

PACE Project Science monthly update for the PACE Science Team

July 2016

Executive summary

The Project focused much of its energy on preparing for and presenting at the Key Decision Point A (KDP-A) event on 16 Jun 2016. This was the milestone to advance from Pre-Phase A (pre-formulation) to Phase A (formulation). Success! Now in Phase A, the mission financial clock has started ticking. Otherwise, the Project continued their intense technical, cost, and science evaluation of the OCI concept as it impacts SNRs, continued exploring alternative options to acquire a PACE polarimeter, and continued their dialog with the Canadian Space Agency/NRL regarding the potential contributed dedicated coastal instrument. Details are presented below, with the purpose of providing new information since the past monthly update.

Details

Project milestones

- Key Decision Point A (KDP-A), the gateway into Phase A (mission formulation), was conducted successfully on Jun 16. The Project is now in Phase A.
- The Acquisition Strategy Meeting (ASM) will be conducted in the late Summer / early Fall. This is the event where HQ will codify the method of procuring the PACE polarimeter and spacecraft (bus).
- The mission System Requirements Review (SRR) is tentatively scheduled for Fall-Winter 2016. This is a major review, required to be completed before entering Phase B, that evaluates whether the proposed mission and systems architecture is credible and responsive to mission requirements, constraints, and resources.
- If a procured polarimeter is pursued (via a formal Request for Proposals this Fall), we hope an award can be made by Apr 2017.
- We hope a decision on the dedicated coastal instrument can be made by Oct 2016.

Instruments

- The Project will participate in a 2-day workshop later this month with CSA in Ottawa, Canada to further discuss their coastal instrument. This is a CSA-hosted event to engage regional stakeholders. The Project requested additional funding to support the inclusion of a coastal instrument, but has yet to hear back on this from NASA HQ.
- The OCI System Engineering team continued to focus on requirements for OCI CCDs, which need to be acquired soon to enable robust testing and inclusion in engineering test units. The Instrument Scientist hosted a webinar on Jun 30 to present the current OCI concept to the science team. The webinar was recorded and can be acquired/viewed from/on the PACE Web site.

- The Project released a Request for Information on Jun 17 to explore procurement of a polarimeter. Responses are due on Jul 18. Pending direction at the ASM, a formal Request for Proposals could be released in the Fall.

Science analyses

All science data analysis packages will be shared with the Science Team. All input from the Science Team on any of the analyses, before or after completion, is most welcome.

- SNRs: Project Science continued to evaluate the impact of SNRs (provided by Engineering) for the evolving OCI concepts. Recall that the OBPG developed a Monte Carlo approach to evaluate the impact of noise on derived remote-sensing reflectances, the uncertainties from which will be used to infer if the OCI SNRs can meet mission threshold requirements on these reflectances. Current status: the SNR model for the current OCI concept has been expanded from the 26 bands listed in Table 3.1 of the PACE Science Definition Team report to 5 nm spectral resolution. Highlights:
 - o We still believe the threshold uncertainty in the red (max of 0.002 reflectance or 10%) to be scientifically insufficient. We continued to look into refinement of this to inform Systems Engineering of our needs to enable science related to phytoplankton fluorescence, gaseous transmission, etc. ST thoughts welcome.
 - o On the minds of the OCI Systems Engineering team: CCD read rates, analog-to-digital convertors, their effective numbers of bits, and their space readiness, numbers of CCD read taps, Lmax values assigned to each tap, transitions zones between the blue and red spectrographs, and CCD electron well capacities. All of which impact performance, cost, and SNRs.
- Altitude reduction from 675 km to ~420 km: Per the request of HQ, the Project explored the technical and scientific impacts of lowering the PACE observatory altitude to ~420 km. Hypothetically, were a satellite constellation to be formed around PACE, this would benefit LIDAR and radar instruments used in oceanographic and atmospheric studies. We do not believe there to be substantial impacts to core PACE science with this altitude reduction. Systems Engineering, however, has identified technical, schedule, and cost risks that would need further investigation if this option is truly explored. They predict roughly 8 weeks of dedicated analyses to fully define the impacts to the OCI optical prescription and the spacecraft. A discussion with HQ will be conducted on Jul 11.
- At the request of Project Science, the OCI team will extend the UV spectral range in their current concept to ~315 nm. One major benefit of this could be characterization of ozone to support ocean color atmospheric correction with relying on ancillary data sources. A case study using heritage OMI/OMPS ozone algorithms with a PACE spectral configuration is underway.
- Spectral super-sampling: Project Science continued compiling and evaluating the utilities of collecting data of finer spectral resolution than 5 nm and spectral steps (e.g., 1.25 nm) of overlapping 5 nm bands (FWHM) for small spectral ranges (e.g., the chlorophyll fluorescence peak and NO₂ range as identified in the SDT). ST suggestions for additional (limited) spectral domains where such sampling would have significant benefits are welcome. Thank you to those of you who have commented on this.

- SWIR bands: There may be some flexibility in the central position and widths of several SWIR bands. ST input on SWIR band positions and widths are welcome.
- Others in the queue (advance input welcome from the ST): science impacts of spatial aggregation to smaller pixels at the end-of-scan (something the current OCI concept can do for UV-NIR, but not SWIR).

Communications

The Ocean Ecology Lab and OBPG have been increasingly supporting the ocean color communications and outreach material coming out of GSFC. Please let the Project know about related ocean color, clouds, and aerosols communications and outreach activities!

The PACE Web site (<http://pace.gsfc.nasa.gov>) continues to evolve. Please check it out. A publications library is under development. Annette and her team are compiling references from the current science team – team members will likely be contacted at some point to vet their parts in this substantial compilation of papers.

Applied Sciences

The Project has requested additional budget support to develop an Applied Sciences program in accordance with an upcoming HQ/ESD directive, but has not yet heard back. In the meantime, the HQ Applied Sciences team and Project have continued development of a formal PACE Mission Applied Sciences Plan – crafted acknowledging and in accordance with the approved budget – the deadline for which is KDP-B (entry into Phase B, roughly early Spring 2017).