JWST Update

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JWST Program Office
23-June-2020
RECENT UPDATES

Programmatic
- NASA and Northrop given permission to continue work during COVID19 stay-at-home period
  - Progress being made, but efficiency hits for social distancing protocols
  - LRD Schedule will be assessed in mid-July, prior to entry into Observatory Environments testing

Observatory
- Completing final steps before environmental tests (Comprehensive System Test #4 and Ground Segment Test #3)
  - e.g., Cryocooler final fill completed, deployable tower test completed

Science and Operations
- Ground segment testing and operations rehearsals suspended, plan for restarting being worked as STScI begins reopening (started 15-June)
- Call for Cycle 1 General Observers due date announcement late July, will give community 12 weeks to prepare proposals
## Fiscal Year 2020 JWST HQ Milestones

<table>
<thead>
<tr>
<th>Month</th>
<th>Milestone</th>
<th>FY2019 Delerral</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-19</td>
<td>1 Spacecraft Element level post-environment deployments complete</td>
<td></td>
<td>Completed 10/9/19</td>
</tr>
<tr>
<td>Nov-19</td>
<td>2 Flight Software build 3.4 delivered</td>
<td></td>
<td>Completed 8/30/19</td>
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<tr>
<td></td>
<td>3 Data Management Subsystem build 7.4 delivered</td>
<td></td>
<td>Completed 11/25/19</td>
</tr>
<tr>
<td>Dec-19</td>
<td>4 Replacement traveling wave tunable amplifiers (TWTAs) delivered</td>
<td></td>
<td>Completed 11/22/19</td>
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<tr>
<td>Jan-20</td>
<td>5 Spacecraft Element level Sunshield post-environment folding complete</td>
<td></td>
<td>Completed 1/22/20</td>
</tr>
<tr>
<td></td>
<td>6 Deployable Tower Assembly deployment #1 complete</td>
<td></td>
<td>Completed 1/28/20</td>
</tr>
<tr>
<td>Feb-20</td>
<td>7 Flight coupled loads analysis #2 delivered</td>
<td></td>
<td>Completed 2/28/20</td>
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<tr>
<td></td>
<td>8 Command/Telemetry Processor (CTP) replacement delivered</td>
<td></td>
<td>Completed 1/13/20</td>
</tr>
<tr>
<td>Mar-20</td>
<td>9 Replacement CTP &amp; TWTA installed into Spacecraft</td>
<td></td>
<td>Completed 2/24/20</td>
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<tr>
<td></td>
<td>10 Conduct fourth early commissioning exercise</td>
<td></td>
<td>Completed 2/12/20</td>
</tr>
<tr>
<td>Apr-20</td>
<td>11 Deliver Science and Operations Center release 2.1</td>
<td></td>
<td>Completed 4/30/20</td>
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<tr>
<td>May-20</td>
<td>12 Comprehensive System Test #4 readiness review complete</td>
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<tr>
<td></td>
<td>13 Full Observatory level acoustics testing complete</td>
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<tr>
<td>Jun-20</td>
<td>14 Full Observatory level vibration testing complete</td>
<td></td>
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<tr>
<td>Jul-20</td>
<td>15 Telescope primary mirror wing deployment complete</td>
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<tr>
<td>Aug-20</td>
<td>16 Final Sunshield membrane tensioning complete</td>
<td></td>
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<tr>
<td></td>
<td>17 Evaluation of Cycle 1 General Observers proposals (by Time Allocation Committee)</td>
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</table>

*Blue font (underline) denotes milestones accomplished ahead of schedule, orange font denotes milestones accomplished late.*
Current Funded Schedule Reserve

- Reserve Usage Plan
- GSFC Recommended Reserves
- Current Reserve
- Events

1. Batten Cover Issue
2. Bumper Cover Issue
3. Coupled Loads Analysis 8+ accommodations
4. Longer than planned SCE vibration testing
5. Late Thermal Vac start + post env, schedule adjustments
6. TWTA and CTP repairs and I&T spans increases post audits
7. One panel opening and other efficiencies
8. Cryocooler tasks, OTIS installation safety measures
9. Post SCE/OTIS integration sunshield, MTS repairs
10. MU, Solar Array, unrealized opportunities from #7
11. COVID-19 related schedule erosion

Date
- May 2018
- June 2018
- July 2018
- August 2018
- September 2018
- October 2018
- November 2018
- December 2018
- January 2019
- February 2019
- March 2019
- April 2019
- May 2019
- June 2019
- July 2019
- August 2019
- September 2019
- October 2019
- November 2019
- December 2019
- January 2020
- February 2020
- March 2020
- April 2020
- May 2020
- June 2020
- July 2020
- August 2020
- September 2020
- October 2020
- November 2020
- December 2020
- January 2021
- February 2021
- March 2021
- April 2021

Months of Schedule Reserve
- 10
- 9
- 8
- 7
- 6
- 5
- 4
- 3
- 2
- 1
- 0

Spacecraft Element I&T
Observatory I&T
Ship to Launch site
Launch
Remaining I&T Activities

Observatory Pre-environmental Deployments
- Deploy Wings
- Cryocooler field joint mate
- Stow Wings
- Full Stow UPS
- OBS 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 Tower
- Deploy Sunshield Membranes
- Stow Core
- Fold Sunshield Membranes
- CST5/GSEG 4

Observatory Final Build
- Final OBS Ops
- Slipping Props
- Full Stow UPS
- OBS Ready to ship to launch site
- Final OBS Operations
- Shipping Preps
- Final OBS to ship to launch site
- Full Stow UPS

✓ = Completed activities

Blue boxes are first time activities
TRAVELING WAVE TUNABLE AMPLIFIER (TWTA)

- Status:
  - During pre-thermal vac ‘on the lid’ testing (Mar ‘19), TWTA-1 unexpectedly powered off after having been operational for hours
  - Decision: procure two new TWTAs from vendor
  - Installation and preliminary testing successfully completed by 24-Feb (on schedule)
  - TWTA-1 unit returned to vendor, root cause determined to be transformer windings manufacturing error, other units exonerated
  - Unit will be fully tested via the upcoming Comprehensive System Test in late June/July 2020

Closing

Blue underlined text indicates changes from last meeting
CTP REPLACEMENT

- Status:
  - During System Level tests in Dec 2018 through Apr 2019, Command and Telemetry Process number 2 (CTP-2) exhibited multiple unplanned power-off events. CTP was fully operational prior to the tests. No failures occurred since 24-April-2019.
  - Decision: upgrade an engineering unit to flight specifications and install it
  - Installation and preliminary testing successfully completed by 24-Feb (on schedule)
  - Unit will be fully tested via the upcoming Comprehensive System Test in late June/early July 2020
  - CTP-2 unit studied at Northrop, root cause, bad transformer (different issue from TWTA), other units exonerated.

Closing
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 residual pressure (\(\Delta pressure \leq 90\) pascals, capability 18 pascals).

• Actions:
  - More sensitive pressure transducers flown on three Ariane 5 flights confirm that there is residual pressure within the fairing that exceeds the capabilities (measured values \(~ 55\) pascals).
  - Passive open-vents first flight 18-Feb measured value \(~ 32\) pascals \(~ 65\) deg opening)
  - Second flight (July) with passive vents will include 1] the new vents (opened to the full 80 deg) and 2] a sealed fairing to trap

Blue underlined text indicates changes from last meeting
MEMBRANE RELEASE DEVICES (MRD) & NON-EXPLOSIVE ACTUATORS (NEA)

• MRD
  • Evaluation of simultaneous ascent (mechanical, acoustic) and pressure loads show negative margins on some highly-loaded MRDs
  • Will require additional MRD unit proof load tests
  • Building new parts from stronger materials for change out as required
  • Built 5 new MRDs with new material. Three will are installed for Observatory environments (August), 2 are going through a series of offline tests. Existing MRDs will be going through additional tests as well and may meet load requirements.

• NEA
  • The NEA for one sunshield MRD failed to release when actuated using the redundant side only electrical signal.
  • The NEA fired correctly when signaled on the primary side.
  • The anomaly has been localized to the NEA portion of this actuator
  • New NEAs being manufactured and will be ready in time for installation during final observatory stow before shipping.

Blue underlined text indicates changes from last meeting
The Deployable Radiator Shade Assembly – Horizontal system redesign of the slip joint interfaces is underway. The tube and node structure in undergoing disassembly now and will be followed by the tubes undergoing an end-fitting replacement and then reassembly and then qualification testing.

- The 4 DRSA-H panels have been disassembled and are ready for installation of the new end fittings.

- The new end fittings have been delayed a few weeks because they require anodizing and that vendor was slow to restart after shutting down due to COVID. They are now up and operating so progress can be made again.
FLIGHT BATTERY CHANGE

Results from recent contingency analyses indicate the amount of time to work contingencies in the event of post-launch solar array deployment (t +30 min) anomaly has fallen under 3 hours with the current ~53 AH battery (HCM Li Ion).

- Fortunately, we procured a spare (Moli-M Li Ion) battery that was of considerably larger capacity ~106 AH – two years ago and it is ready to go. This more than double capacity will provide more than sufficient time to complete all possible contingency operations to recover the solar array.

- For these reasons, the project has decided to switch to the space battery. GSFC Engineering Directorate and the Standing Review Board have been briefed on this decision.
new observatory images here in final version of presentation
Since the September 2011 replan JWST reports high-level milestones monthly to numerous stakeholders.

### MILESTONE PERFORMANCE

<table>
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<th>Total Milestones</th>
<th>Total Milestones Completed</th>
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*Milestone accounting in FY2014 was complicated by the government shutdown and multicomponent milestones*