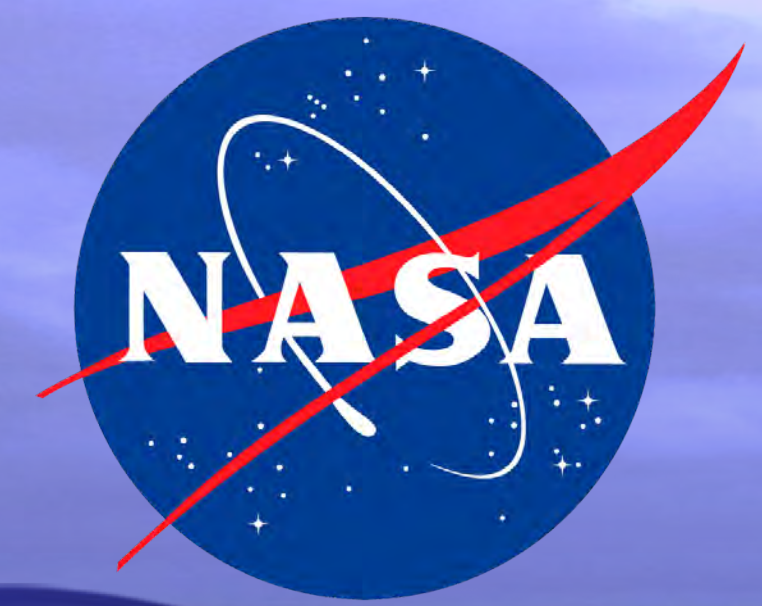# NASA Plankton, Aerosol, Cloud, ocean Ecosystem (PACE) Mission: Applications

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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 (OCI)** 345-890 nm in 5 nm steps – plus, SWIR bands @ 940, 1038, 1250, 1378, 1615, 2130, & 2260 nm; ~1km ground sample distance at nadir
+ **Two small multi-angle polarimeters (SPEXone & HARP2)**; ~3km ground sample distance at nadir
+ 1 to 2-day global coverage to solar & sensor zenith angles of 75° & 60°
+ Sun-synchronous, polar orbit with an Equatorial crossing time of 13:00
+ 675-km altitude & 98° inclination
+ Class C (limited redundancy) for 3 years of operations & 10 years of fuel

OCI   **SPEXone**   **HARP2**

Science Goals

(1) **Continue NASA's multi-decade, global record** of satellite ocean color, clouds and atmospheric 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.

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

Required Products from OCI	
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 (τ < 0.3)
Diffuse attenuation	Cloud top pressure (τ > 3)
Fluorescence line height	Shortwave radiation effect
Example Advanced & Evaluation Products	
Phytoplankton pigments	Liquid / ice cloud water path
Plankton physiology	Polarimeter-specific products
Community structure (PFTs)	Applied-sciences specific products
Carbon fluxes & stocks	Land data products (e.g. MODIS terrestrial products)

Harmful Algal Bloom in Lake Eerie
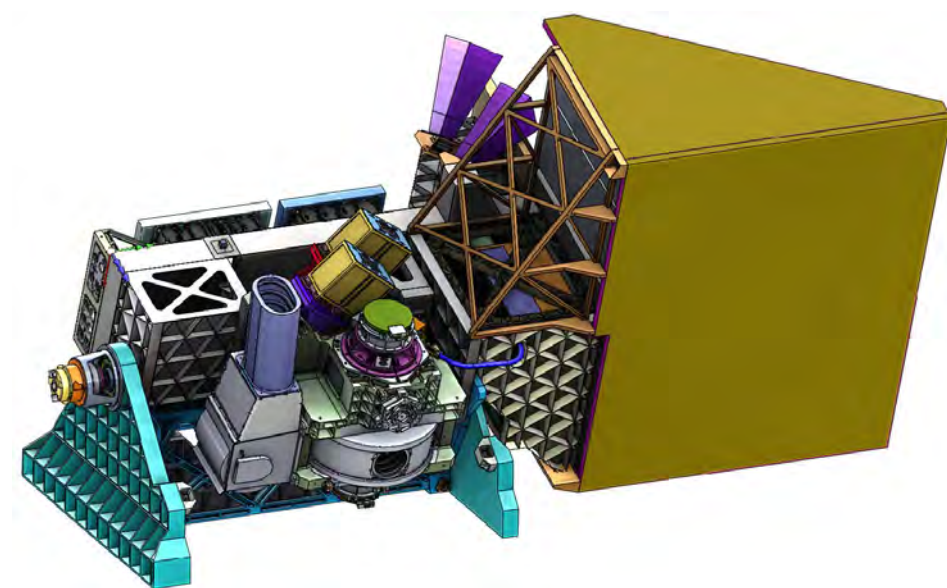
Air Pollution from wildfire in CA

Pre-launch Applications Efforts

The goal of the PACE Early Adopter (EA) Program is to promote applied research to facilitate feedback on PACE products pre-launch, and accelerate the use of PACE products post-launch. A key objective is to **accelerate the use and integration of PACE products into policy, decision-making and scientific support settings** by providing support and guidance to EAs who incorporate PACE data in their applications.
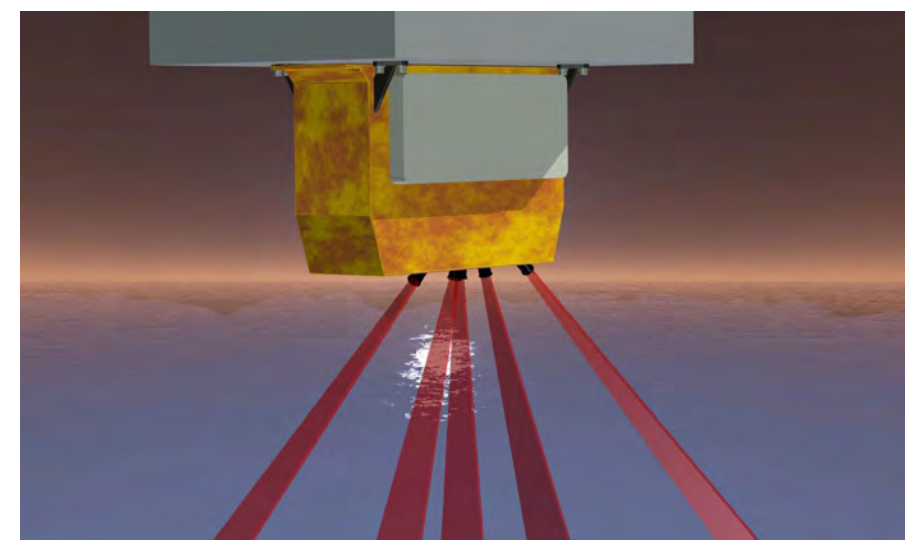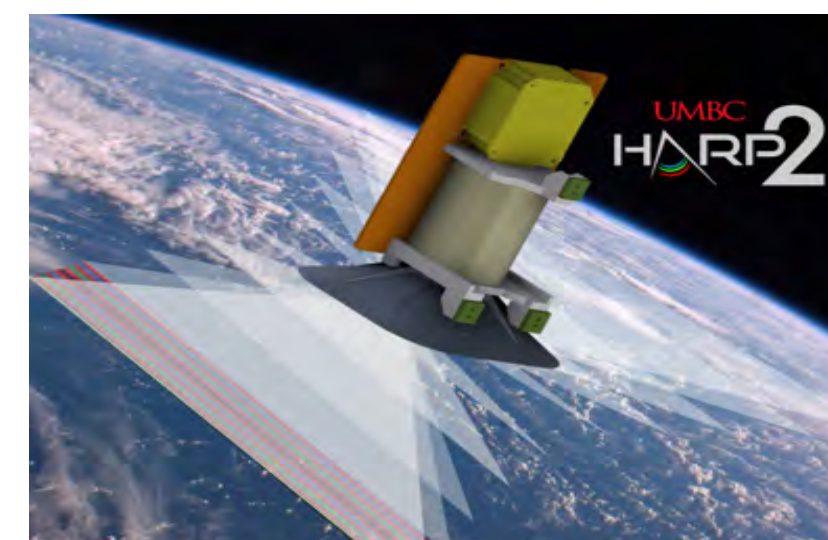
End Users
Exclusive access to preliminary test data; Provide feedback on functionality and Cal/Val

← Early Adopter Program →

Science and Applications Team
Develop simulated datasets and products

Benefits to Early Adopters

- Access to developmental products and interaction with the product developer will enable EAs to be **among the first to integrate the new PACE products into their systems.**
- Early Adopters will have opportunities to participate in the implementation of the PACE Applications Plan by taking **lead roles in PACE applications research, meetings, workshops, and related activities.**

Benefits to Science Team

- The Science Team members will **gain a partner who can evaluate products and offer feedback from a functionality perspective as well as potential calibration and validation information.**
- The Early Adopter will provide the PACE Applications Team quantitative metrics and testimonials that explain how the use of a product will **improve a policy or decision relevant to their organizational goals and objectives.**

End User Community Engagement

PACE Applications activities are designed to support and engage key stakeholders and Early Adopters to promote the use of PACE products by relevant user communities.

Anticipated activities and resources include:
- **Data workshops and short courses** to provide hands-on instruction for data access and use of data products
- **Applications tutorials** for working with PACE data (online and offline)
- **Workshops** with targeted science communities & highlighting results from Early Adopters
- PACE Applications **Working Group** to address pertinent issues (e.g. validation activities)

Additional Literature and Resources

- PACE Applications documentation: white papers and brochures
  https://pace.oceansciences.org/applications.htm
- PACE Science & Applications Team Solicitation is open (NSPIRES). Proposals due July 15, 2019

Comments/Suggestions/Feedback

Do you know someone who could be a PACE Early Adopter?
Do you have experience with…
    - pre-launch activities for Applications?
    - Applications of hyperspectral ocean color, and/or advanced polarimetry data?
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Acknowledgements