

PACE Mission Updates

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



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OCRT, September 2022

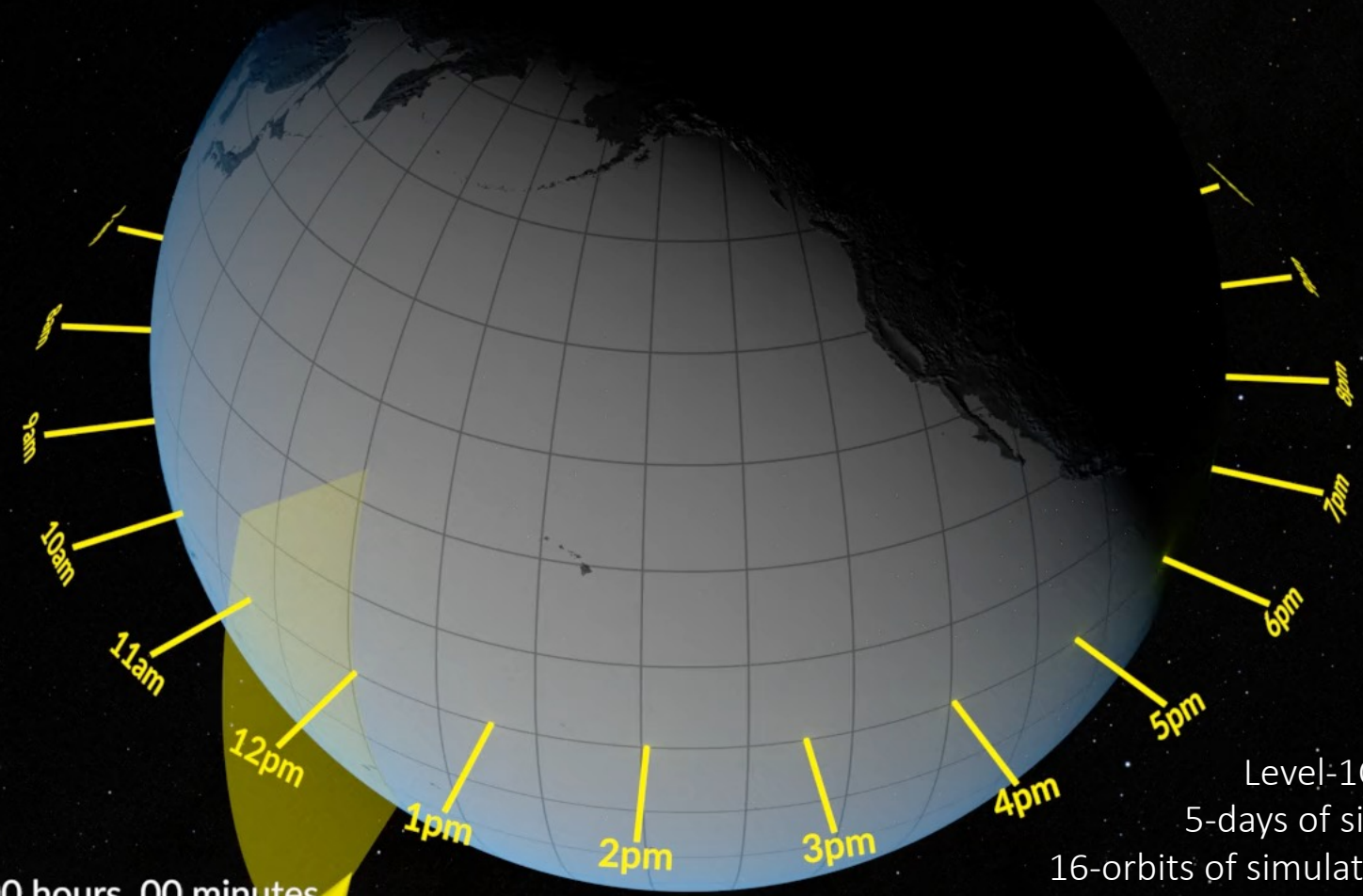


2021 United Nations Decade
2030 of Ocean Science
for Sustainable Development

T-minus 16 months to launch!

440, 510, 670, 880 nm
 30 channels in 10 bands
 10:00 local crossing time, green, NIR
 88° view angles for red
 90° view angles for green
 67 km GSD
 35 km altitude

hyperspectral 340-890 nm
 320 channels in 10 bands
 940, 1038, 1250, 1378, 1615, 2130, 2260 nm
 5-5.5 m resolution
 1-to-2 day global coverage
 1 km² GSD
 ±20° tilt



Orbit: 01 elapsed: 00 hours 00 minutes

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

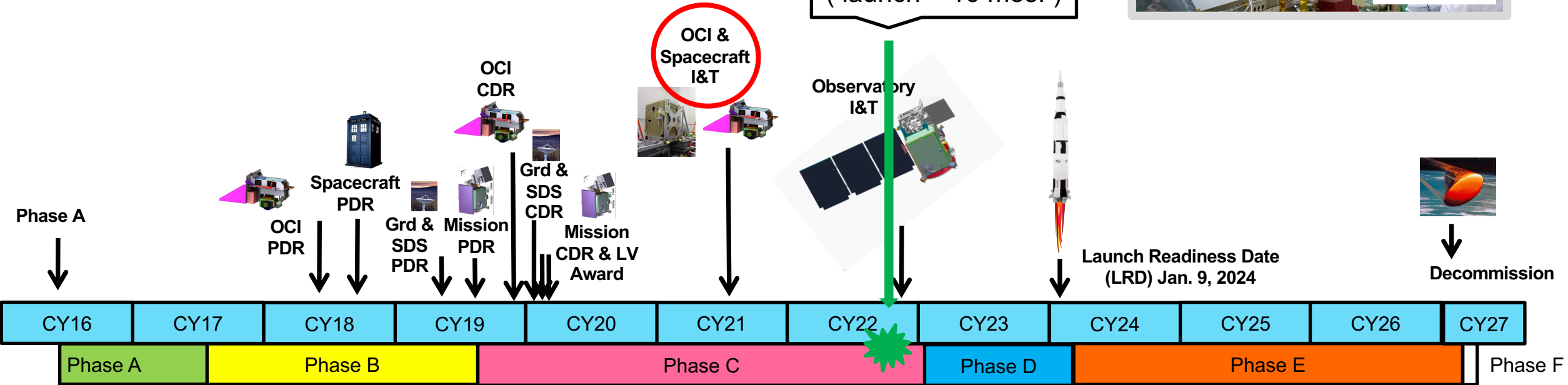
- individual element flight builds & testing nearing completion
- winds down after our mission System Integration Review (Nov 2022)

Phase D – system assembly, integration & test, launch

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



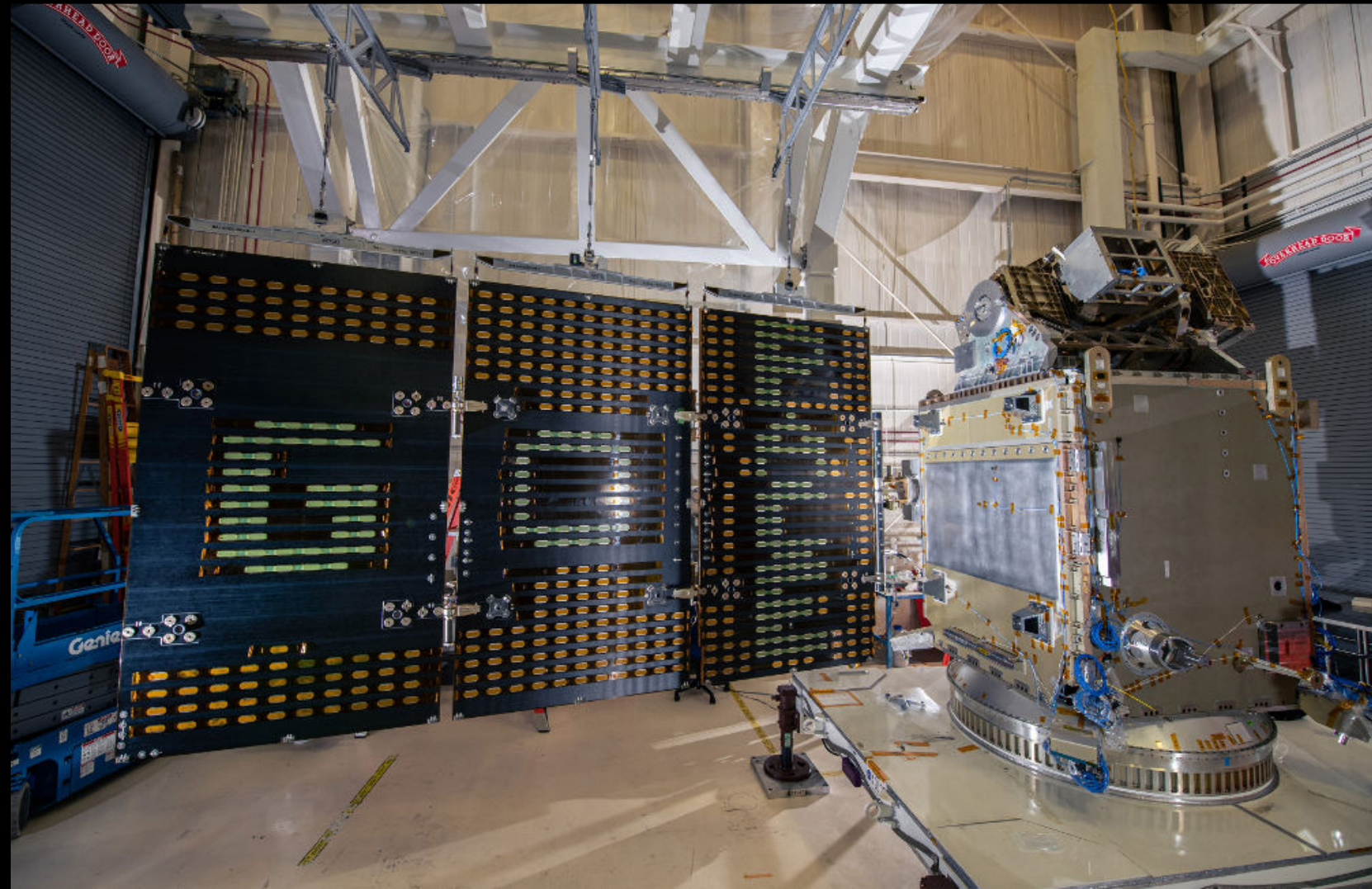
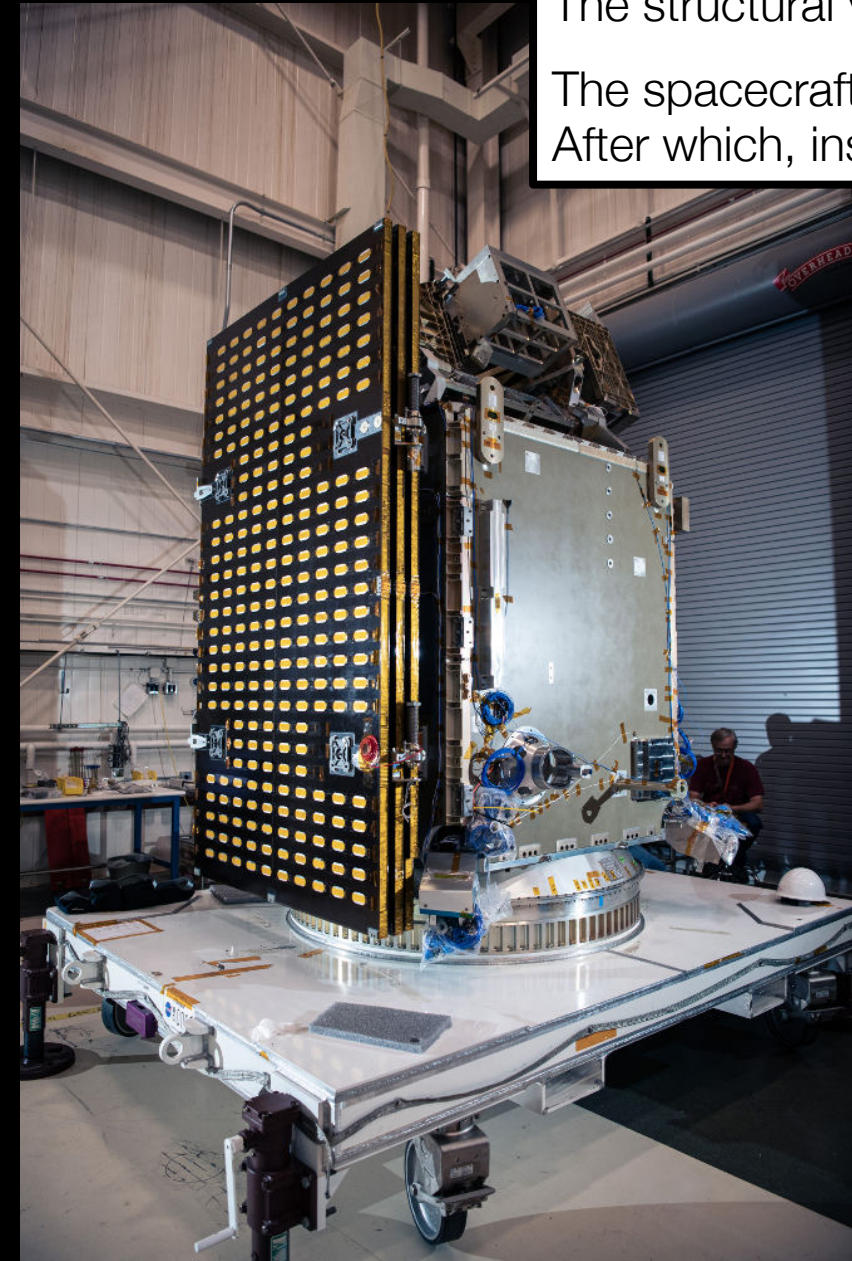
We are here.
(launch – 16 mos.)



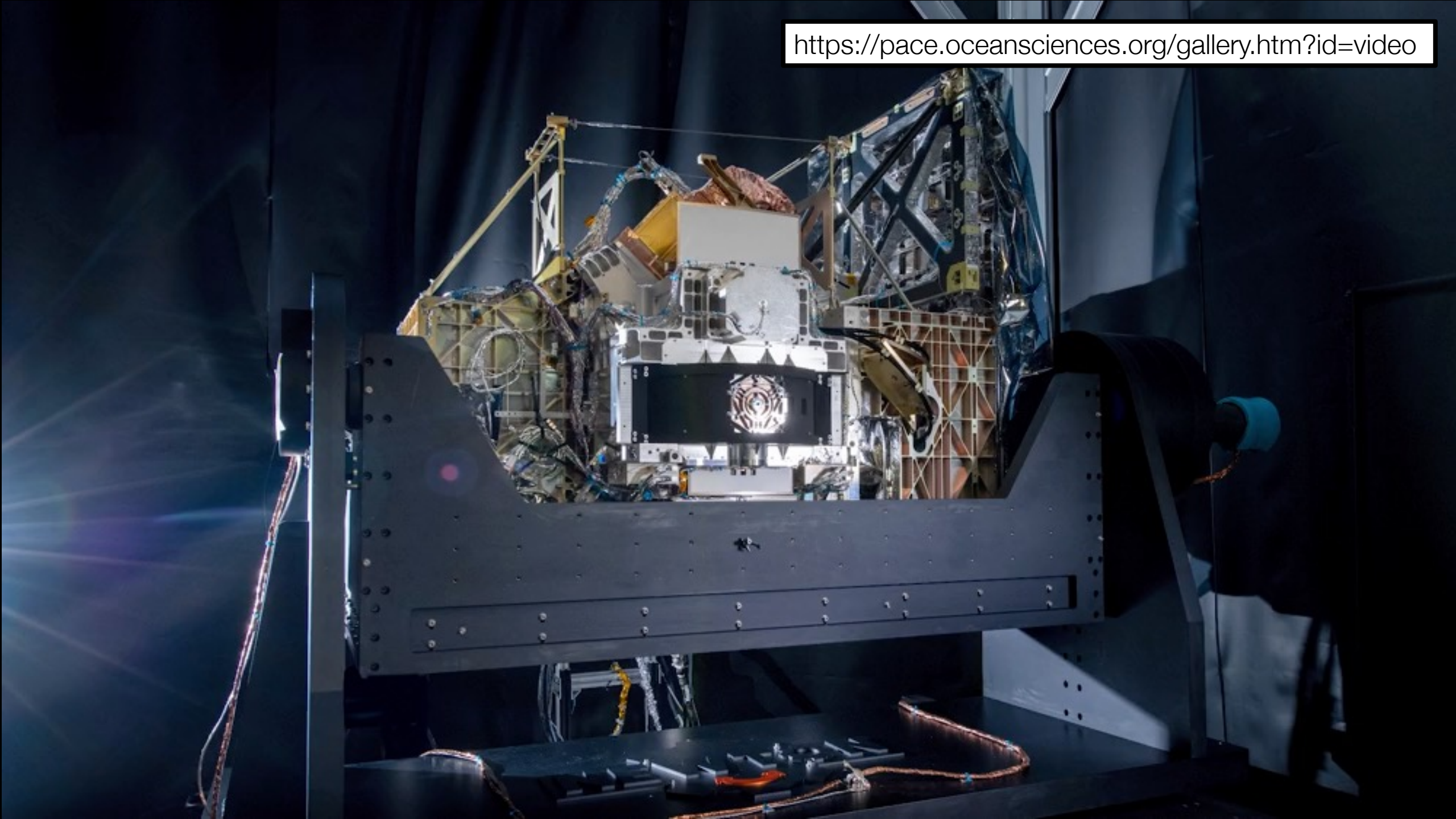
<https://pace.oceansciences.org/gallery.htm?id=video>



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



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





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

OSU, SeaBird Scientific

radiometric float

- small
- portable
- profiling
- long-duration
- COTS legacies

test deployments conducted (e.g., Crete)

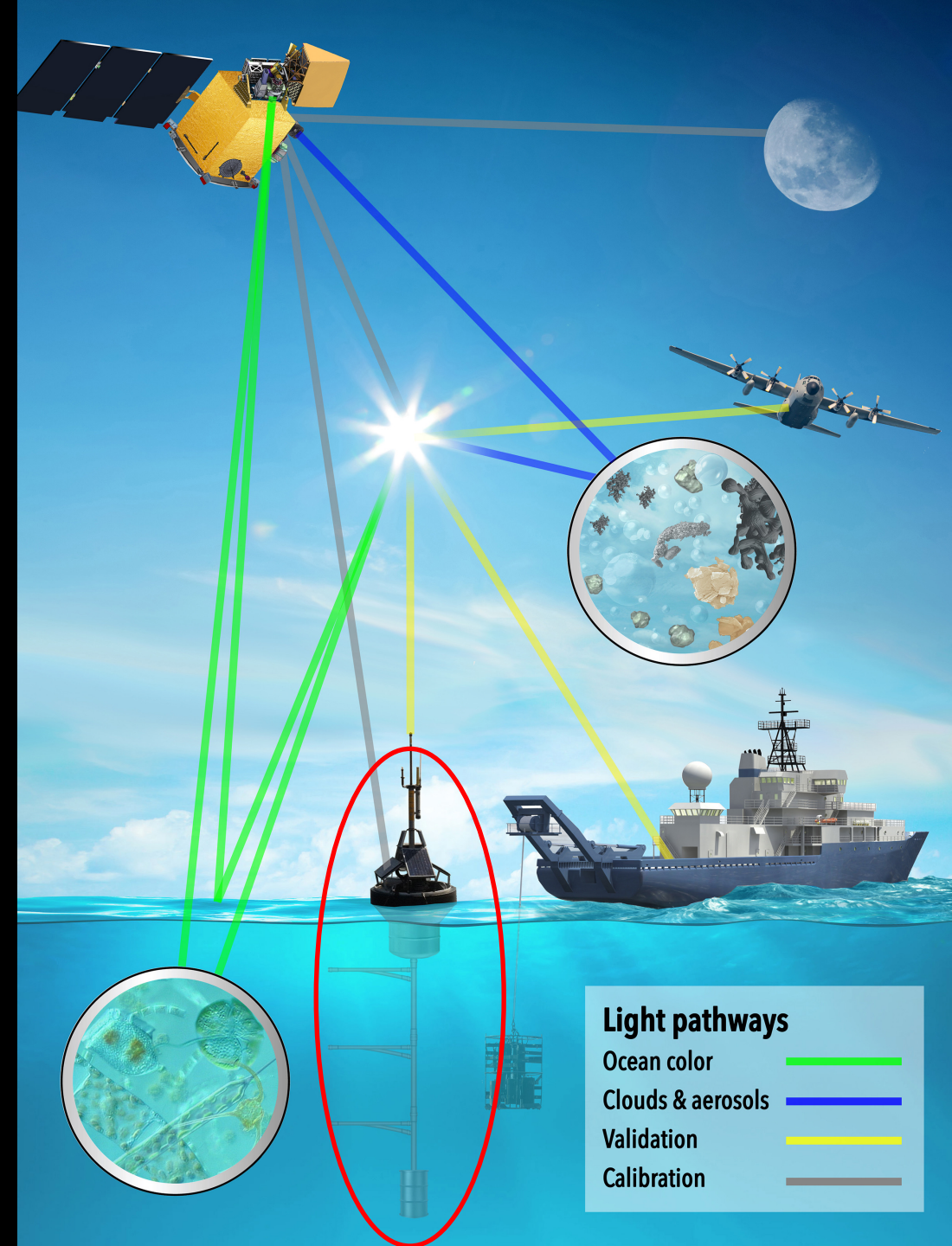
(2) MarONet

U.Miami, NIST

radiometric buoy

- large
- 20' container
- 3 fixed arms
- long-deployment
- MOBY legacy

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



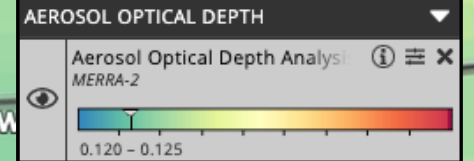
Google Earth

Data SIO, NOAA, U.S. Navy, NGA, GE
Image Landsat / Copernicus
Data LDEO-Columbia, NSF, NOAA

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



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

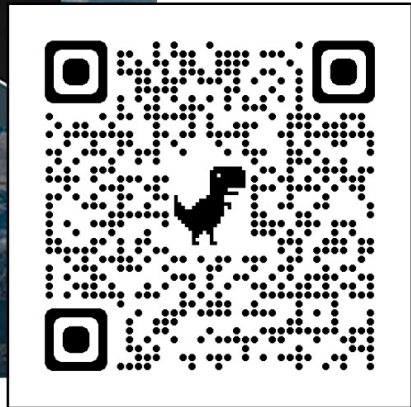


September 14-15, 2022

Virtual Event



Register
here:



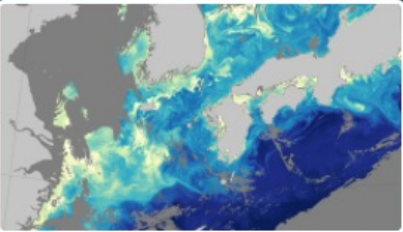
resources & useful info

data product descriptions + access to simulated data & characterizations

PACE technical memos & other documents

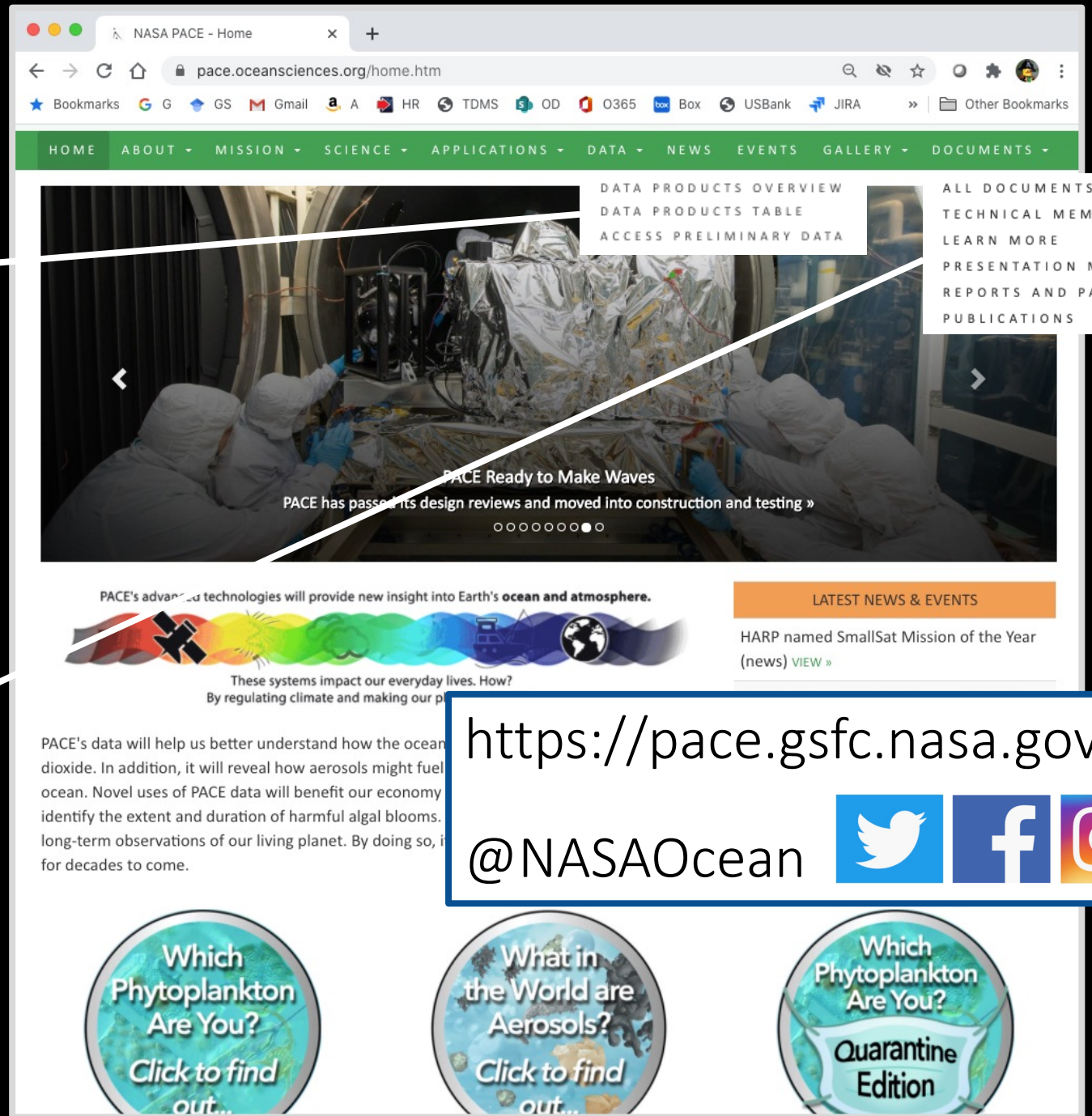
Data Products Overview

Ocean Properties to be Produced by OCI
Bio-optical and biogeochemical properties of seawater constituents in the sunlit upper ocean.



Products >

<p>NASA/TM-2018-219027/ Vol. 7 PACE Technical Report Series Volume 7 June 2018, Charles R. McClain, and P. Annam Wordell, Editors</p> <p>Ocean Color Instrument (OCI) Concept Design Studies</p> <p>Shankar Ahnadi, Robert Arnone, Michael J. Behrenfeld, Bruce Cairns, Anne Corcoran, Robert E. Egle, Bruce Frank, David Hagler, Aron Hlavka, Antonio Marullo, Leifun L. W. McEwen, Clifford Odell, James Oviatt, Steve Rabinovitch, Frederick S. P. O'Neil, Wayne Robinson, Sergio R. Solorzano, Ryan Vandermolen, Tully Weathers, and Arnon Wordell</p> <p>Extended UV Capability for Ozone Retrieval Chlorophyll Fluorescence Requirements Estimates for Optimal Sensing of Coastal Features Analysis Supporting an OCI 1038 nm Band Analysis of OCI SWIR Bands Strategy & Requirements: Solar & Lunar Calibrations Ltyp and Lmax Calculations for the OCI Analysis of OCI Spectral Resolution Considerations</p> <p>[Dec-18] Ocean Color Instrument (OCI) Concept Design Studies MORE ></p>	<p>NASA/TM-2018-219027/ Vol. 6 PACE Technical Report Series Volume 6 June 2018, Charles R. McClain, and P. Annam Wordell, Editors</p> <p>Data Product Requirements and Error Budgets Consensus Document</p> <p>Franklin Ahnadi, Anne Corcoran, Bryan A. Franz, Endre M. Karolyhosi, Leifun L. W. McEwen, Frederick S. P. O'Neil, and Arnon Wordell</p> <p>Ocean Color Science Data Product Requirements OCI Pointing Knowledge & Control Requirements SNR Requirement: Assessment & Verification Derivation of OCI Systematic Error Approach Uncertainty in Ocean Color Observations Uncertainty in Aerosol Model Characterization</p> <p>[Dec-18] Data Product Requirements and Error Budgets Consensus Document MORE ></p>
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PACE Ready to Make Waves

PACE has passed its design reviews and moved into construction and testing »

PACE's advanced technologies will provide new insight into Earth's ocean and atmosphere.

These systems impact our everyday lives. How?
By regulating climate and making our planet more habitable.

Latest News & Events
HARP named SmallSat Mission of the Year (news) [VIEW >](#)

PACE's data will help us better understand how the ocean absorbs carbon dioxide. In addition, it will reveal how aerosols might fuel harmful algal blooms. Novel uses of PACE data will benefit our economy and help us identify the extent and duration of harmful algal blooms. Long-term observations of our living planet. By doing so, we can better understand our planet for decades to come.

<https://pace.gsfc.nasa.gov>

@NASAOcean

Which Phytoplankton Are You?
Click to find out...

What in the World are Aerosols?
Click to find out...

Which Phytoplankton Are You?
Quarantine Edition

<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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OCB Science Highlights

News

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/>


Plankton, Aerosol, Cloud, ocean Ecosystem

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*

PACE

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

Plankton, Aerosol, Cloud, ocean Ecosystem

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>

