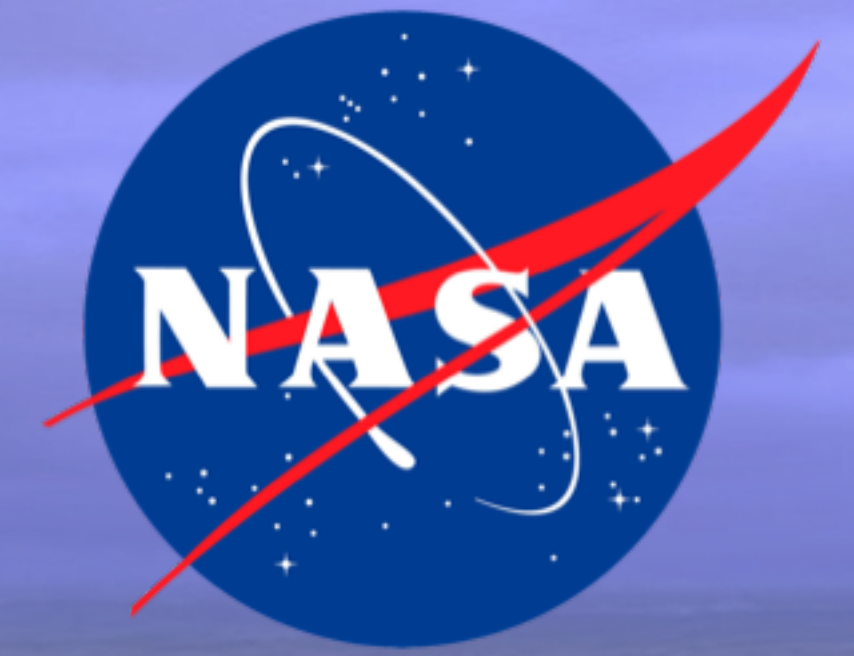




The NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) Mission



PACE will extend and improve NASA's 20-plus years of global satellite observations of our living ocean, aerosols, and clouds and initiate an advanced set of climate-relevant data records. By determining the distribution of phytoplankton, PACE will help assess ocean health. It will also continue key measurements related to air quality and climate. *This strategic mission is a Program of Record in the 2017 Decadal Survey for Earth Science and Applications for Space.*

Key Mission Characteristics

- * Hyperspectral ocean color instrument & two small multi-angle polarimeters
- * 2-day global coverage to solar & sensor zenith angles of 75° & 60°
- * Sun-synchronous, polar orbit with a local Equatorial crossing time of ~13:00
- * 675-km altitude & 98° inclination
- * Class C (limited redundancy) for 3 years of operations & 10 years of fuel

Multi-Angle Polarimetry on PACE

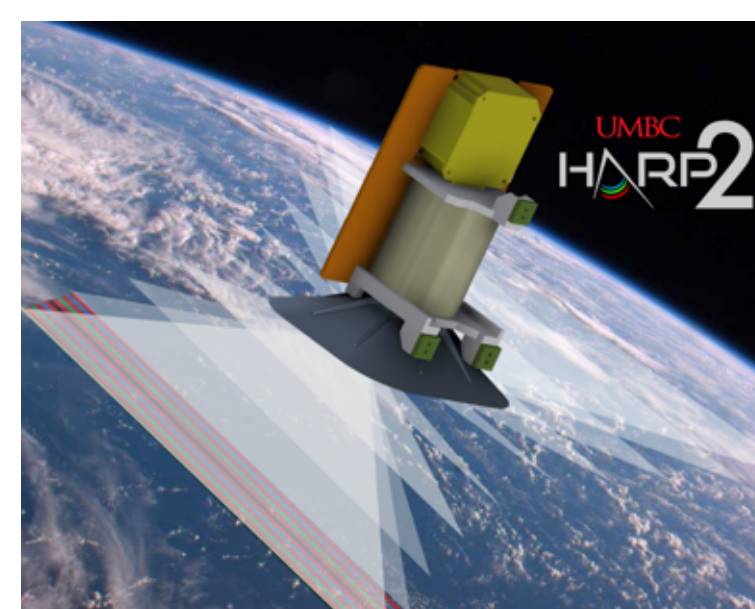
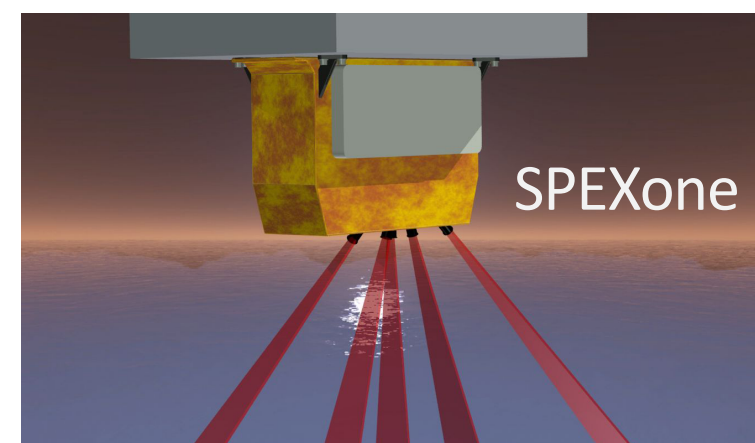
Improved characterization of aerosol particles from a polarimeter will improve the quantification of Earth's energy budget, produce data products for the aerosol and cloud communities, and improve atmospheric correction for ocean color.

Spectro-Polarimeter for Planetary Exploration (SPeXone)

Contribution from the Netherlands (SRON, NSO, Airbus)

Hyper Angular Rainbow Polarimeter (HARP-2)

Contribution from University of Maryland Baltimore County (UMBC)



	SPeXone	HARP-2
Attributes	Hyperspectral (UV) & narrow swath	Hyperangular & wide swath
Spectral range [resolution]	385-770 nm [hyperspectral 2 nm]	440, 550, 670 nm [10 nm] & 870 nm [40 nm]
Number of viewing angles [degrees]	5 [-52°, -20°, 0°, 20°, 52°]	20 for 440, 550, 870 nm & 60 for 670 nm [114°]
Coverage [swath width]	9° [100 km]	94° [1550 km]
Ground sample distance	2.5 km ²	3 km ²

Mission Elements & Schedule

Mission Management:

Hyperspectral Ocean Color Instrument:

Multi-angle Polarimeters:

Spacecraft / Mission Operations:

Science Data Processing:

Competed Science Teams:

Goddard Space Flight Center (GSFC)

GSFC

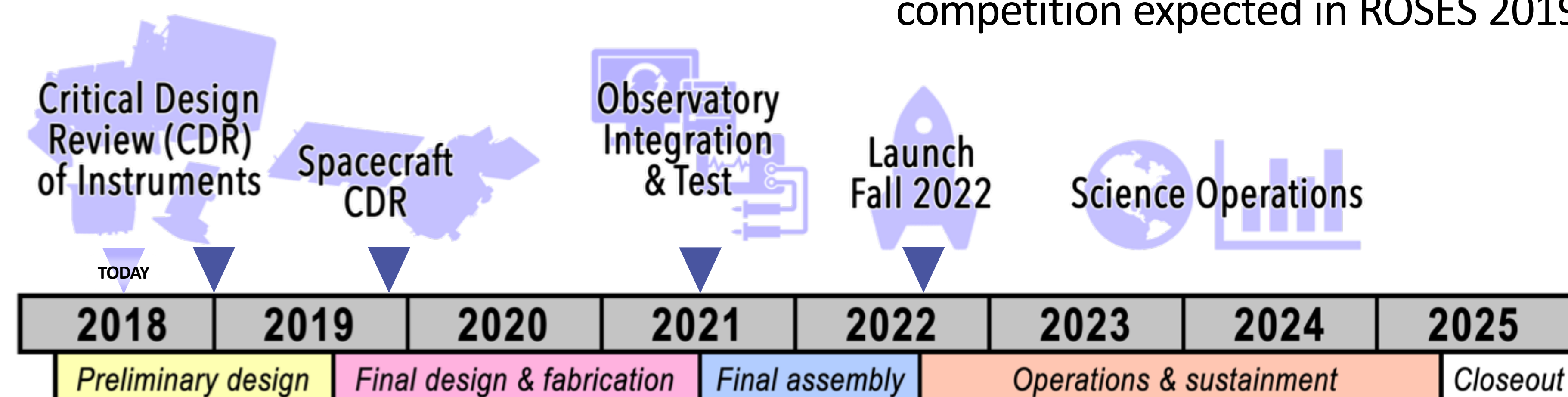
SRON / NSO / Airbus, UMBC

GSFC

GSFC Ocean Biology Processing Group

NASA Earth Sciences Division. Next

competition expected in ROSES 2019.



Science Goals

- (1) **Continue NASA's multi-decade record** of satellite ocean color, clouds and aerosol particles observations from SeaWiFS, MODIS, MISR, and VIIRS; and
- (2) **Provide new measurements** of aerosols, clouds, aquatic biology, ecology, and biogeochemistry through the spectral resolution of the Ocean Color Instrument (OCI) and multi-angle polarimetry.

PACE will be NASA's most advanced global ocean color & aerosol mission to date

Ocean Color Instrument (OCI)

Unprecedented characterization of ocean color and derived biogeophysical products and improved characterization of aerosol and cloud properties.

- * **5 nm resolution from 350 to 890 nm** (goal of 320 nm) and capabilities for finer spectral sampling (1.25 or 2.5 nm) over limited, programmable spectral ranges

- * **Spectral channels at 940, 1038, 1250, 1378, 1615, 2130 and 2260 nm**

Support for aerosol & cloud data products, plus ocean color atmospheric correction

- * **1-km² ground sample distance at nadir**

- * **±20-deg tilt to avoid Sun glint**

- * **No image striping**

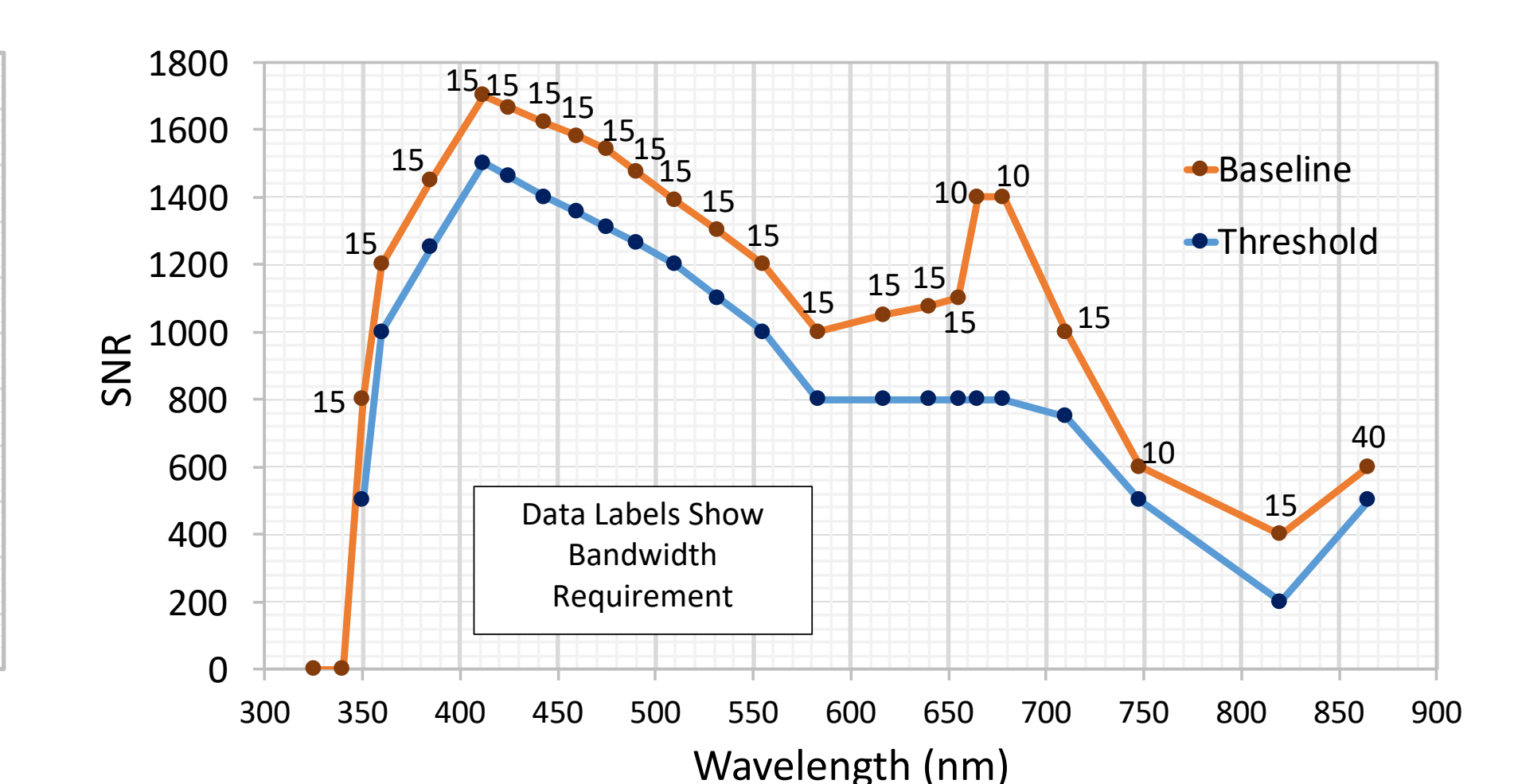
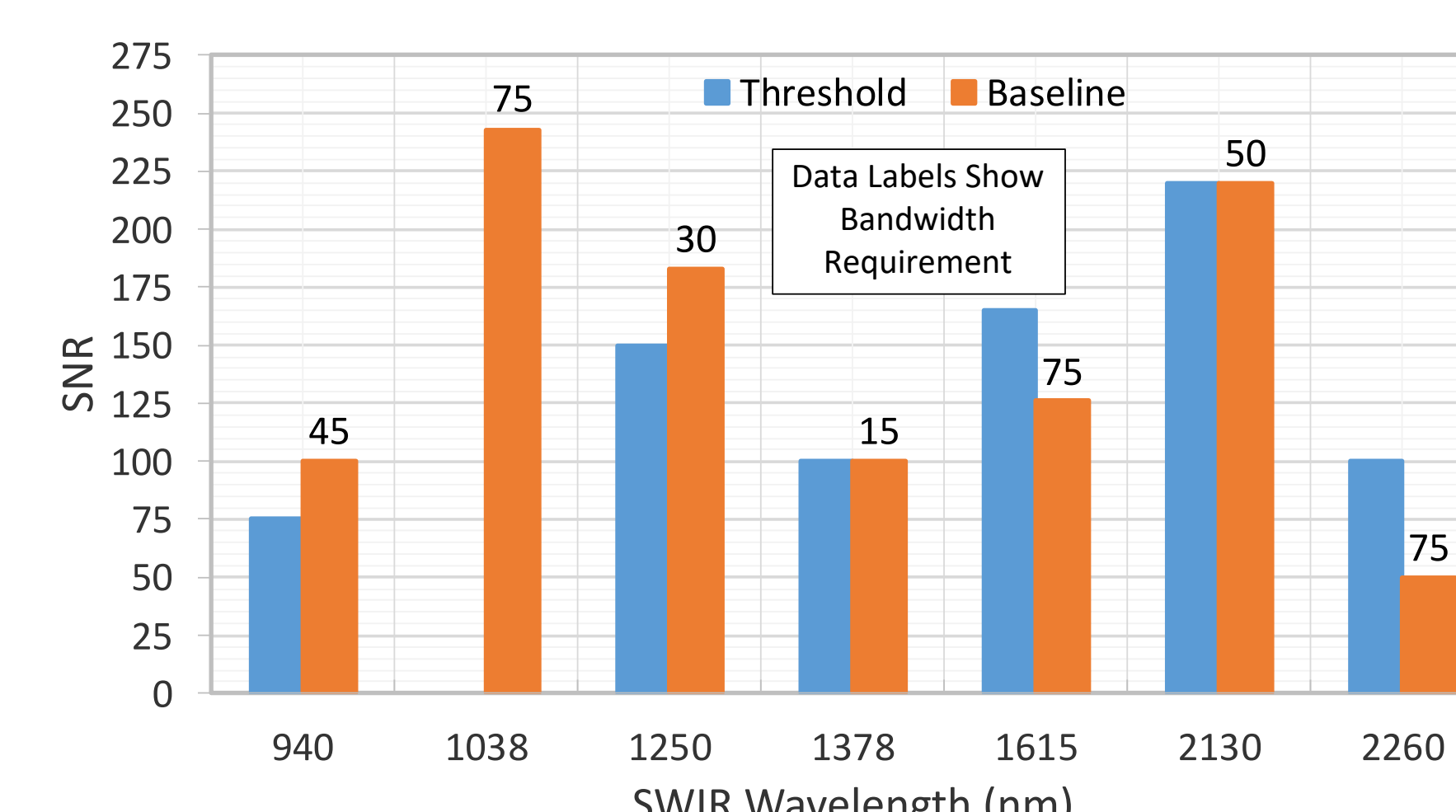
Single-science-pixel rotating scanner to avoid striping, much like SeaWiFS.

- * **Monthly lunar calibration of all science detectors through Earth-view port**

Required to achieve mission-long 0.1% relative temporal stability. To be complemented by daily & monthly solar calibrations (& spectral solar calibrations).

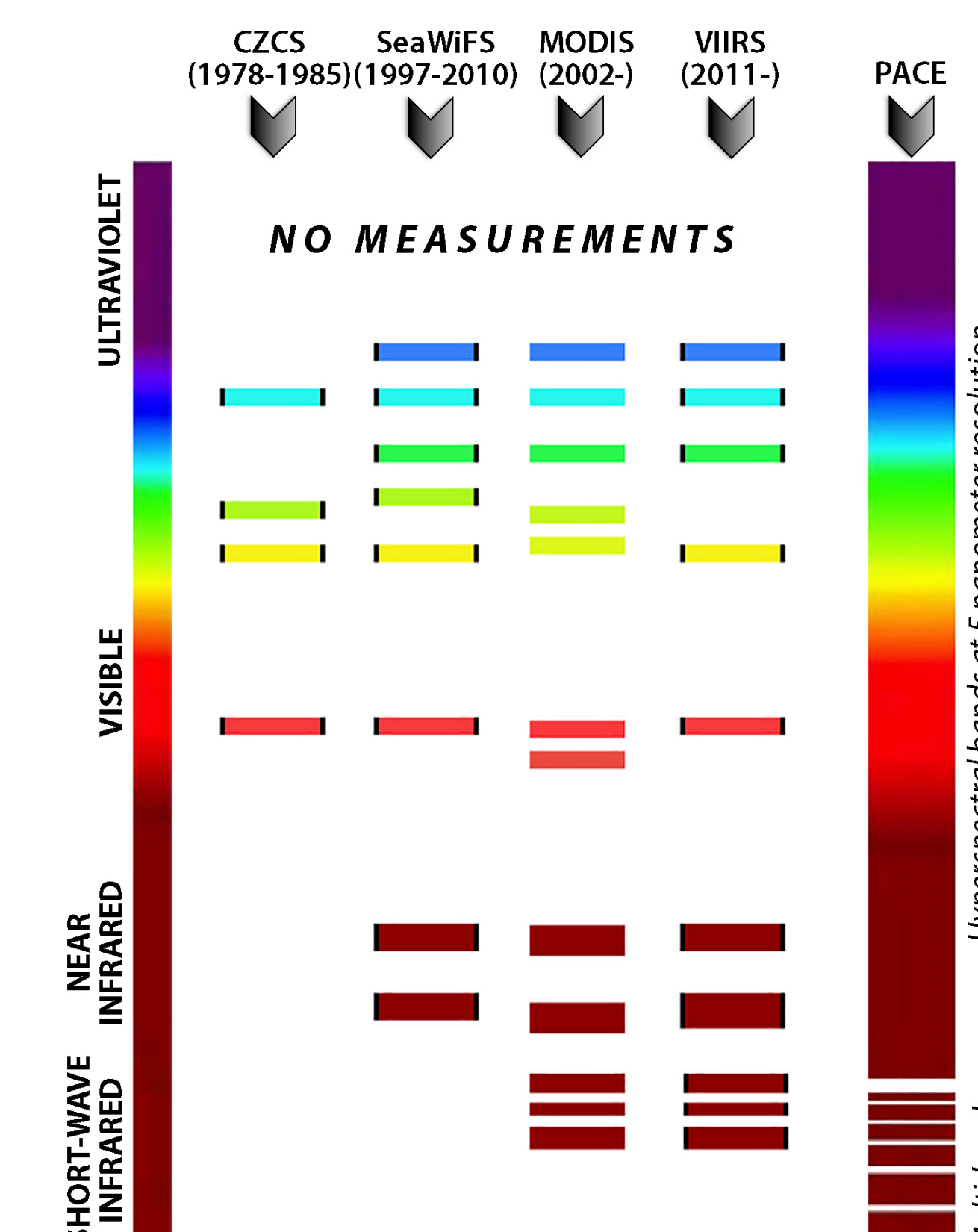
- * **≤0.5% total systematic error for blue-to-near infrared wavelengths**

- * **Signal-to-noise ratios optimized for global ocean color, aerosols and clouds**



OCI Spectral Coverage & Mission Data Products

PACE's expanded spectral coverage – as compared with ocean color heritage sensors – will result in a variety of science data products.



Required Products	
Water-leaving reflectance	Aerosol optical thickness
Chlorophyll-a	Aerosol fine mode fraction
Phytoplankton absorption	Liquid / ice cloud optical thickness
NAP + CDOM absorption	Liquid / ice cloud effective radius
Particulate backscattering	Cloud layer detection ($\tau < 0.3$)
Diffuse attenuation	Cloud top pressure ($\tau > 3$)
Fluorescence line height	Shortwave radiation effect
Example Advanced & Evaluation Products	
Carbon stocks & fluxes	PAR, light attenuation, water quality
Phytoplankton pigments	Liquid / ice cloud water path
Plankton physiology	Polarimeter-specific products
Community structure (PFTs)	Applied-sciences specific products
Productivity	Land data products (TBD)