2020 RECAP

Significant progress during a challenging year

• Observatory

  Successfully completed its environmental testing (launch vibration and acoustics)

  Successfully completed pre-environmental comprehensive system testing (electrical functional)

  Nearly finished with all post-environmental test deployments

  Launch date moved from March to October

• Science & Operations Center: commissioning rehearsals, Cycle 1 proposal receipt
RECENT UPDATES

Programmatic

NASA and Northrop continuing to work but with COVID19 social distancing protocols meaning some reduced efficiencies
Sufficient funds and schedule margin for 31-Oct launch readiness date

Observatory

Completed the final sunshield deployments and the flight stow process has begun
  - Working some anomalies along the way but nothing that invalidates the deployment and are preparing the data to present to the Standing Review Board

Science and Operations

Ground segment testing and operations rehearsals continuing
1173 Cycle 1 General Observers proposals received
SIMPLIFIED SCHEDULE

- **Final deployments, fold and stow**
- **Development, Testing, Release**
- **Ground System Freeze**
- **Observatory**
- **Launch Site Processing**

- Days of project funded critical path (mission pacing) schedule reserve
- Ground System
- Science

- Northrop-Grumman
- Space Telescope Science Institute
- Guiana Space Center
KOUROU ACTIVITIES

- Prep for Shipment & Load O SSTARS: 4 days
- Ship Travels to Launch Site: 12 days
- OSTTARS convoy to SSC and Initial Arrival Tasks: 3 days
- Observatory Inspections, Aliveness Test: 4 days

- CST-6 and RF Testing: 10 days
- Prop Deconfig & DSN Config: 3 days
- Final Observatory Closeouts: 4 days
- PA Integration and CCU3 Ops: 4 days

- SSB Propellant Loading: 12 days
- Observatory Move to BAF & Transfer to HE: 2 days
- JWST Hoist to Launcher: 1 day
- Final Red Tag/ Green Tag & MU Closeouts: 1 day

- Fairing Integration: 4 days
- MDR Aliveness, EEPROM: 1 day
- Launcher Processing: 4 days
- Rollout and Start Countdown: 1 day

+16 days of schedule reserve
## Fiscal Year 2021 JWST HQ Milestones

<table>
<thead>
<tr>
<th>Month</th>
<th>Milestone</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Oct-20</td>
<td>1 Complete Observatory Environmental Testing</td>
<td>Completed 10/2/20</td>
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<td>Nov-20</td>
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<td>Dec-20</td>
<td>2 Complete Post Environmental Testing Spacecraft Bus Deployments</td>
<td>Completed 11/12/20</td>
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<td>Jan-21</td>
<td>3 Complete Post Environmental Testing Sunshield Deployments</td>
<td>Completed 12/16/20</td>
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<td>Feb-21</td>
<td>4 Complete Comprehensive System Test #5</td>
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<td>Mar-21</td>
<td>5 Complete Cycle 1 Geneal Observer Proposal Reviews</td>
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<td>6 Sunshield Fold Complete</td>
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<td>7 Launch Readiness Exercise #2</td>
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<td>Apr-21</td>
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<td>May-21</td>
<td>8 Final Deployable Tower deployment</td>
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<td>Jul-21</td>
<td>9 Final Observatory Stow Complete</td>
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<td>10 Observatory Pre-Ship Review</td>
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<td>11 Launch Readiness Exercise #4</td>
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<td>Aug-21</td>
<td>12 Operational Readiness Review</td>
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<td>13 Ship Observatory to Launch Site</td>
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<td>Sep-21</td>
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Blue font (underline) denotes milestones accomplished ahead of schedule, orange font denotes milestones accomplished late.
CURRENT FUNDED SCHEDULE RESERVE

Reserve uses: (1) Bldg M4 issues, additional Z-axis vibe run, (2) Ka-band measurements, APCO adapter (3) Planned sunshield repairs and patching
Since the September 2011 replan JWST reports high-level milestones monthly to numerous stakeholders.

MILESTONE PERFORMANCE

<table>
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<tr>
<th>Fiscal Year</th>
<th>Total Milestones</th>
<th>Total Milestones Completed</th>
<th>Number Completed Early</th>
<th>Number Completed Late</th>
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<th>Deferred more than one quarter</th>
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*Milestone accounting in FY2014 was complicated by the government shutdown and multicomponent milestones. *Milestone reporting stopped during COVID-19 impacted months.
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.
- Built 5 new MRDs with new material. Three were installed for Observatory environments, 2 went through a series of offline tests.
- Resolution: All MRDs will have positive margins based on either additional proof testing or replacing Collets and Stems with alternate material.

**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 have been manufactured and will be ready in time for installation during final observatory stow before shipping.
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 Pa).
  - Passive open-vents first flight 18-Feb measured value ~32 Pa (~65 deg opening)
  - Second flight with passive vents included 1] the new vents (opened to the full 80 deg) and 2] a sealed fairing to trap residual air in the fairing honeycomb, measured 31 Pa

Fairing Vent
FAIRING DEPRESSURIZATION

- Plan: Determine that the Sunshield MRDs, membranes and telescope and spacecraft hardware can tolerate 2X fairing pressure level at jettison (i.e., 0.36 Pa). This is a joint NASA and Northrop effort.
- NASA and Northrop performed independent assessments as cross-checks.
- Final coupon testing revealed more capability in the membrane material than first assumed.
- Two locations on layer 5 (layer closest to the primary) are being patched (additional thickness), but all other location exonerated by testing.
FASTENER RETORQUING

• Issue Description:
  Data sampling method used during installation of fasteners specified to be torqued “above run-in torque” was inadequate to capture the full range of running torques

Action Plan/Status:
  Re-audit of all JWST drawings that require above run-in torque (COMPLETE)
  Pre-OBS Environment Assessment (COMPLETE)
  Identification of hardware rework prior to Post-OBS Deployments (COMPLETE)
  Flight Exoneration (COMPLETE)
  Identification of hardware rework after Post-OBS Deployments (COMPLETE)
  Running Torque Flight Exoneration Review/Technical Interchange Meeting (COMPLETE)

• Expected Resolution:
  Fasteners either re-torqued or exonerated by analysis prior to Launch
  Approximately 450 were retorqued prior to environmental testing and ~120 fasteners are being retorqued during the final stowing process and will be complete next month
The JWST Cycle 1 GO/AR deadline was on November 24, 2020.
A total of 1174 submissions were received by this date.
Extension requests from 29 PIs for 40 proposals – all granted.
All proposals save one were completed by the extension deadline on December 3, 2020.

The 1173 complete proposals include:
- 1084 GO proposals for ~24,500 hours, ~4:1 oversubscription
- 14 Survey proposals for at least 860 hours
- 75 AR proposals (including theory, cloud computing, data analysis tools)
- 374 proposal led by ESA PIs (31.9%)
- 44 proposals led by Canadian PIs (3.8%)
- 12766 Co-investigators in total – ~50% more than HST Cycle 28
- 4332 Unique investigators (PI, co-PI & co-I) - ~25% more than HST Cycle 28
  - 1985 investigators have not previously applied for HST time

Representation from:
- 44 Countries
- 45 US states + DC and the Virgin Islands

TAC meeting scheduled for February 16-19 (Galactic panels), February 23-26 (Extragalactic panels) & March 1-4 2021 (Ex. Comm)