

The Orbiting Carbon Observatory (OCO) Mission



Watching The Earth Breathe... Mapping CO₂ From Space.

The OCO-3 Mission: Science Objectives and Instrument Performance

May 9, 2018 Compiled by Annmarie Eldering

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Progressing to our goal



- Funding secured in March 23rd budget by US Congress
- Instrument integration is complete
- Thermal vacuum (TVAC) testing is underway
- Payload to be delivered to storage when TVAC is done
- Payload will be shipped to Cape Canaveral ~ Nov 2018 for integration on launch vehicle
- Launch is planned on a Space-X Dragon in February 2019







ISS External Payload















- Payload status (with pictures!)
- Preliminary TVAC results
- Global simulations
- Context Camera data
- Snapshot mode planning and simulations
- What you can expect (launch, IOC, data flows)











The other view of complete build







Payload with LVIS and transportation cart











- We completed a full year of simulations at 1/240th true data density
- Tommy Taylor, Chris O'dell and I are revising a paper draft near completion
- Overall findings
 - Sufficient SNR to get data products with similar quality to OCO-2
 - Sampling pattern changes and can be very different in a daily sense, but on a seasonal, and even monthly scale, data density show full global coverage
 - Chris and Tommy apply the bias analysis tools (cheating by using truth input), and see features and bias terms similar to the OCO-2 data → points to this being algorithm driven
- GOAL: Get simulated data set to flux inversion community to test the use of OCO-2 and OCO-3 data together. Keep experiment small, so we can complete it before launch. Volunteers??









Context Cameras on OCO-3



- Internal context camera (red image) specifically for geolocation. Gold mirrors will alter the color balance of the image.
- External context camera (left) will collect a large image in false color.





OCO-3 Science Planning – Snapshot Mode













OCO-3 Snapshots Plus Context Camera



- During City Mode scan, the context imager will take pictures every 15 seconds
 - Provides an overlapping set of images that will extend ~15-20 km outside X_{CO2} snapshot mode data (something like 1.5 to twice the image on the right)
- Science opportunity
 - Large industrial plumes will be clearly visible in the imagery
 - X_{CO2} field can be compared to plume – especially when visible plume disappears









Orbital ATK







- Thomas Kurosu and Ryan Pavlick are building tools that we will use inflight
 - Use actual ISS orbit path data for 2015
 - Using operational software that controls the pointing system
 - Assess when areas of interest are in view for OCO-3
 - Begin testing automated prioritization and visualization tools
- Key tasks
 - Does our planned prioritization/selection scheme work? What are the tradeoffs if number of locations sampled and revisit frequency?
 - What will these maps really look like with the operational tools for controlling the pointing mechanism? Develop parameters to get desired shapes of maps
 - Collect feedback from science users about the maps/frequency/priorities
 - I clearly need to talk to Claude and the MicroCarb team!







New Snapshot targets from ODIAC (colored by emission intensity)







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Zoom in of Southwest of US







What we really see, considering restrictions on pointing system











Center of tracks of data collected for snapshot over Los Angeles

- Plotted over nightlights, just to show the scan area relative to the populated areas
- Just one example orbit tracks change all the time, so there are changes to the mapped area



-119.4 -118.8 -118.2 -117.6 -117.0 -116.4

Orbital ATK

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Footprints sketched for snapshot over LA



• There will be footprint rotation – not yet in these simulations





The Big Picture



- Key Science Activities
 - Installation on the ISS in Feb 2019 (STM meeting in coordination)
 - IOC will take 2 to 3 months decontaminate instrument, verify pointing, exercise each observation mode, etc → OCO-2 work likely to slow down in that period, due to overlap of teams
 - We will prioritize delivery of nadir/glint global data first
 - Then target mode
 - Then snapshot mode
- Still working on
 - Delivery and format of context camera imagery
 - Snapshot/target server to help users find special observations of interest more easily → including searchable mapping tools







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BACKUP



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Simulated OCO-3 Snapshot Mapping (circa 2015)

















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Target Measurement plan



- Target measurements for OCO-3 will look just like OCO-2 (except from some footprint rotations....)
- The big changes
 - We are not limited to just 19 targets, like OCO-2 is
 - We lose a lot less ND/GL data before and after the target collection
 - We can collect a few a day if we want
- We will likely collect more targets than OCO-2, but only twice as many, not 10 times as many, as OCO-2 has been able to meet validation needs.







