National Aeronautics and Space Administration

JWST Program Office

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JWST Program Director

Briefing to the APS
April 17, 2013

Staying Focused

Focus on

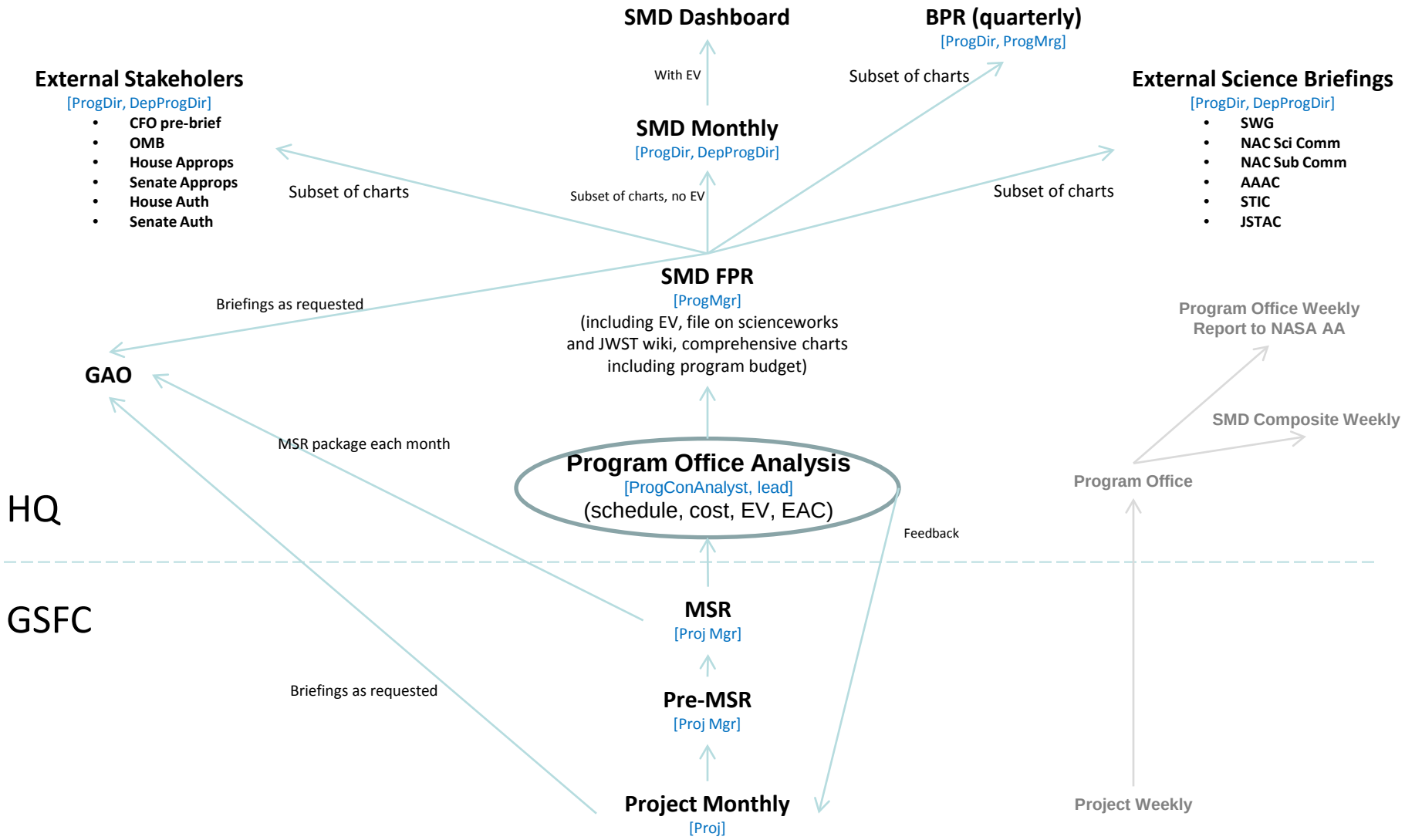
- Execution: Do what we said we are going to do – and where possible, better
- Communication: Maintain and increase open communications with NASA senior management, partners, customers and stakeholders
- Education: Highlighting the tremendous science returns we will achieve from JWST

- **Execution: Know where we are now and project ahead**
  - Tight teamwork between Program and Project Office – Clearly understand and respect the roles
  - Develop the PP&C capability for the HQ Program Office partnering with GSFC Code 400 for an integrated evaluation capability for the day-to-day (monthly) monitoring/assessment/and projection capabilities
    - Both GSFC and HQ see the data at the same time
  - Increase the technical capability in support of the HQ Program Office for targeted opportunities
  - Series of daily, weekly, monthly, quarterly interchange meetings
- **Communication: Maintain open communications with partners, customers and stakeholders**
  - Standardize the messaging focusing on key swing point issues for a consistent message with NASA Senior Management, Hill, OMB, OSTB, etc
  - Senior Executive quarterlies with senior leadership with contractors, Centers, and HQ
  - Close coordination of the integrated Program assessment with senior management working with all HQ oversight organizations.
  - Establishment of HQ level milestones reported to stakeholders
  - All-hands with Centers and contractors
  - Quarterly tag ups with International Partners
  - Deputy Program Director oversees the communication planning ensuring an integrated message leading to a crescendo at launch
- **Education: Highlighting the tremendous science returns we will achieve from JWST**
  - Partner with the outreach office and NASA Chief Scientist for Agency strategic messaging related to science

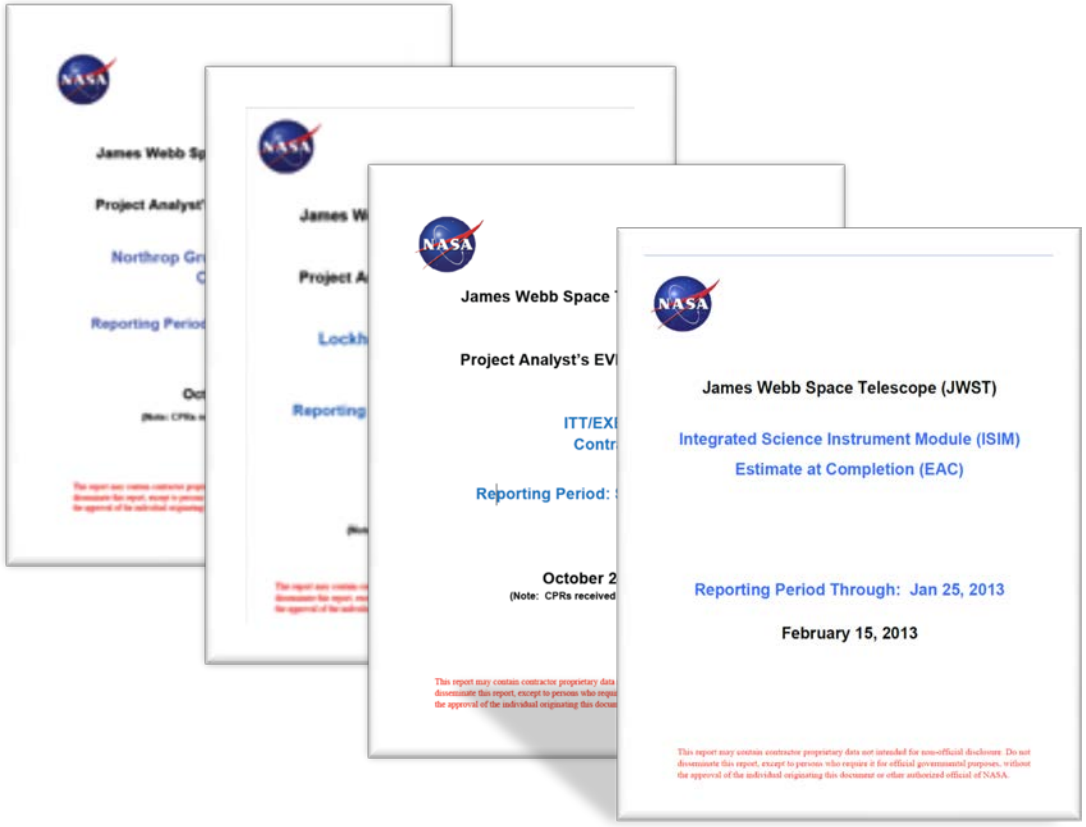
Keeping our Partners and Stakeholders Informed

- Daily tag-ups with the Project Manager (Program Manager)
- Weekly or more meetings with NASA AA and SMD AA (Director/Deputy Program Director)
- Weekly meetings/telecons with GSFC Project Manager (Program Director/Program office)
- Weekly meetings/telecons with GSFC Center Director (Program Director)
- Weekly tag ups with APD Director (Director/Deputy Director)
- Weekly telecons with project science team (Deputy Director)
- Monthly Flight Program Review with SMD (Program Office)
- Monthly meetings with AURA, Inc. (Director/Deputy Program Director)
- Monthly presentations to OMB/OSTP with more detailed quarterly briefings (Director/Deputy Program Director)
- Quarterly briefings to House authorization committee staff, House appropriations staff, Senate authorization committee staff, Senate appropriations staff (Director/Deputy Program Director)
- Quarterly presentations to the NAC Science Committee, and scientific groups such as; SWG, AAAC, STIC, JSTAC, etc. (Director/Deputy Program Director)
- Senior Executive Quarterly meetings with Center Director, NGAS VP, LM VP, other senior members of industrial team (NASA AA, Director/Deputy Program Director, Program Manager)
- Quarterly (or as needed) telecons/meetings with ESA and CSA directors (Program Director)
- All-Hands with Centers and Contractors (Director/Deputy Program Director, Scientists)

JWST Program and Project Data and Analysis Flow
Internal and External Interactions



Cost/Schedule Metrics



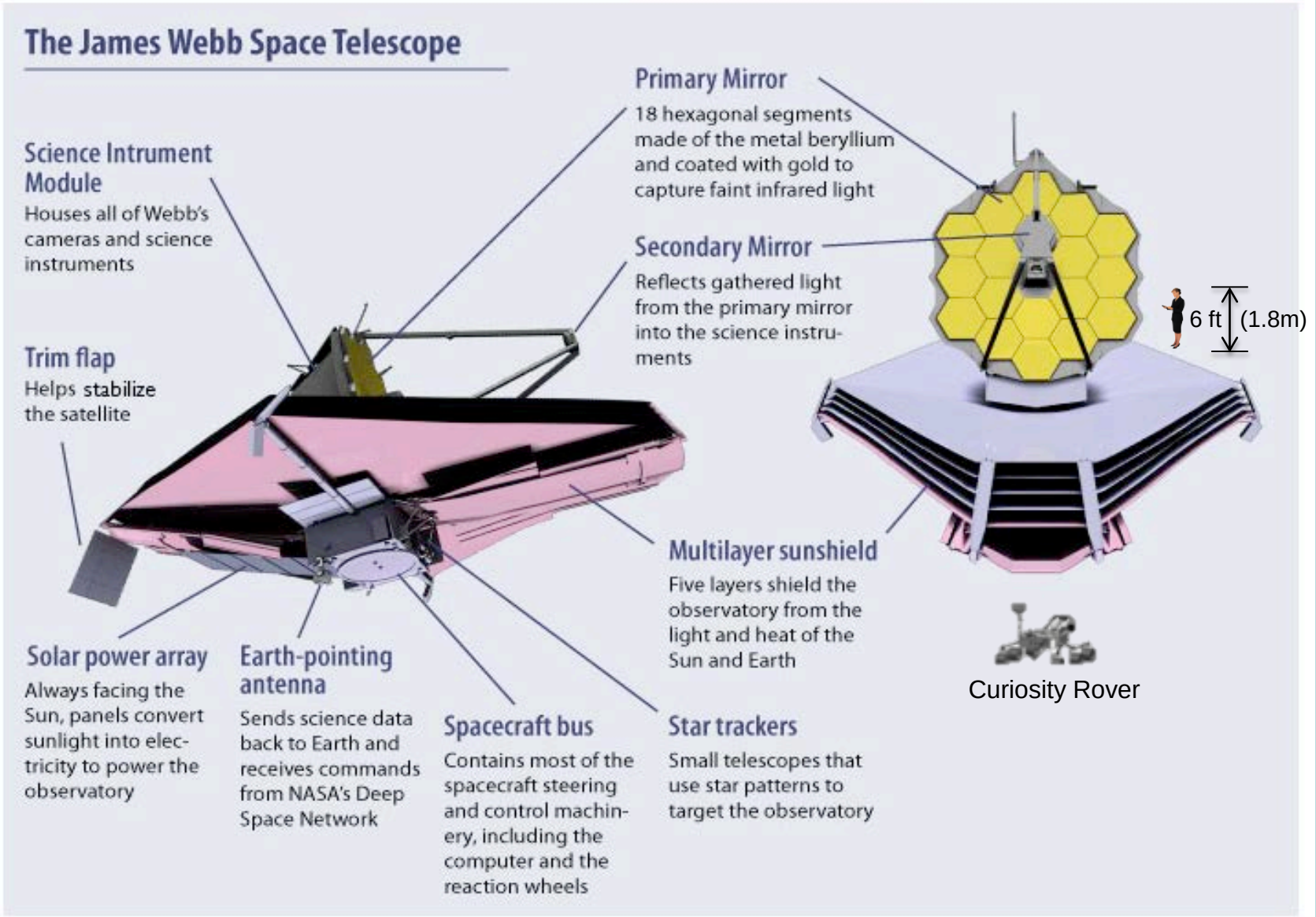
Cost metrics: CPI, TCPI, Cost variances, Budget-at-complete, management reserve, burn rates, *etc.* (>20 in total)

Schedule metrics: schedule variances, logical consistency, leads, lags, constraints, float, missed tasks, critical path index, tripwires, *etc.* (23 in total)

☛STScI prototype metrics under test.

Tracking good performance and forecasting problem areas

Observatory Overview

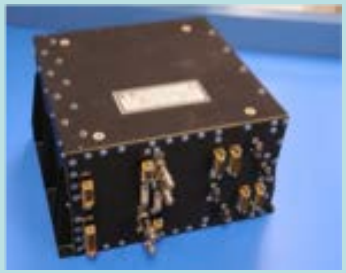


JWST 2013 Progress

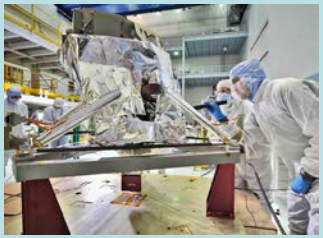
Spacecraft


Sunshield Template


Folded Sunshield Template


Solid State Recorder

Science Instruments

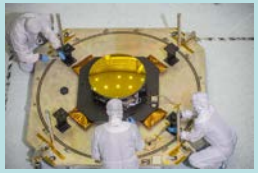

MIRI


FGS/NIRISS


NIRCam


NIRSpec

Telescope


Secondary Mirror

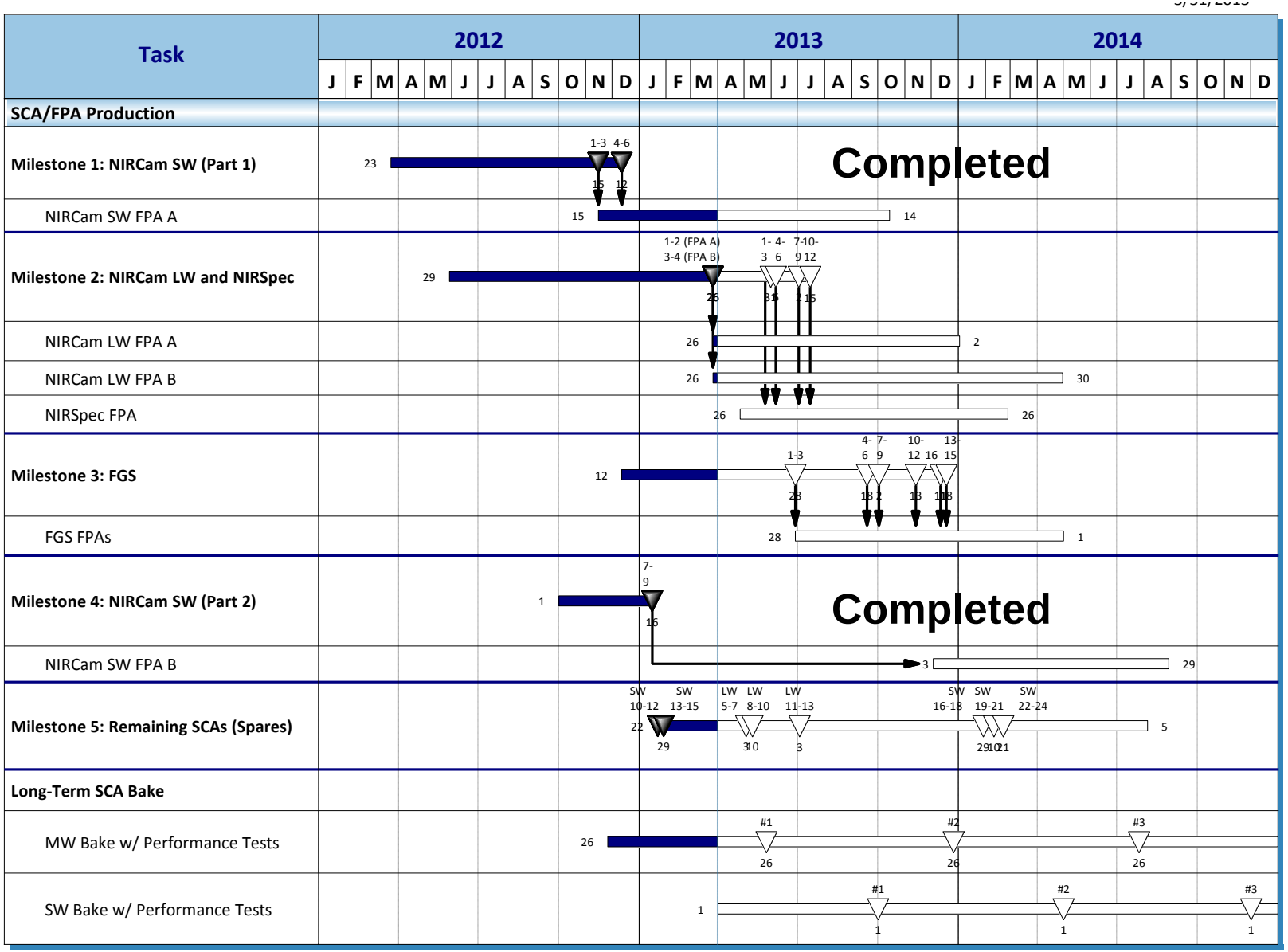

Aft Optics System


Primary Backplane Center Section


Primary Wings

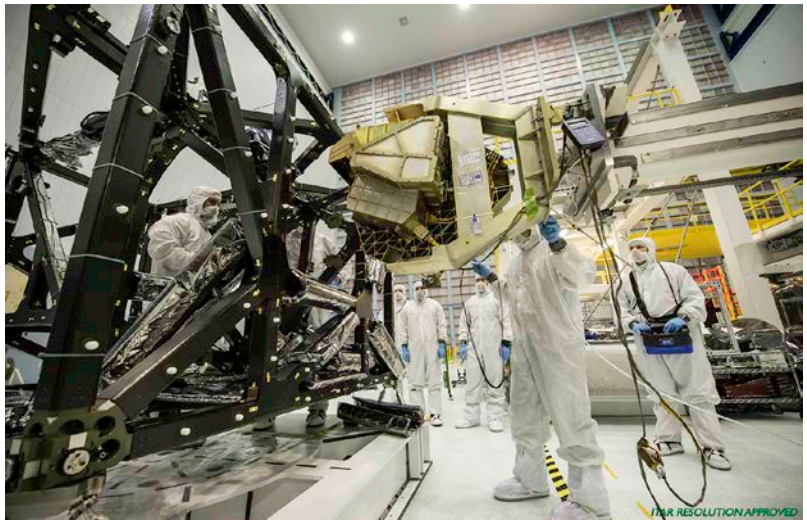

Primary Mirror Segments

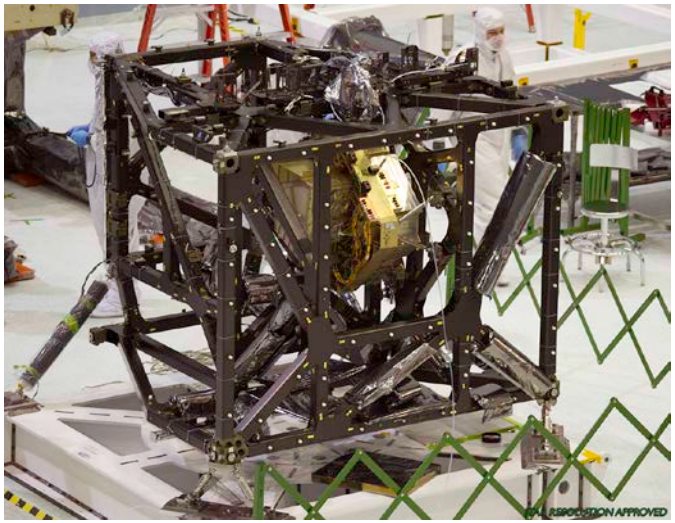
NIR SCA and FPA Fabrication Summary



ISIM I&T Status

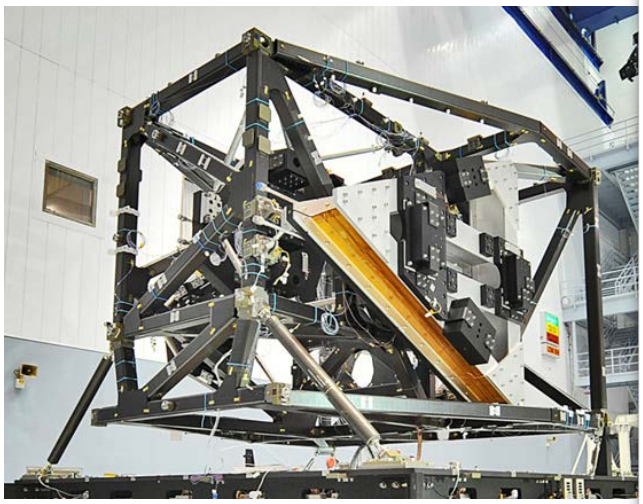
Completed Flight FGS installation onto ISIM Structure



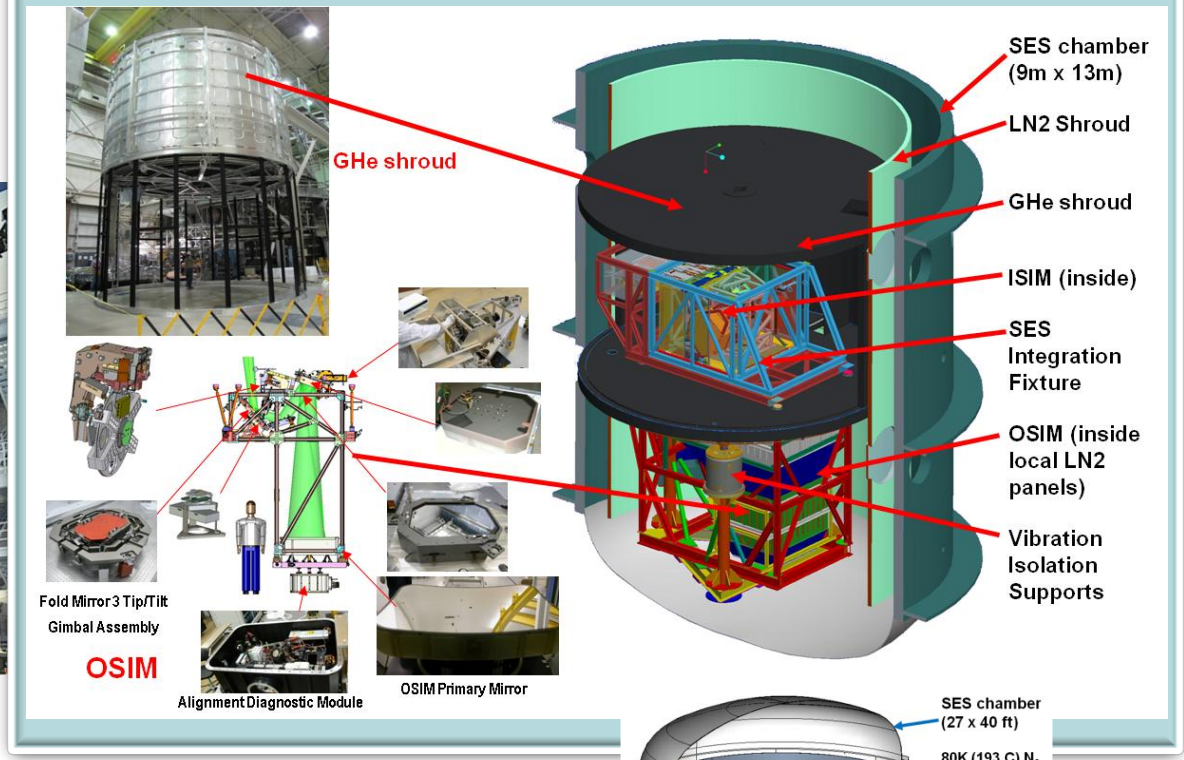


Integration of the Integrated Science Instrument Module (ISIM) Is Well Underway

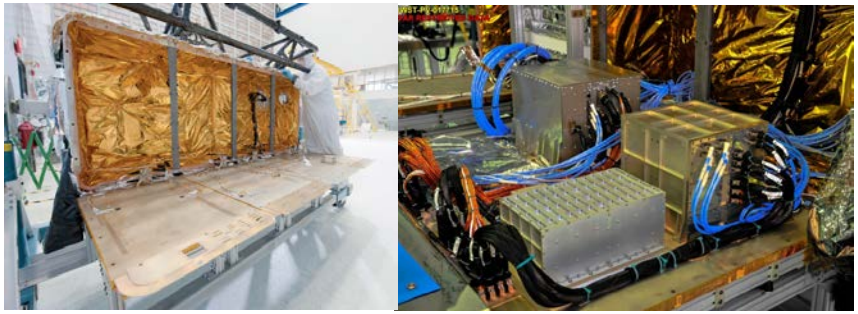
ISIM Structure

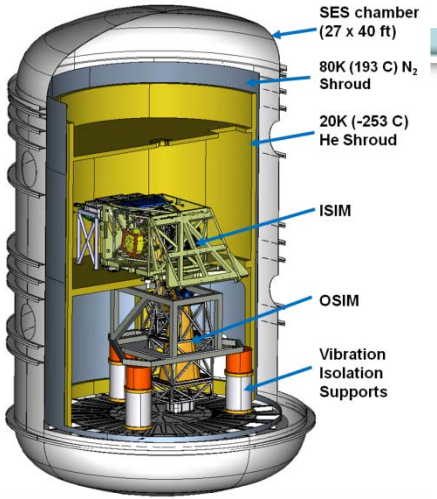


Space Environment Simulator Chamber at GSFC



ISIM Electronics





Integrated Testing of the Instruments and Optics

Chamber A at the Johnson Space Center

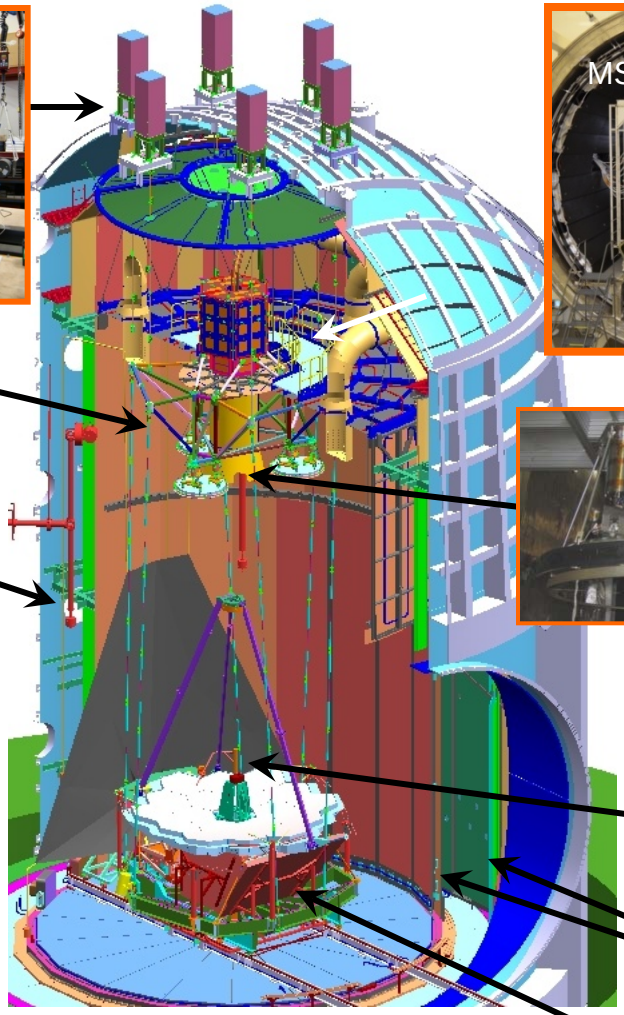
Boilerplate Apollo S/C 008 in Chamber A with side-sun solar

http://www.nasa.gov/mission_pages/webb/news/chamber-a.html

OTIS Test and Subsystems Progress and Status

Chamber Isolator Units
- Isolators Assembled
- Testing will start this month

Hanging Configuration
- HOSS and USF Weldment Fab started, machining and welding has started
- Telescope Rods rough machined and heat treated for stress.
- Joint Qual Testing underway at CTD.



Center of Curvature Optical Assembly (COCOA)
- Multiwavelength interferometer, null, calibration equipment, coarse/fine PM phasing tools, Displacement Measuring Interferometer
  - Storage at XRCF

3 Autocollimating Flat Mirrors (ACFs)
- Piston and Tilt actuation
  - Test Chamber re-configured
  - Mirrors are queued for processing

Cryo Position Metrology (CPM)
- Completed CDA – working Actions
- Absolute Distance Measurement (ADM) on HOSS – design effort started

Space Vehicle Thermal Simulator (SVTS)
- SVTS-SRR – Review Jan. 23rd.
- Working Cryocooler and thermal interfaces

TTS – Thermal Telemetry System
- IDR – Jan 24rth
- Completed field work at JSC in Dec.

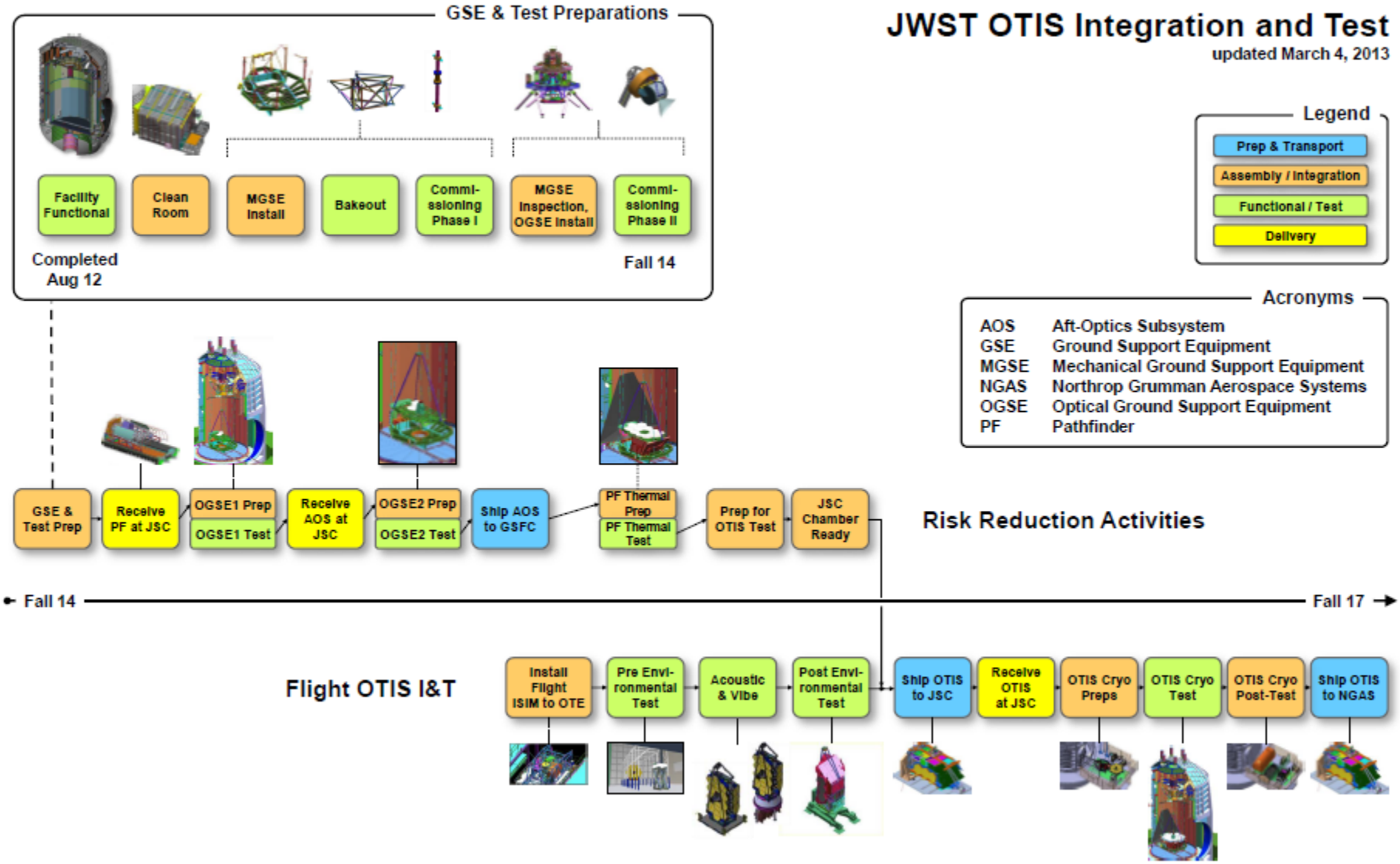
AOS Source Plate and Cable Support
- Supporting design requirements and documentation for design started

LN2 and Helium Cryogenic Shrouds and "barn door"

Deep Space Edge Radiation Sink (DSERS) – supporting structural frame design has started

http://www.nasa.gov/mission_pages/webb/news/chamber-a.html

OTIS Integration and Test



Spacecraft Critical Design Review

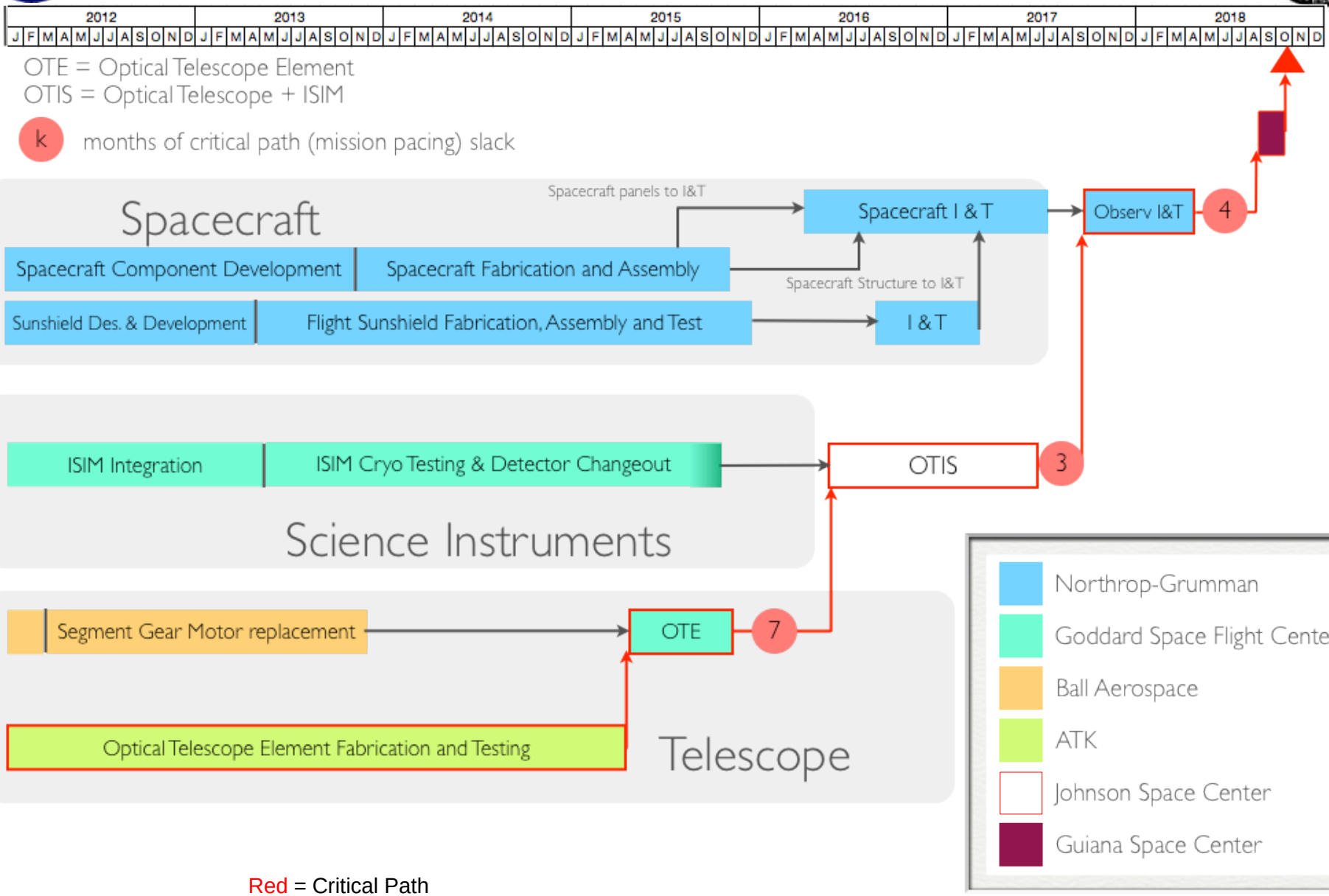
- Spacecraft is the final major element to undergo CDR (December 2013)
- JWST will need to have mass margin issue resolved ~6 months prior to CDR
- Project and NGAS on a good trajectory to solve issue
- Analyses by ESA/Arianespace to see what extra margin may be releasable by launch vehicle.

Budget

Current (FY14 Budget, FY15 guidelines) Life-Cycle Cost Estimate by Year and Phase/ Includes Program-held UFE, Indirect, Labor and CoF)

	Prior	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	CTC	Total
Total	3528.9	530.6	627.6	659.1	646.6	621.6	571.1	536.9	305.0	197.5	610.0	8834.9
Pre-Formulation and Formulation	1800.1	-	-	-	-	-	-	-	-	-	-	1800.1
Development	1728.8	530.6	627.6	659.1	646.6	621.6	571.1	536.9	228.0	47.5	-	6197.8
Operations	-	-	-	-	-	-	-	-	77.0	150.0	610.0	837.0
PY2014				658.2	645.4	620	569.4	534.9				8827.5
EPO Reduction				0.9	1.2	1.6	1.7	2				

JWST Schedule



Red = Critical Path

Milestone Performance

- Since the September 2011 replan JWST reports high-level milestones monthly to numerous stakeholders

	Total Milestones	Total Milestones Completed	Number Completed Early	Number Completed Late	Deferred to Next Year
FY 2011	21	21	6	3	0
FY2012	37	34	16	2	3
FY2013	41	14	9	3*	0

*Late milestones are forecast to complete in FY13

Fiscal 2013 Milestones

Month	Milestone	Comment
October 2012	1. Headquarters delivery to project of funding plan for fiscal 2013 2. Spacecraft batteries preliminary design review 3. Spacecraft command & telemetry computer review (Northrop internal review) 4. Second review of optical test equipment for Johnson Space Center (JSC) thermal vacuum chamber test of telescope and instruments (OTIS)	1. Completed 9/15 2. Completed 9/6 3. Completed 8/30 4. Completed 10/17
November 2012	5. Spacecraft-to-Optical Telescope Element/science instruments stray light and thermal barrier structures preliminary design review 6. Port side spacecraft equipment panel design review (Northrop internal review) 7. Complete electrical checkout of combined mid-infrared instrument (MIRI) and integrated science instrument module (ISIM)	5. Completed 10/18 6. Completed 10/4 7. Completed 11/19, 2 days of testing required in Jan. due to FSW bug (divide by zero)
December 2012	8. First engineering model of the spacecraft command and telemetry computer delivered to test bed 9. Reinstall beam image analyzer onto telescope simulator (OSIM) used in ISIM cryogenic testing 10. Complete electrical checkout of combined fine guidance sensor (FGS) and ISIM	8. Completed 11/8 9. Completed 12/19 10. Completed 12/20
January 2013	11. Aft optical system complete 12. Receive JWST carrier container to be used in moving the observatory to testing and launch sites 13. System design review of the software employed in managing all the data returned from the spacecraft to the operations center 14. Deliver MIRI cover/thermal shield to ISIM integration and test (I&T)	11. Completed 1/10 12. Completed 11/16 13. Completed 12/6 14. Dynamics and Thermal issue have delayed delivery to 4/19
February 2013	15. Secondary Mirror Support Structure I&T tooling fixture complete 16. Primary mirror backplane support wing assemblies complete 17. Spacecraft Primary Structure Manufacturing Readiness Review 18. Start cryogenic certification test of OSIM	15. Completed 2/27 16. Completed 2/19 17. Completed 1/28 18. Completed 3/14– delayed by Global Precipitation Measurement exit from SES chamber
March 2013	20. Deliver last primary mirror actuator motor electronics unit (Cryo Multiplex Unit) 21. Spacecraft fine sun sensor critical design review 22. Space Vehicle Thermal Simulator systems requirements review 23. Complete FGS & MIRI integration onto ISIM	20. Units completed, ship date is 4/26 21. Completed 1/15 22. Completed 1/23 23. FGS installed, MIRI installation delayed till Apr. to accommodate MIRI Shield to I&T delivery

Blue font denotes milestones accomplished ahead of schedule, orange font denotes milestones accomplished late.

Fiscal 2013 Milestones

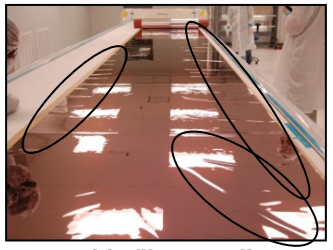
Month	Milestone	Comment
April 2013	24. Sunshield Template Membrane Layer #2 fabrication complete 25. Spacecraft-to-ground communications subsystem critical design review 26. Software build v 1.1 for the system that senses and controls Webb's active mirrors	25. Completed 3/12
May 2013	27. Telescope primary mirror backplane support fixture (BSF) assembly complete (holds ISIM, primary mirror and spacecraft together for launch)	
June 2013	28. Spacecraft thermal control system critical design review 29. Spacecraft wiring critical design review 30. Rods that suspend telescope and instruments from ceiling of JSC thermal vacuum chamber for testing complete 31. Start first ISIM cryogenic test (risk reduction activity)	31. Moved to July 2013 – delayed by Global Precipitation Measurement exit from SES Chamber
July 2013	32. MIRI detector cooling attachment (flight Cold Head Assembly) delivered to GSFC [delayed fiscal 2012 milestone] 33. Spacecraft flight software build 2.1 test readiness review	
August 2013	35. Latest acceptable date of Near Infrared Camera (NIRCam) into ISIM integration and test flow for inclusion in second ISIM cryogenic test 36. BSF/ Primary mirror backplane center section integration complete	
September 2013	37. Latest acceptable arrival of Flight Near Infrared Spectrograph (NIRSpec) for inclusion in second ISIM cryogenic test 38. Sunshield membrane cover manufacturing readiness review 39. Completion of studies and trades for mission mass margin in preparation of spacecraft critical design review 40. Complete first ISIM cryogenic test 41. JSC thermal vacuum chamber frame that holds test equipment suspended above the JWST mirror and instruments ready for painting	

Blue font denotes milestones accomplished ahead of schedule, orange font denotes milestones accomplished late.

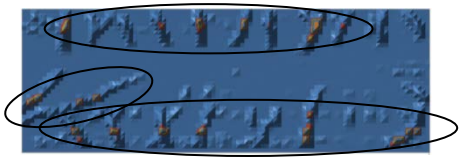
Sunshield Flight Material Edge Waviness

Sunshield Material Edge Waviness (PM&P – 1)

- Issue
  - Edge waviness discovered in Sunshield material
  - Edge waviness may prevent proper seam alignment
- Investigation Activities
  - Completed investigation activities.
    - Review of qualification creep test data under constant load at 395K and storage loads showed little movement. This does not support Creep or storage as possible root causes but does not eliminate them as a contributing causes.
  - The film casting process was determined to be the main contributor to wavy film.
  - The lack of a flatness requirement was also identified as a contributing cause.
- Corrective Actions
  - All corrective actions determined. Documentation in-work.
  - Measure material waviness before and after coating and select acceptable material
    - Flatness measurements of new Kapton E material completed and indicated a mix of flat and wavy material.
    - Sufficient material produced to select only flat film.
  - Work with Nexolve to improve kitting and seaming operations.

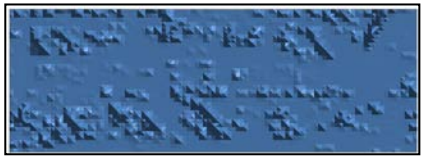


Old Not Acceptable film - 2-mil Kapton/VDA/Si

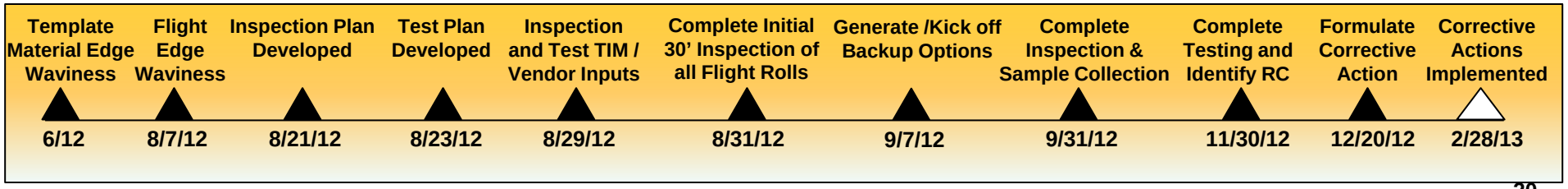


Old film with displacements up to 10 mils/in as shown in Red – Not Acceptable.

New film with displacements up to 10 mils/in – Not Acceptable.



New film displacements no larger than 2 mils/in – Acceptable.

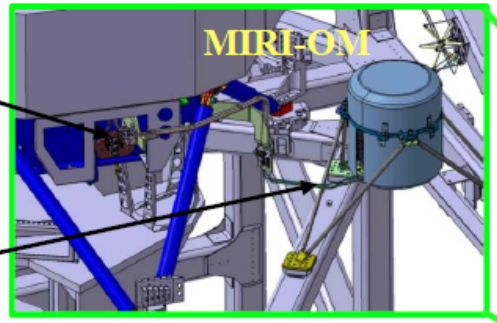


Cooler Hardware on JWST

Cold Head Assy (CHA)/Region 1

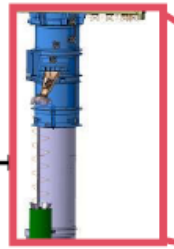
Optics Module Stage (OMS)
(6K heat exchanger)

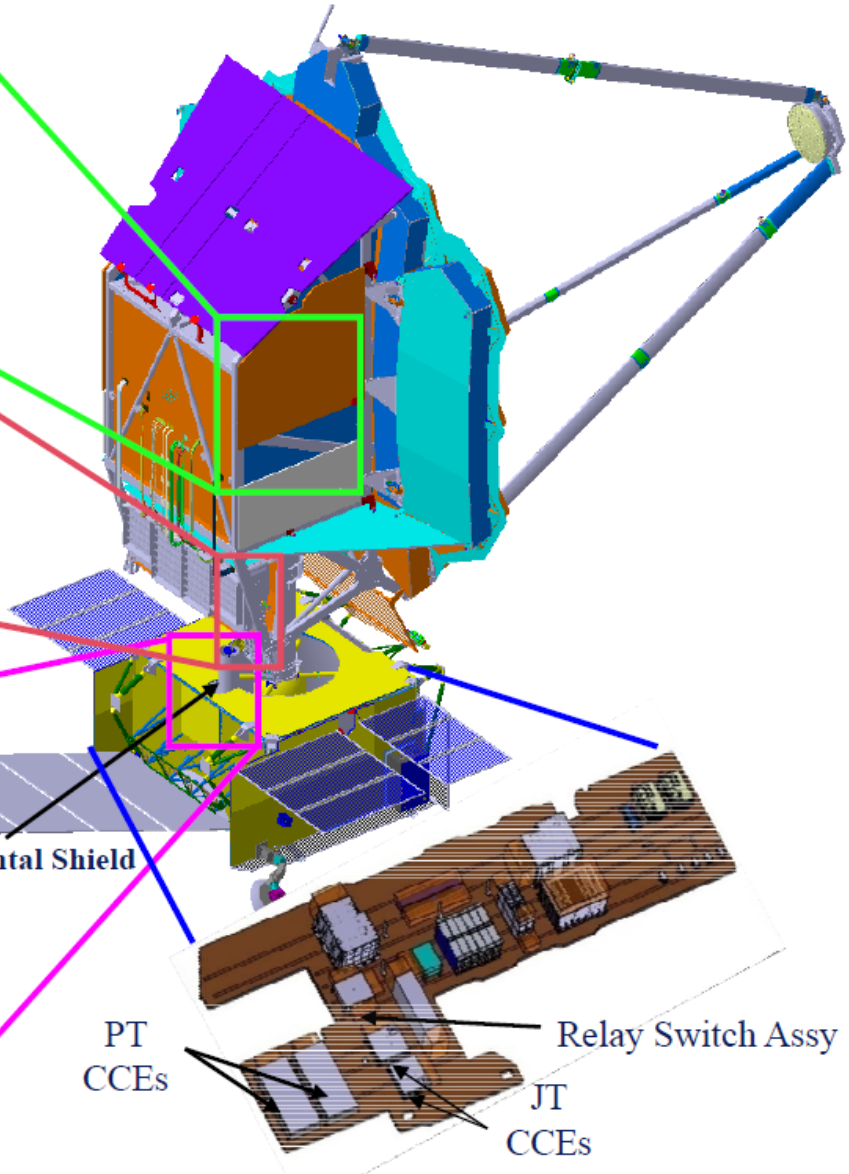
Heat exchanger Stage
Assembly (HSA)
(Recuperator, valves)



Cooler Tower Assy (CTA)/Region 2

Refrig. Line Deploy. Assy (RLDA)





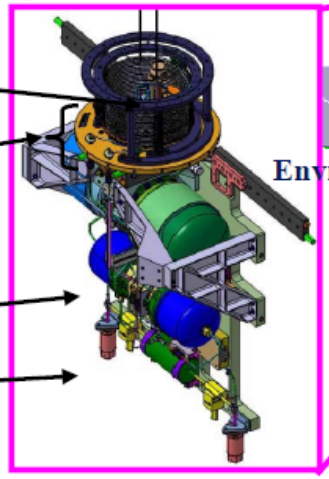
Cooler Compressor Assy (CCA)/Region 3

PT Pre-cooler
Coldhead

JT Recuperator

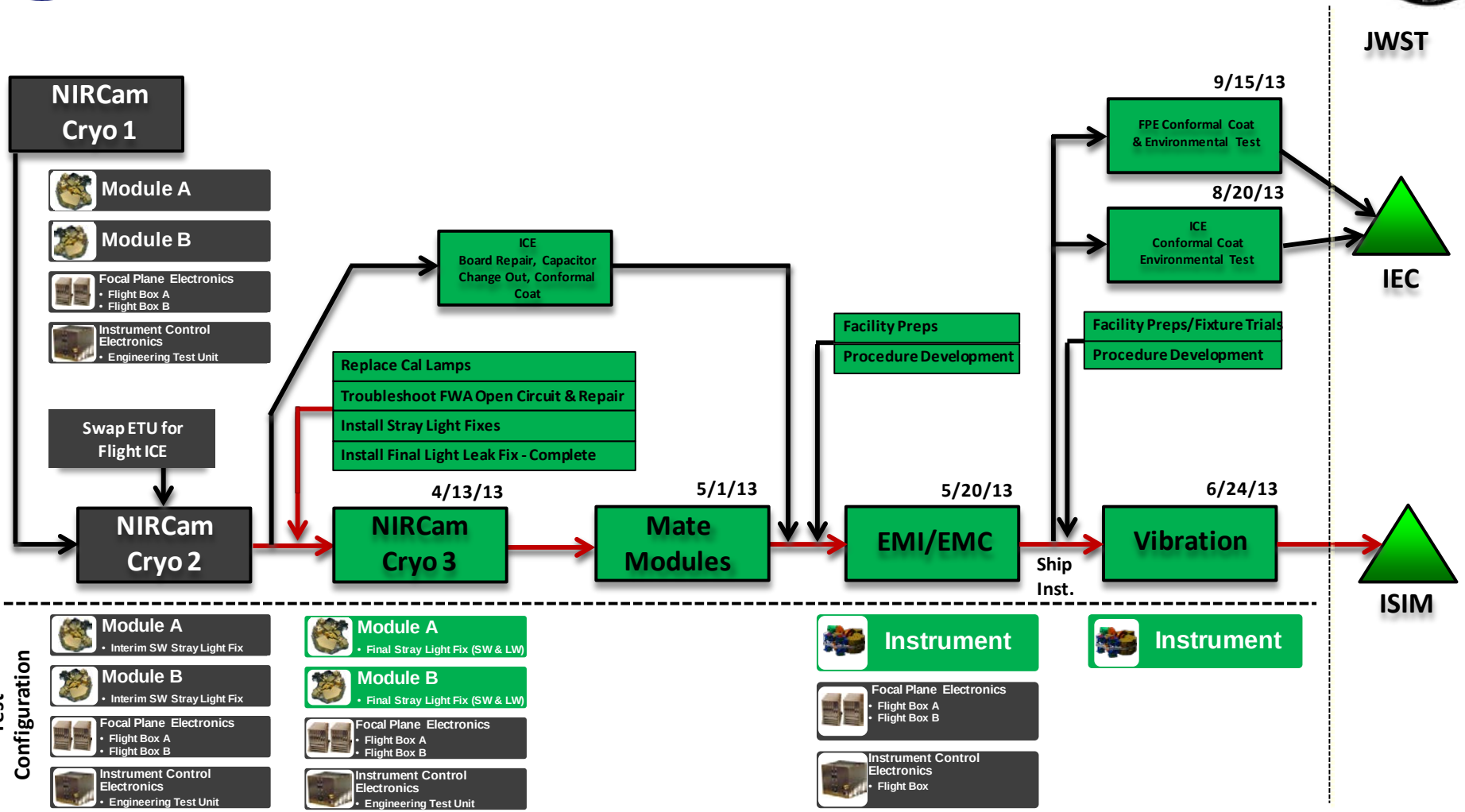
PT Compressor

JT Compressor



Cooler Control Electronics Assy (CCEA)/Region 3

NIRCam Test & Delivery Flow

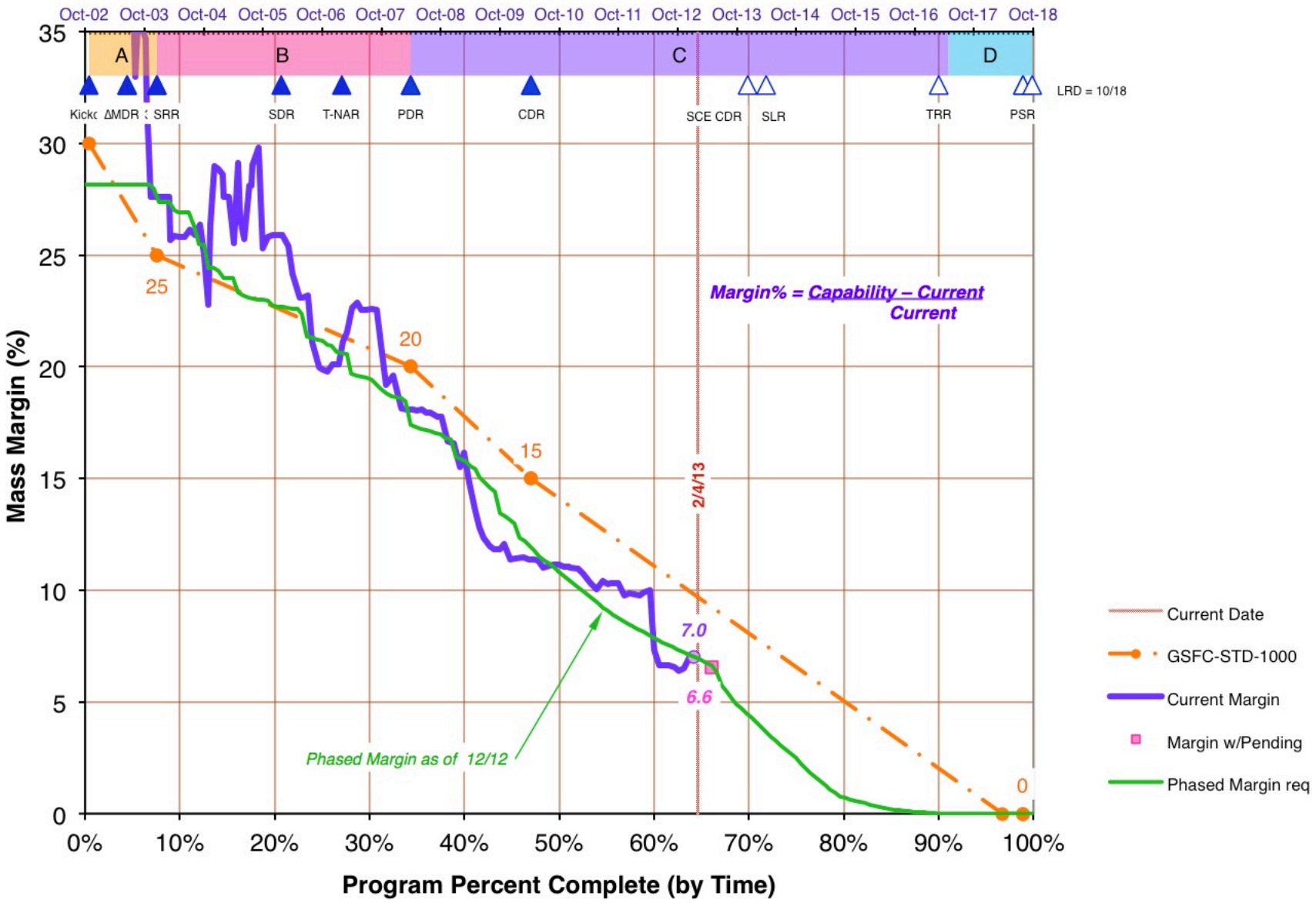


Legend

- Red Arrows are Critical Path
- ISIM = Integrated Science Instrument Module
- IEC = Instrument Electronics Compartment

TPM - Mass Margin

Status as of: 2/4/13



Recent Program/Project Images

Pathfinder Structure

Pathfinder on ROF in M8 at NGAS

Primary Mirror Segment Assembly (PSMA) Installation Fixture (PAIF) Demo

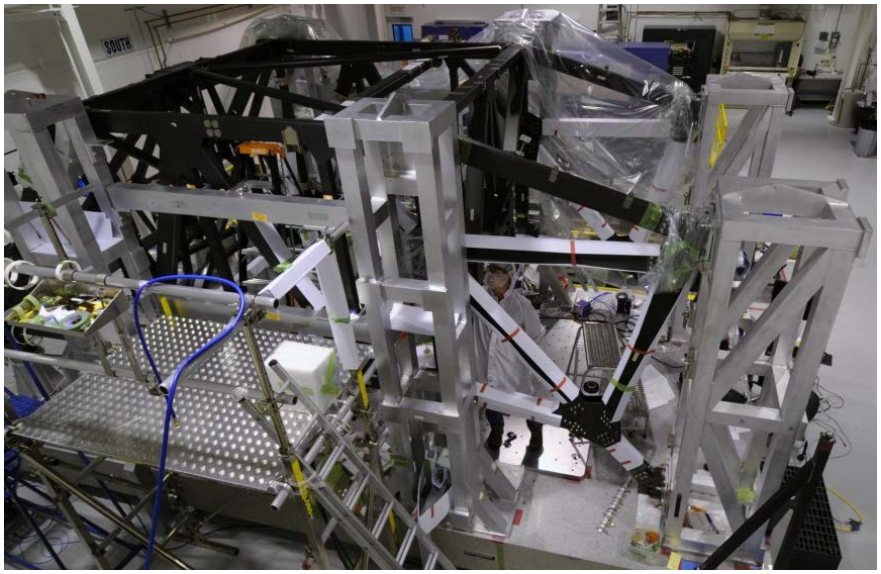
- Demonstrations of placement of mirror mass model on BESTA

Critical Path Progress: Flight Backplane Bonding Status

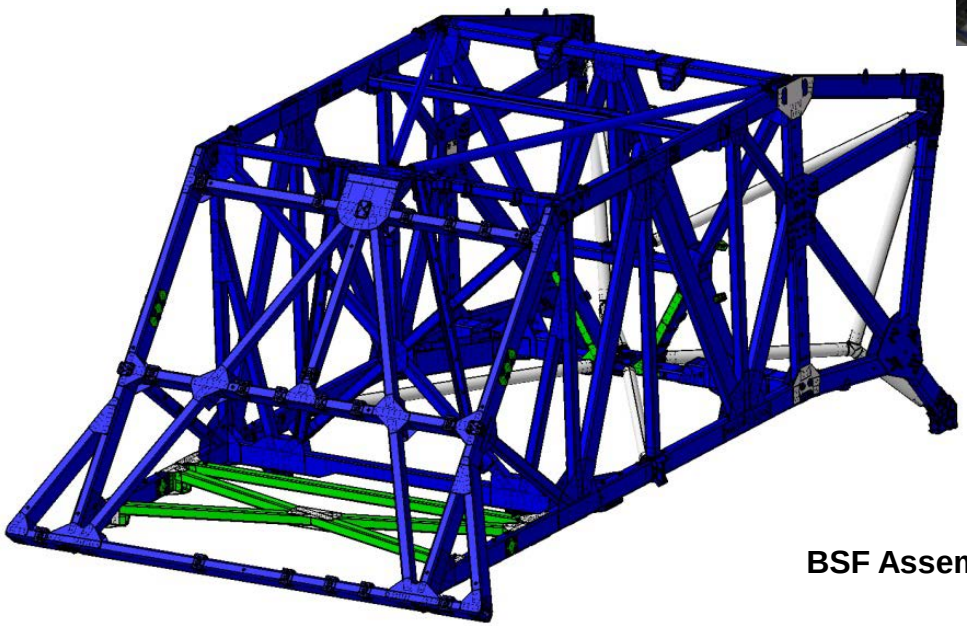
- **Wing Assembly: Completed**
  - Wings delivered to MSFC's XRCF for testing 3/20

Critical Path Progress: Flight Backplane Bonding Status

- **Backplane Support Fixture assembly efforts:**
  - Removable round strut fittings are bonded
  - Roof support tube and gusset plates are bonded
  - Floor structure rework completed
  - Integration 6 efforts are underway
    - +V3 end cross struts in dryfit
    - -V3 cross struts in dryfit



BSF Assembly Mar 20, 2013



: Not Assembled
: Assembled
: Assembled since last month

BSF Assembly - Integration 1 - 6

Backplane Support Fixture

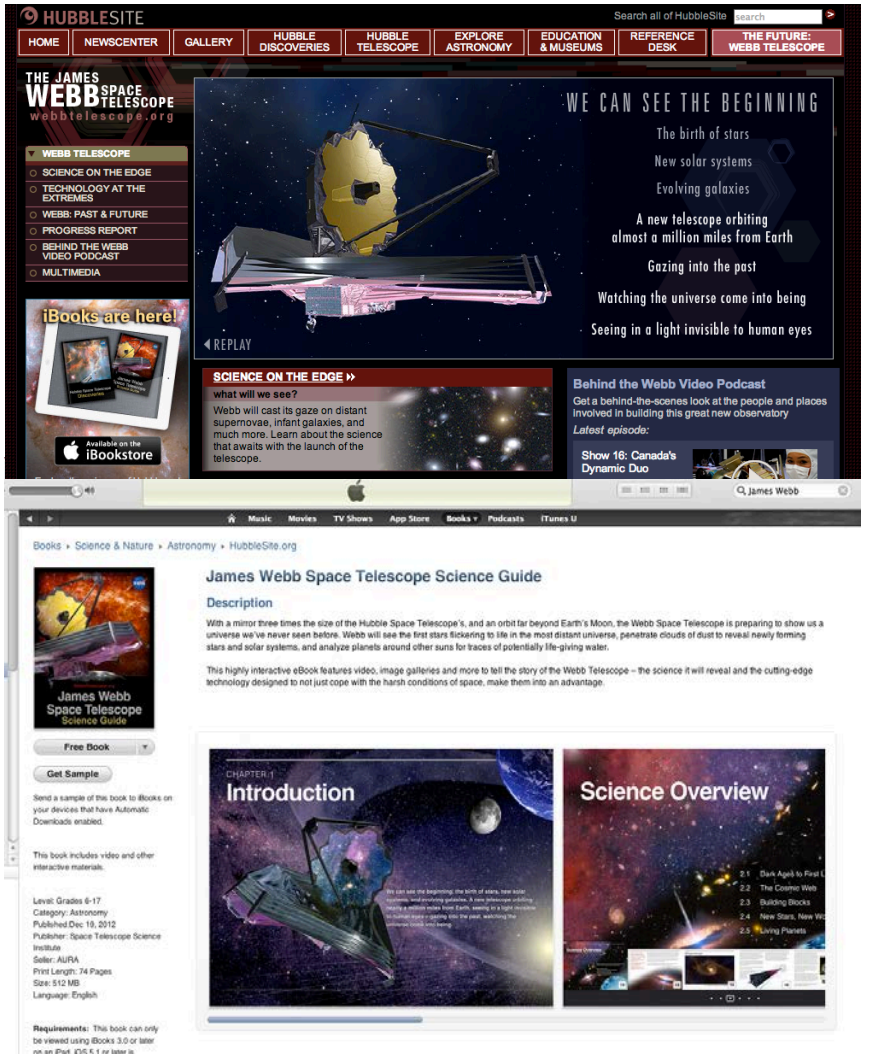
Yearly Themes

- ✓ **2013: Instrument Integration**: The Science instruments will be finished and begin their testing as an integrated science payload
- ✓ **2014: Manufacturing the Spacecraft**: Construction will commence of the spacecraft that will carry the science instruments and the telescope
- ✓ **2015: Assembling the Mirror:** The mirror segments, secondary mirror and aft optics will all be assembled into the telescope
- ✓ **2016: Observatory Assembly**: The three main components of the observatory will be completed (instruments, telescope, spacecraft)
- ✓ **2017: Observatory Testing**: The three main components of the observatory will be tested and readied for assembly (instruments, telescope, spacecraft) into a single unit
- ✓ **2018: Kourou Countdown**: All parts of the observatory will be brought together, tested and readied for launch in Kourou, French Guiana

Staying Current

www.jwst.nasa.gov

webbtelescope.org



iBook for JWST free on iTunes
(search for "James Webb Space Telescope")

ACRONYM LIST

ASIC	Application Specific Integrated Circuit
BATC	Ball Aerospace
BP	Backplane
CBE	Current Best Estimate
CCOS	Computer Controlled Optical Surfacing
CDA	Critical Design Audit
CMU	Cryo Mux Unit
ECP	Engineering Change Proposal
EDU	Engineering Development Unit
EMTB	Engineering Model Testbed
EOL	End of Life
ESPI	Electronic Speckle Pattern Interferometer
ETU	Engineering Test Unit
FGS	Fine Guidance Sensor
FPE	Focal Plane Electronic
HIP	Hot Isostatic Pressure
ICE	Independent Cost Estimate
ICE	ISIM Control Electronics
IDR	Integrated Design Review
IEA	ISIM Enclosure Assembly
IEC	ISIM Electronics Compartment
IPAO	Independent Program Assessment Office
IPT	Integrated Product Team
IRT	Independent Review Team
ISIM	Integrated Science Instrument Module
ITAR	International Traffic in Arms Regulations
JT	Joule-Thomson
JWST	James Webb Space Telescope
LM ATC	Lockheed Martin
LRD	Launch Readiness Date
MIRI	Mid Infrared Instrument
MOR	Mission Operations Review
MOU	Memorandum of Understanding
MRB	Material Review Board
MSS	Micro-shutter Subsystem
NGST	Northrop Grumman Space Technology
NIRCam	Near Infrared Camera
NIRSpec	Near Infrared Spectrograph
OM	Optical Module
OSIM	OTE Simulator
OTE	Optical Telescope Element
PM	Primary Mirror
PMBSS	Primary Mirror Backplane Support Structure
PMSA	Primary Mirror Segment Assembly
PDA	Preliminary Design Audit
PIT	Product Integrity Team
PSF	Point Spread Function
RFA	Request for Action
RLDA	Refrigerant Line Deployment Assembly
RTC	Request for Technical Change
S&OC	Science and Operations Center
SBC	Single Board Computer
SC	Spacecraft
SCTS	Spacecraft Cargo Transportation System
SDR	System Definition Review
SIDU	Science Instrument Development Unit
SM	Secondary Mirror
SMD	Science Mission Directorate
SRB	Standing Review Board
STScI	Space Telescope Science Institute
SV	Space Vehicle
SWG	Science Working Group
TBT	Testbed Telescope
TFI	Tunable Filter Instrument
TM	Tertiary Mirror
TRR	Test Readiness Review
VM	Verification Model
WFE	Wavefront Error
WFSC	Wavefront Sensing & Control
XRCF	X-Ray & Cryogenic Facility