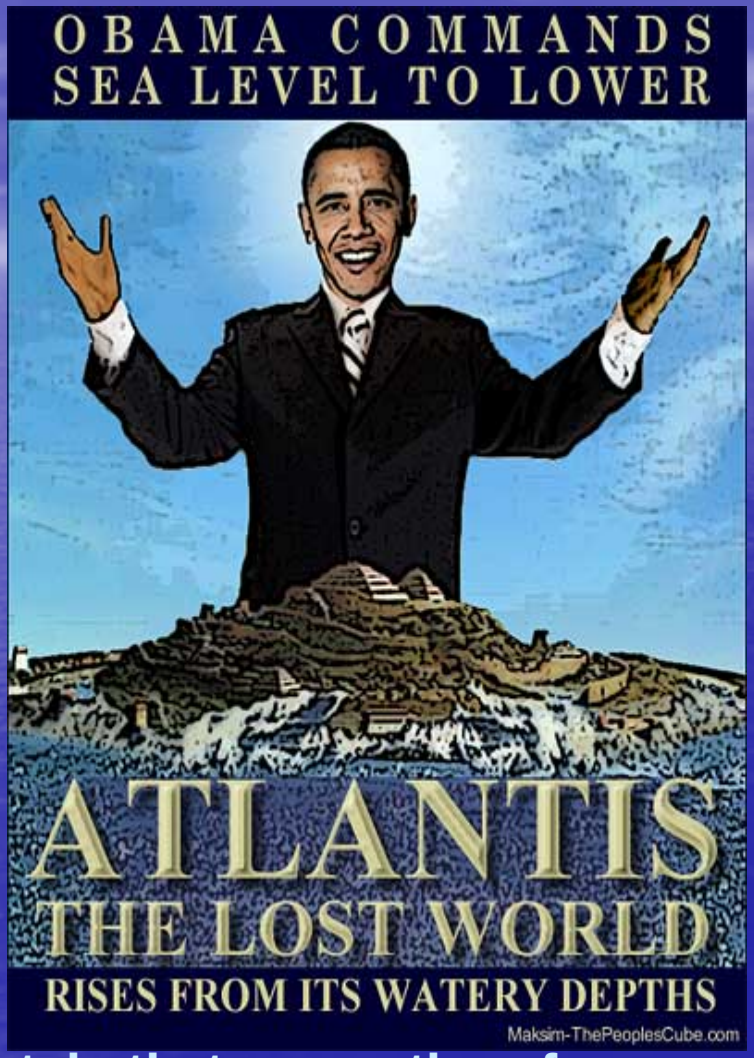
Jason-3 System Drift Requirement

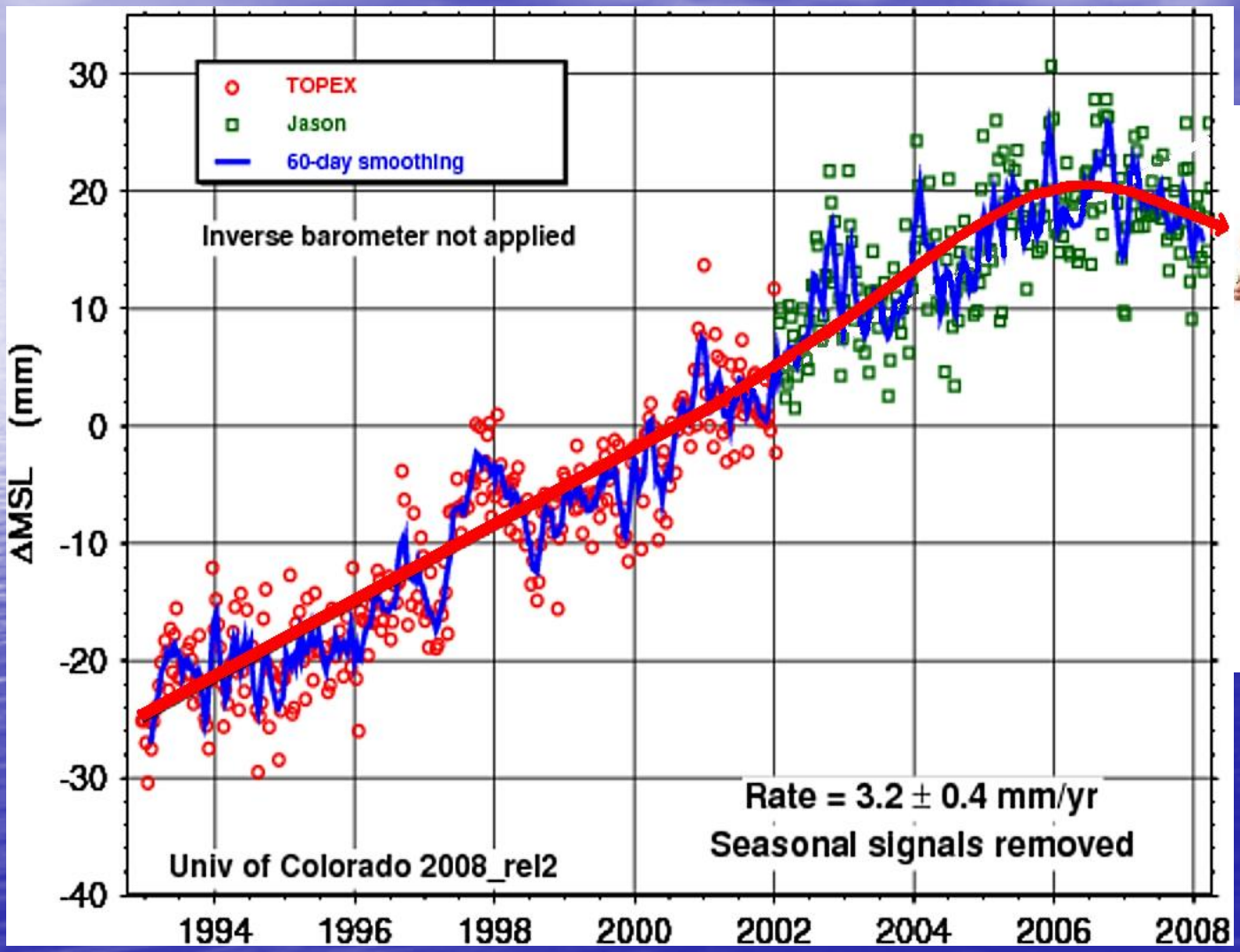
Recap from last year's OSTST in Seattle

Can this guy lower the seas ?



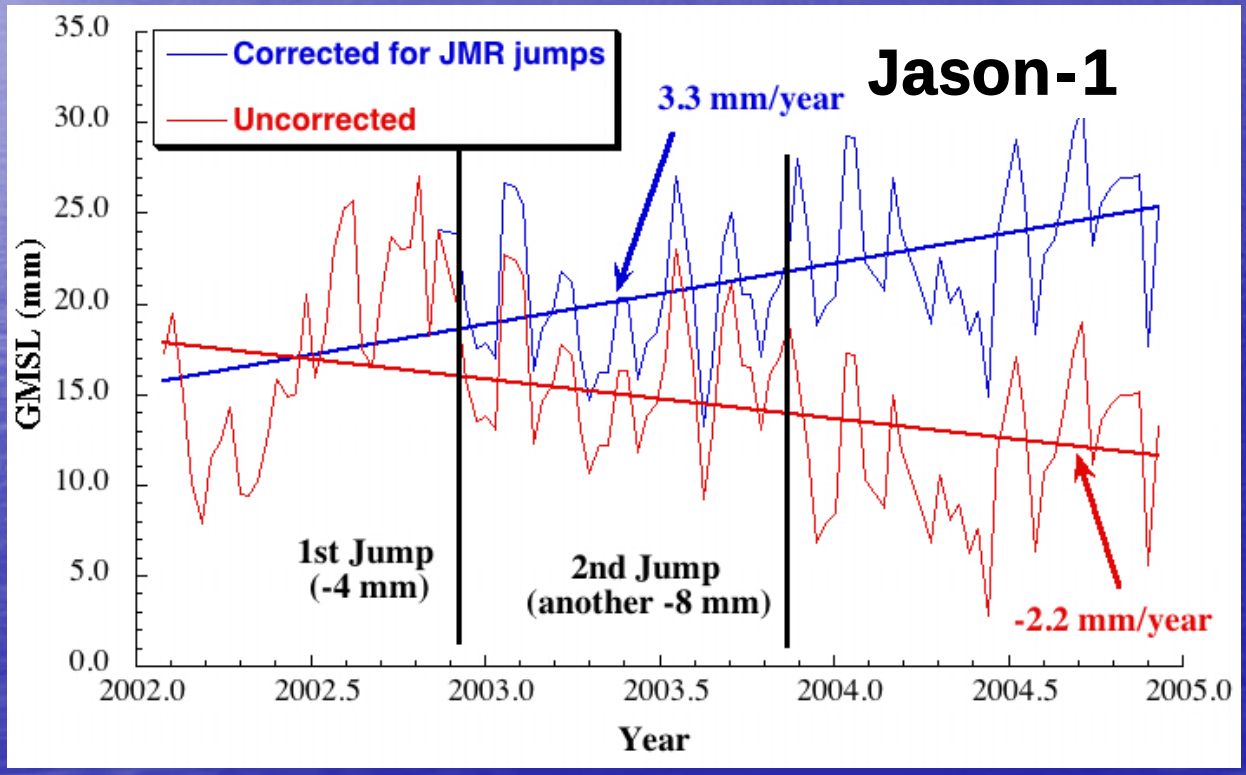
"I am absolutely certain that generations from now, we will be able to look back and tell our children that this was the moment when the rise of the oceans began to slow and our planet began to heal."
- Barack Obama, June 3, 2008

Why not? This guy did....



Why Does the Jason-3 Radiometer Need Onboard Calibration?

Radiometer drifts & jumps directly affect globally averaged sea level observations



This record remained "broken" until 2004 when the jumps were corrected in the GDRs

At the 2009 OSTST Meeting in Seattle, we identified the radiometer as the largest source of error in the estimate of global mean sea level and asked the Jason-3 Project to consider improving its stability

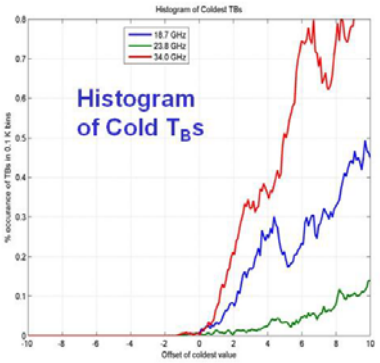
Outcome:

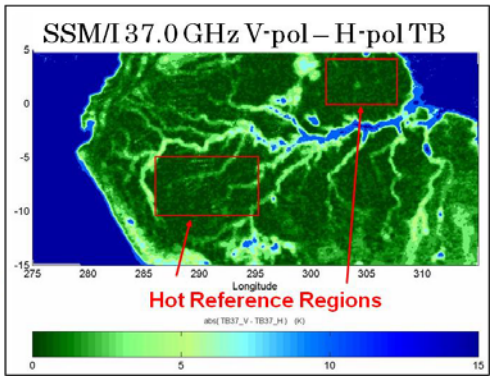
OSTST considered the requirements and performed an assessment of current techniques to meet long term stability requirement

JPL is performing a feasibility study

Radiometer Long Term Calibration Derived from External Sources

- Compare radiometer to on-Earth hot and cold T_B references
  - Vicarious Cold Reference
  - Amazon pseudo-blackbody regions

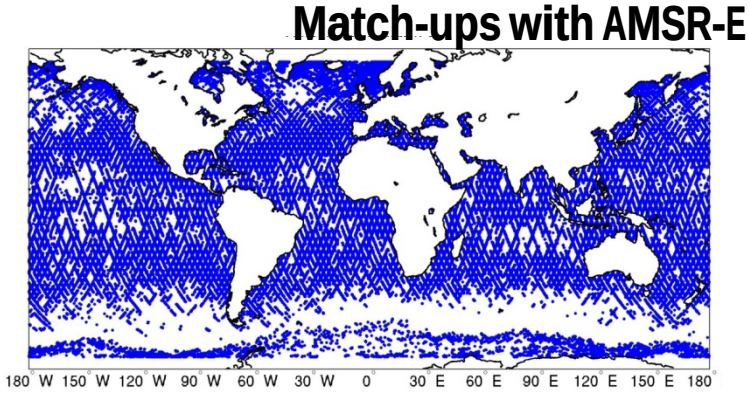


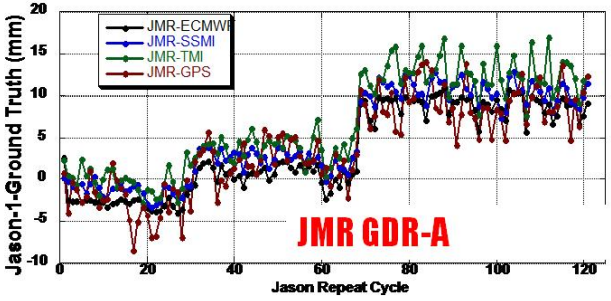


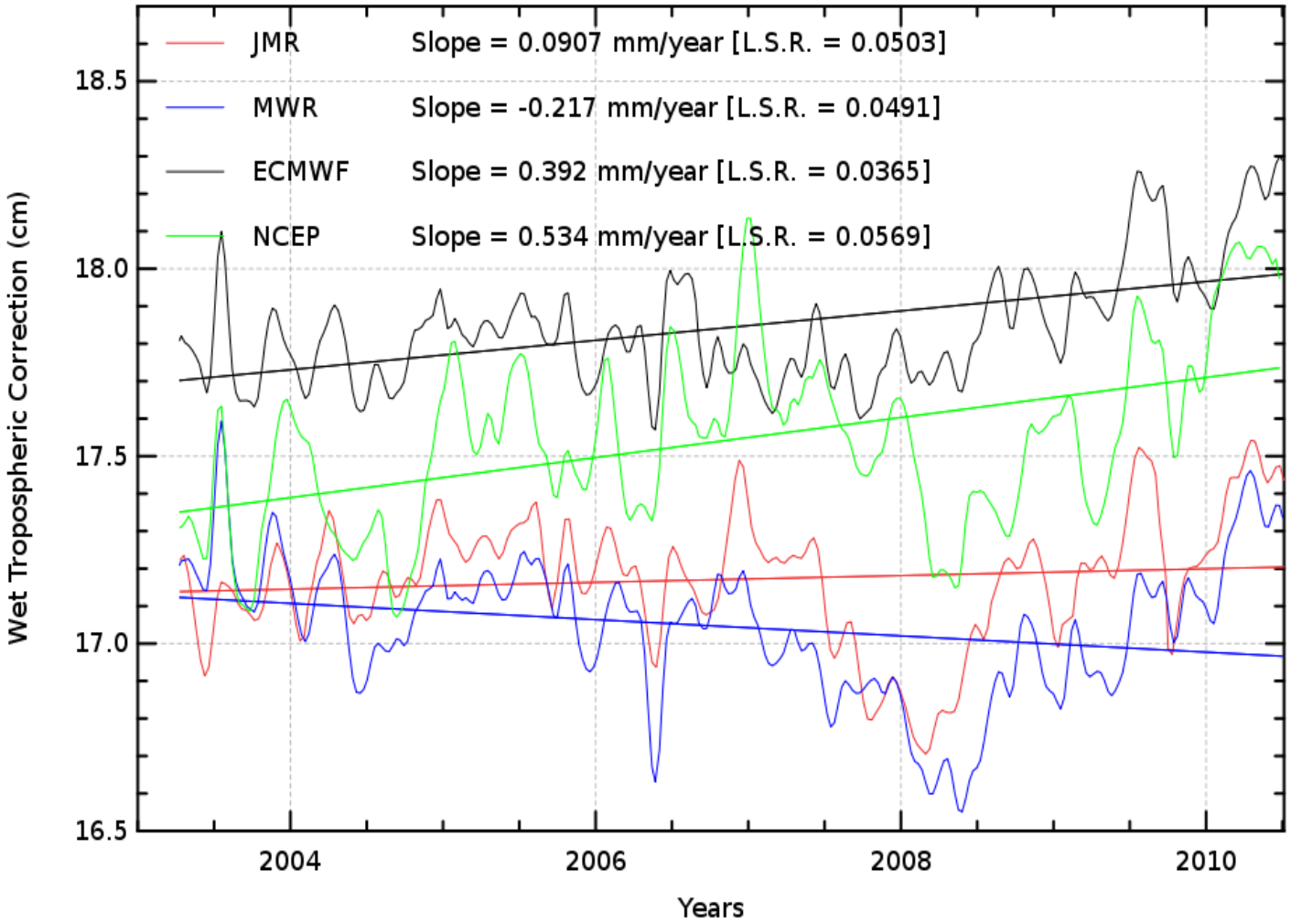
- Inter-sensor TB comparisons
  - AMSR-E, SSMI, TMI, JMR, AMSU, Envisat
  - Requires model to transfer one sensor's measurement to another

- Compare geophysical retrievals to in-situ measurements, models and other sensors
  - ECMWF, NCEP, SSMI, TMI, AMSR-E, GPS, RaOb, JMR, SSMIS

- Look for consistency between comparisons to assess and maintain stability to 0.1K/yr or 1mm/yr level







Monitoring of the **filtered** wet tropospheric correction (absolute value) from JMR, MWR, ECMWF and NCEP models (sampled by Envisat) with **adjustment of the annual signal** from Jason-1 and Envisat missions with restriction on the **Jason-1 spatial coverage**. Arbitrary bias is used to compare the datasets.

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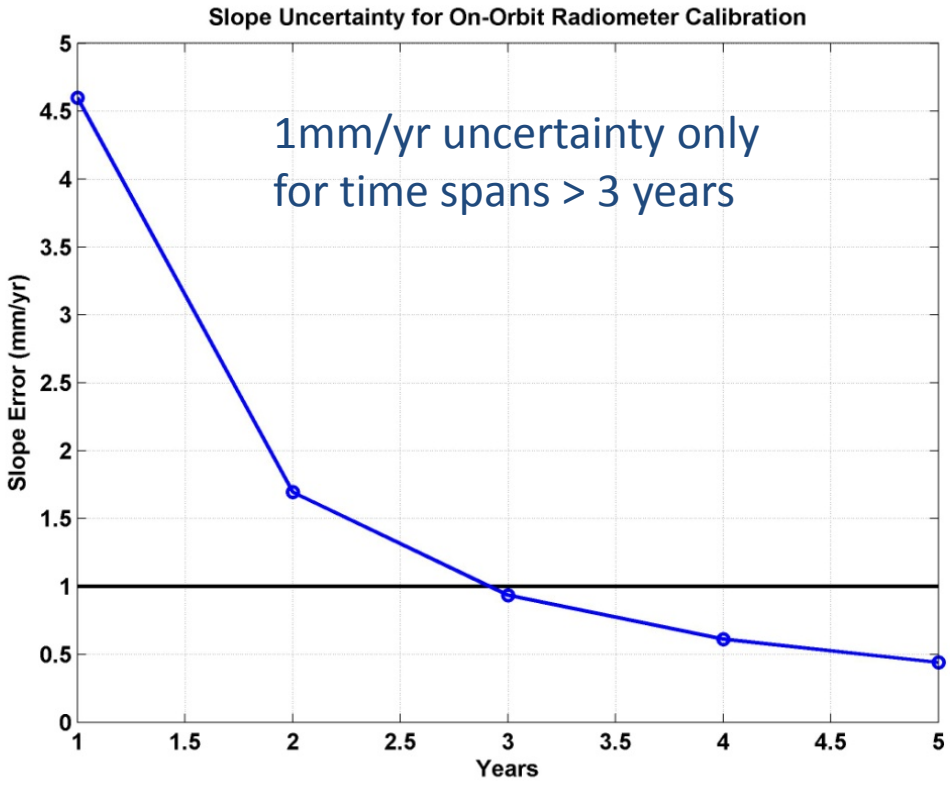
Estimated Wet PD Drift Uncertainty using Current Approach versus time span



Uncertainty on Wet PD slope (mm/yr) versus time span assuming monthly 0.5K calibration uncertainty and no drift in "ground truth"

Calibration uncertainty based on an estimate of ancillary data sources certain to be available in the Jason-3 and Jason-CS time frame

Assumption of no drift in ground truth may not be valid on decadal time scales

Reliance on on-orbit calibration techniques risky for maintaining long term climate record

Instrument Processing Splinter Discussion Summary

- What level of stability is required and over what time span?
  - NOAA Jason-3 requirement is 1mm/yr over a 5 year time span
  - CEOS requirement is 0.5 mm/decade
  - No specification discussed on regional stability, but global mean stability isn't sufficient to ensure regional stability

- For current altimeter missions, radiometer wet path delay stability on long time scales (>30 days) derived from ancillary sources
  - No control over "external references" and fidelity of on-orbit calibration approach may change over time reflecting changes and availability of "ground truth"
  - References may not be stable over time and no way to validate it
  - External references should be used for validation, not calibration
- **Recommendation:** To perform climate measurements, future missions (e.g. Jason-3, Jason-CS…) must consider radiometer with capability for long term stability

Requirement Clarification

Requirement: Jason 3 shall measure globally averaged sea level relative to levels established during the cal/val phase with zero bias +/- 1 mm (standard error) averaged over any one year period.

Verification: Accuracy will be verified by comparison with no less than 50 tide gauges that provide the widest possible geographic coverage.

Latency: As a goal, the project will attempt to design Jason-3 to meet this level of accuracy with a latency of 2 months, in time for production of the GDR.

Explanation: Small auto correlation, 4.9 mm RMS variability between altimeter – tide gauge:

$$\text{error on mean} = 4.9 \text{ mm} / \text{sqrt}(23 - 1)$$

$$\text{slope error} = \text{mean square error} / \text{sqrt}(\text{sum} (t_i - t_{mean})^2)$$

duration	error
1 year	3.5 mm/yr
2 years	1.3 mm/yr
3 years	0.68 mm/yr

For Jason-3, this should be a **goal**

Goal: Jason 3 shall measure globally averaged sea level relative to levels established during the cal/val phase with zero bias +/- 1 mm (standard error) averaged over any one year period.

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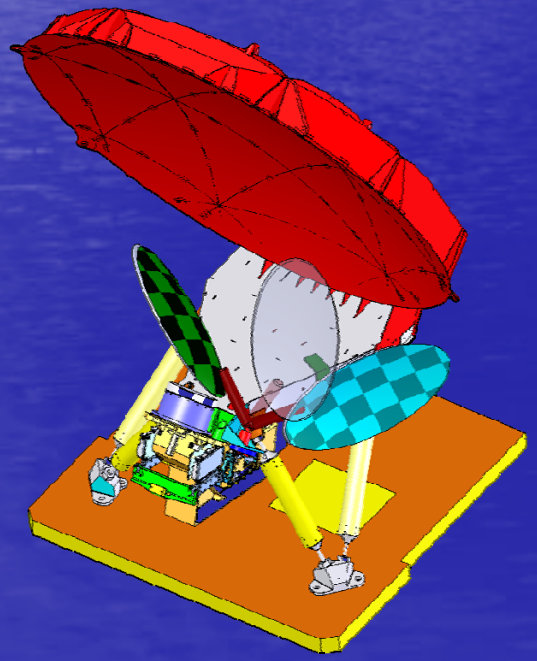
Jason-3

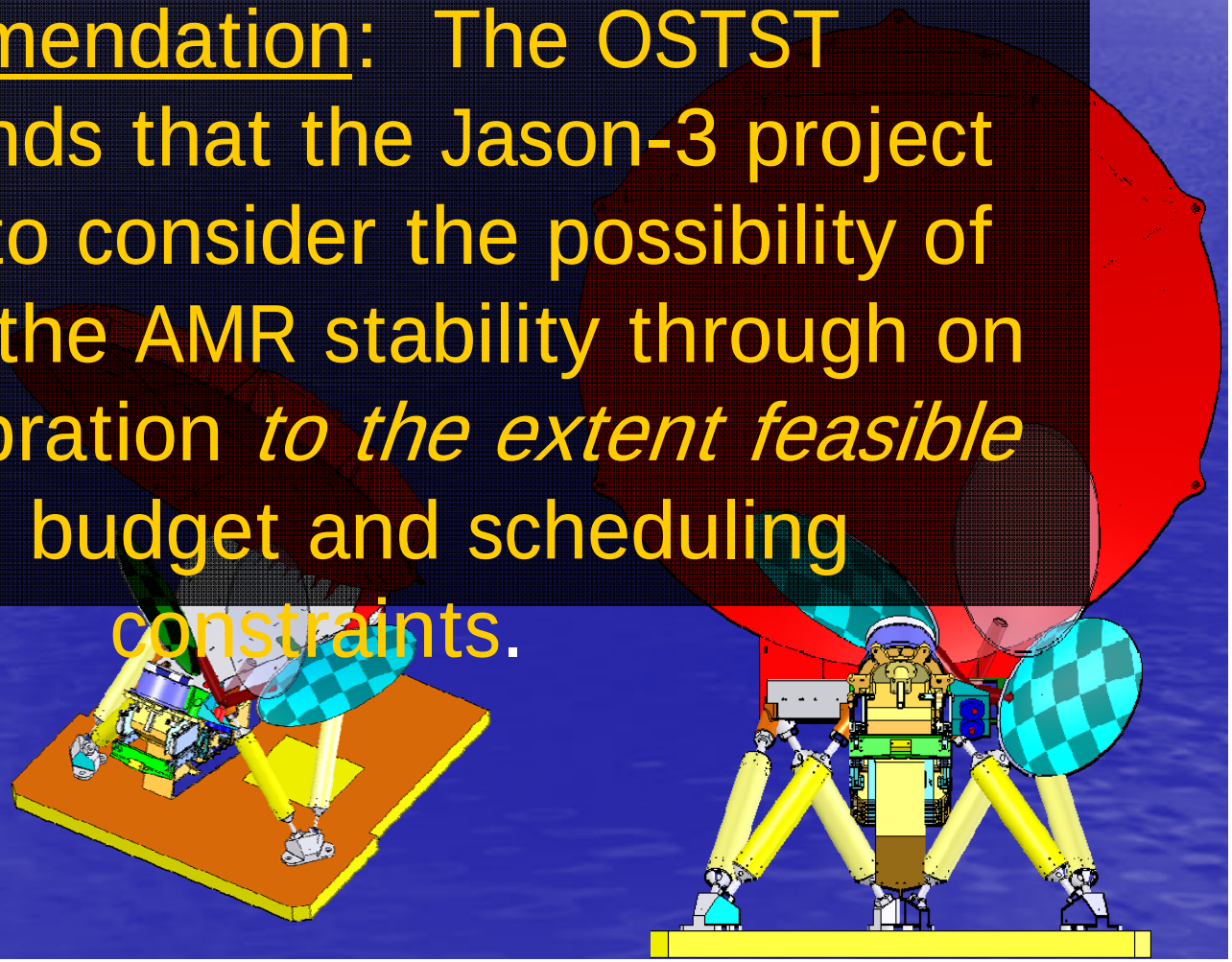
- NOAA asked JPL to perform a feasibility study to assess the possibility of adding an on-board absolute calibration reference to the AMR for Jason-3 to be completed this month
- Preliminary results indication a possible solution requiring further detailed study between partners
- An independent review of the options is planned in the near future



Jason-3

- However, to be feasible, CNES must also study impact of this design change on satellite integration.

Recommendation: The OSTST recommends that the Jason-3 project continue to consider the possibility of improving the AMR stability through on board calibration *to the extent feasible* within budget and scheduling constraints.



Jason-CS

The OSTST also recommends that Jason-CS meet the following requirement at the mission level:

Requirement: Jason CS shall measure globally averaged sea level relative to levels established during the cal/val phase with zero bias +/- 1 mm (standard error) averaged over any one year period.