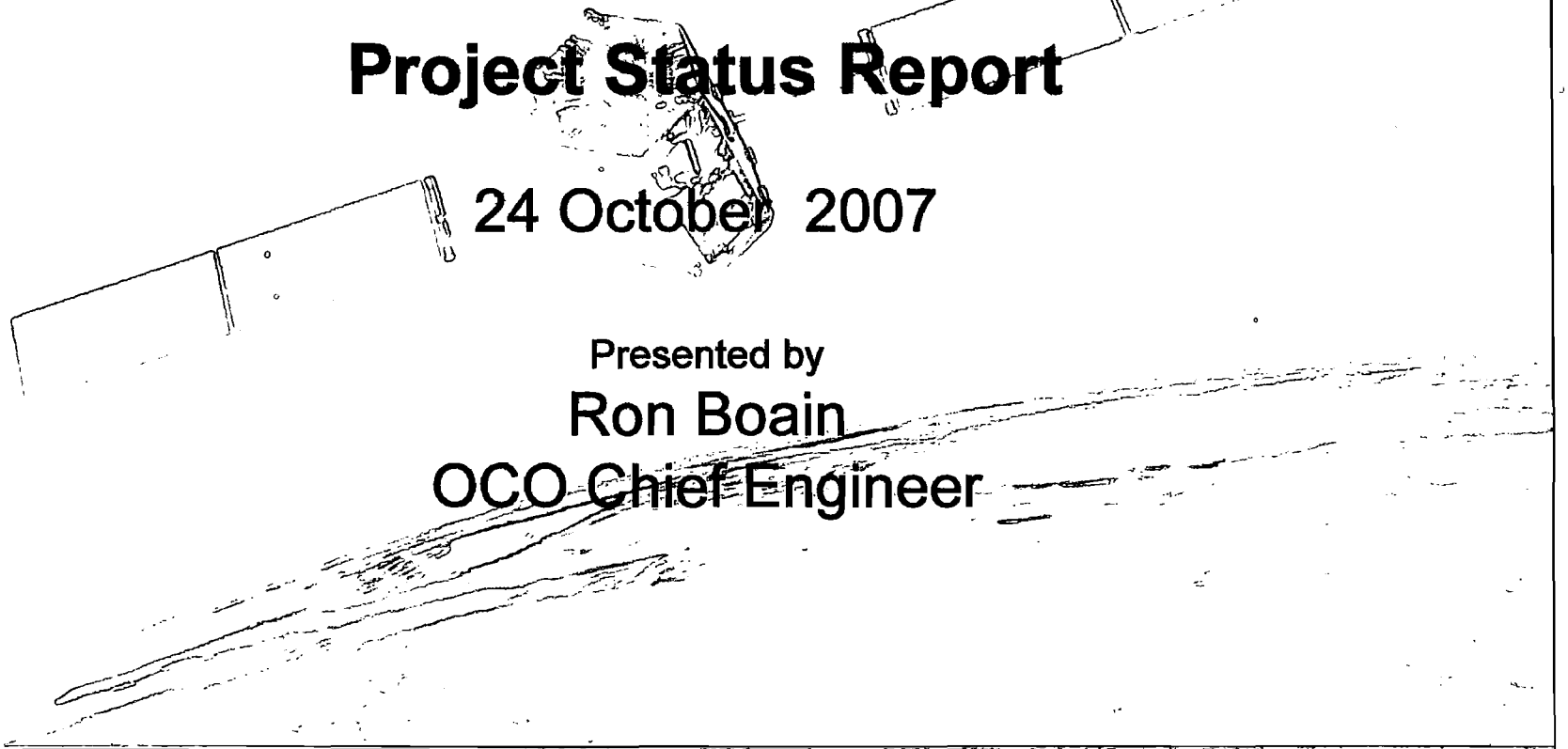
National Aeronautics and Space Administration
Jet Propulsion Laboratory
California Institute of Technology

The Orbiting Carbon Observatory (OCO) Mission

Watching The Earth Breathe...Mapping CO_2 From Space.



Project Status Report

24 October 2007

Presented by
Ron Boain
OCO Chief Engineer

Watching the Earth breathe.... mapping CO2 from space.
Orbiting Carbon Observatory

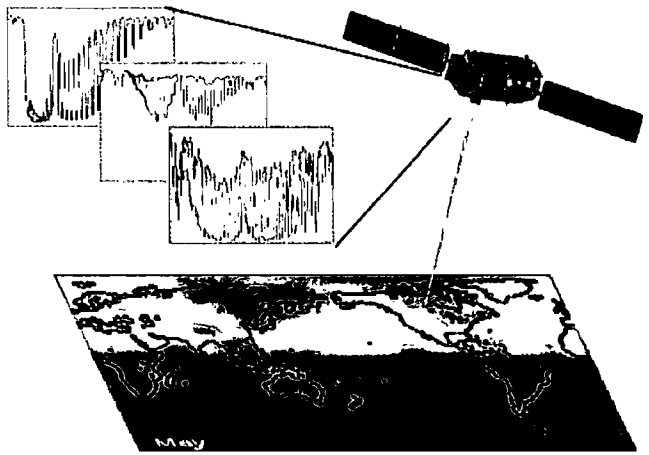
JPL Orbital Hamilton Sundstrand
A United Technologies Company

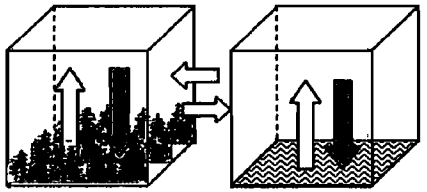
The Orbiting Carbon Observatory (OCO)

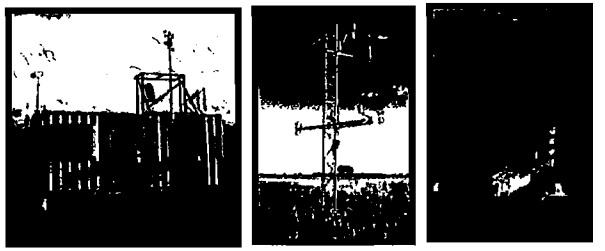
OCO will acquire the space-based data needed to identify CO_2 sources and sinks and quantify their variability over the seasonal cycle

Approach:

- **Collect spatially resolved, high resolution spectroscopic observations of CO_2 and O_2 absorption in reflected sunlight**
- **Use these data to resolve spatial and temporal variations in the *column averaged CO2 dry air mole fraction*, X_{CO2} over the sunlit hemisphere**
- **Employ independent calibration and validation approaches to produce X_{CO2} estimates with random errors and biases no larger than 1 - 2 ppm (0.3 - 0.5%) on regional scales at monthly intervals**







Project Overview

The Orbiting Carbon Observatory (OCO)

Watching The Earth Breathe...Mapping CO2 From Space

Salient Features

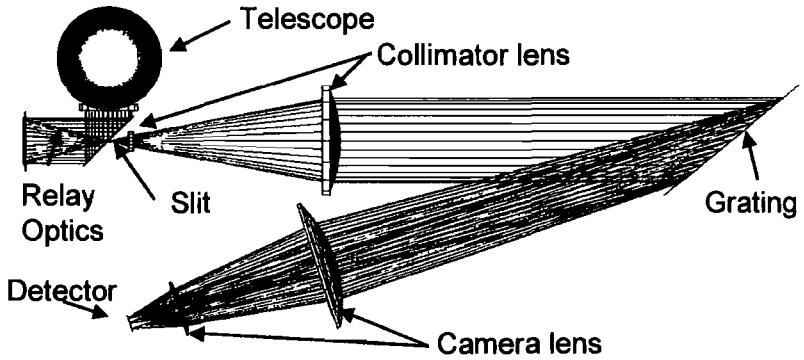
High-Resolution, Three-Channel Grating Spectrometer
Partnership with HS (Instrument) and OSC (Spacecraft)
High Heritage Spacecraft, Flies in Formation with the A-Train
Launch date: December 15, 2008 on Taurus XL from VAFB
Operational life: 2 years
Principal Investigator: Dr. David Crisp, Deputy: Dr. Charles Miller
Project Manager: Thomas Livermore, Deputy: Dr. Ralph Basilio
JPL Program Manager: Dr. Steven Bard
Program Scientist: Dr. William Emanuel, NASA HQ
Program Manager: Eric Ianson, NASA HQ

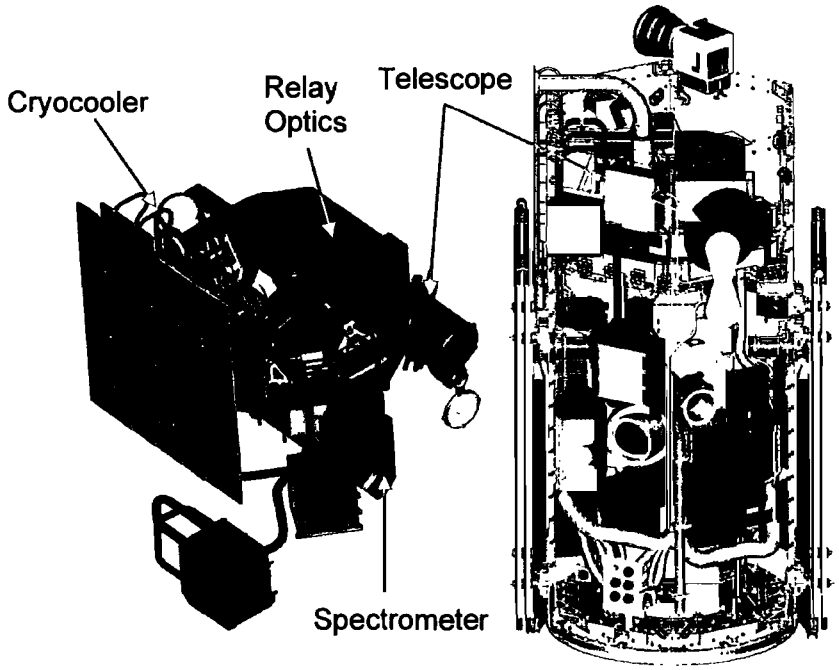
Science

- **Collect the first space-based measurements of atmospheric CO_2 with the precision, resolution, and coverage needed to characterize its sources and sinks on regional scales and quantify their variability over the seasonal cycle.**
- **Use independent data validation approaches to ensure high accuracy (1-2 ppm, 0.3% - 0.5%)**
- **Reliable climate predictions require an improved understanding of CO_2 sinks**
  - **What human and natural processes are controlling atmospheric CO_2?**
  - **What are the relative roles of the oceans and land ecosystems in absorbing CO_2?**

The OCO Instrument

- **Three bore-sighted, high resolution, grating spectrometers**
  - CO_2 1.61 μm band
  - CO_2 2.06 μm band
  - O_2 0.765 μm A-band
- **Similar optics and electronics**
  - Common 200 mm f/1.9 telescope
  - Spectrometers cooled to <0 °C
  - Resolving Power ~20,000
  - Common Read-out Integrated Circuits and electronics for focal plane arrays
- **Existing Designs For Critical Components**
  - Detectors: WFC-3, Deep Impact (RSC)
  - Cryocooler: TES flight spare (NGST)
- **Provided by Hamilton Sundstrand Sensor Systems (Pomona CA) with Instrument integration & test at JPL**





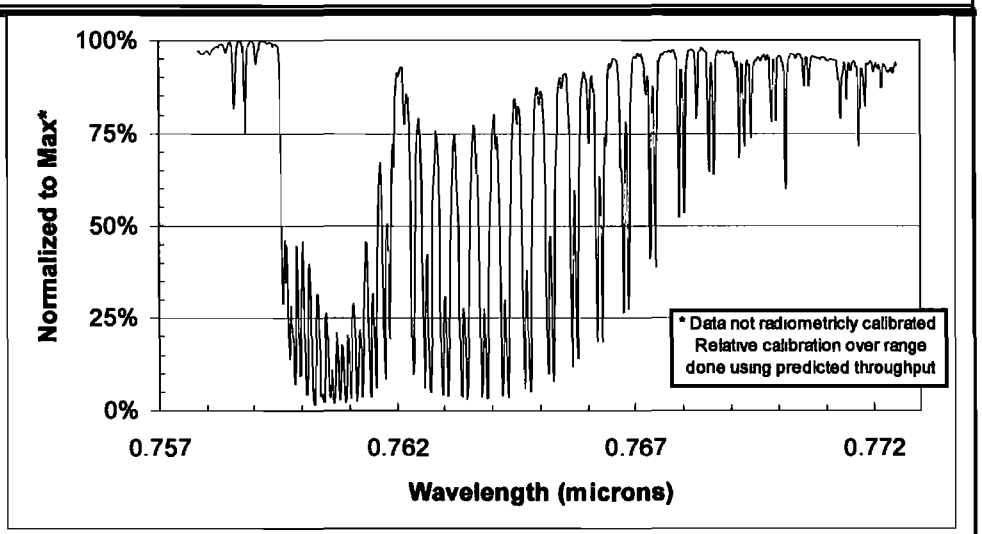
Instrument Recent Accomplishments

Planned (Baselined) Date	Completed Date	Status / Description
1-Sep-07	03-Sep-07	Complete focus test
2-Sep-07	24-Sep-07	Complete T/V 1 test: "first light" measured
18-Sep-07	25-Sep-07	Liquid pin focus shims
27-Sep-07	11-Oct-07	Reinstall Analog Front-End Electronics (AFE) assembly after rework/conformal coat
3-Oct-07	11-Oct-07	Integrate cryocooler
22-Oct-07	08-Oct-07	Integrate Baffle/Calibration Assembly (BCA) integrated successfully, but since removed

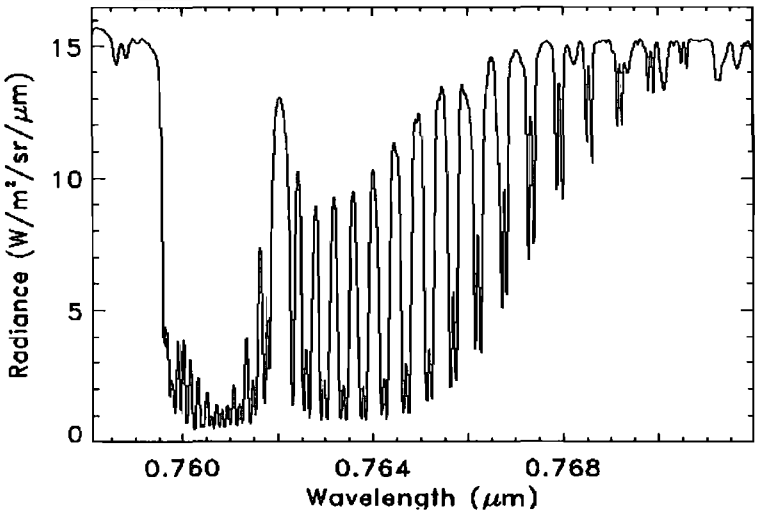
- Additional Accomplishments
  - BCA vibration test completed
- Near Term Plans
  - EMC/EMI testing in late Oct
  - Vibe testing in first half of Nov
  - T/V-2 tests starting in early Dec

OCO First Light Spectra Meet Design Specs (1/3)

First Light Solar Spectrum recorded with OCO flight instrument 9/2/07
O2 A-band

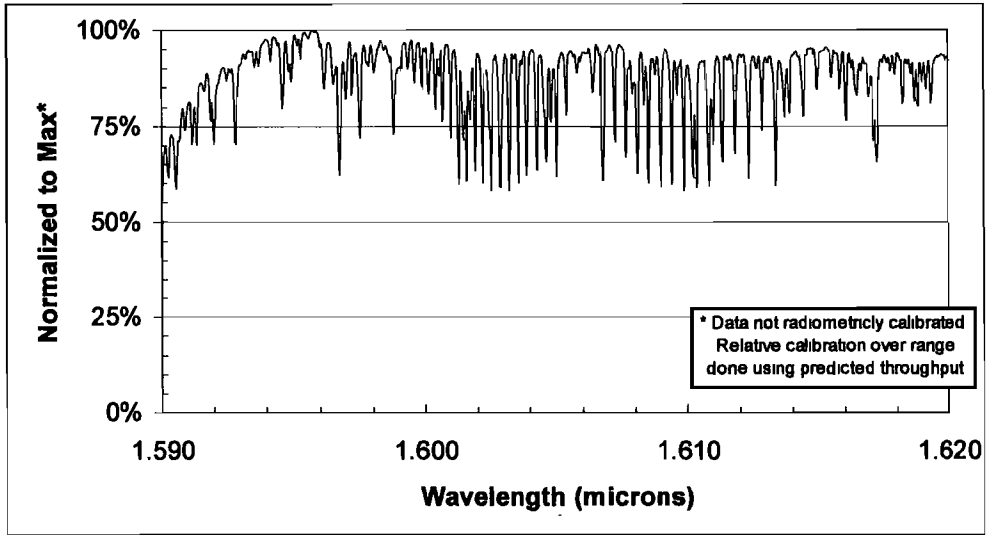


Simulated spectrum for the OCO flight instrument design from the Step-2 proposal, Feb 2002

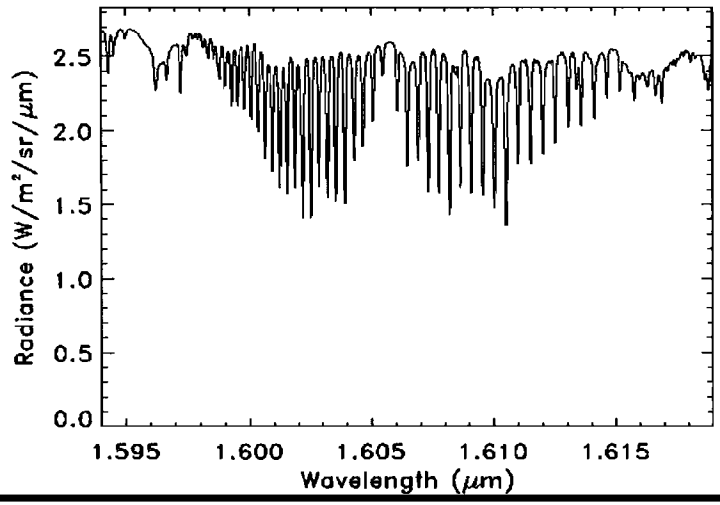


OCO First Light Spectra Meet Design Specs (2/3)

First Light Solar Spectrum recorded with OCO flight instrument 9/2/07
Weak CO2 band

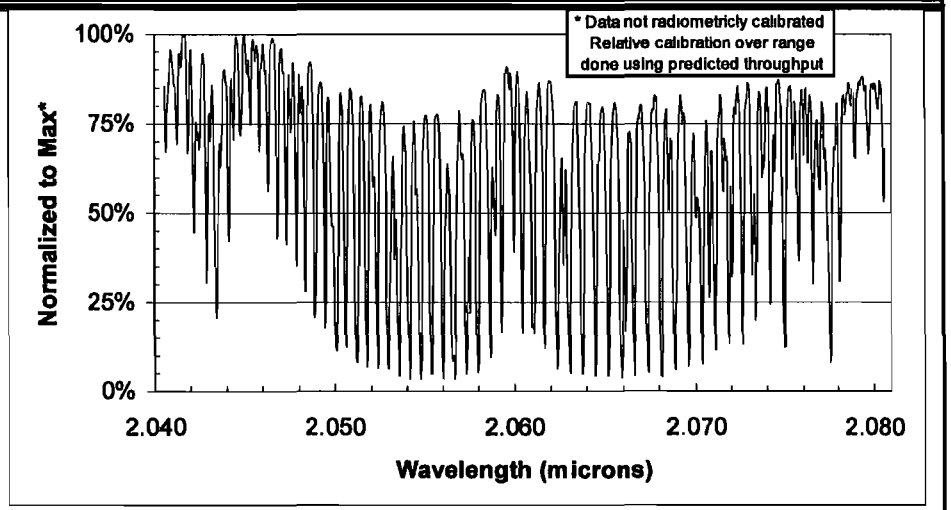


Simulated spectrum for the OCO flight instrument design from the Step-2 proposal, Feb 2002

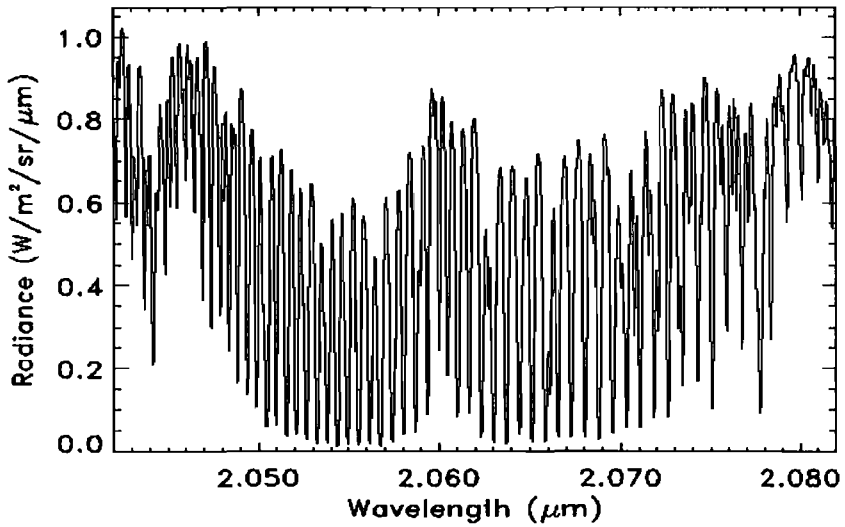


OCO First Light Spectra Meet Design Specs (3/3)

First Light Solar Spectrum recorded with OCO flight instrument 9/2/07
Strong CO2 band



Simulated spectrum for the OCO flight instrument design from the Step-2 proposal, Feb 2002



Spacecraft Recent Accomplishments

Planned Date	Completed Date	Status / Description
30 Jul 07	31 Aug	Receive X, Y, Z, and Skew RWAs (Reaction Wheel Assemblies)
20 May 07	11 Sep	Receive MIMU (Miniature Inertial Measurement Unit)
20 Jul 07	24 Sep	Receive X-Band Transmitter
31 Aug 07	24 Sep	Receive SADA 1,2
9 Aug 07	28 Aug	Integrate core electronics (APE, CEU, PRE)
12 Aug 07	28 Sep	Receive SSR
12 Aug 07	05 Oct	Receive S-Band Receiver and Transceiver
15 Sep 07	11 Sep	Receive DSN Filter
13 Aug 07	5 Sep	Integrate battery (Electrical)
5 Sep 07	7 Sep	Integrate RWAs (Mechanical & Electrical)
7 Sep 07	11 Sep	Integrate TAM (Mechanical & Electrical)
11 Sep 07	17 Sep	Integrate MTBs (Mechanical & Electrical) Y-axis mechanical only
20 Sep 07	18 Sep	Integrate DSN Filter (Mechanical)
18 Sep 07	19 Sep	Integrate CSS (body mounted cells)
5 Sep 07	20 Sep	Integrate MIMU (Mechanical & Electrical)
24 Sep 07	08 Oct	Integrate Star Tracker (Mechanical & Electrical)
24 Sep 07		Solar Array Pre Ship Review
1 Oct 07		Integrate Propulsion Module and Y axis MTB
10 Oct 07		Integrate RF components (S-Band, X-Band, SSR, DSN Filter)
15 Oct 07		Integrate SADE, SADA #1 and SADA #2

Spacecraft Integration Status

Component		At OSC	HRCR Complete	Mechanical Integration	Electrical Integration
Structure		■	■	■	
Harness		■	■	■	
APE		■	▨	■	■
CEU		■	▨	■	■
PRE		■	■	■	■
Fuse Assembly	NF	■		■	■
	F	■			
TAM		■	■	■	■
MTB	X	■	■	■	■
	Y	■	■	■	
	Z	■	■	■	■
B-Wheel	X	■	■	■	■
	Y	■	■	■	■
	Z	■	■	■	■
A-Wheel	NF	■		■	■
	F				
Star Tracker		■	■	■	■
MIMU		■	■	■	■

Component		At OSC	HRCR Complete	Mechanical Integration	Electrical Integration
GPS		■	■	■	■
Prop Module		■			
CSS	B	■		■	■
	SA	■			
Battery		■	■		■
DSN Filter		■		■	
X-Band		■		■	
S-Band	R	■			
	TR	■			
SSR		■	■	■	
SADE		■		■	
SADA	#1	■		■	
	#2	■		■	
Solar Array	#1				
	#2				
HDRM	#1				
	#2				

Not Applicable ■ Complete ▨ Review Held

- **A-Wheel delivery: 7 November**
- **Solar Array and HDRMs delivery: mid November, date expected next week at FRB**

MOS Recent Accomplishments and Future Plans

Planned Date	Completed Date	Status / Description
24-Aug-07	14-Sep-07	Deliver GDS Build 1.3 for I&T
02-Sep-07	02-Sep-07	First atmospheric spectra from instrument recorded & analyzed
13-Sep-07	13-Sep-07	Project Algorithm Status Meeting
21-Sep-07	est. 12-Oct-07	Complete EDOS MOU
30-Sep-07		Approve OCO Project Service Level Agreement (PSLA) update
01-Oct-07		Flight Rules/Constraints (initial release as standalone document)
24-Oct-07		Support ESMO MOWG

- The project is assessing the cost, schedule, and risks resulting from a NASA HQ-directed change to use the GSFC distributed active archive center (DAAC) rather than the JPL Physical Oceanography DAAC (or PODAAC)

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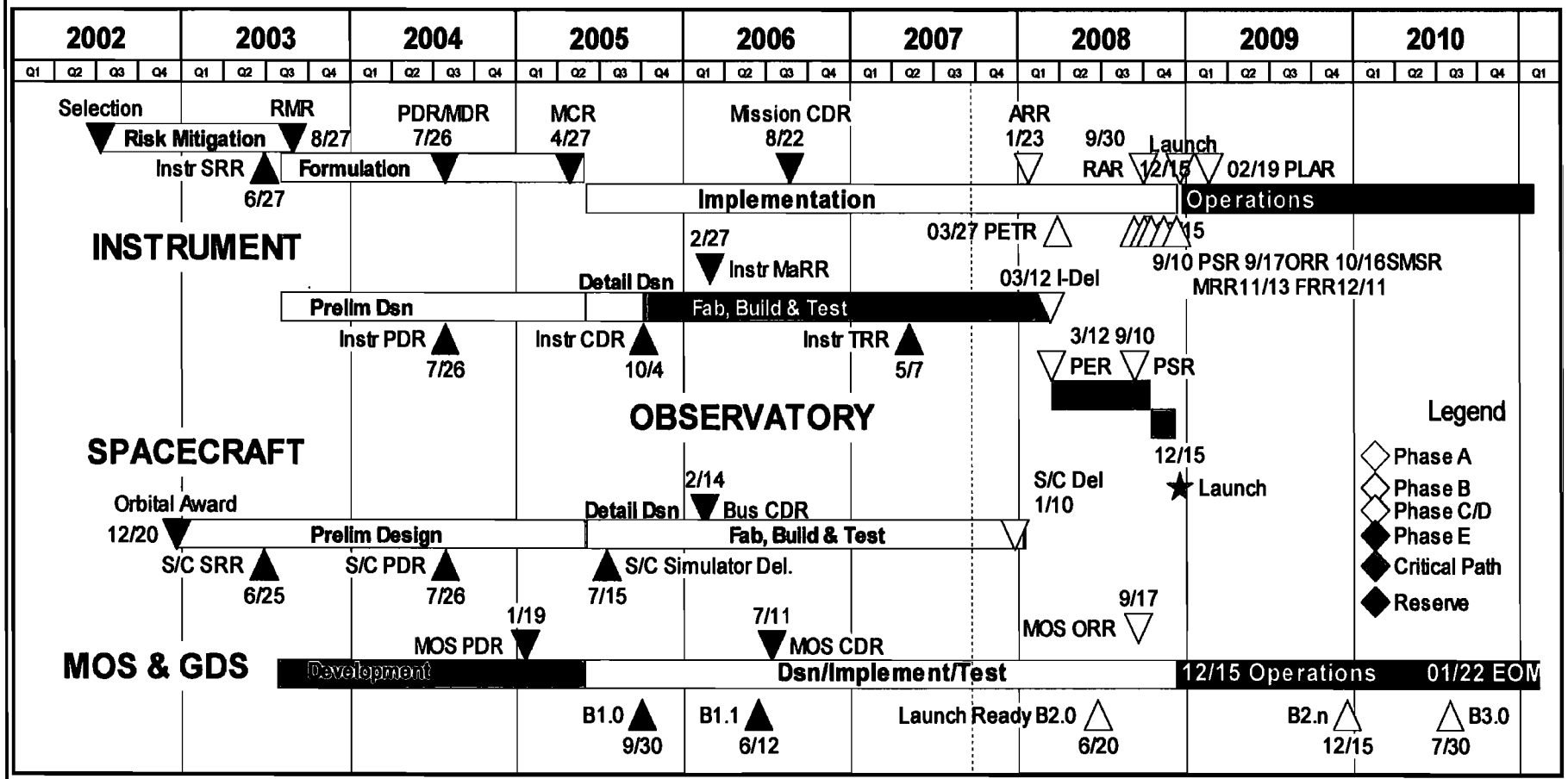
Project Top Level Schedule



Rev

Status Summary

- The spacecraft I&T effort at Orbital continues and is going well
- The Instrument mechanical integration team has been augmented with additional personnel to allow 7-day workweeks leading up to Instrument thermal vacuum test # 2 in December
  - Full-court press to hold schedule
- The project is holding schedule for a December 2008 launch

End of File