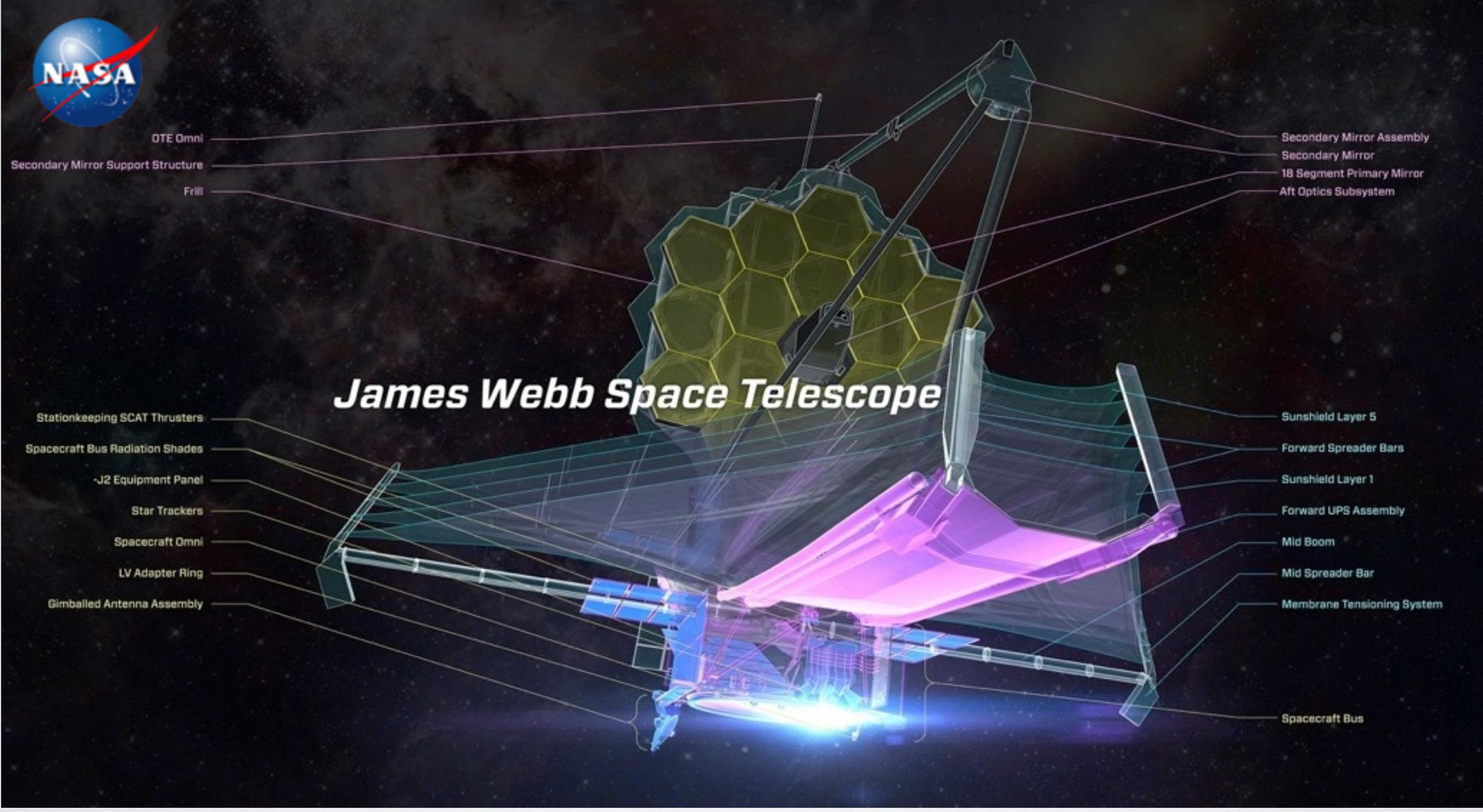


July 23, 2018

Eric P. Smith

JWST Program Office

Recent Updates

- Programmatic
  - Established a new, 80% confidence level, launch date of March 2021 following receipt of, and initial stages of implementing, Independent Review Board recommendations
- Spacecraft Element
  - Post Acoustics Test inspection revealed loose hardware from the sunshield membrane covers
    - Repairs underway, introduced a ~5 month delay into schedule (accounted for in the March 2021 launch date)
- OTIS (Optical Telescope + Integrated Science instruments)
  - Completed warm functional tests of telescope and instruments
  - Completed Aft Deployable ISIM Radiator deployment test (post cryo-vac test)
- Science and Operations
  - GO Call will be re-issued in late 2019/early 2020 (allowing at least 14 months to launch date)
  - Ground segment testing and operations rehearsals

IRB Report Summary & Conculsions

- JWST is an observatory with incredible capability, awesome scientific potential and significant complexity, risk and first-time events

- OTIS integration and Test (I&T) is complete and has demonstrated the exceptional science capability of the system

- Significant launch date delays and resulting cost caused by human errors, embedded problems, excessive optimism in I&T planning, lack of sunshield experience and system complexity have occurred. Small I&T problems can have a major impact on schedule and cost

- JWST inherent risk requires mission success is the highest priority in completing JWST development

- The Webb IRB believes that implementing all recommendation in this report will contribute to maximizing the success development of JWST

- The Webb IRB believe that JWST should continue based on its extraordinary scientific potential and critical role in maintaining U.S. leadership in astronomy and astrophysics

IRB Recommendations & Response Focus

NASA-focused	Northrop-focused	NASA & Northrop
Commissioning Risks	Human mistakes during I&T	Mission Success
Residual Risks	Responsible Design Engineers	
Launch Vehicle	I&T Staffing Adequacy	
Transportation	Staff Morale	
Mission Operations	Embedded Problems	
JWST Reporting & Management Communications		
Engagement of the Science Community		

INDEPENDENT REVIEW BOARD (IRB) FINDINGS & NASA RESPONSE

Download the Independent Review Board Report and the NASA Response

https://www.nasa.gov/press-release/nasa-completes-webb-telescope-review-commits-to-launch-in-early-2021

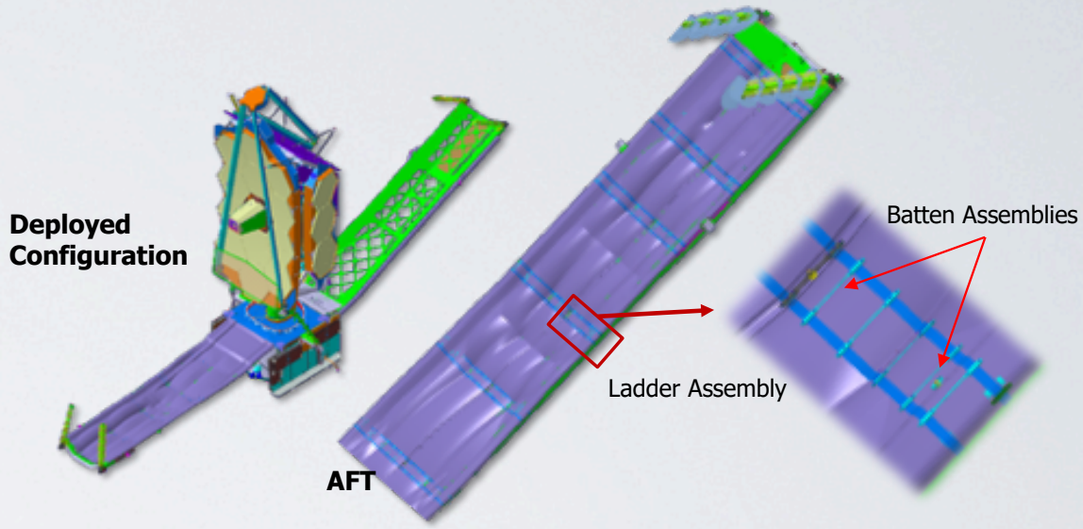
https://www.nasa.gov/sites/default/files/atoms/files/webb_irb_report_and_response_0.pdf

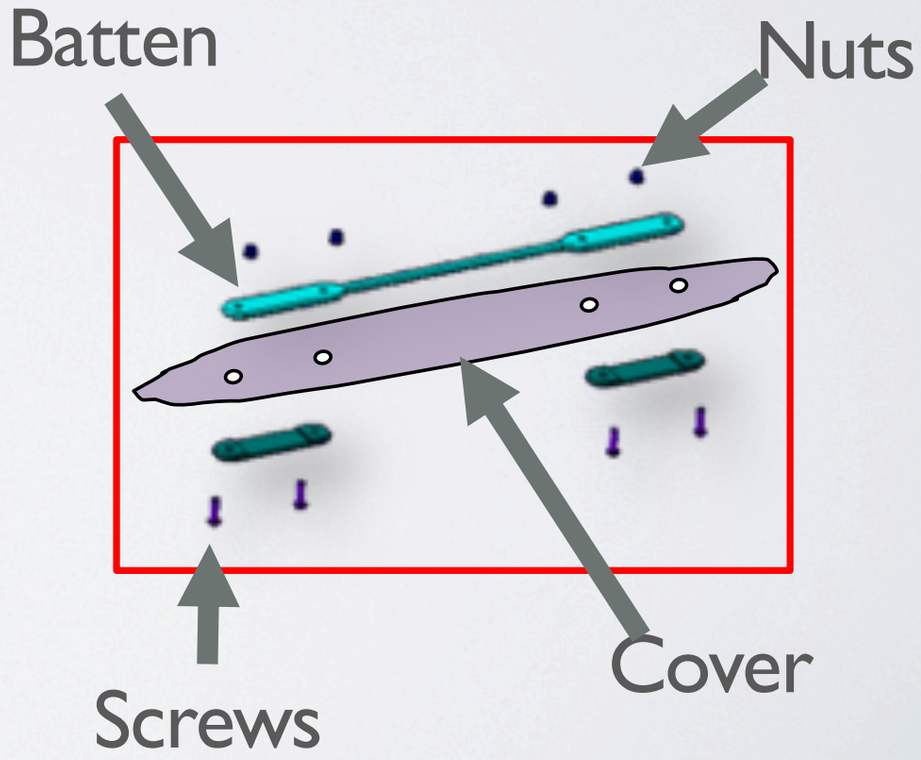
Current Technical Issues

- Maintaining Schedule Performance
- Sunshield Membrane Cover Repair
- OTIS Problem Failure Report (PFR) progress
  - Mirror Stability
  - NIRCam Pupil Wheel

Sunshield Membrane Covers

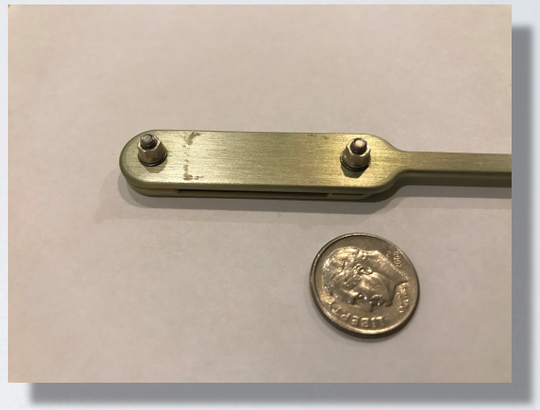
- Spacecraft element (bus plus sunshield) successfully passed its shock test and completed the acoustic testing, but the loose batten issue was discovered prior to sine vibration testing (first week in May).
  - The new fasteners have been installed, torqued, and epoxied. Installation of the batten covers is complete.
  - Working the potential cover redesign to address the depress situation in parallel
  - The covers will then be reinstalled and the spacecraft element will run through acoustics again followed by vibration and back to normal I&T flow.





Sunshield Membrane Covers

Sunshield membrane covers at Northrop Grumman prior to batten repairs



Nut Side of Batten Assembly

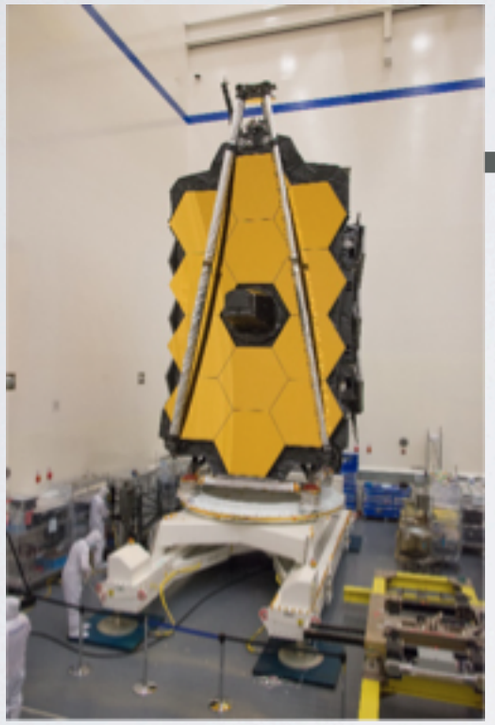
OTIS PFRs

- PFR JWST-181: Aft Deployable ISIM Radiator (ADIR) Panel Deployment Failure
  - Closed with successful ADIR deployment Test at NGAS
- PFR JWST-190: Primary Mirror Segment Assembly (PSMA) Stability
  - Closes with PMSA closeout modifications and final wavefront assessments ~August
- PFR JWST-191: MIRI ISIM Control Electronics (ICE)-B 1553 Bus Drop-outs
  - Closed - Closure package went to FRB last week
- PFR JWST-192: NIRCam MOD-B, ICE-1, SW PW element move failure
  - During the execution of the Warm ISIM Functional (WIF) Test, a command from the NIRCam Instrument Control Electronics (ICE) Box #1 to move the Module B Short Wave B-Side Pupil Wheel (PW) showed anomalous current in the trend data.
  - The anomaly was repeated both during additional steps in the WIF, and during follow-on diagnostic data gathering.
  - Failure Review Board is on-going and leading cause appears to be a failed ICE Box 1 printed wiring board solder joint in the PW drive circuit to the PW redundant coils.
  - If this drive path is no longer considered viable, there are still three functioning configurations to drive the wheel (ICE-1 primary drive, ICE-2 primary and redundant drives).

Remaining I&T Activities*

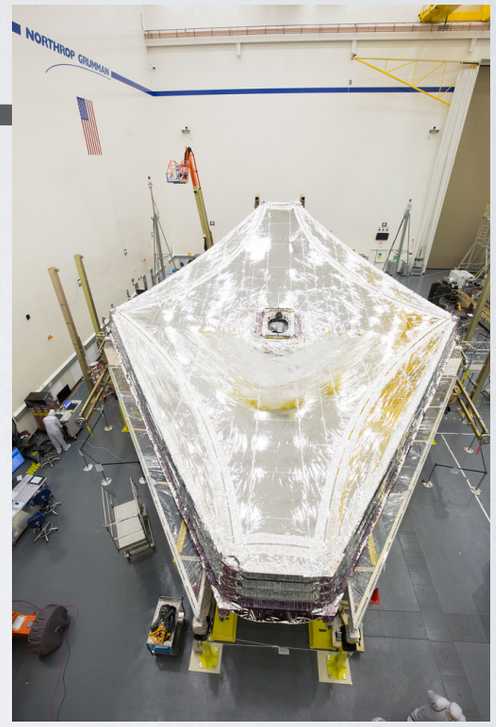
Science Payload

- OTIS Deployment at NGAS
  (secondary mirror support structure)



Spacecraft Element

- Acoustics, (w/repaired hardware) vibe, & thermal vacuum tests
- Post-Environmental deployment



Observatory Integration

- Pre-environ. Observatory deployment
- Observatory fold and stow
- Observatory system (electrical) test
- Observatory vibration, acoustics tests
- Observatory deployment
- Observatory fold and stow for launch
- Observatory final system test

NOTE: *Top-level tasks to go. Many activities are associated with each of these steps

First-time activity

Fiscal Year 2018 JWST HQ Milestones

Month		Milestone	FY2017 Deferral	Comment
Oct-17	1	Science & Operations Center software package Release 2		Completed 10/2/17
	2	Hold Consent to Warm Up Telescope following cryovacuum testing meeting		Completed 10/21/17
	3	Deliver Launch Rehearsal Plan to NASA		Completed 10/2/17
	4	Pre-Environmental testing Sunshield Deployment		Completed 10/23/17
Nov-17	5	Tension the Flight Membranes while on the Spacecraft	•	Completed 10/25/17
	6	Complete Telescope cryovacuum test	•	Completed 10/20/17
Dec-17	7	Issue Cycle 1 General Observer call for proposals		Completed 11/30/17
	8	Backup Mission Operation Center ready for use		Completed 11/17/17
	9	Conduct Operational Readiness Exercise #4		Completed 12/7/17
Jan-18	10	Complete Wave Front Sensing & Control commissioning exercise		Completed 3/10/18
	11	Install spacecraft horizontal radiator panels	•	Completed 1/3/18
Feb-18	12	Complete Spacecraft Element (combined spacecraft and sunshield) Acoustic Test	•	Completed 3/25/18
	13	Conduct Observatory Deployment Review #3		Completed 1/31/18
Mar-18	14	Complete Spacecraft Element Vibration Test		Delayed by Membrane Cover batten issue
	15	Spacecraft thrusters modules ready for installation		Completed 2/19/18
	16	Ship Telescope from Johnson Space Center to Northrop-Grumman		Completed 2/2/18
Apr-18	17	Deliver results from Spacecraft Element acoustic and vibration tests	•	Delayed by Membrane Cover batten issue
	18	Complete post shipment functional testing of the Telescope		Delayed by Spacecraft Element I&T delays
May-18	19	Begin Spacecraft element thermal vacuum test	•	Delayed by Membrane Cover batten issue
	20	Deliver analysis of launch effects on JWST Observatory	•	Delayed to July by I&T delays
Jun-18	21	Launch Readiness Exercise #1		
	22	Deliver final version of the spacecraft handbook to NASA		Completed 5/9/18
Jul-18	23	Complete Ground Segment test #2		
	24	Retension sunshield after thermal vacuum testing of the Spacecraft Element		
	25	Conduct Spacecraft Element Compliance Review, part 1		
	26	Complete Johnson Space Center Chamb[illegible] Accom[illegible]ssioning		[illegible]6/14/18
Aug-18	27	Complete Telescope d[illegible] to Northrop Gumma[illegible]		
	28	Conduct Integrated Te[illegible]ise		
	29	Cycle 1 General Observers proposal selection		
	30	Deliver Spacecraft Element to Observatory Integration and Test		
Sep-18	31	Complete integration of the Telescope onto the Spacecraft Element		

Will be updated

Blue font(underline) denotes milestones accomplished ahead of schedule, orange font denotes milestones accomplished late. "•" denotes 2017 milestones carried forward.

Milestone Performance

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

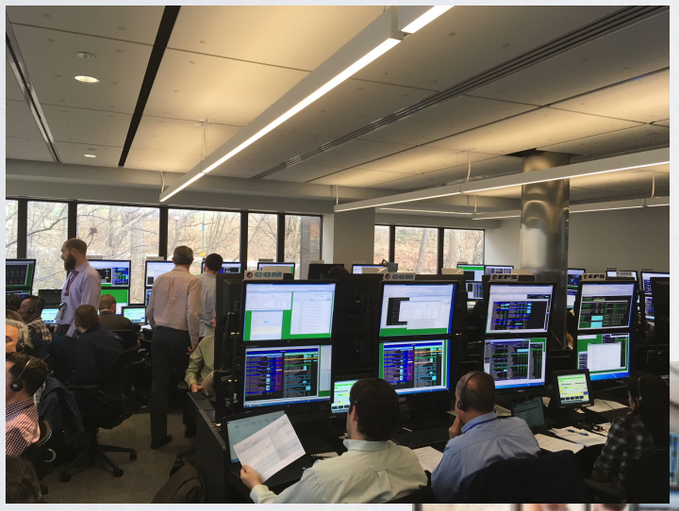
	Total Milestones	Total Milestones Completed	Number Completed Early	Number Completed Late	Deferred to Next Year	Deferred more than one quarter
FY2011	21	21	6	3	0	0
FY2012	37	34	16	2	3	3
FY2013	41	38	20	5	3	2
FY2014❖	36	23	10	8	11	10
FY2015	48	44	22	12	4	3
FY2016	45	39	25	7	6	2
FY2017	38	32	12	13	8	5
FY2018	31	17	7	7*	11	12

*Late milestones have been completed late within the year or are forecast to complete late within the year. Deferred milestones are not included in the number-completed-late tally.

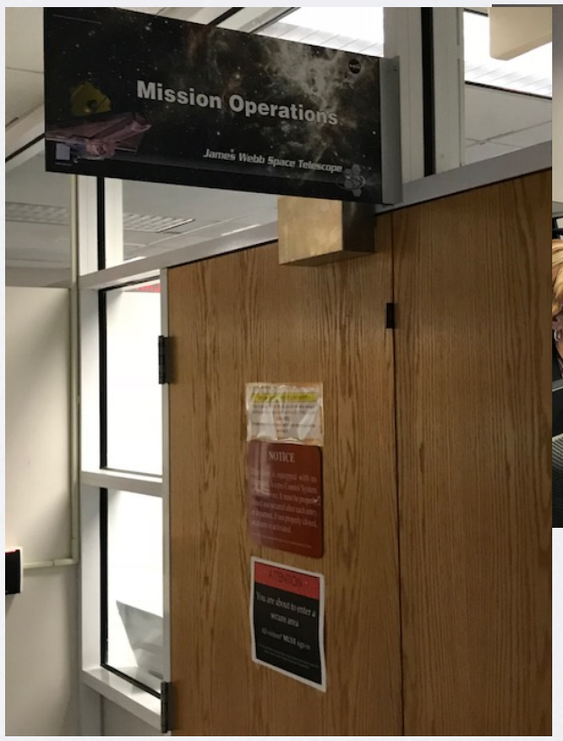
❖ Milestone accounting in FY2014 was complicated by the government shutdown and multicomponent milestones

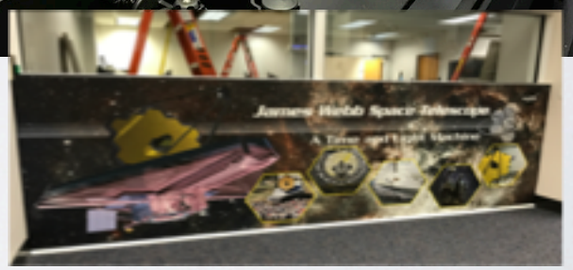
Mission Operations Activities & Facilities

Successful GSEG-1 utilized SN antenna (left), DSN test trailer and dedicated personnel (right)



Mission Operation Center at STScI





Backup Mission Operation Center (bMOC) in GSFC Building 32