SURREY
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How healthy are our oceans ?

esa

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Contents

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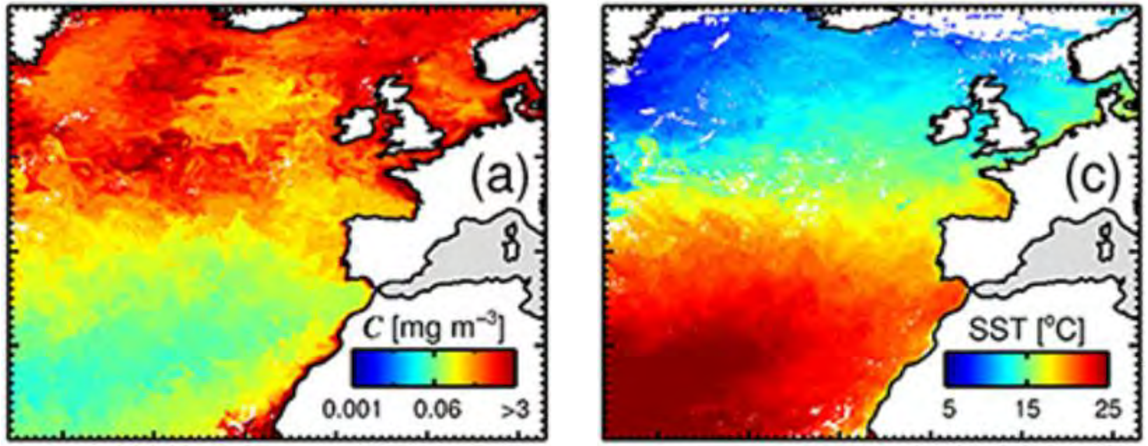
Background

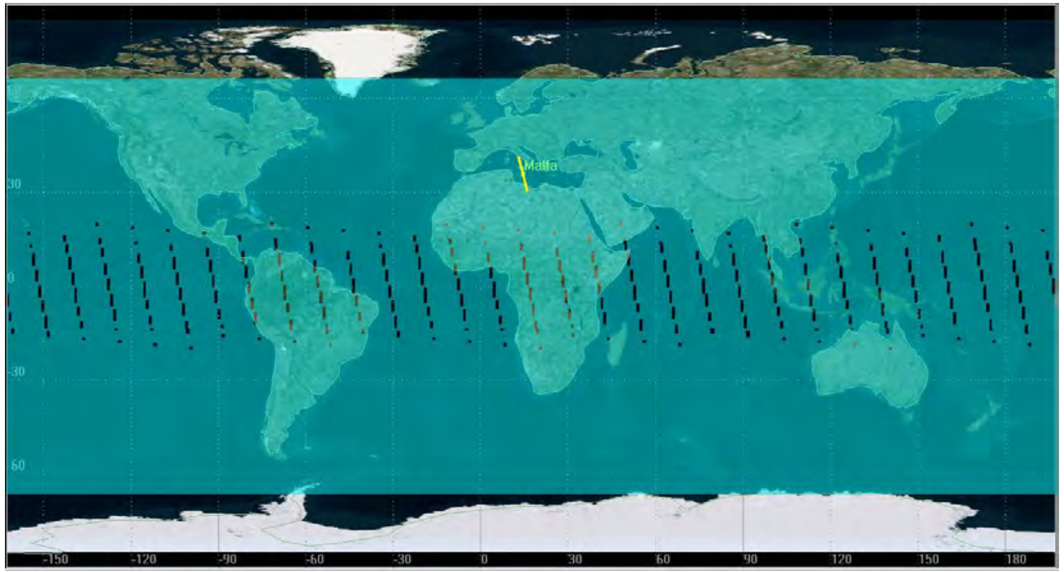
- Since the advent of the first ocean-colour and thermal sensors (e.g. CZCS and AVHRR) it has become clear that these two data streams can be used synergistically to understand the ocean [1]
- Additionally simultaneous estimates of sea skin temperature and ocean colour can help with retrievals in both data streams:
  - Emissivity in turbid waters [2]
  - Phytoplankton type retrievals [3-5]
  - Bio-physical feedback [6]
  - Air-sea gas exchange [7]

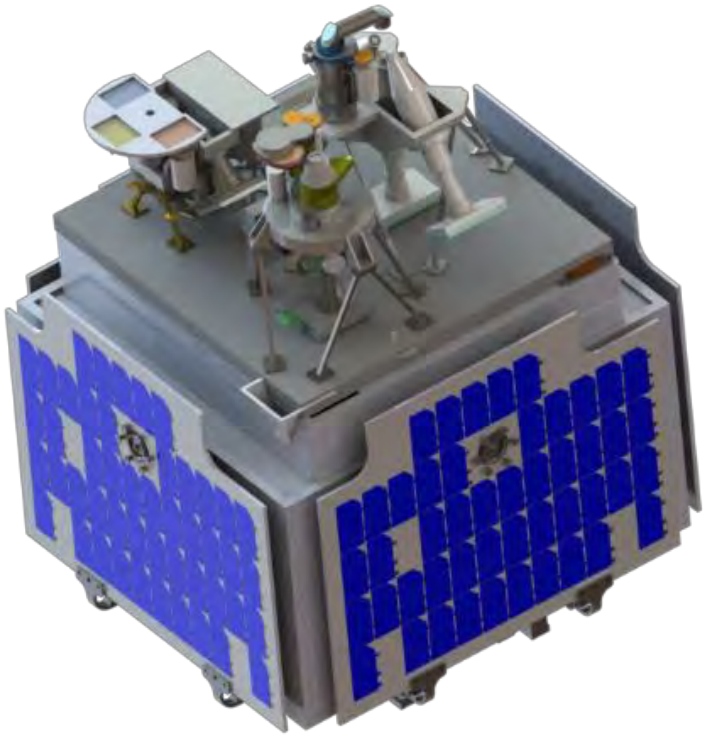


- Moreover better ocean colour product is obtained when atmospheric effects are removed using precise information about absorbing aerosols [8]

Concept description

- Simultaneous retrieval of ocean colour, sea skin temperature and aerosol optical depth using a constellation of 16 microsatellites to provide 8 global daily accesses
- Tailored ECSS compliance
- Mission lifetime: 7 years
- Single satellite wet mass: 77kg
- SSO: 560km



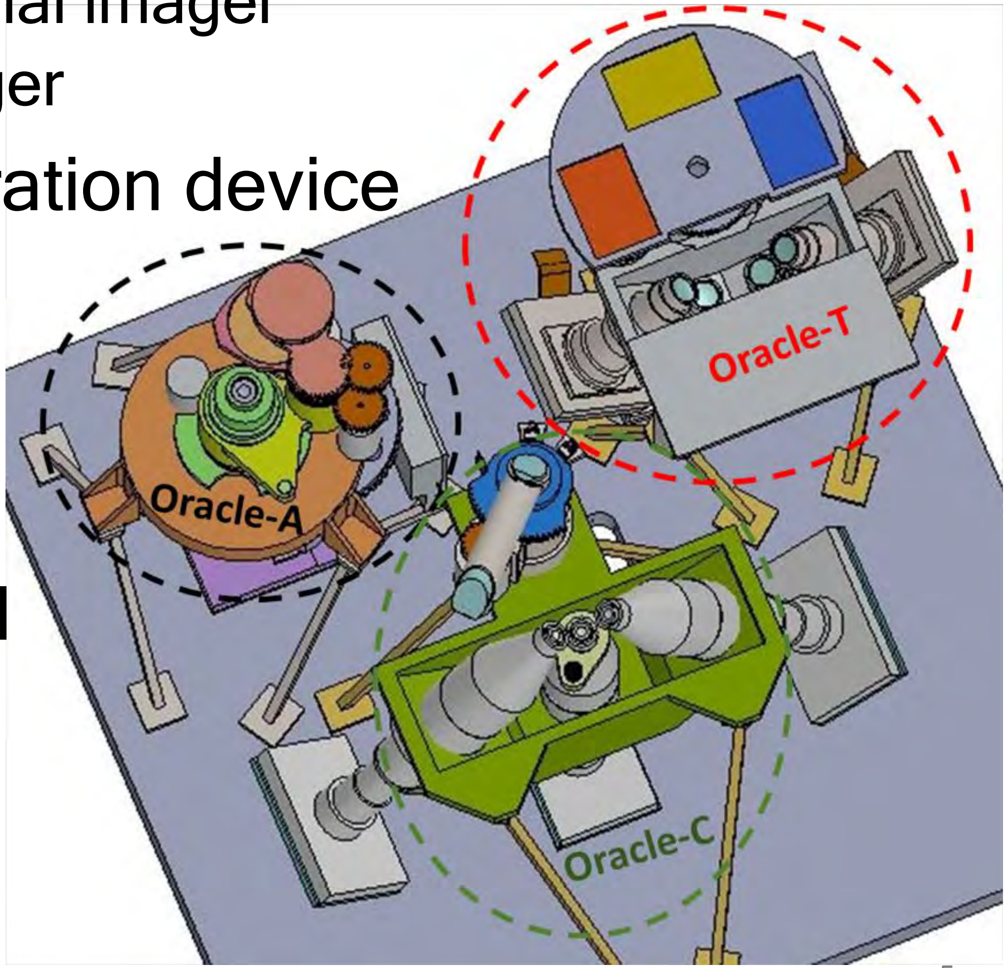


Instrument: overview

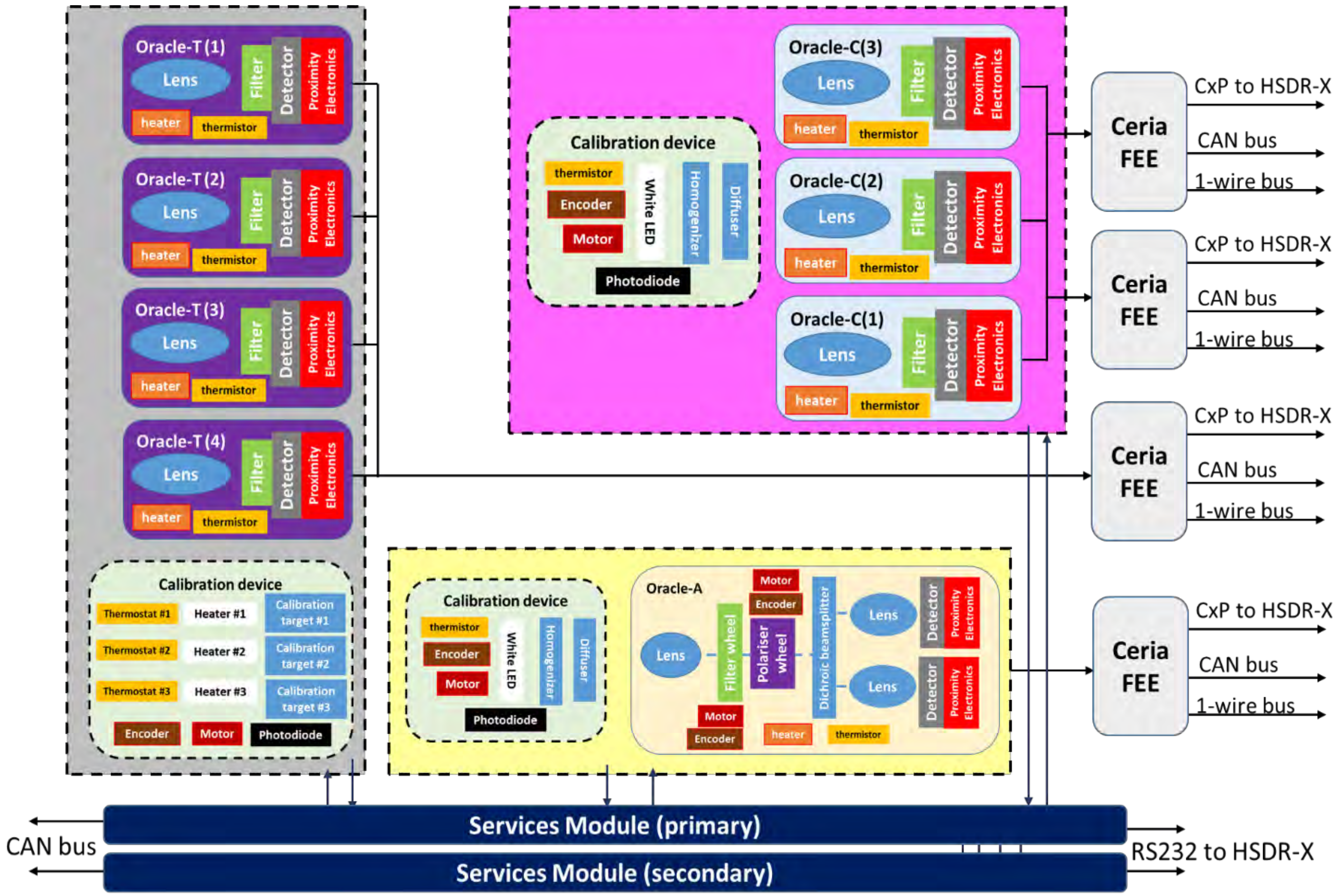
- Oracle instrument consists of three imagers:
  - Oracle-C: multi-spectral pushbroom colour imager
  - Oracle-T: multi-spectral pushbroom thermal imager
  - Oracle-A: multi-spectral polarimetric imager
- Each imager has its own internal calibration device

Parameter	Oracle-C	Oracle-T	Oracle-A
GSD (m)	100	300	900
Swath (km)	1152	1152	1152

- Completed to initial design review level



Instrument: architecture



Instrument: modelled performance

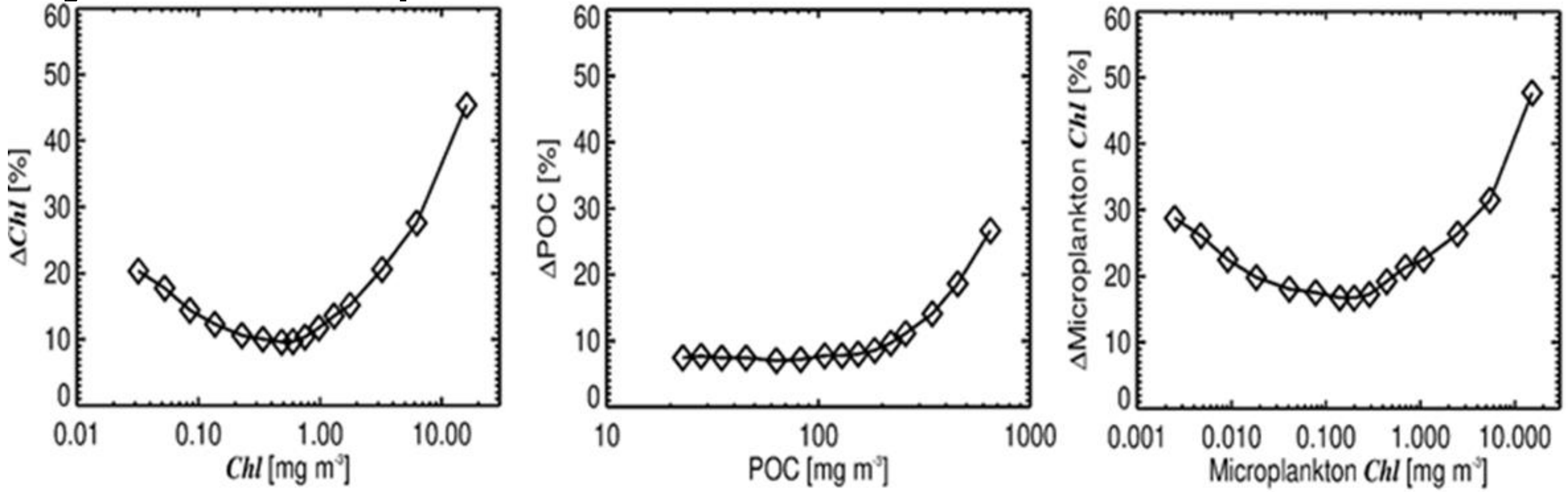
- At this initial design level instrument performance meets all requirements

Parameter	Oracle-C		Oracle-T		Oracle-A	
	Requirement	Modelled	Requirement	Modelled	Requirement	Modelled
GSD (at 560km SSO)	100m	100m	300m	300m	900m	900m
Multispectral bands	8	8	3	3	11	11
Min. MTF at Nyquist	0.1	0.17	0.1	0.12	0.1	0.31
Min. SNR (visible)	400	468*	-	-	200	261**
Min. SNR (IR)	400	574*	-	-	200	281**
Max. NETD	-	-	0.2K	0.2K***	-	-
Polarisation sensitivity	<0.05	<0.05	-	-	>0.95	0.97
Radiometric accuracy	0.05	0.05	0.05	0.05	0.05	0.05
Viewing angles	-	-	-	-	7	7
Polarisation states	-	-	-	-	3	3

*OLCI radiance levels
**3MI radiance levels
***Scene temperature of 300K

Types of products

- The Chl concentration, POC concentration and microplankton Chl estimated using the ocean colour models:
    - OC3 (SeaWiFS) algorithm
    - Brewin Microplankton Chl algorithm
    - Stramski POC algorithm
    - a standard band ratio algorithm used by NASA
- Model parameters for OC3, Stramski and Brewin were varied by producing a Gaussian probability distribution and assumed 5% uncertainty in model parameters



Conclusion

- Development of Oracle concept to initial design review is complete, meeting all requirements
- User assessment indicates that the concept is useful in allowing better understanding of ocean health through examination of phytoplankton populations
- Requires constellation of 16 micro-satellites to provide 8 regular global daily accesses

References

	Title	Doc #	Date
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2	Retrieval of sea surface temperature from MODIS data in coastal waters, Cavalli et al	Sustainability 9(11)	2017
3	Uncertainty in ocean-colour estimates of chlorophyll for phytoplankton groups, Brewin et al	doi.10.3389/fmars.2017.00104	2017
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5	Temperature-correlated changes in phytoplankton community structure are restricted to polar waters, Ward et al	PloS one, 10(8)	2015
6	Biological control of surface temperature in the Arabian Sea, Sathyendranath et al	Nature, 349(6304)	1991
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Thank you

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