PACE Mission Updates

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Keeping PACE with the NASA Plankton, Aerosol, Cloud, ocean Ecosystem mission

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2021 2030 United Nations Decade of Ocean Science for Sustainable Development

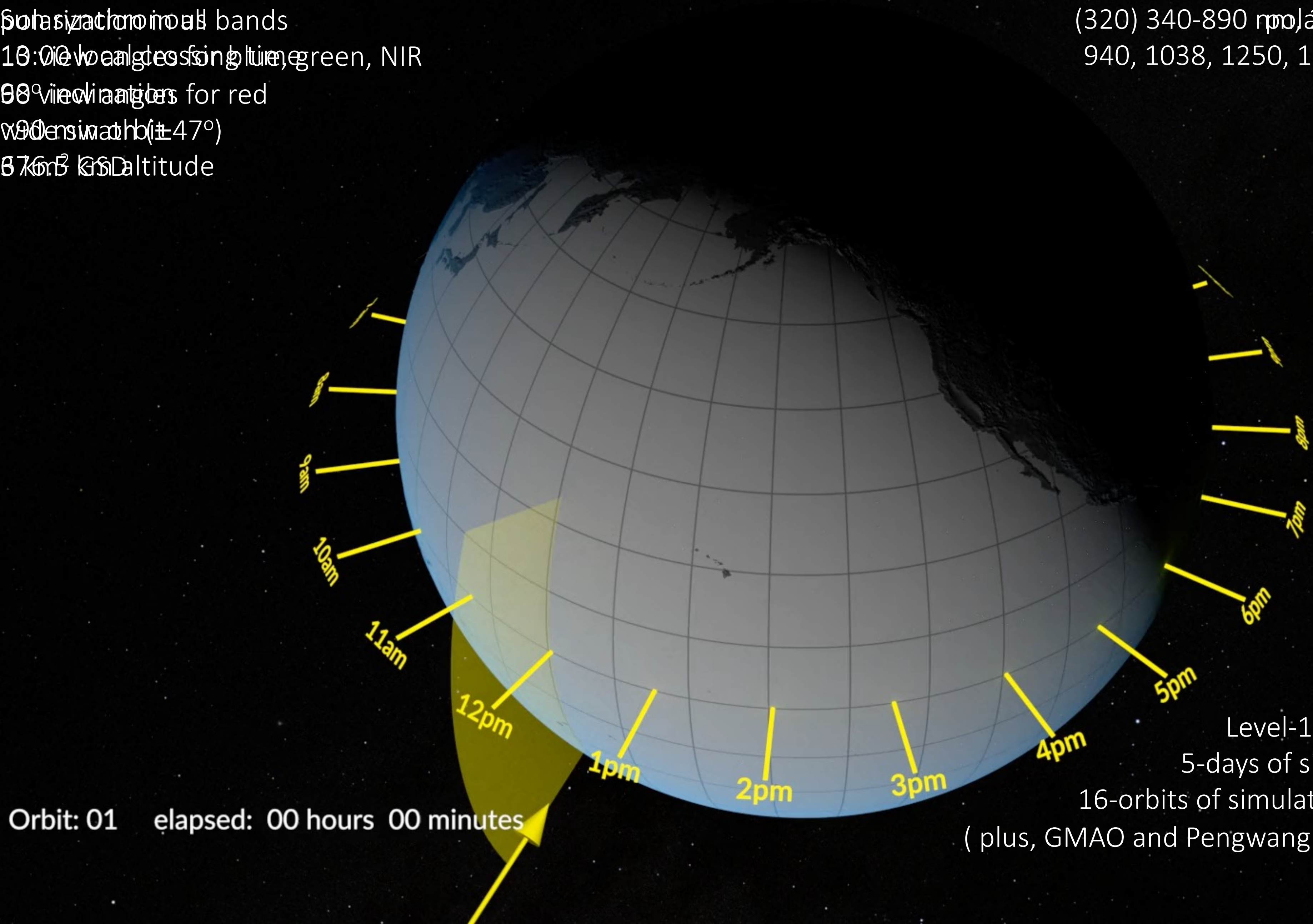
T-minus 16 months to launch!

440, 550, 670, 890 nm
polarization all bands
10 view angles for blue, green, NIR
60 view angles for red
wide swath (±47°)
3 km² GSD

ascending polar orbit
Sun synchronous
13:00 local crossing time
98° inclination
~90 min orbit
676.5 km altitude

hyperspectral scanning radiometer
(320) 340-890 nm, 2.5 nm steps, 5 nm FWHM
940, 1038, 1250, 1378, 1615, 2130, 2260 nm
1-to-2 day global coverage
1 km² GSD
±20° tilt

385-770 nm, 5 nm steps
polarization 15-45 nm FWHM
5 view angles
narrow swath (±4.5°)
2.5 km² GSD



Level-1C common grid developed
5-days of simulated OCI L1B available
16-orbits of simulated SPEXone data available
(plus, GMAO and Pengwang Zhai (UMBC) simulations)

PACE mission update: where are we?

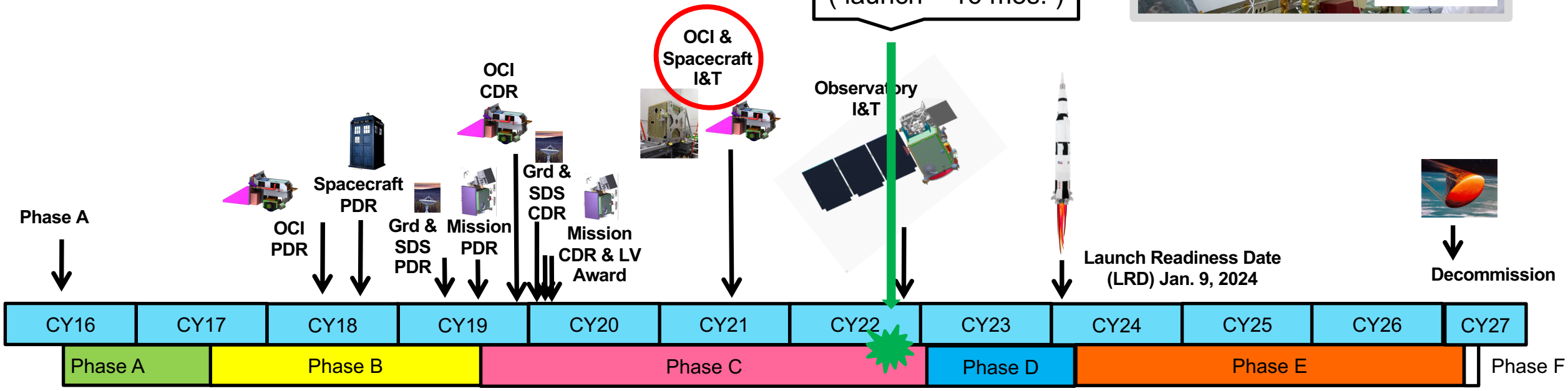
Phase C – final design & fabrication

- individual element flight builds & testing nearing completion
- winds down after our mission System Integration Review (Nov 2022)

Phase D – system assembly, integration & test, launch

- integrate OCI & HARP2 onto the spacecraft
- observatory-level testing
- launch & in-orbit commissioning (60 days)

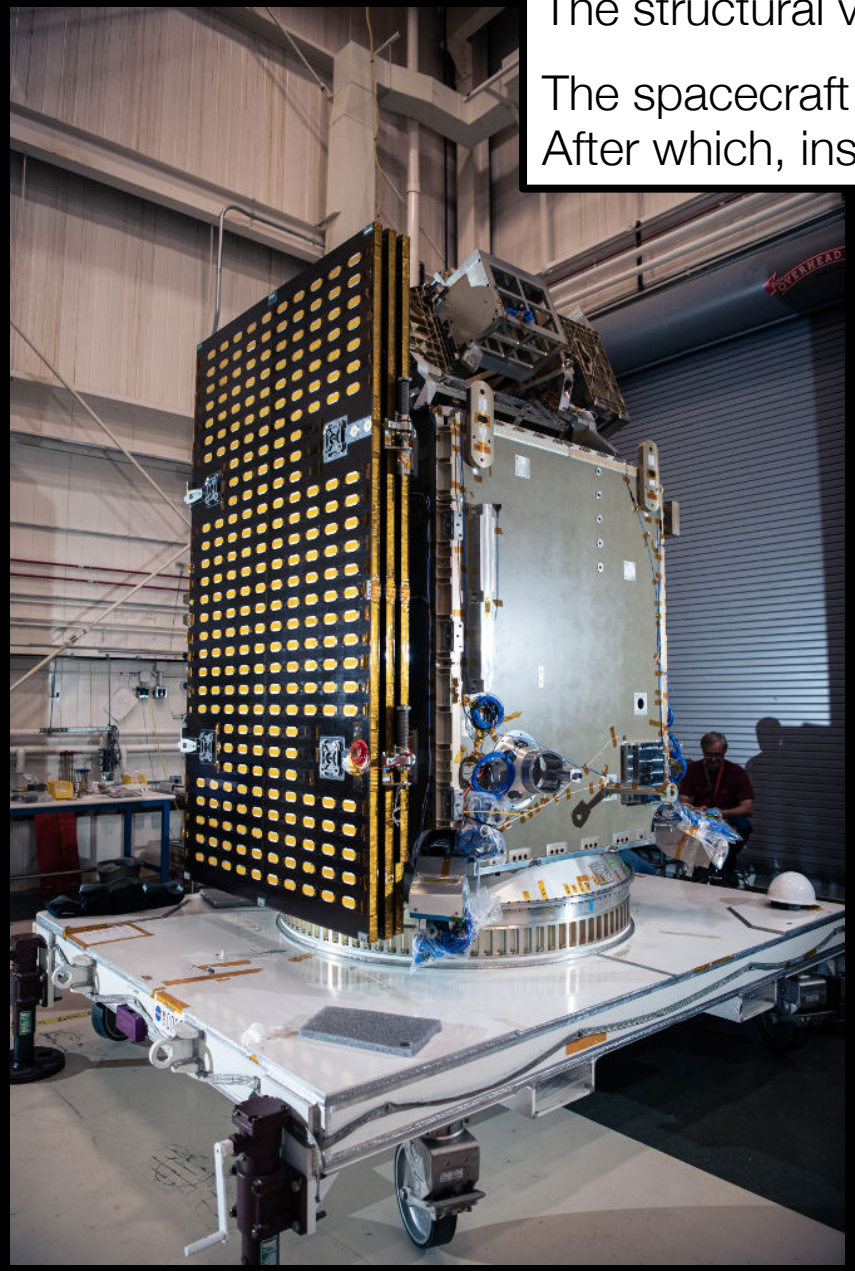
SPEXone integration onto the spacecraft

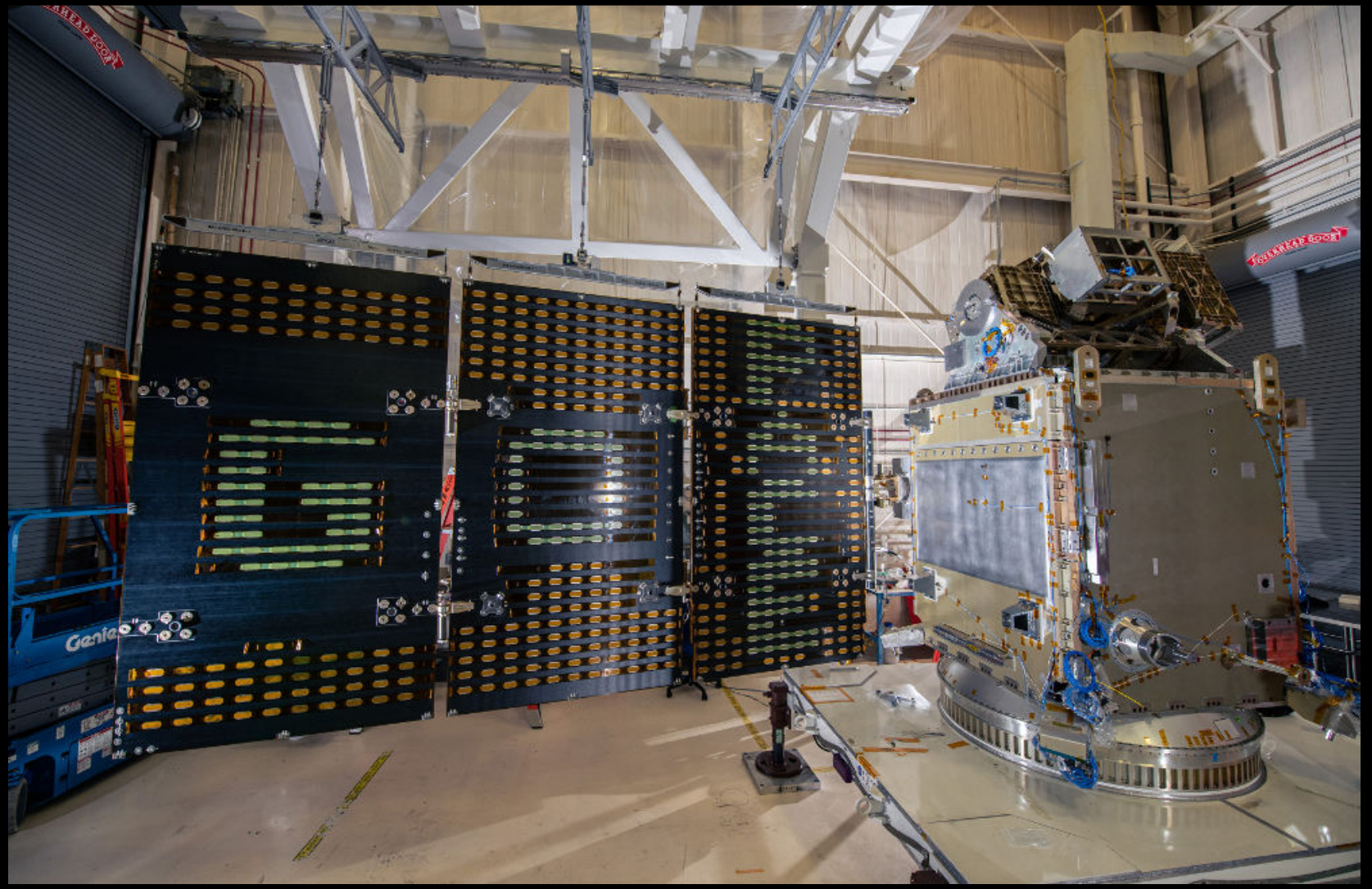


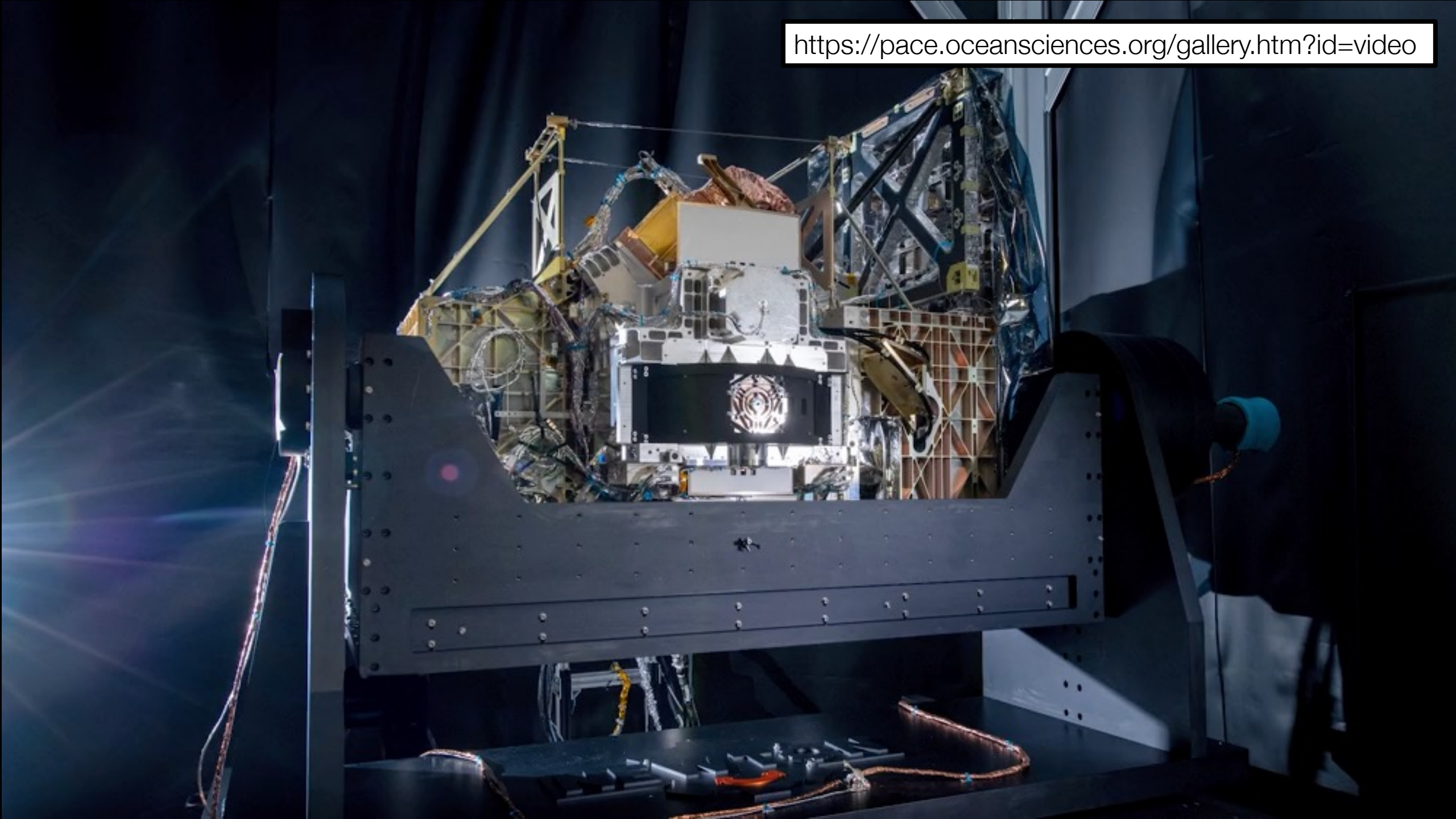

https://pace.oceansciences.org/gallery.htm?id=video

GPS, star trackers, transponders, etc. installed; solar panels, reaction wheels, etc. to go
The structural verification unit (shown) has undergone extensive environmental testing

The spacecraft is currently pursuing a week-long comprehensive performance test
After which, installations will continue as it patiently awaits the delivery of OCI + tilt and HARP2



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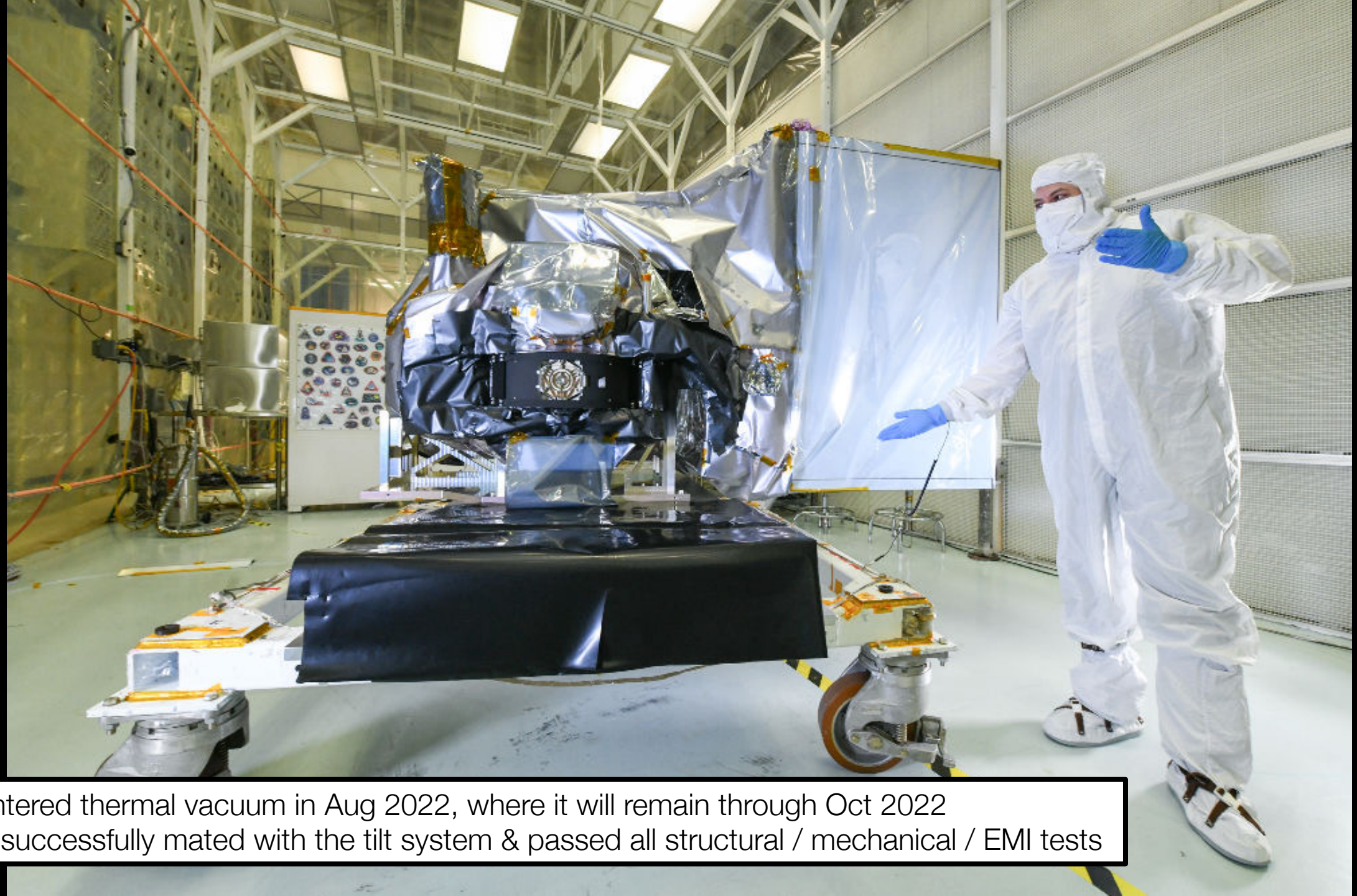


OCI entered thermal vacuum in Aug 2022, where it will remain through Oct 2022
It was successfully mated with the tilt system & passed all structural / mechanical / EMI tests

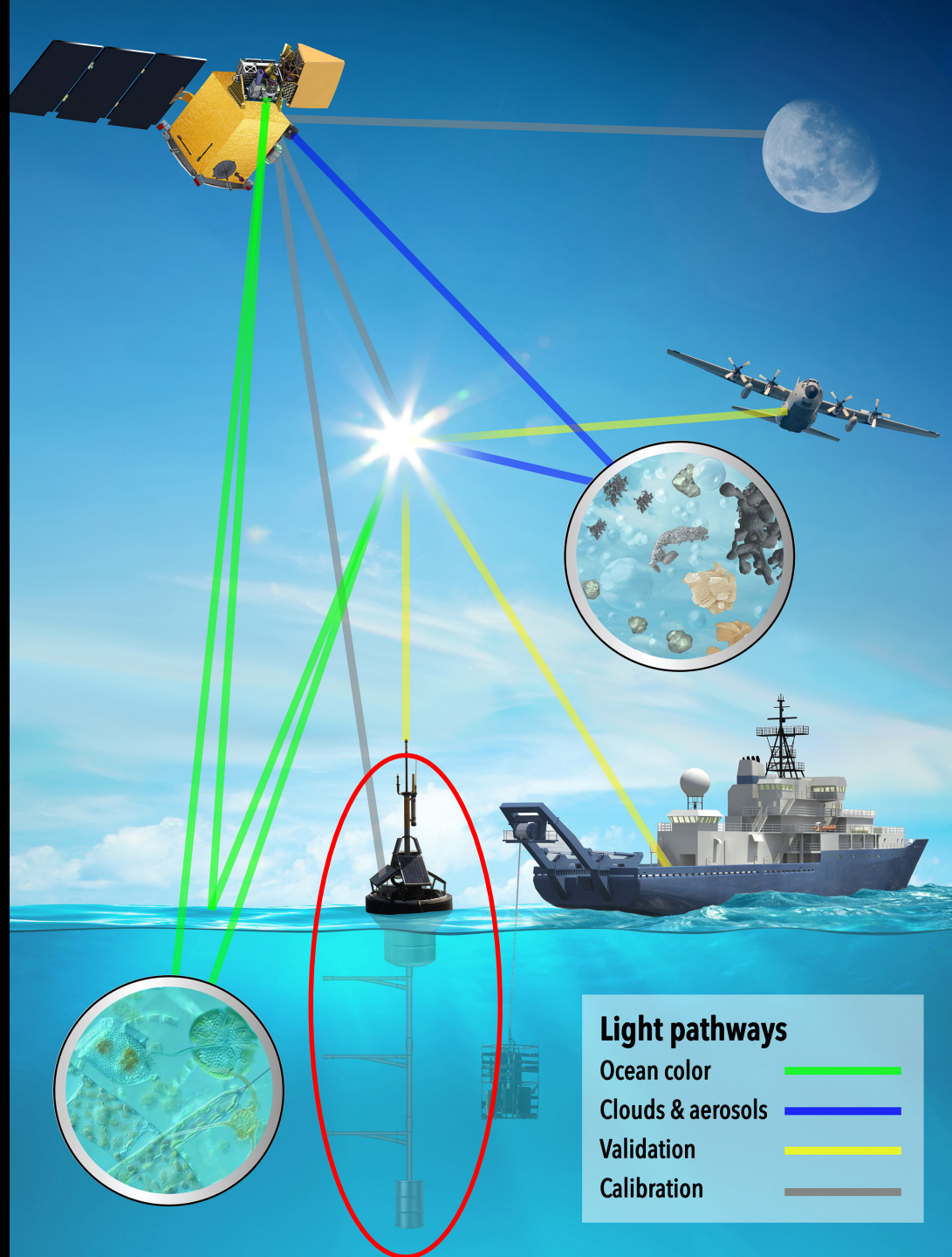
SPEXone was integrated onto the spacecraft in June 2022

HARP2 rebuilt after vibration testing damage in Feb 2022
Flight unit currently in environmental testing @ GSFC
Delivery to the observatory will be in Oct 2022

System Vicarious Calibration (SVC)

both projects preparing for 3rd year activities

(1) HyperNAV	(2) MarONet
OSU, SeaBird Scientific	U.Miami, NIST
radiometric float - small - portable - profiling - long-duration - COTS legacies	radiometric buoy - large - 20’ container - 3 fixed arms - long-deployment - MOBY legacy
test deployments conducted (e.g., Crete)	test deployments conducted; migration to Perth, Australia



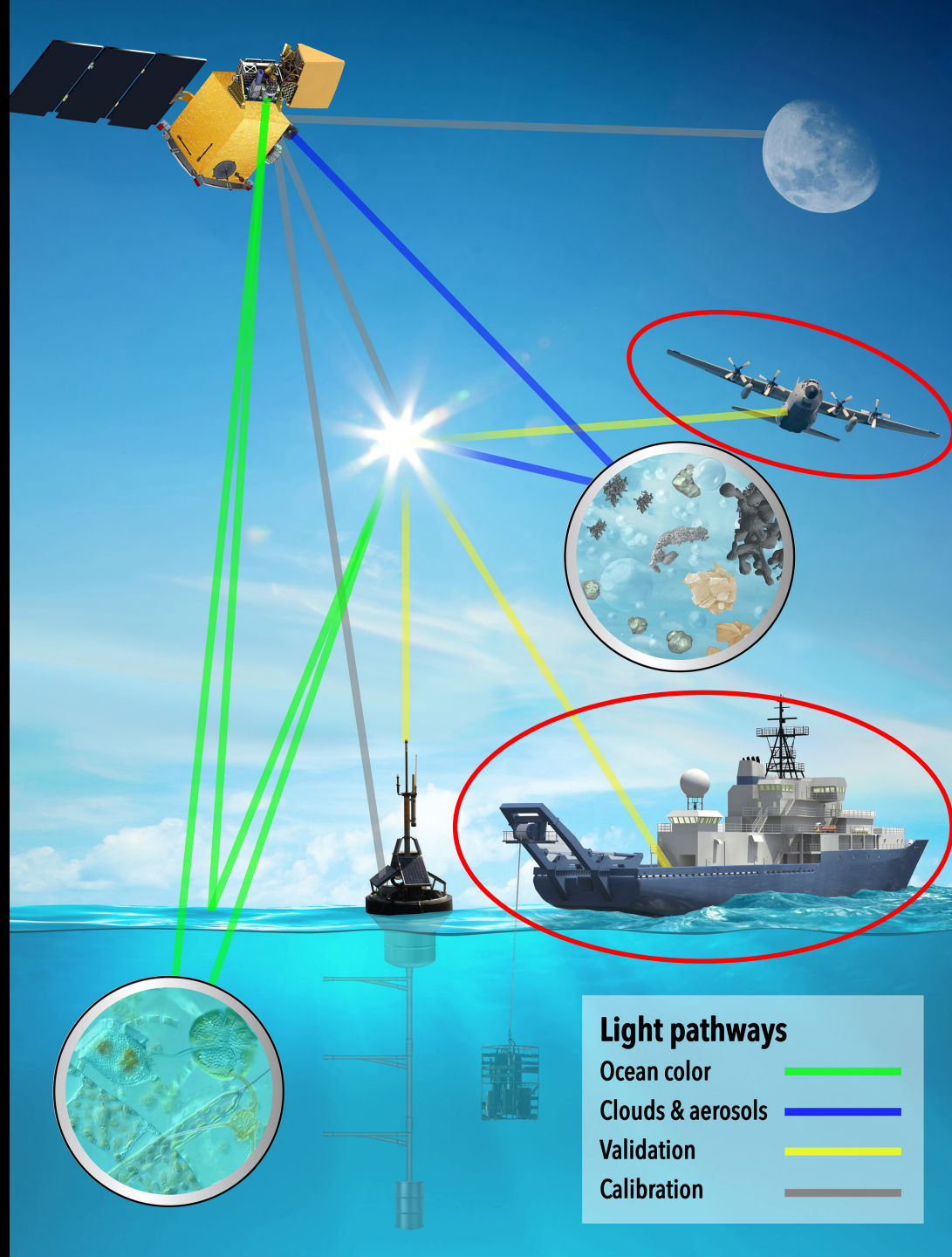
post-launch validation activities

PACE Validation Science Team (PVST)

- composition, scope, & execution in prep
- ROSES-22 late amendment
- selection ~late 2023 prior to launch
- in the field after first light (~spring 2024)

PACE Post-launch Airborne eXperiment (PACE-PAX)

- aircraft (+ in-/on-water TBD)
- planning underway (docs hosted @ *pace.oceansciences.org/campaigns.htm*)
- direct & proxy measurements
- US west coast, Sep 2024
- synergy with PVST anticipated
- not competed



PACE Postlaunch Airborne eXperiment (PACE-PAX)

PACE-PAX (preliminary!)

ER-2 as Remote/Proxy airborne platform,
CIRPAS Twin Otter as Direct airborne platform

CIRPAS Twin Otter

ER-2

Legend

- AERONET sites
- CIRPAS Twin Otter
- CIRPAS Twin Otter Range
- ER-2
- ER-2 Range

Background image is MERRA-2 AOD 550nm monthly analysis for September, 2020

AEROSOL OPTICAL DEPTH

Aerosol Optical Depth Analysis
MERRA-2

0.120 – 0.125

California based field campaign, September 2024

Two aircraft flying out of their home base:

- CIRPAS Twin Otter – Direct measurements
- NASA ER-2 – Remote/Proxy measurements

~60 flight hours each over four weeks

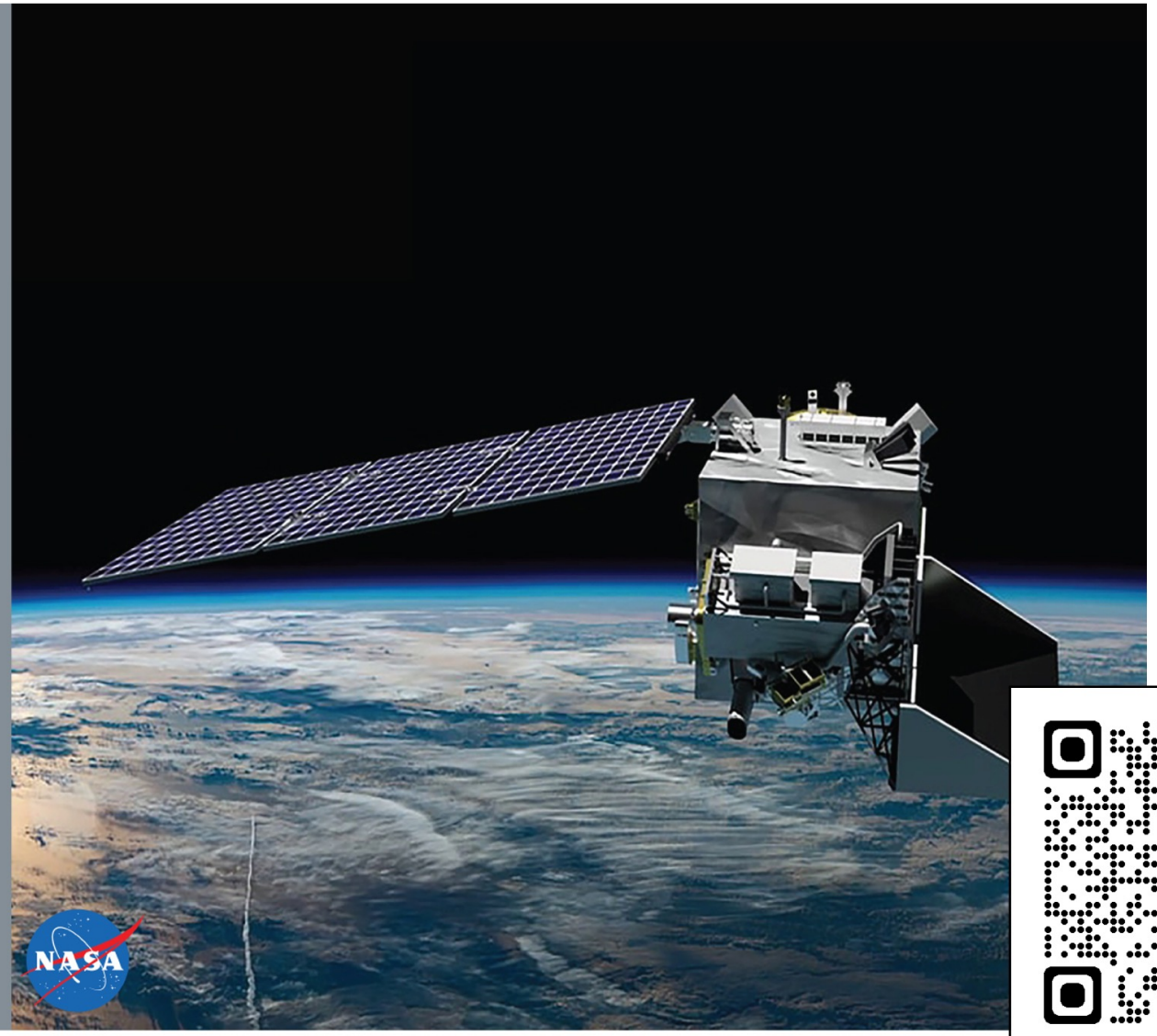
coordinated flights

overflights of AERONET, ships (?) and other ground sites.

PACE Applications Workshop

September 14-15, 2022

Virtual Event

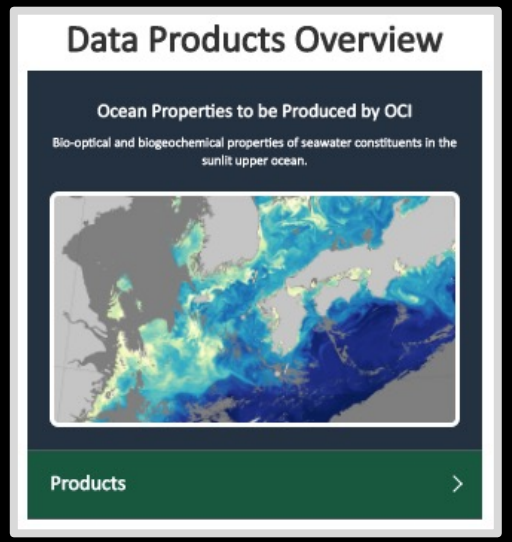


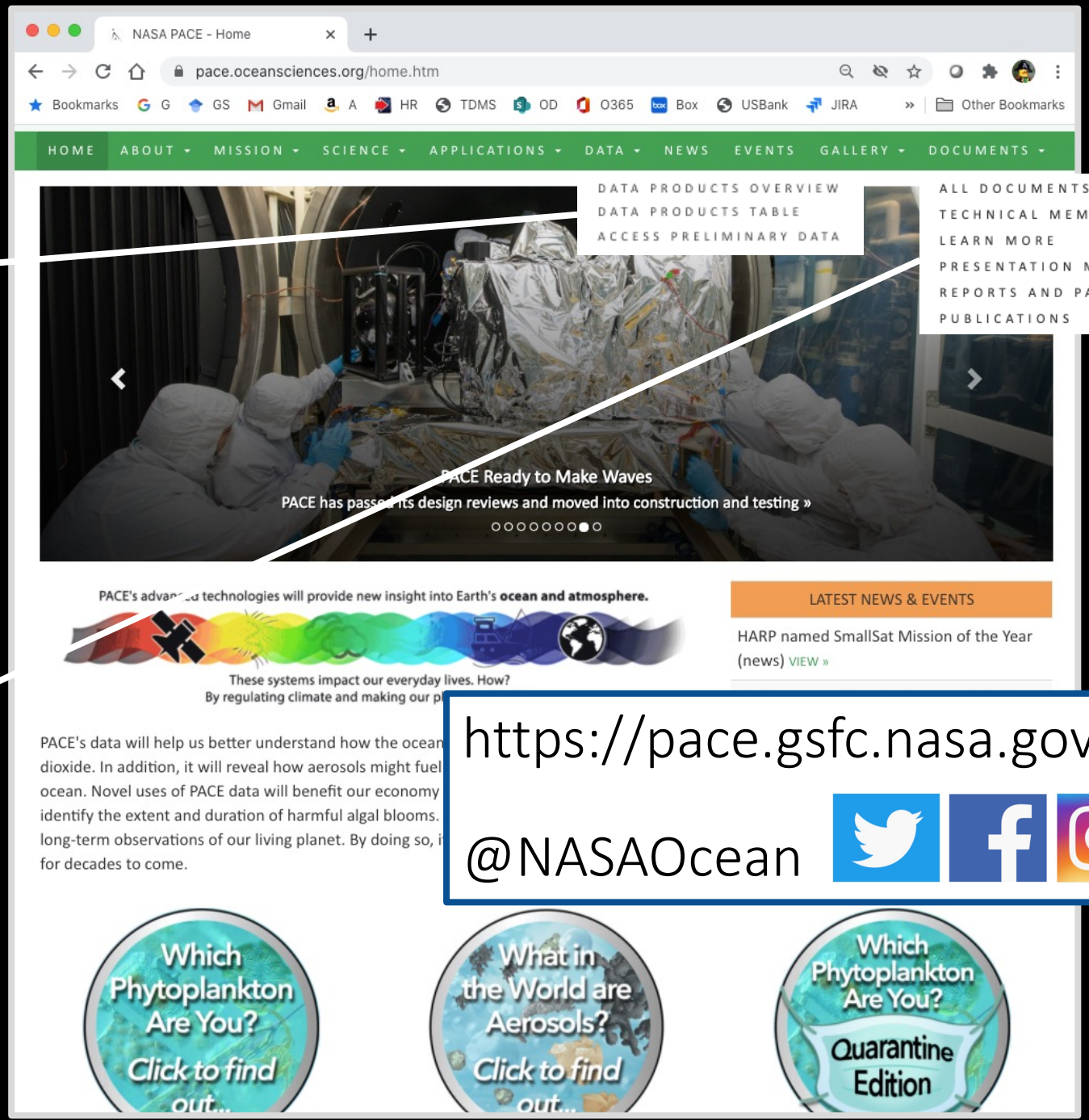
Register here:

resources & useful info

data product descriptions + access to simulated data & characterizations

PACE technical memos & other documents





https://pace.gsfc.nasa.gov

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Ocean Carbon & Biogeochemistry

Studying marine ecosystems and biogeochemical cycles in the face of environmental change

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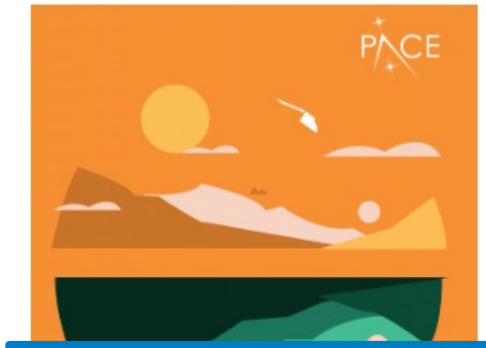
What's behind the curtain of the NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) mission? Training Activity

https://www.us-ocb.org/pace-mission-training-activity/



Background

In 2015, NASA directed the PACE mission to Goddard Space Flight Center following recommendations from the 2010 NASA document *Responding to the Challenge of Climate and Environmental Change: NASA's plan for Climate-Centric Architecture for Earth Observations and Applications from Space*. This direction ultimately realized the research communities' decade-plus push for a future Earth-observing satellite mission to meet growing needs for scientific discovery. A central objective of PACE is enabling new insights on the sensitivity of global aquatic ecology and biogeochemistry to environmental change.

While heritage ocean color missions have provided desperately needed platforms for observing grossly under-sampled ocean ecosystems since 1997, the oceanographic community quickly recognized the need for enhanced satellite measurement capabilities to address the additional issues of changing phytoplankton distributions,

Science & Applications Team #3 to be competed in ROSES-23
To be assembled in late 2023 to precede launch

Congrats to Lorraine Remer (SAT #1 & #2 Deputy Team Lead) for winning the 2022 AGU *Yoram J. Kaufman Outstanding Research and Unselfish Cooperation Award*

Congrats to Brian Cairns (PACE Deputy Project Scientist – Atmospheres) for winning the 2022 APOLO *François Arago Award in Polarimetric Remote Sensing*

PACE Postlaunch Airborne eXperiment (PACE-PAX)

Validation objectives	ID	Measurement objectives
1. Validate new retrieval properties	**a**	Land surface parameters
	b	Ocean radiometric parameters
	c	Aerosol parameters over the ocean
	d	Aerosol parameters over land
	e	Cloud parameters
	f	Ocean surface parameters
2. Assess spatial and temporal scale impact on validation	**a**	Cloud parameters
	b	Aerosol parameters
3. Validate in a narrow swath	**a**	Aerosol parameters over the ocean
	b	Aerosol parameters over land
4. Validate radiometric and polarimetric properties	**a**	Validate large reflectances
	b	Validate large reflectances with high polarization
	c	Validate large reflectances with low polarization
	d	Overfly vicarious calibration sites
5. Target specific geometries, season, and time of day	**a**	Aerosol over ocean retrieval geometry dependence
	b	Aerosol over land retrieval geometry dependence
	c	Cloud property retrieval geometry dependence

Validation objectives	ID	Measurement objectives
6. Focus on specific processes or phenomena	**a**	High aerosol loads over land
	b	High aerosol loads over ocean
	c	Multiple aerosol layers
	d	Aerosol under thin cirrus
	e	Aerosol above liquid phase cloud
	f	Broken clouds with complex structure
	g	Dust aerosols over ocean
	h	Aerosol and ocean parameters over turbid waters
	i	Aerosol and ocean parameters over biologically productive waters
	j	Aerosol and ocean parameters with and without reflected sunglint
	k	Smoke aerosols over ocean

https://pace.oceansciences.org/campaigns.htm