National Aeronautics and Space Administration

JWST Program Office

Astrophysics Subcommittee
February 23, 2012

Implementing the New Baseline

- Completed the replan (9/23/2011) with an October 2018 launch date
  - Plan has adequate cost and schedule reserves consistent with ICRP recommendation
  - Additional $44M in FY11 was approved by Congress
  - FY12 budget approved by Congress with full funding for JWST
  - FY13 PBR fully funds the new baseline
- Recent Accomplishments
  - All flight optics have been cryo tested and meet requirements
  - Completed the Aft Optic System integration and alignment
  - Primary Mirror Backup Support Structure center section nearly complete (94% of bonding is complete)
  - Sunshield full scale Engineering Development Unit for layer #3 testing completed with good results
  - Instrument deliveries to GSFC begin in Spring 2012
- Brought back in work with additional FY11 funding and FY12 budget
  - Accelerated: Backplane Support Frame (BSF) by 4 months, completion of PMBSS by 4 months, start of Wings by 18 months, end of Flight Optics Integration by 4 months
  - Still have 13 month of funded schedule reserve on critical path
- Instrument deliveries slipped moving ISIM delivery to OTIS by 5 months (31 months to 26 months)
  - Even with Detector change out, still have 11 months slack for ISIM delivery to OTIS
  - ETUs for NIRSpec and NIRCam will be used in ISIM Cryo Test 1(all have flight hardware for CT 2+3)

JWST made great progress in FY11 and continues to do so in FY12**, achieving milestones within cost and schedule and executing to the** new baseline

JWST Budget

Table 1a: JWST Development Cost and Schedule

Project	Base Year	Base Year Development Cost Estimate ($M)	Current Year	Current Year Development Cost Estimate ($M)	Cost Change (%)	Key Milestone	Base Year Milestone Date	Current Year Milestone Date	Milestone Change (months)
James Webb Space Telescope	2009	2,581.1	2011	6,197.9	140%	Launch Readiness	06/2014	10/2018	52

Table 1b: JWST Life-Cycle Cost

Budget Authority ($millions)	Prior	FY 2010 Actual	FY 2011 Enacted	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	BTC	LCC Total
Revised Profile	2,552.3	461.4	515.3	527.6	627.6	659.1	646.6	621.6	2,223.6	8,835.0

Enacted Nov, 2011
(includes CoF funding)

President's FY13 requested amounts
(FY2017 level is $571.1M)

Table 1a and 1b from the JWST Project Cost and Schedule Analysis Report (the Breach Report) sent to Congress in October 2011

Master Schedule

JWST Overview Schedule

2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019

FY10 | FY11 | FY12 | FY13 | FY14 | FY15 | FY16 | FY17 | FY18 | FY19

2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3 4 | 1 2 3

Major Mission Milestones

CDR 4 | TRR 3 | MOR 4 | SIR 9 | KDP-D 12 | PSR 8 | LRD 10 | ORR 4 | FRR/KDP-IV 9

Integration & Test

SC Panel Integ 4 | CCA, Prop Integ 7 | SS Integ 8 10 | SC Test | SC/OTE I&T 7 9 | Launch Site 5 9 10

JSC CH A GSE Install 2 4 | PF Install/ Test 11 | OTIS I&T 7 | 2 7

OTE

Primary Mirrors

Start EDU 3rd Cryo Test 8 | Del PF PMSA 4 | 1st Batch 9 | Last Batch 2 | 41

PF SMSS/Strut Integ 10 | PF Optics Integ 8 11 2 | 3 2

Flt Optics Integ 7 12 4 | 4 3

Flight Structure (PMBSS)

BSF Assy Start 11 | Wing Assy Start 3

Flight PMBSS 2 | OTE Structure Assy/Test 6

Sunshield

TemplateMembrane Fab 10 | Astro Tube Fab 2 9 11

MRR 4 | Flt Membrane Fab 4 | GSE Design/Fab

Flt Membrane 2

Structure Mfg & Test 6 | 12 | 12 4 | 4 8 | Integ Skeleton & Membrane 2

Spacecraft

CDR 6 | SC Panel & SC Structure 11 | SC Structure 4 3 | 4

ISIM

I &T

Start I&T 7 | PER 12 | Del Flt ISIM to OTIS 2 5 | 26

NIRSpec

ETU Del 1 | Flt Del 8

MIRI

STM Del 3 | Flt Del 4

NIRCam

ETU Del 5 | Flt Del 8

FGS

ETU Del 5 | Flt Del 6

Cryo Cooler System

Fit Check CHA 4 | Flt CHA 8

ETU CCES/CELS 10 | CCA Mock-up 10 | Flt CTA 2 | Flt CCA/CCE 1 | Flt CCA/CCE (Spares) 7

Ground Segment

CCTS Build 2.3 4 | CCTS Build 2.4 1 | CCTS Build 2.5 9 | Begin End-to-End Grnd/Flt Seg Testing 10 | Comissioning 10 4

Launch Segment

Safety Submittal 2 8 | LV Lift Performance Verified 12 | Flight Adapter Fit Check 10 | CLA6 4 7

Safety Submittal 3 | RAMF | Ariane Adapter 11 | DCI Release 2 (Final) 5 6 7 | Flight Adapter & Shogun Equip 3 | CLA7 9 12 | CLA8 4 7 | LV Readiness Review (RAV) 9

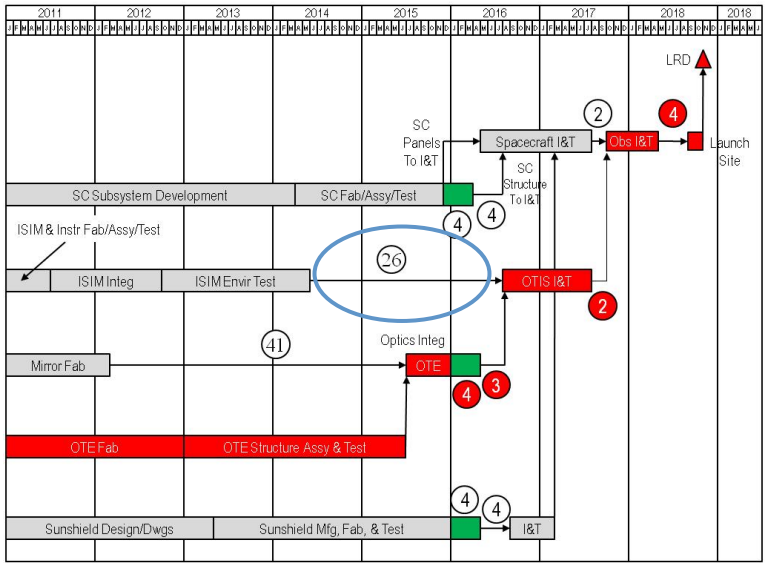
After testing of replacement detectors, the ISIM flow will be updated to show the detector change-out strategy.

13 Months of Funded Critical Path Slack
- 6 Months at Observatory I&T
- 3 Months at OTE I&T
- 4 Months of Embeded Slack in OTE Activities

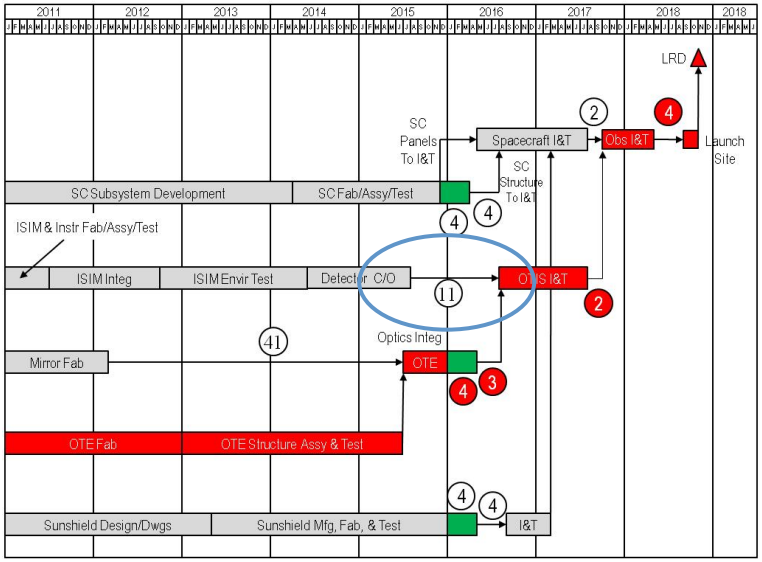
REV -

Notional Detector Swap Out Schedule Impact

Schedule Reflecting Instrument Slips



Schedule Reflecting
Instrument Slips/Detector Swap Out

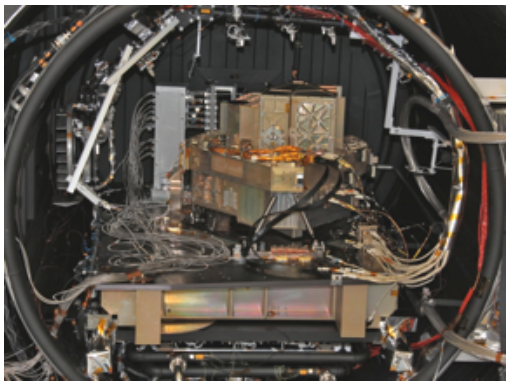


- **Risks against remaining "notional" 11 mos. "schedule bath tub" include**
  - **Instruments are not yet delivered**
  - New detectors delayed from Teledyne
  - **Unexpected problems during ISIM integration**
  - **Complexity and scope of the ISIM cryo test program**
  - **Unexpected problems during detector change out and retest**
  - Facility conflicts at GSFC with other projects

- **Additionally, project working closely with NGAS to accelerate OTE schedule to provide more schedule flexibility during OTIS testing – makes maintaining the current near term ISIM testing a necessity**

Recent Hardware Progress

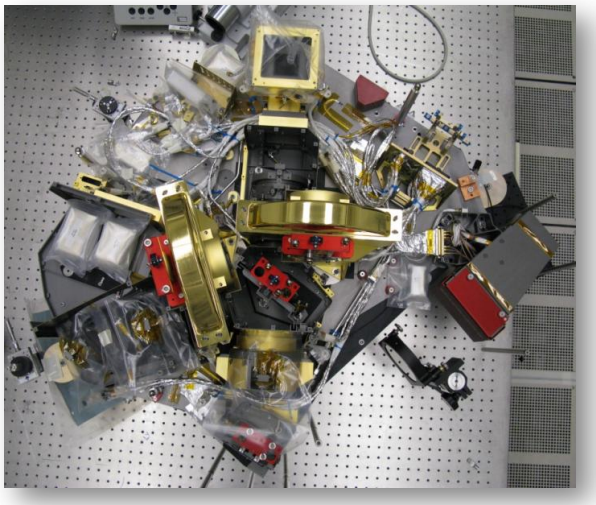
Sunshield Layer 5 Test Unit



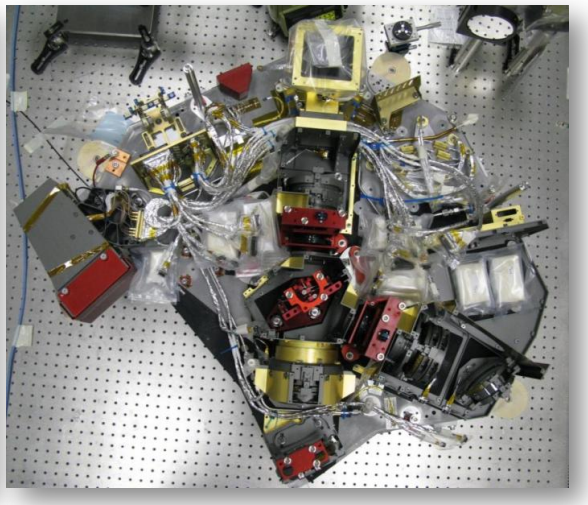
CSA's Fine Guidance Sensor
leaving its 85 day cryo test

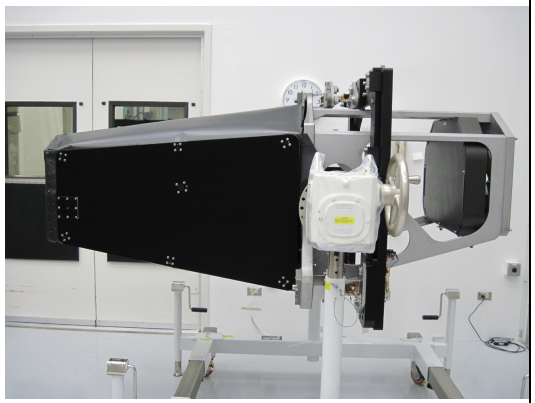
NIRCam

Module A

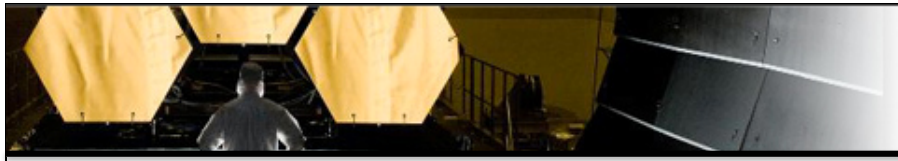


Module B





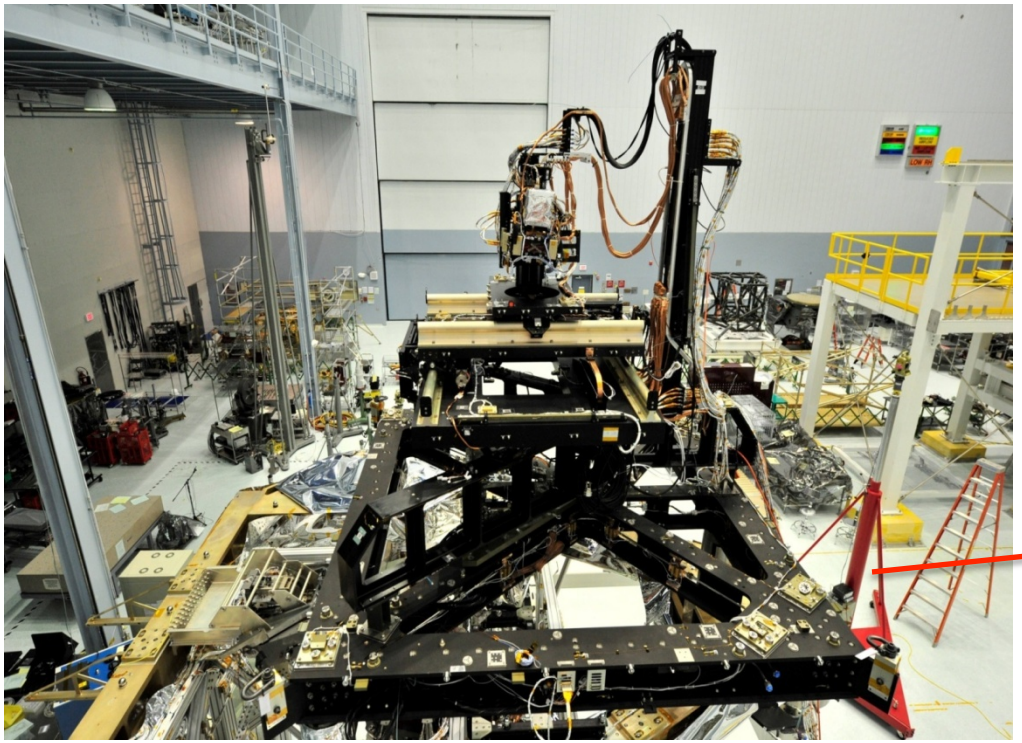
Flight Aft Optics
System ready for test



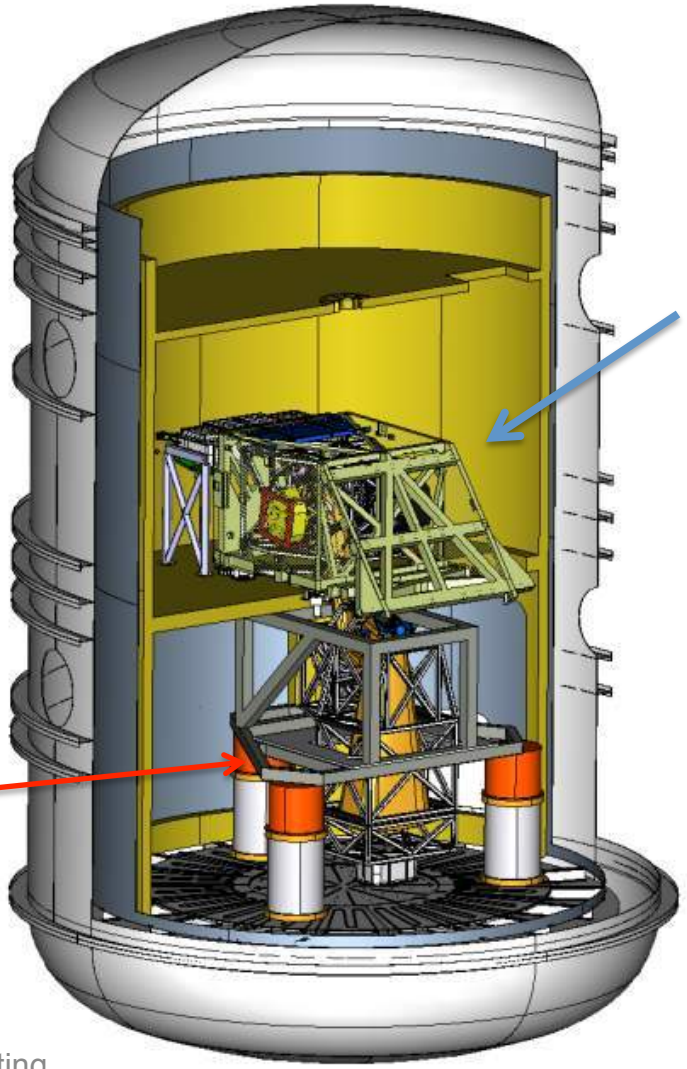
Optical telescope element Simulator (OSIM) Integration

Status as of: 1/31/12

Beam Image Analyzer atop the OSIM



Space Environment Simulator Chamber at GSFC



JWST FY12 Milestones (1 of 2)

Month	Milestone	Comments
Oct '11	Begin construction of 140,000-lb robotic facility to build segmented main mirror at GSFC	Assembly began 10/4
Nov '11	Complete electronics simulator model for Integrated Science Instrument Module ("ISIM") Deliver tools for software development environment and verification	Completed 11/15 Completed 10/27
Dec '11	Install Helium shroud floor at Johnson Space Center thermal vacuum chamber ("JSC TVC") Determine root cause of NIRSpec optical bench flaw	Completed 10/26 Completed 12/15
Jan '12	Conduct Critical Design Review for Spacecraft-to-Optical Telescope Element vibration isolation system Finish building Center of Curvature Optical Assembly ("COCOA") for testing primary mirror in JSC TVC Review preliminary requirements for ground structure for spacecraft equipment panels Complete Aft Optic System integration and alignment Update Program Plan and Program Commitment Agreement to reflect replan	Completed 12/15 Completed 1/13 Completed 12/1 Completed 12/2 Completed 1/28
Feb '12	Complete assembly and initial testing of main mirrors at Marshall Space Flight Center Install Helium shroud walls at JSC TVC	Completed 12/19
Mar '12	Complete assessment of System Engineering Team thermal margins Deliver ISIM computer #2 to ISIM integration and testing Complete analysis of JSC TVC telescope testing equipment plans	

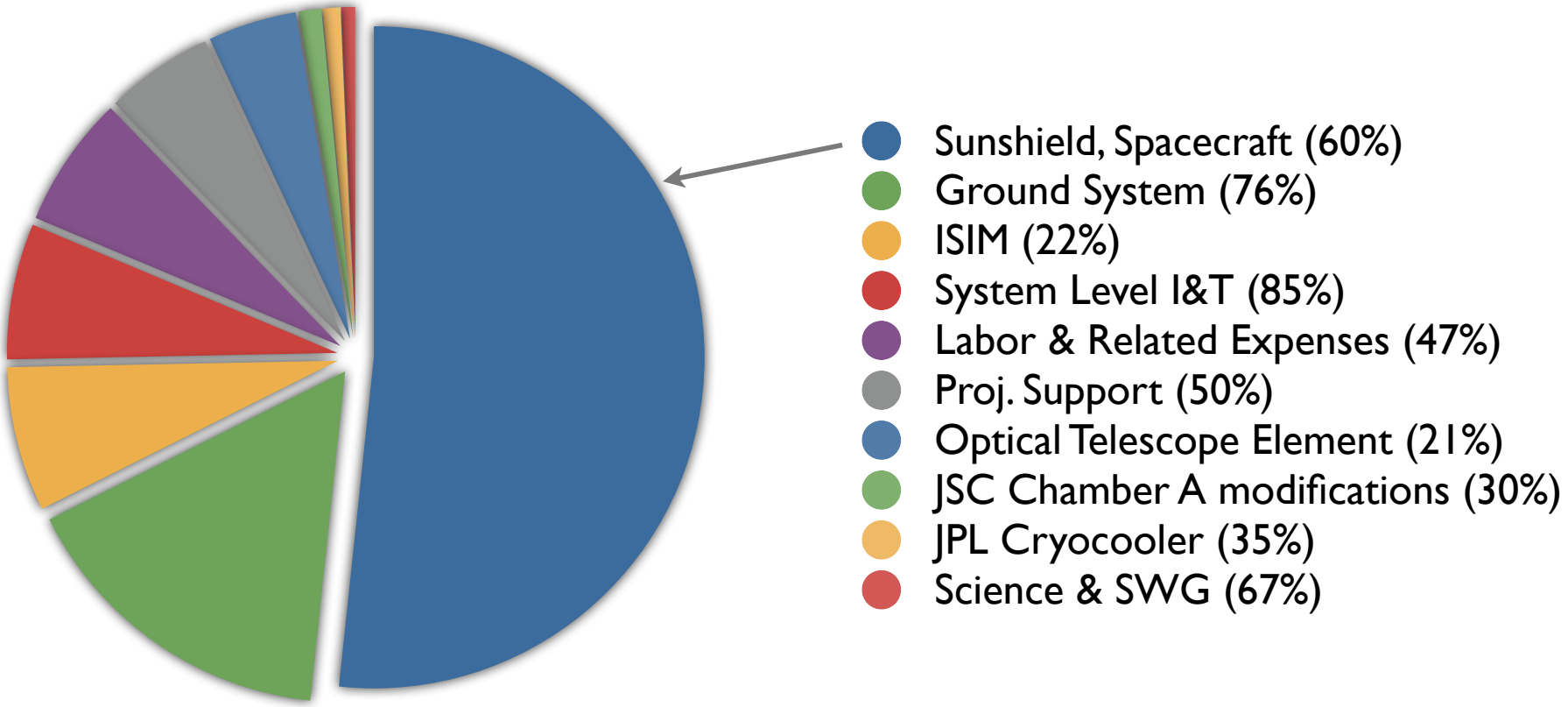
Blue indicates milestone completed ahead of schedule

JWST FY12 Milestones (2 of 2)

Apr '12	Receive Flight Mid-infrared Instrument (MIRI) from Europe, first of the telescope's four science instruments Complete Critical Design Review for Sunshield Support Structure Complete all composite parts for mechanism that lifts telescope away from spacecraft after launch (Deployable Tower Assembly)	
May'12	Finish testing the COCOA Measure Sunshield template layer 5 shape to confirm its accuracy Conduct budgetary and schedule review of initial program and project performance since completing the 2011 replan	
Jun '12	Complete modifications of JSC TVC Complete Critical Design Review for telescope-ground communications system Complete designs for structures that will hold telescope inside JSC TVC Complete Preliminary Design Review for equipment that tests Sunshield deployment	
Jul '12	Reach agreement with Program Office on FY13 spending plan Deliver Flight Fine Guidance Sensor Deliver flight software to ISIM Integration and Testing ("ISIM I & T") Complete Solar array Preliminary Design Audit Deliver MIRI Cryo Cooler "Cold Head Assembly" (critical component of MIRI cooling) to ISIM I&T Complete fabrication of end fitting for Secondary Mirror Support Structure	Flight CHA to be delivered in June 2013. No impact, work around in place.
Aug '12	Order remaining JSC thermal vacuum chamber vibration isolators	
Sep '12	Deliver NIRCam, the second of the telescope's four science instruments Deliver telescope simulator for ISIM I&T Start testing of cryogenic camera system, used for subsequent JSC I & T Complete center section of Backplane Support Structure for main mirror Deliver NIRSpec, the third of the telescope's four science instruments	Delivery date moved to 2/13. No impact to, work around in place.

Work-To-Go

FY12 to Launch and Commissioning



Relative proportion of project funding to-go

% work on this element to-go