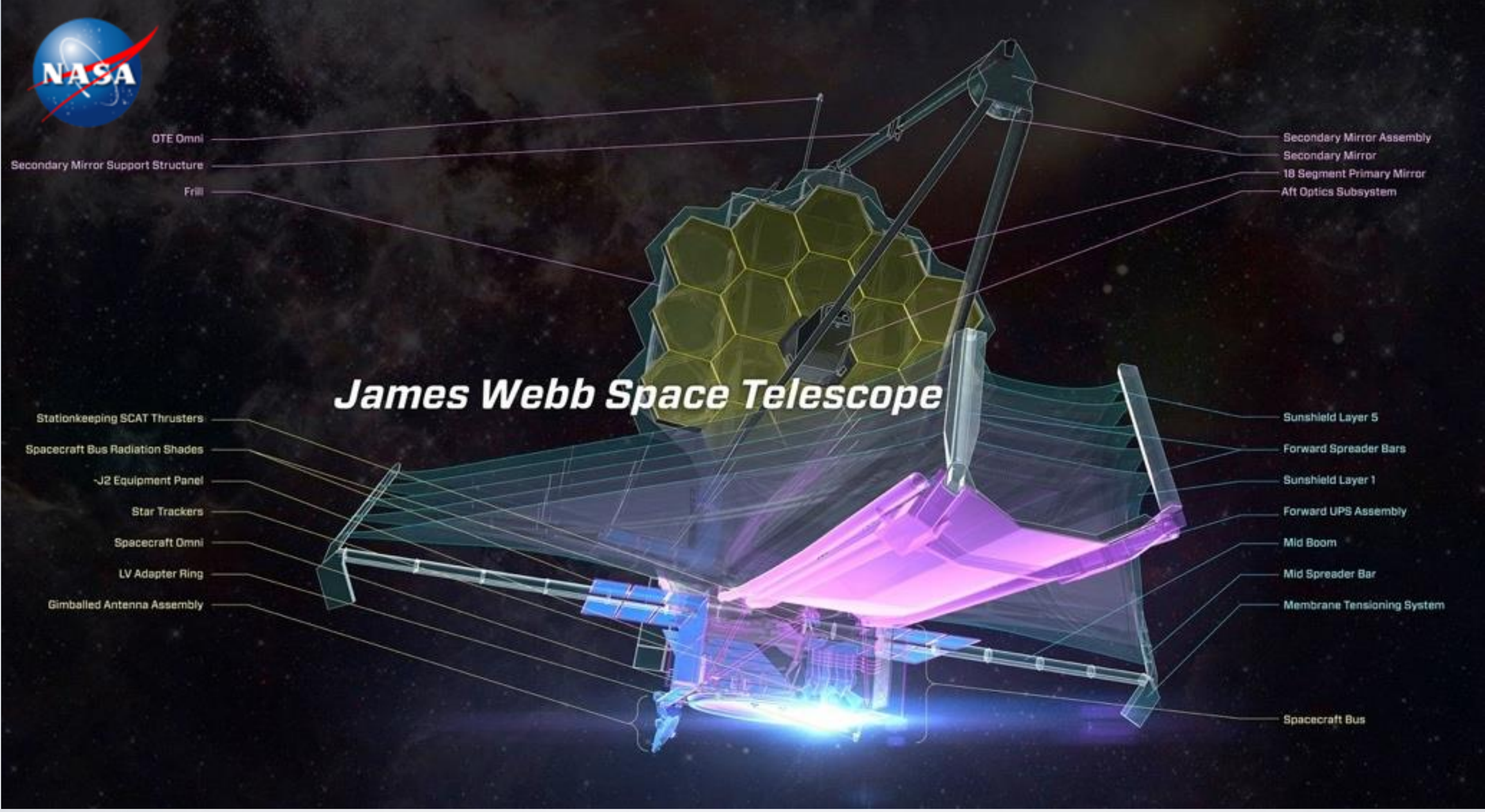


October 28, 2019

JWST Program Office

SIMPLIFIED SCHEDULE

2019					2020												2021		
A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M

k months of project funded critical path (mission pacing) schedule reserve

Integration | Deployment & Stow | TWTA, CTP Repair & System Test | Vibe & Acoustics Tests | Deployment & Stow | Shipping Prep

2 | 1

Observatory

Ground System Freeze

Development, Testing, Release

Ground System

Cy1 GO Proposal Call | Cy1 GO Proposals Due | Cy1 TAC

Science

Northrop-Grumman | Space Telescope Science Institute | Guiana Space Center

Remaining I&T Activities*

Post SCE-Environmental Sunshield Deployments & Repairs

Observatory Pre-environmental Deployments

System (electrical) test

Vibration and acoustics tests

Observatory Post-environmental deployments

Final system test

Observatory fold and stow for launch

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

Remaining I&T Activities

SCE Post-Environmental Deployments

Deploy Tower (X) → Deploy Sunshield Membranes (X) → Sunshield Updates → Stow Core → Fold/Repair Sunshield Membranes → Stow Tower → J2 Panel Opening → Stow Midbooms

Observatory Pre-environmental Deployments

Deploy Wings → Cryocooler field joint mate → Stow Wings → Full Stow UPS → Bipod Release 1st Motion → Partial Stow UPS → Deploy Tower → Install 4-bar/J3 Panel MRDs

Stow Tower → Full Stow UPS → OBS Closeout Operations → CST4/ GSEG 3 → Launch Lock Tower Cable Tray

Observatory Environmental Test

Move OBS to LATF → Acoustic Test → Move OBS to M4 → Vibration Testing → Move OBS to M8

Observatory Post-environmental Deployments

GAA, CCA, STSA release → Deploy UPS → Deploy Wings → IEC, CJAA, ADIR +v3 release → Stow Wings → Deploy Tower → Deploy Sunshield Membranes

Stow Core → Fold Sunshield Membranes CST5/GSEG 4 → Temp. Stow Tower → Stow Midbooms → Partial Stow UPS → Temp Deploy Tower → Install 4-bar/J3 panel MRDs

Final Stow Tower → LL Tower Cable Tray → Full Stow UPS

Observatory Final Build

Final OBS Ops → Shipping Preps → OBS Ready to ship to launch site

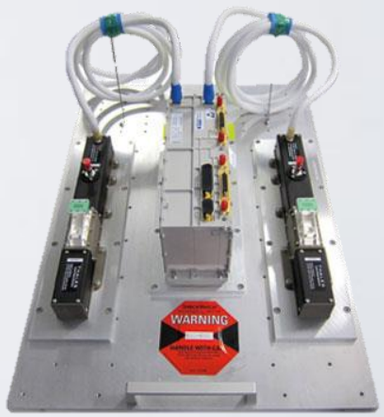
Blue boxes are first time activities

Recent Updates

- Programmatic
  - Conducted the Systems Integration Review (SIR), the prelude to Key Decision Point D by the agency. KDP-D (November) marks the formal transition from construction into integration and test. KDP-D is where agency plans for remaining costs and schedule are formalized.
  - Annual GAO audit concluding, exit conference scheduled for November
- Observatory
  - Successfully completed Spacecraft Element (SCE: sunshield + spacecraft bus) thermal vacuum testing
  - OTIS (telescope + science instruments) and SCE have been mechanically and electrically integrated forming the Observatory.
  - Telescope deployment driven by spacecraft electronics
  - Sunshield deployment and tensioning driven by spacecraft electronics
- Science and Operations
  - Ground segment testing and operations rehearsals continuing (e.g., science operations, contingencies)
  - All Software elements at better than 97% requirements delivered to-date

Current Technical Issues

- Maintaining schedule performance
- Depressurization at fairing jettison
- Spacecraft Element (Post thermal vac. work)
  - Command Telemetry Processor (#2)
  - Traveling Wave Tube Amplifier (#1)



Fairing Depressurization

- Issue: Residual air trapped in folded sunshield membrane may cause an over-stress condition at the time of fairing separation due to the depress rate ($\Delta pressure \leq 0.013$ psi, capability 0.005 psi).

- Actions:
  - More sensitive pressure transducers flown on two Ariane 5 flights confirm that there is residual pressure within the faring that exceeds the capabilities (measured values = 0.008 psi). Third flight next month
  - Working pressure driven (passive) designs to latch vents open on ascent
  - Passive vents will fly in 2020 prior to Webb launch

Blue underlined text indicates changes from last meeting

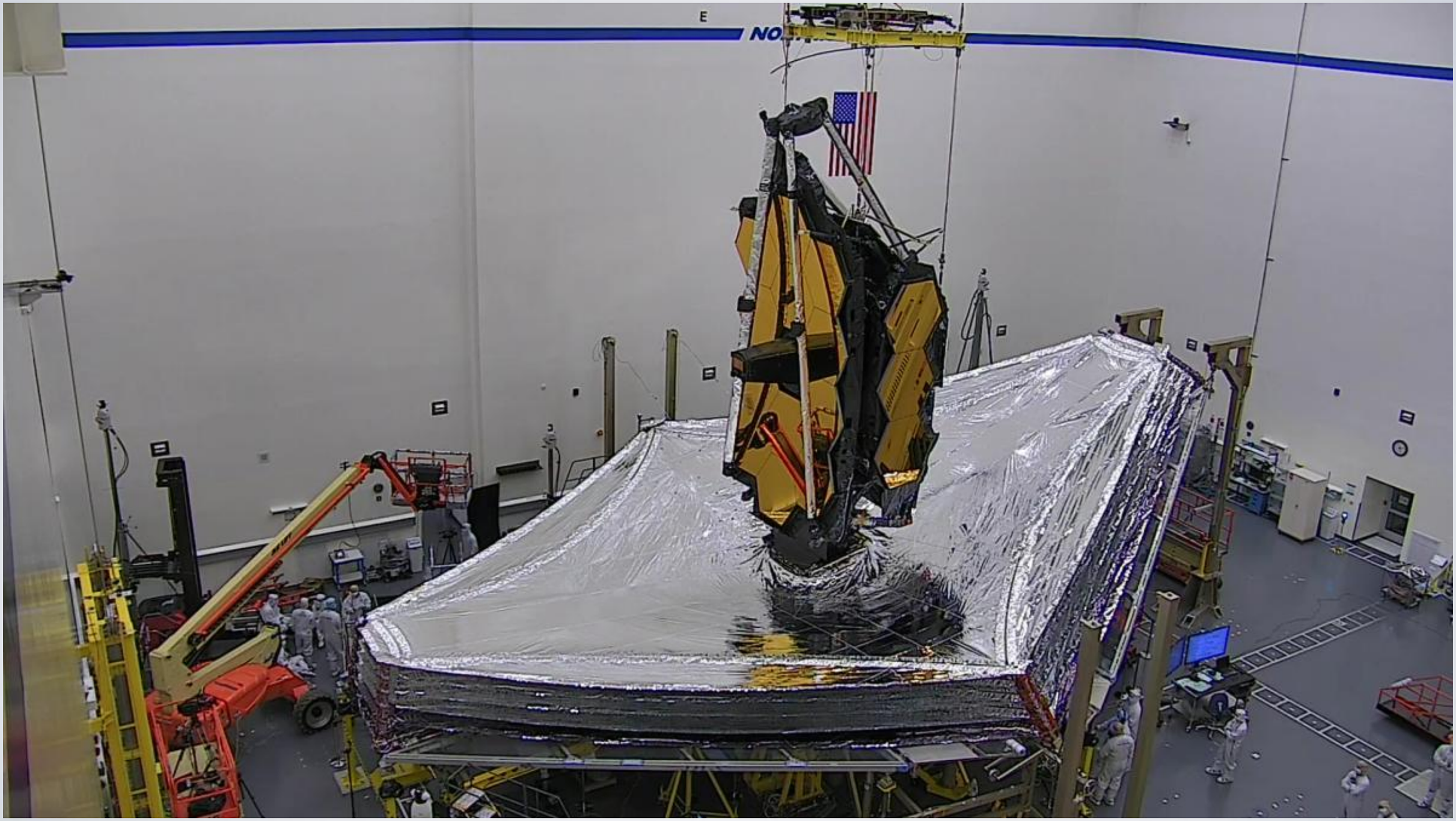
Command and Telemetry Processor (CTP)

- Description:
  - During System Level tests (Dec ‘18-Apr ‘19), CTP-2 exhibited two failed turn-ons and two unplanned power-off events. CTP was fully operational prior to the tests and no failures have occurred since 4/24/19.
- Action Plan & Status
  - Flight Unit
    - Comprehensive fishbone and disposition of possible causes ONGOING
    - SRB RFA action Item response 9/24/19
    - FRB for External Load Test, CTP-2 removal disposition End Nov/Dec
  - CTP-3 (EM to Flight Unit Upgrade)
    - Successfully completed Unit review on 10/3/19 COMPLETE
    - CT
    - P-3 I&T delivery forecast 12/20/19
- Expected Resolution / Impact
  - CTP-3 delivery to I&T
  - Installation during J2 panel opening in early 2020

Traveling Wave Tunable Amplifier (TWTA)

- Description:
  - During pre-environments testing, TWTA-1 unexpectedly powered off after having been operational for hours
- Action Plan & Status:
  - Proceed with environ. tests with added bus voltage and current monitoring FRB approved
  - Evaluate New TWTA build and replacement options COMPLETE
  - Generate comprehensive fishbone of possible causes COMPLETE
  - Manufacturing Readiness Review at vendor COMPLETE
  - Review (Pre FRB) for panel open process COMPLETE
  - Return to FRB for TWTA removal COMPLETE
  - Delivery from vendor 10/29/19
- Expected Resolution/Impact:
  - Substitute TWTA-1 with new unit
  - Return to FRB for TWTA-1 Debug/Repair plan at vendor facility
  - Plan is to replace unit during J2 panel opening in early 2020

Fully Tensioned Sunshield



Backup

Fiscal Year 2019 JWST HQ Milestones

Month		Milestone	Comment
Oct-18	1	Conduct Wavefront Sensing rehearsal #2 at the Missions Operations Center (MOC)	Completed 10/6/18
	2	Stow the sunshield into launch position following repairs of the membrane covers	Completed 9/28/18
	3	Spacecraft Element (SCE) ready for resumption of environmental testing following MCA repairs	Completed 10/19/18
Nov-18	4	Complete Spacecraft Element Acoustic Test	Completed 10/28/18
	5	Deliver Observatory Science and Operations software build	Completed 10/19/18
Dec-18	6	Conduct Science Operations rehearsal #4 at the MOC	Completed 12/21/18
	7	Begin Spacecraft Element vibration testing	Completed 11/15/18
	8	Complete the validation of science payload software	Completed 10/27/18
Jan-19	9	Conduct a SCE Comprehensive System Test in preparation for thermal vacuum testing	Completed 9/26/18
Feb-19	10	Deliver final results for SCE environmental testing	Complete 4/5/2019
	11	Conduct Early Commissioning Exercise #2 at the MOC	Completed 3/6/2019 (Government shutdown delay)
Mar-19	12	Begin Spacecraft Element thermal vacuum test	Completed 4/7/19
	13	Deliver the flight version of launch vehicle coupled loads analysis #2 Observatory model	Completed 5/6/19
Apr-19	14	Open thermal vacuum chamber door following testing	Completed 5/19/19
	15	Conduct Wavefront Sensing rehearsal #3 at the MOC	Completed 4/12/19
May-19	-	NONE	
Jun-19	16	Complete Spacecraft Element post-launch environmental testing deployment	replanned to follow science payload installation (FY20)
	17	Complete the secondary mirror structure deployment driven by the Spacecraft Element	Completed 7/13/19
Jul-19	18	Received updated Cycle 1 proposals from the Guaranteed Time Observers	Completed 6/25/19
	19	Conduct Science Operations rehearsal #5 at the MOC	Completed 7/12/19
Aug-19	20	Complete Spacecraft Element post-launch environments and thermal vacuum testing folding	replanned to follow science payload installation (FY20)
	21	Observatory System Integration Review (SIR)	Completed 7/25/2019 (Part 1), 10/19 (Part 2)
Sep-19	22	Install science payload onto the Spacecraft Element	Completed 8/23/19
	23	Deliver the flight version of launch vehicle coupled loads analysis #2 results and detailed assessment	replanned to follow science payload installation (FY20)
	24	Spacecraft Element Integration complete	Completed 6/29/19
	25	Conduct Contingency Planning rehearsal #3 at the MOC	Completed 9/27/19

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

Fiscal Year 2020 JWST HQ Milestones

Month		Milestone	FY2019 Deferral	Comment
Oct-19	1	Spacecraft Element level post-environment deployments complete	•	
Nov-19	2	Flight Software build 3.4 delivered		
	3	Data Management Subsystem build 7.4 delivered		
Dec-19	4	Replacement traveling wave tunable amplifiers (TWTAs) delivered		
Jan-20	5	Spacecraft Element level Sunshield post-environment folding complete	•	
	6	Deployable Tower Assembly deployment complete		
Feb-20	7	Flight coupled loads analysis #2 delivered	•	
	8	Command/Telemetry Processor (CTP) replacement delivered		
Mar-20	9	Replacement CTP & TWTA installed into Spacecraft		
	10	Conduct fourth early commissioning exercise		
Apr-20	11	Comprehensive System Test #4 readiness review complete		
	12	Deliver Science and Operations Center release 2.1		
May-20	13	Full Observatory level acoustics testing complete		
Jun-20	14	Full Observatory level vibration testing complete		
Jul-20	15	Telescope primary mirror wing deployment complete		
Aug-20	16	Final Sunshield membrane tensioning complete		
	17	Evaluation of Cycle 1 General Observer proposals (by Time Allocation Committee)		
Sep-20	18	Third launch readiness exercise conducted		

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