



# Wide Swath Ocean Altimeter



**Presented by E. Thouvenot, CNES  
(for the GAMBLE meeting)**

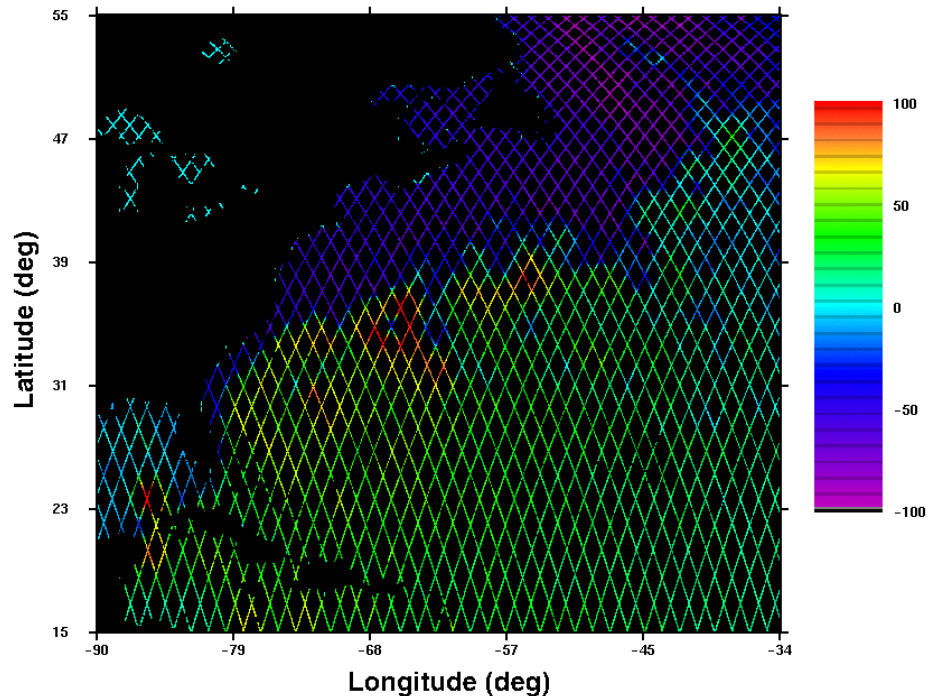
**Information provided by  
E. Rodriguez and B. Pollard, JPL**

## WSOA on OSTM Science Goals

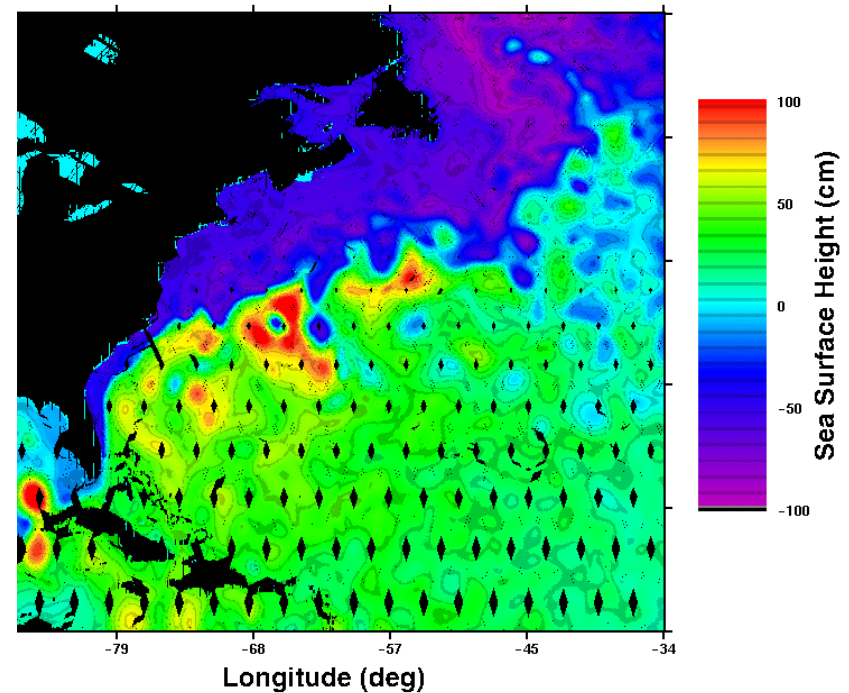
- **Science Goals: Demonstrate the utility of radar interferometry for the study of**
  - Oceanic mesoscale eddies, fronts, and boundary currents, which are the most energetic elements of the oceanic general circulation.
  - Eddy mean-flow interactions, eddy transports, and the role of eddies in climate.
  - Physical-biological interactions and the role of eddies in the carbon cycle.
  - Coastal tides and open ocean internal tides.
- **Technology Goals**
  - Verify the error budget for interferometer and off-nadir media corrections.

# Wide Swath Ocean Altimeter WSOA Science Rationale

Topex Orbit, 2 Altimeters:  
150km equatorial spacing, 10 day repeat



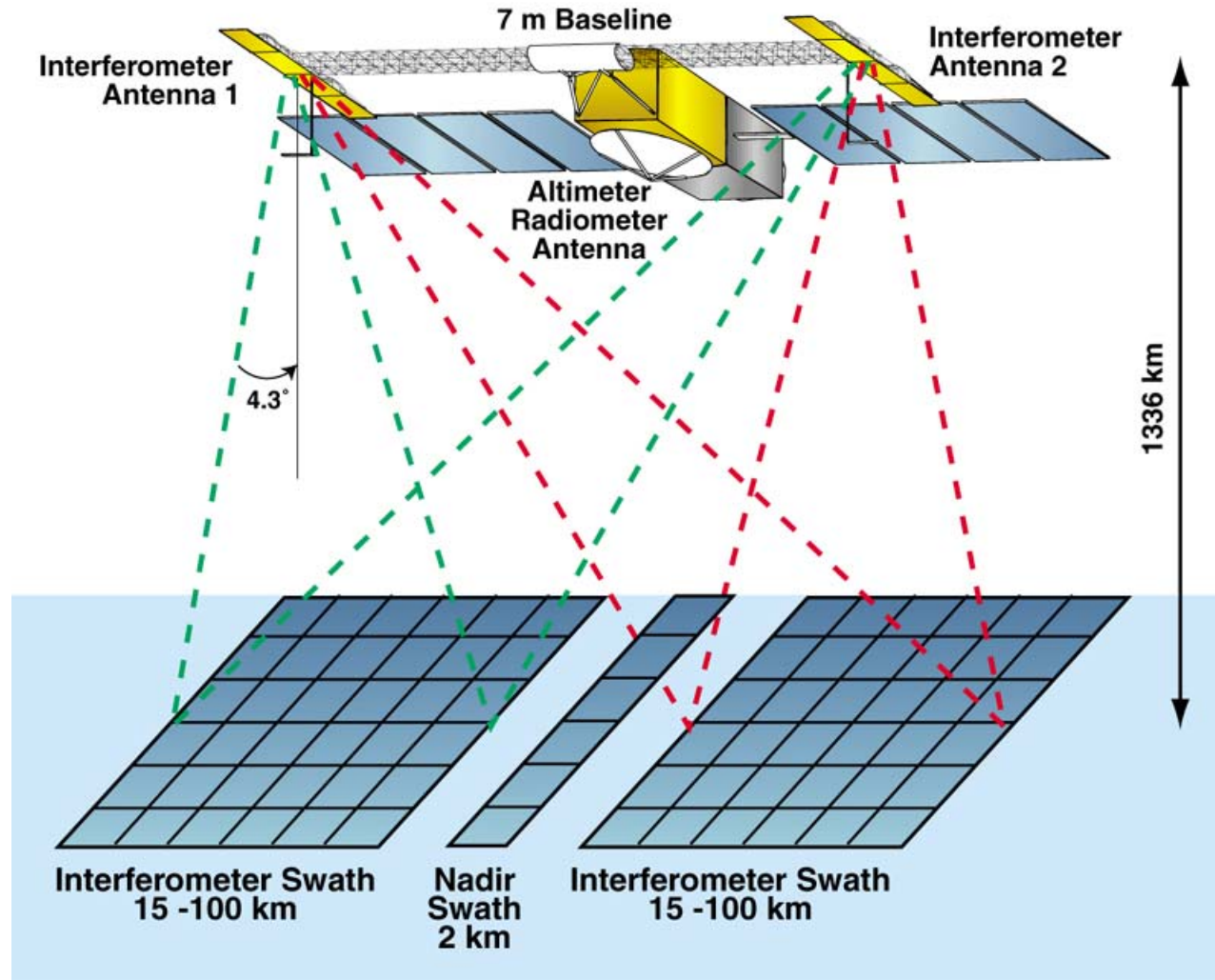
Topex Orbit, 1 satellite, fixed yaw coverage  
Wide-Swath altimeter, 10 day repeat



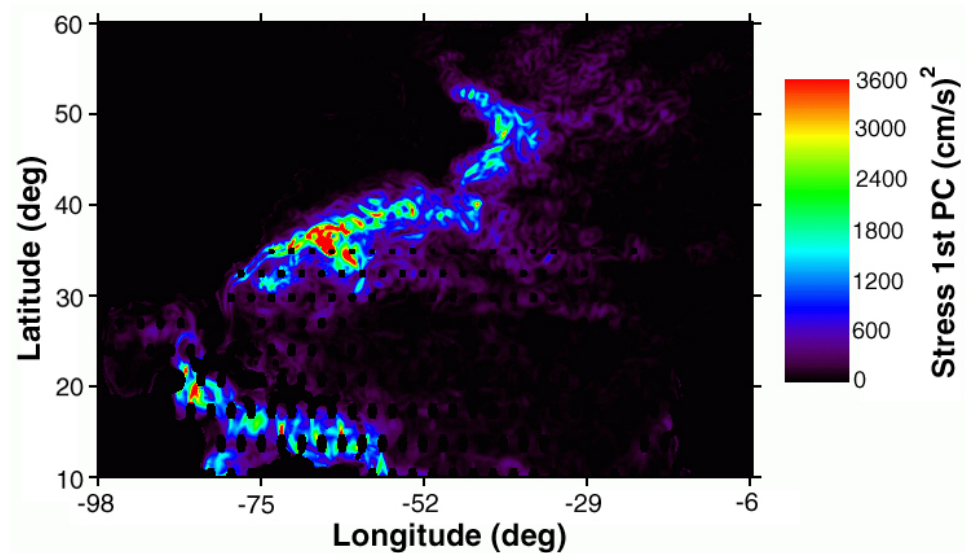
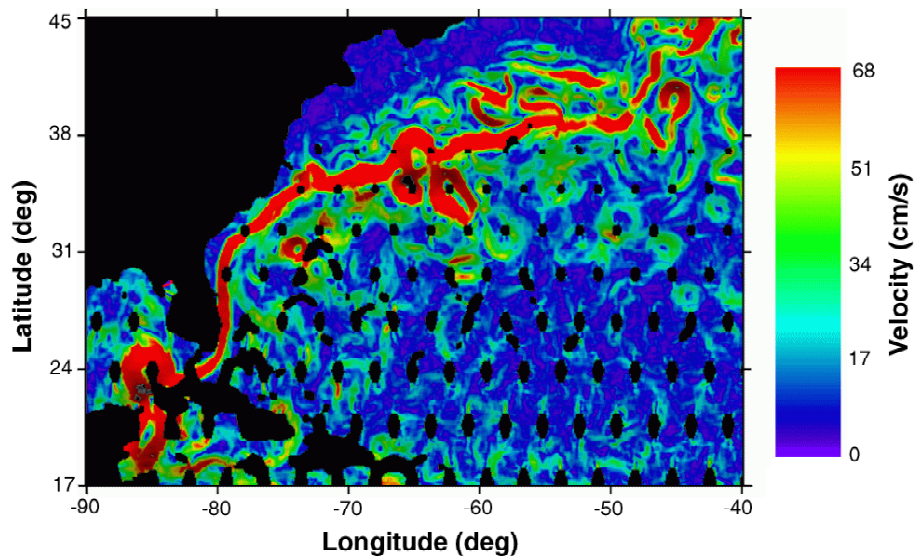
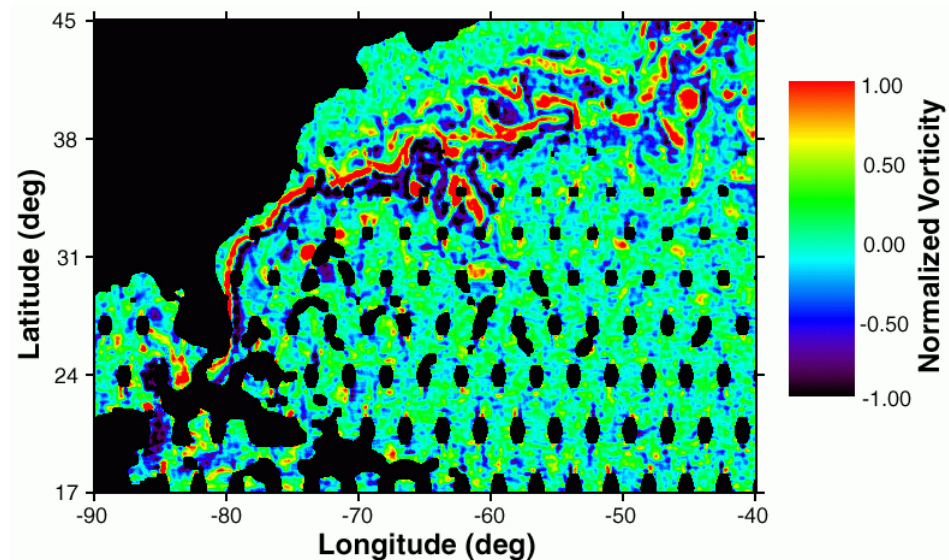
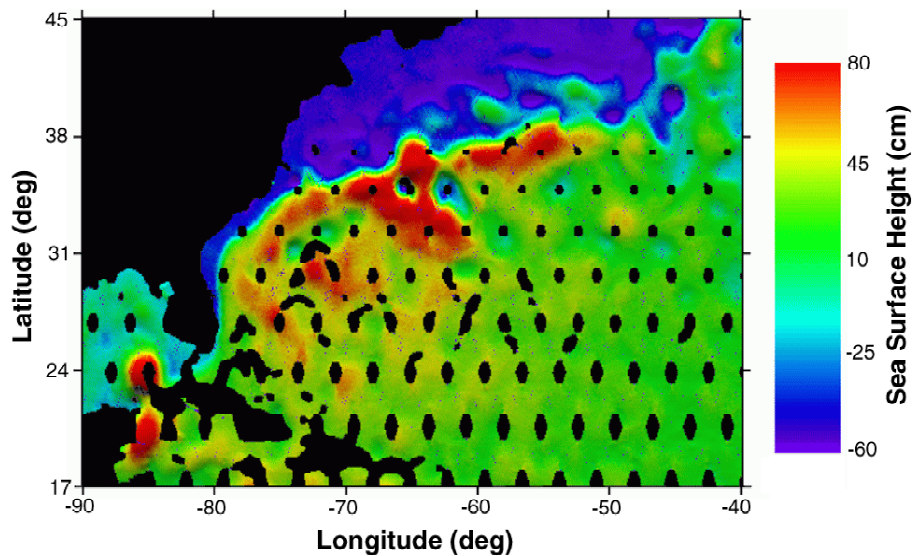
High resolution ocean topography measurements requires several coordinated nadir altimeters. A better coverage from a single platform can be obtained using an instrument which can image a swath instantaneously.

# Wide Swath Ocean Altimeter

## Wide Swath Altimeter Concept



## A New Generation of Ocean Products

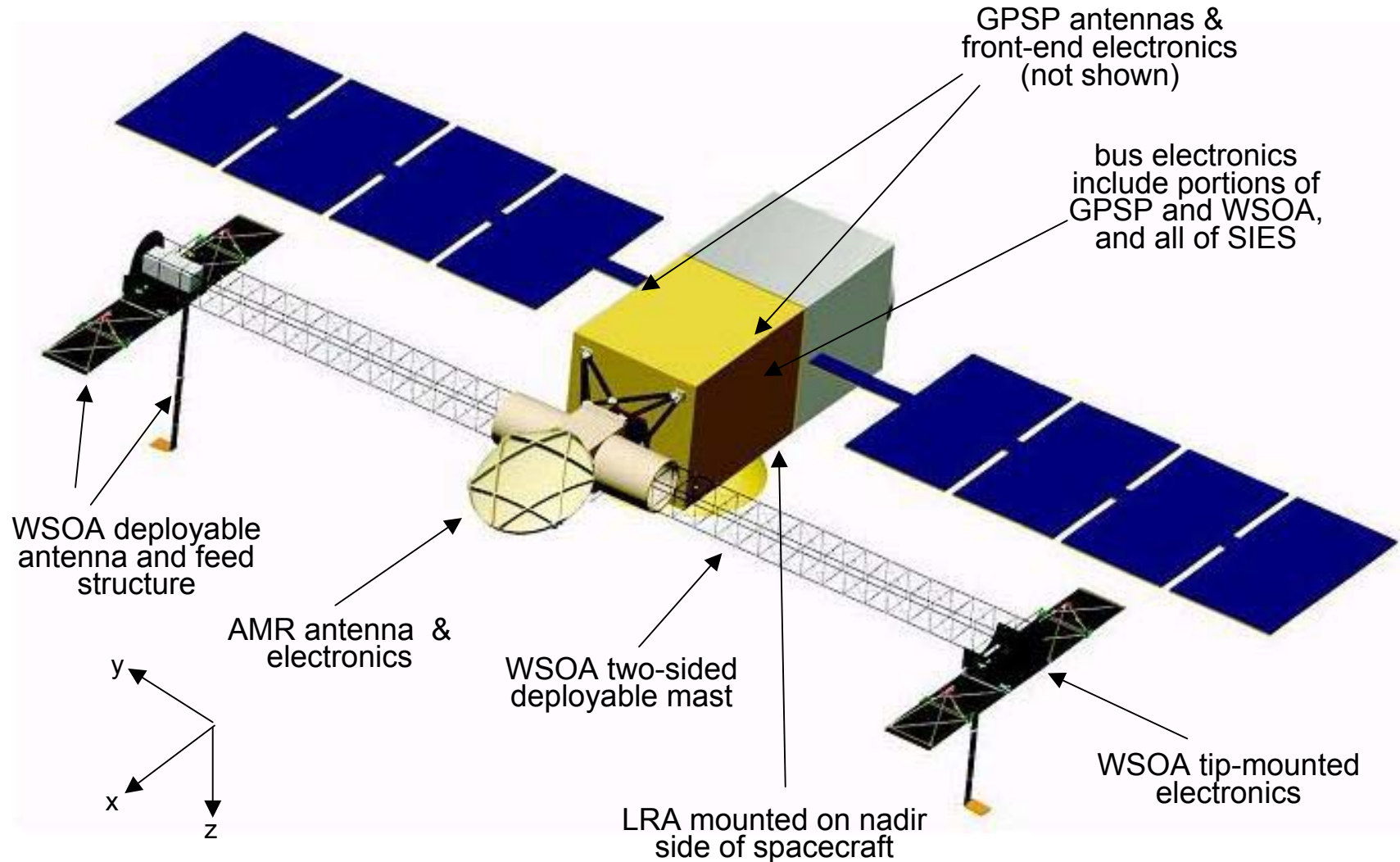




# Wide Swath Altimeter on OSTM Concept

- Proteus platform
- Jason Ku-band and C-band nadir altimeters
- Doris, GPS, and retro-reflectors for precision orbit determination.
- **Next generation three-frequency radiometer for wet tropo correction**
- **Wide Swath Interferometer as additional experimental payload**
  - Ku-band wide swath (<200 km) interferometer with 15km spatial height posting
  - No impact to core mission

# Wide Swath Ocean Altimeter OSTM Payload Concept



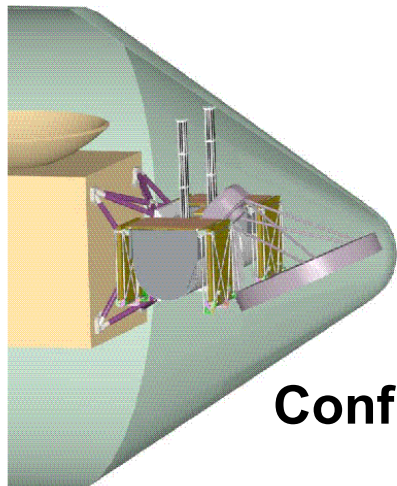


## WSOA Technology Heritage

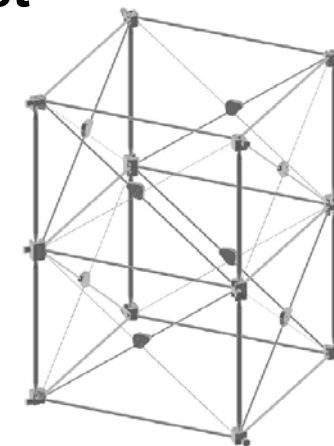
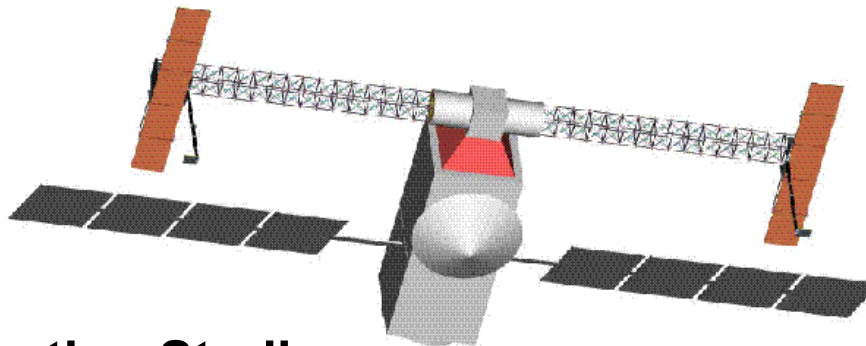
- **Under the NASA Instrument Incubator Program (IIP), detailed studies or prototypes have been made of the following WSOA subsystems during the last 3 years:**
  - **Mast stability and frequency analysis**
  - **Antenna stability and deployment repeatability**
  - **Interferometric onboard processor**
  - **Light dual-polarized reflectarray antenna technology**
- **Interferometric phenomenology and algorithms have a heritage of over 15 years**
- **The Shuttle Radar Topography Mission (SRTM) and the German X-SAR instrument have demonstrated spaceborne simultaneous interferometric measurements with a 60m mast**
- **WSOA mast technology is an evolution from the SRTM mast**
- **There are no major known technology hurdles in the deployment of a WSOA in the near future**

## Instrument Incubator Technology Development

Light, stiff deployable mast

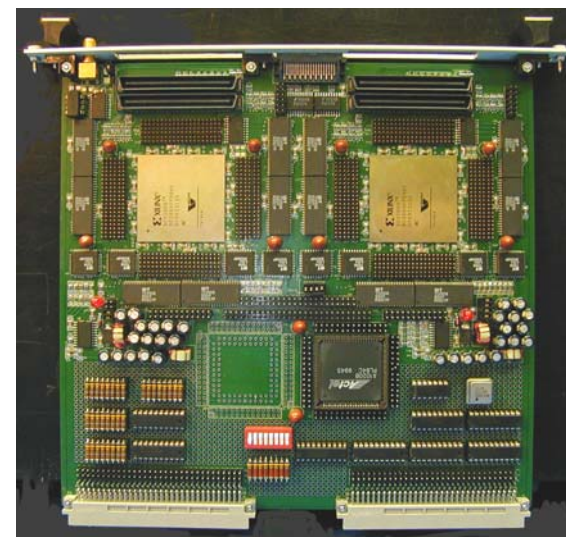
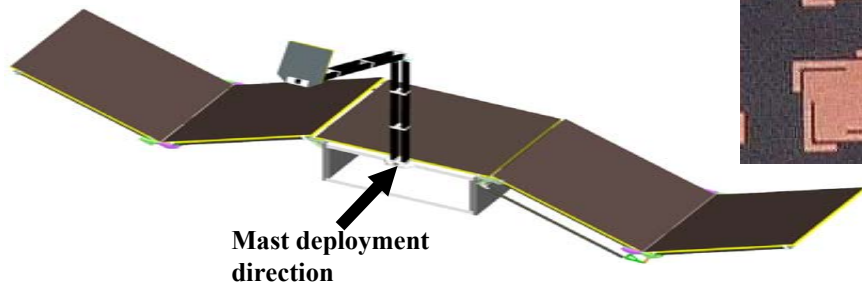
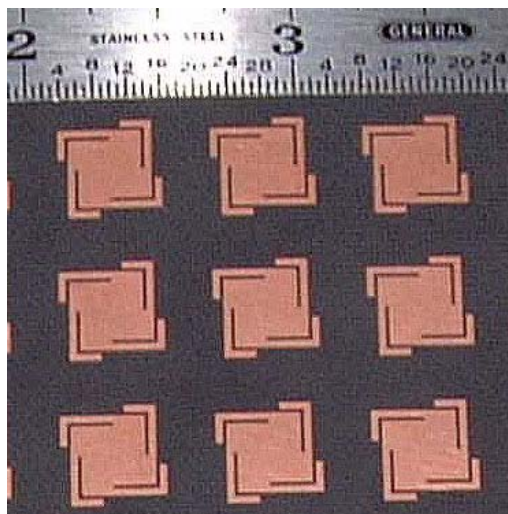


Configuration Studies



Onboard Processor

Deployable  
Reflectarray Antenna



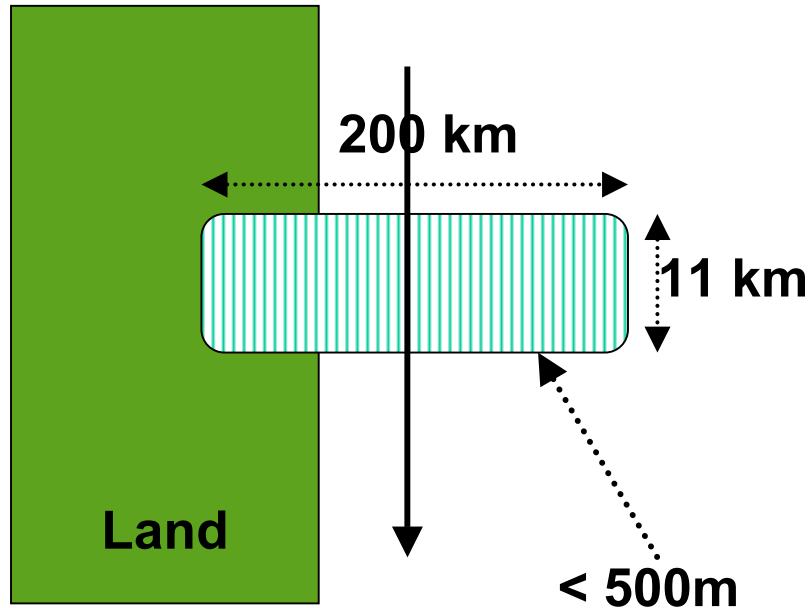


# Wide Swath Ocean Altimeter WSOA on OSTM Error Budget

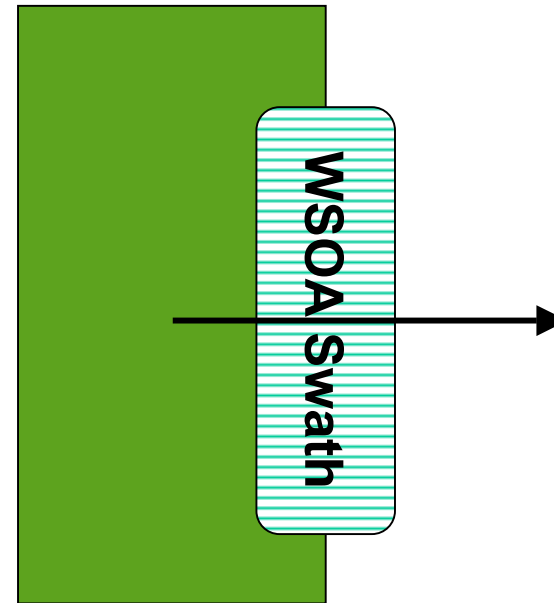


Error Source	26 km	47 km	68 km	89 km	Jason
<b>Interferometric Precision (WSOA)</b>	<b>1.9</b>	<b>1.7</b>	<b>1.9</b>	<b>2.5</b>	1.7
<b>Residual Systematic Error (WSOA)</b>	<b>1.6</b>	<b>1.9</b>	<b>2.4</b>	<b>2.9</b>	1.4
EM Bias	2.0	2.0	2.0	2.0	2.0
Wet Troposphere	1.2	1.2	1.2	1.2	1.2
Dry Troposphere	0.7	0.7	0.7	0.7	0.7
Ionosphere	0.5	0.5	0.5	0.5	0.5
Cross-track Media Decorrelation	1.0	1.3	1.5	1.8	
Height Error [cm]	<b>3.7</b>	<b>3.8</b>	<b>4.2</b>	<b>4.9</b>	<b>3.3</b>
Precision Orbit Error	2.0	2.0	2.0	2.0	2.0
Absolute Height Error [cm]	<b>4.2</b>	<b>4.3</b>	<b>4.7</b>	<b>5.3</b>	<b>3.9</b>

## Coastal Contamination Scenarios

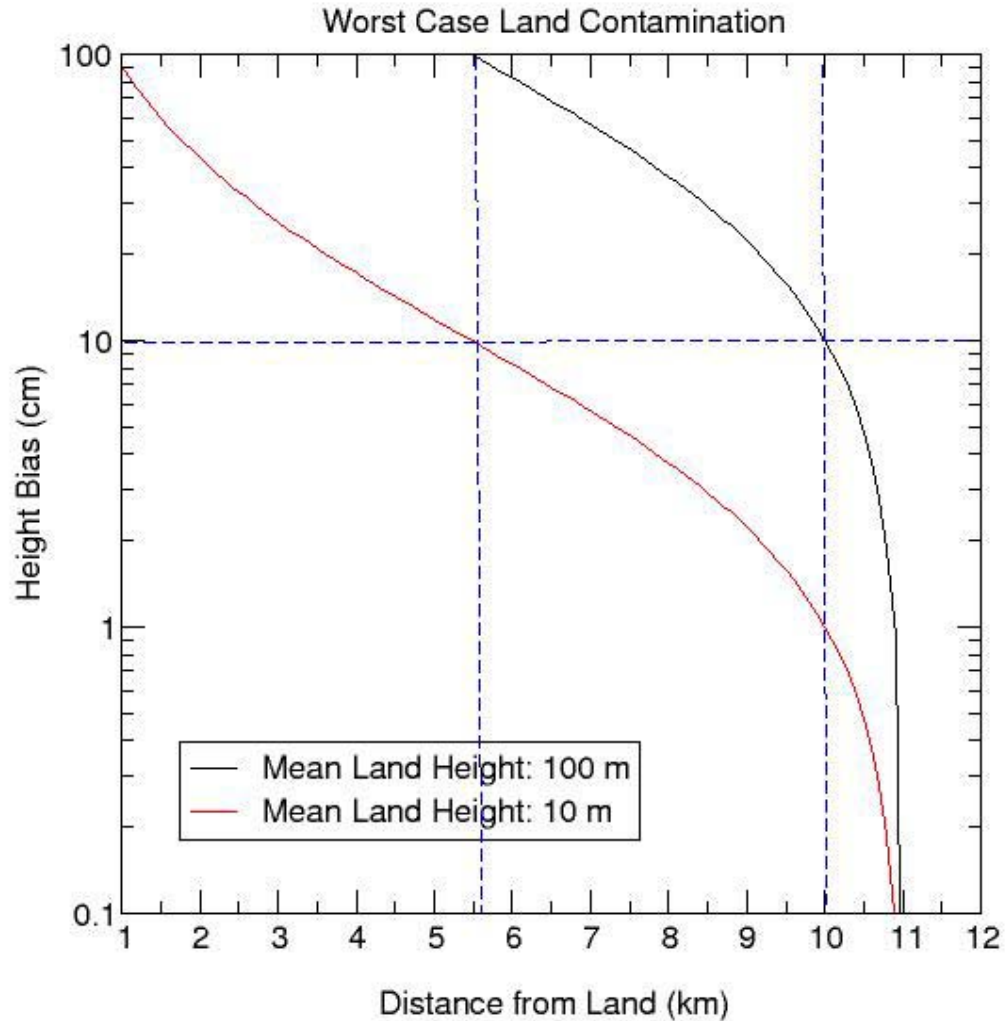


**Best case land contamination:**  
 only the range cells over land  
 are affected, but range cells  
 over the ocean are unaffected.



**Worst case land contamination:**  
 every resolution cell is affected by  
 its fraction over the land.

## Worst Case Height Bias Due to Land Contamination





## Wide Swath Ocean Altimeter



# Key WSOA Science Requirements

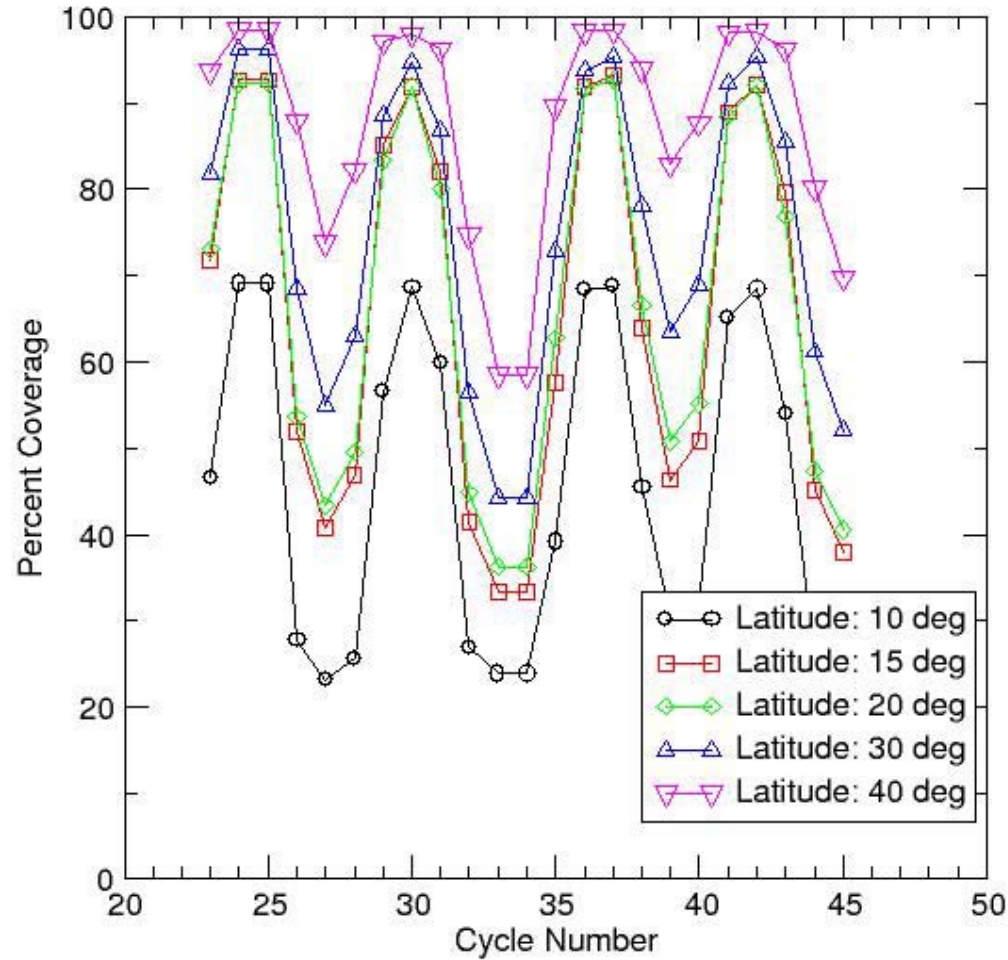
	Minimum Requirement	Measurement Goal	Comments
Height/Velocity Posting	15 km	15 km	
Eddy Spatial Resolution	25 km	15 km	
Eddy Total Height Error	7 cm	5 cm	Need to take into account geographical location and temporal decorrelation
Coast/Tide Spatial Resolution	250 km	50 km	
Coast/Tide Total Height Error	3 cm	3 cm	
Velocity Error	7 cm/s	5 cm/s	Does not include geoid slope errors

The height postings shall be geographically fixed, and independent of spacecraft position and attitude. (Allows computation of mean sea surface).

## WSOA Science Goals and Yaw Steering

- **WSOA on OSTM presents a significant observational capability increase for the measurement of mid-latitude ocean eddies, coastal and internal tides, and physical biological interactions.**
- **For latitudes greater than 40 degrees, almost 100% coverage is available, while for 30 degree latitude coverage varies between ~60% to 100%.**
- **Although yaw steering on OSTM reduces coverage in equatorial regions, mid and high latitude regions have significant increase in coverage over conventional altimetry.**

# Wide Swath Ocean Altimeter Coverage vs Cycle Number



**Assumption: fixed yaw for beta angles < 30 degrees**



## WSOA Science Requirements Status

- **First meeting to review preliminary WSOA science requirements held during Biarritz SWT**
  - Current science requirements represent a “good first cut”
  - Science requirements must be refined to include latitude/longitude/temporal signal strength variations of ocean phenomena
  - Global ocean coverage is strongly desired
- **The WSOA science requirement document will be updated and circulated to members of the WSOA science working group before New Orleans WST meeting**
- **The next review of the science requirements will take place during the New Orleans SWT meeting**



**Wide Swath Ocean Altimeter  
WSOA Science Working Group**



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