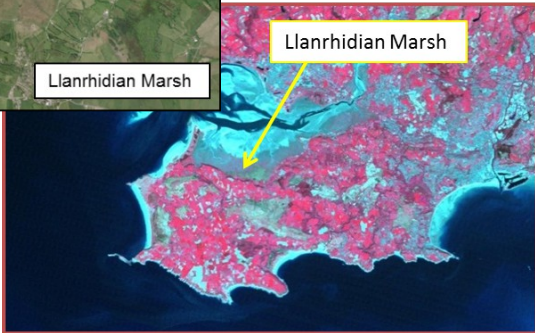
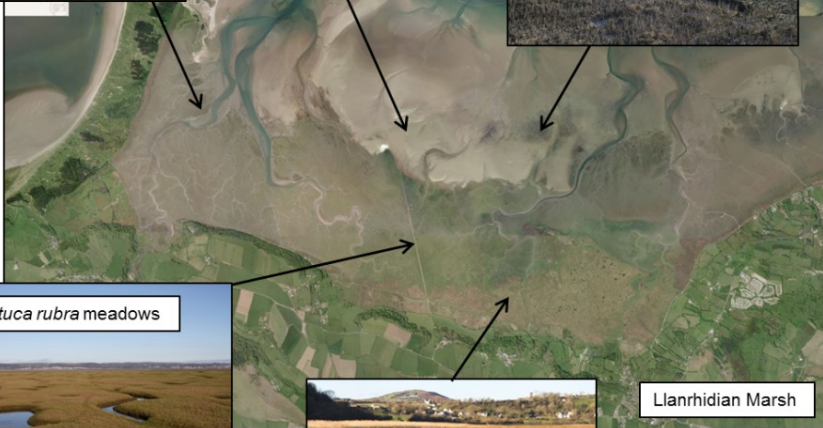
At X band, an overall high entropy trend can be observed, almost apart from the considered target.

Hence, X-Band has limited usefulness for crop and forest type measurements

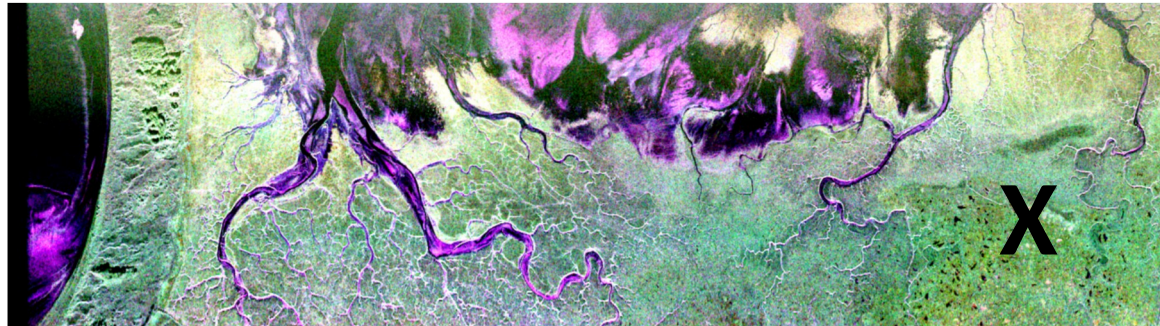
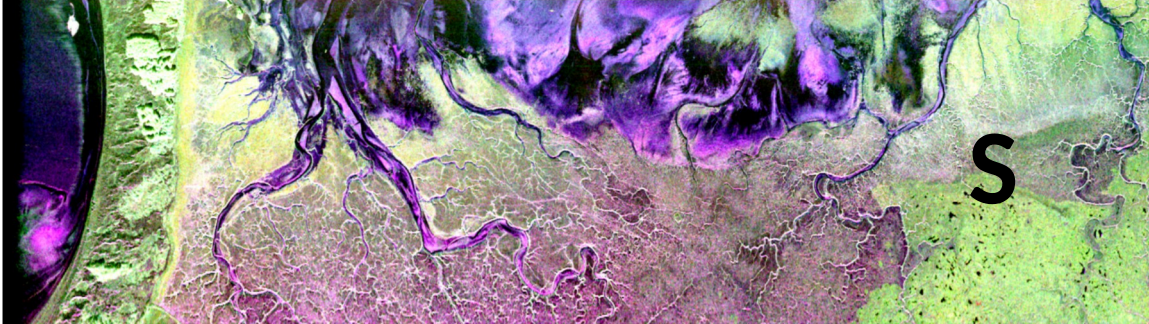


Saltmarsh

Airbus - Sybrand van Beijma



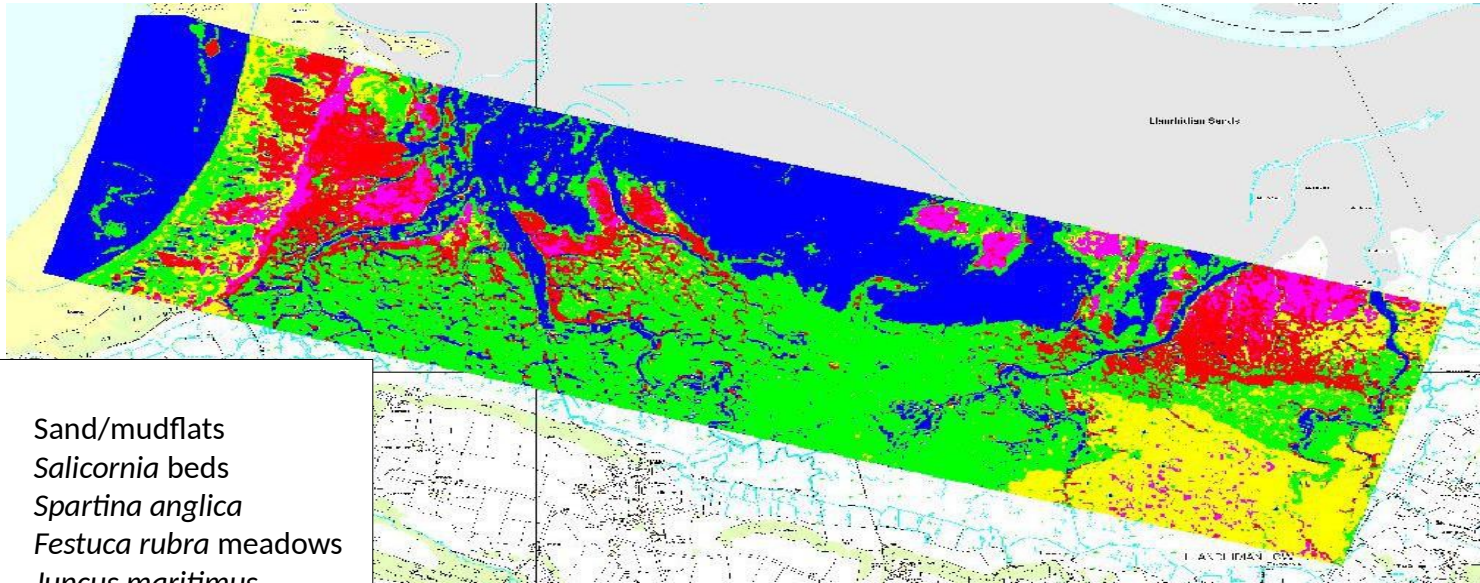
Acquired 28 July 2010 (17-43° incidence angle)



Pre-processed X-Band image, R=HH, G=HV, B=VV

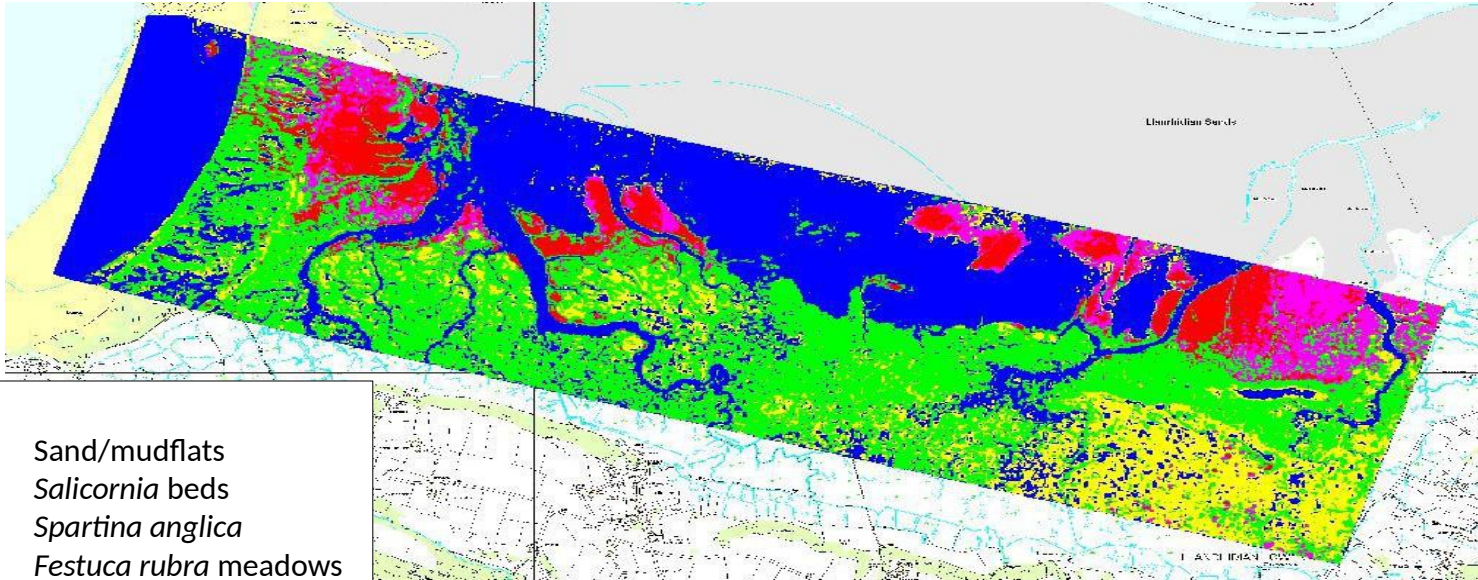
Results unsupervised classification

Wishart classification **S-Band**, based on H/A/ α decomposition

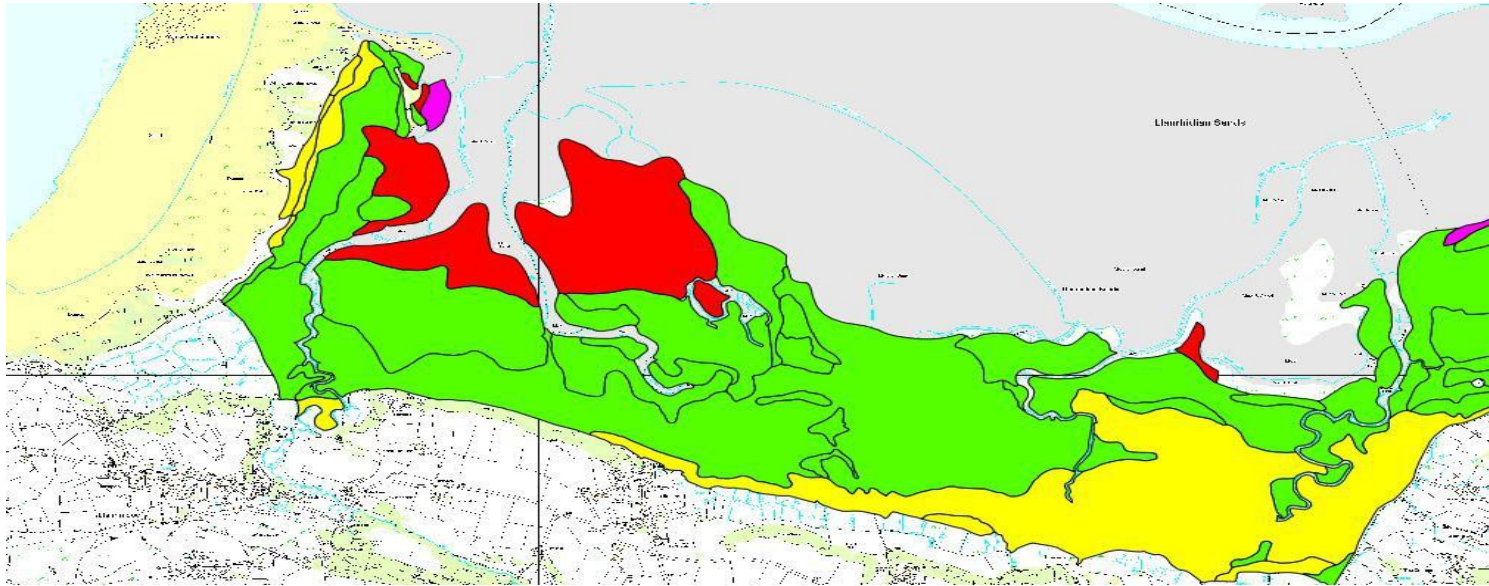


Results unsupervised classification

Wishart classification **X-Band**, based on H/A/ α decomposition



Reference mapping from earlier NVC survey



Saltmarsh

Polarimetric SAR generates useful classification results, highlighting the structural expression of various vegetation types

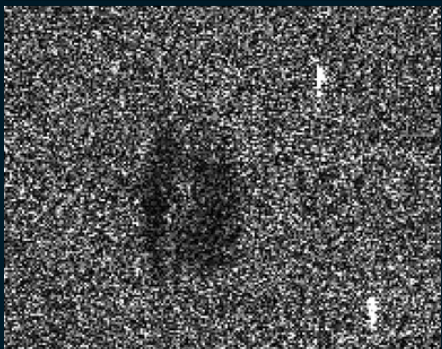
S-Band SAR appears better suited than X-Band SAR for distinguishing between different vegetation types

X-Band appears better at delineating vegetated from bare surfaces

Provides additional information to traditional, optical airborne survey data and could be used for future environmental monitoring

Oil on Water

Aerospace Resources Ltd.



AIRSAR OIL-ON-WATER EXERCISE



Participants

- Aerospace Resources Ltd
- Surrey Satellite Technology Ltd
- DMCii
- Surrey Space Centre, University of Surrey
- Oil Spill Response Ltd
- National Physical Laboratory
- UK Space Agency and the UK's Satellite Applications Catapult
- MCA, MMO, NMIC, DSTL, NERC (UK government units)
- Airbus Space and Defence
- Various oil & gas industry organisations and individual oil & gas companies



Start (BST) 18:27:21

Stop (BST) 18:32:31

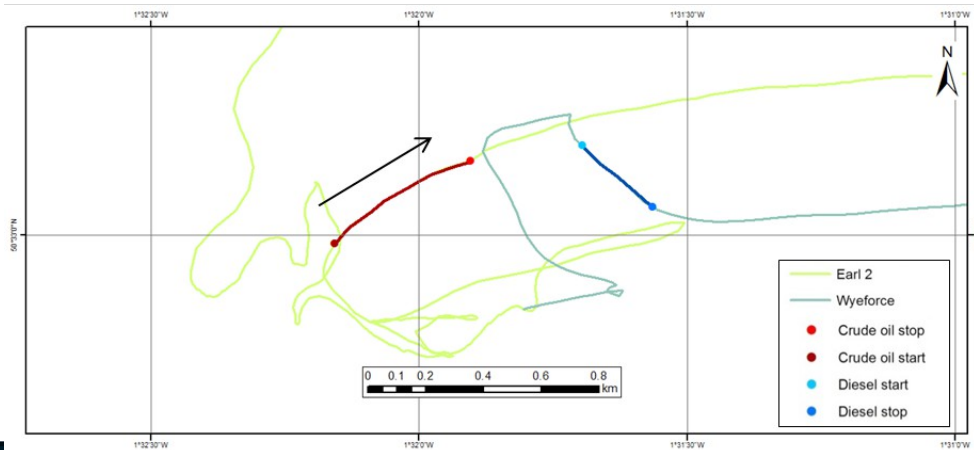
Crude oil release from Earl II stern.
Tigershark remain near start point
of release.



OceanEye EO



OceanEye IR





Diesel released from stern of Wyeforce.



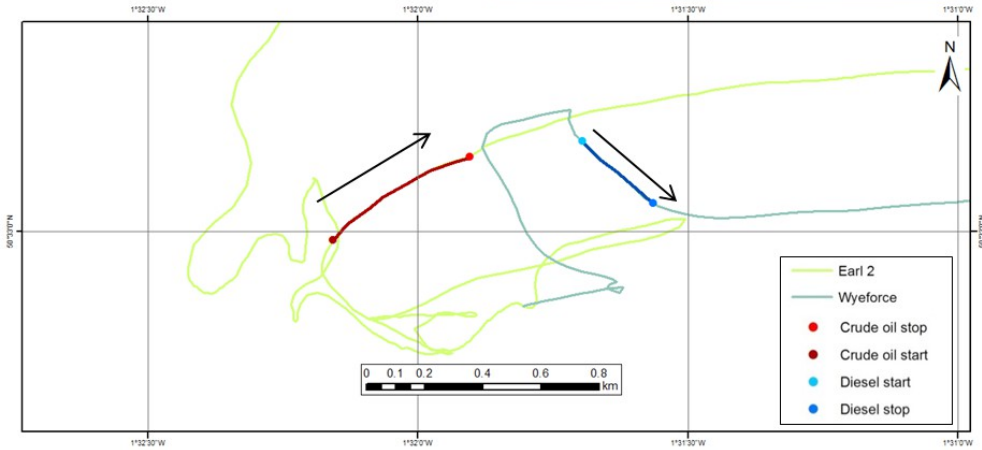
Start (BST) 18:34:08

Stop (BST) 18:37:09

OceanEye EO



OceanEye IR

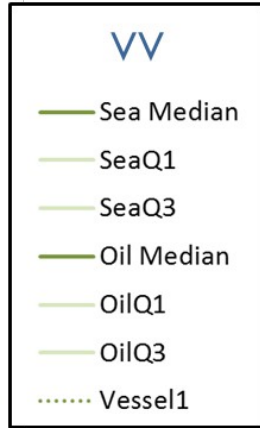
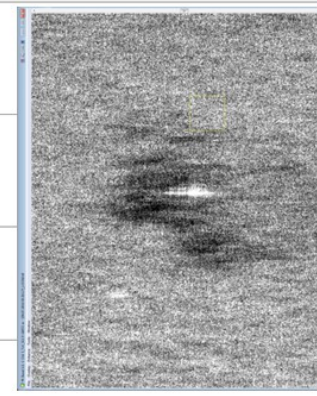
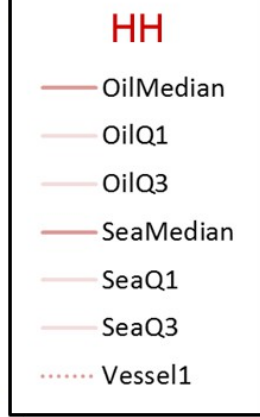
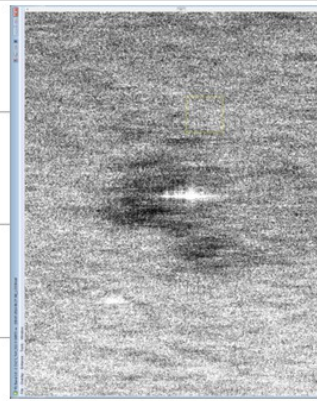
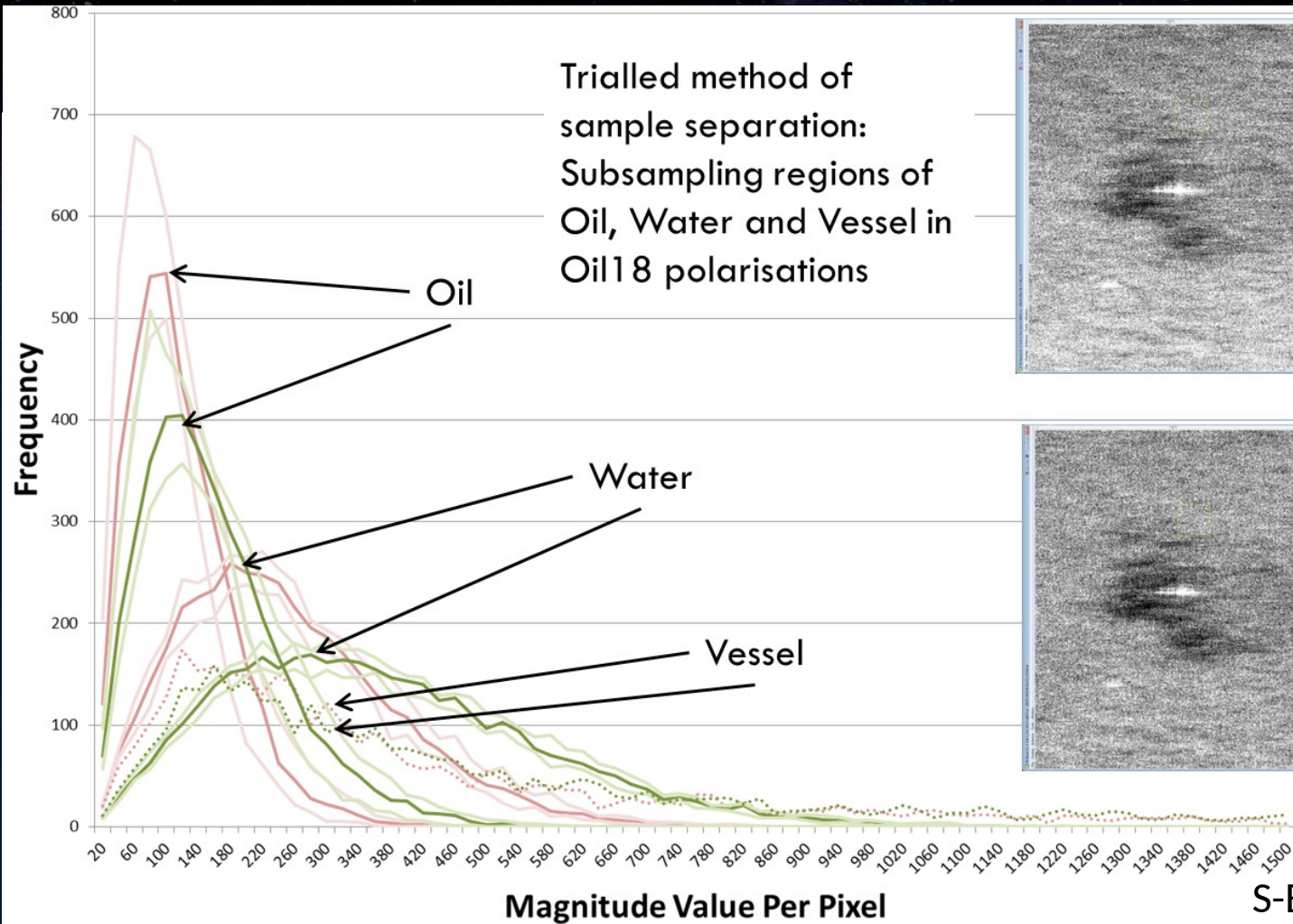


Decreasing wave length ↓

| Dataset | Source | Assessment of Quality and Suitability |
|---|----------------------|---|
| Airbus demonstrator S-band SAR | Airbus Portsmouth | Not all runs and channels worked but oil visible |
| Airbus demonstrator X-band SAR | Airbus Portsmouth | Not all runs and channels worked but oil visible |
| Radarsat-2 C-band SAR | MDA | Oil visible |
| Cobham Dornier fixed nose camera Thermal IR (8-14µm) | OSRL | OK info source |
| Cobham Dornier camera turret IR (3.5-5µm) | OSRL | Good info source |
| Aerostat IR | OSRL | Very clear |
| UK DMC-2 Multispectral Imagery (NIR, R, G) | DMCii | Of limited use for actual exercise monitoring, but good to show no oil in area after event |
| Cobham Dornier camera turret Visible Wide | OSRL | Good info source |
| Cobham Dornier camera turret Visible Narrow | OSRL | Bad - very blurry as zoomed in very far |
| Cobham Dornier fixed nose camera Visible | OSRL | OK info source |
| DSLR from Cobham Dornier Visible | OSRL | Some good images from plane, with georeferenced tags |
| Aerostat -Visible | OSRL | Very clear |
| Cobham Dornier fixed nose camera UV (300-420nm) | OSRL | Oil not clear - no suitable information |
| Spectrometer (400-2500nm) | NPL | - |

Also:

1. Wind speed
2. Sea state
3. Sea temperature
4. Turbidity
5. Sea currents
6. Tides
7. Other weather
8. Vessel tracking
9. AIS
10. Photographic record



S-Band, Amplitude ?

Conclusion

All results shown are excerpts only

S-Band is proven to be useful for oil slick monitoring, vegetation survey, vessel monitoring, waterway and saltmarsh monitoring

The UK has invested in developing applications pre-launch

Launch is expected in 2016



Changing the economics of space

www.sstl.co.uk

