JAMES WEBB SPACE TELESCOPE (JWST) TEST ASSESSMENT TASK (TAT)

Briefing to the NASA Science Mission Directorate

JWST Testing Assessment Task

NASA Headquarters
August 20, 2010
TAT Scope

OTE Structure I&T

ISIM I&T

GSFC SSDIF

OTE I&T

OTE/ISIM I&T

Cryo Optics Test

GSFC SSDIF, JSC 32

OTE Pathfinder Structure

Pathfinder Optics Integration

Pathfinder Cryo Optics Test

NGST M8

GSFC SSDIF

JSC 32

Observatory EM Test Bed (EMTB)

Propulsion Module I&T

Spacecraft Panel I&T

Spacecraft Element I&T

Complete Observatory I&T

NGAS M8, LATF, M4 Vibe

Launch Site I&T

NSG M8, M4 TV

LV Integ

Launch

I&T Responsibility

Execution

Facility

NASA

NGAS

ITT

ESA / ArianeSpace

N/A

NGAS M3

NGAS M8

NGAS M8

NGAS M8

NGAS M8, LATF, M4 Vibe

CSG S5, BAF, ZL3

August 20, 2010
Test Complexity at JSC

- Isolation System-Minus K
- Down Rods
- Upper Suspension Frame (USF)
- Telescope Tension Rods
- Hardpoint Offloader Support System (HOSS)
- HOSS Structure and Hardpoints
- Offloaders
- SDERS

- Center of Curvature Optical Assembly (COCOA)
- COCI (MWL interferometer, null, hexapod, calibration equipment)
- Autocollimating Flat Mirrors (ACF Assembly)
- 3 ACFs (actuated motion)
- Rogue Path
- Cryo Position Metrology Photogrammetry Cameras
- PM Illumination LED's
OTIS Cryo Test Timeline

August 20, 2010
Backup
### Thermal Verification Overview

#### Thermal Architecture Performance Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>2009</th>
<th>2013</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OT Temperature</strong></td>
<td>Function of several architecture thermal features</td>
<td>O</td>
<td>Y</td>
<td>via analysis. OTE temperature is a function of several architecture</td>
</tr>
<tr>
<td><strong>Core Isolation Performance</strong></td>
<td>Critical to overall temperature of OTE and ISIM</td>
<td>O</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td><strong>IEC Isolation Performance</strong></td>
<td>Critical to overall temperature of OTE and ISIM</td>
<td>O</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td><strong>IEC/Core SS Backscatter</strong></td>
<td>Critical to overall temperature of OTE and ISIM</td>
<td>O</td>
<td>Y</td>
<td>A</td>
</tr>
<tr>
<td><strong>Radiator Performance</strong></td>
<td>Dictates total load capability of passive cooling system</td>
<td>G</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heat Strap</strong></td>
<td>Dictates total load capability of passive cooling system</td>
<td></td>
<td>T</td>
<td></td>
</tr>
<tr>
<td><strong>Radiator/Strap end to end</strong></td>
<td>Radiator to strap interface is</td>
<td></td>
<td>T</td>
<td></td>
</tr>
<tr>
<td><strong>Cooler - ISIM Loads</strong></td>
<td>ISIM contributor to total load on cryocooler</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td><strong>Cooler - Line Loads</strong></td>
<td>Observatory contributor to total load on cryocooler</td>
<td>O</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td><strong>Harness Radiator Performance</strong></td>
<td>Major mitigator of IEC to ISIM harness loads</td>
<td>Y</td>
<td>Y</td>
<td>A</td>
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</tbody>
</table>

#### Radiator Load Breakdown

<table>
<thead>
<tr>
<th>Description</th>
<th>2009</th>
<th>2013</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Load (253) dB, FGS Ex.</td>
<td>O</td>
<td>G</td>
<td>A</td>
</tr>
<tr>
<td>Q1 Mounts - C (42) Radiator supports OTE</td>
<td>G</td>
<td>T/A</td>
<td></td>
</tr>
<tr>
<td>Q2 Ext Backload - R (88)</td>
<td>O</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q3 Int Backload - R (0)</td>
<td>O</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4 Strap Load - C (123)</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4A Supports - C (0) strap supports ISIM/OTE</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4B Radiation - R (0) ISIM cavity</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C Instrument - C (123) Load thru Instrument</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C1 Mounts - C (13) Bench to Instrument Mounts</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C2 Radiation - R (25) IEC ISIM cavity</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C3 Instrument Load (0)</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C4A Dissipation (55)</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C5B Harness (30) Harness Total</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C5B1 IRSU(5) to Instrument</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
</tr>
<tr>
<td>Q4C5B2 Instrument (25) FPE/ICE to Instrument</td>
<td>Y</td>
<td>G</td>
<td>T/A</td>
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</tbody>
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# Optical Verification Overview

<table>
<thead>
<tr>
<th>OTE Subsystem Level</th>
<th>SI Level</th>
<th>ISIM</th>
<th>JSC</th>
<th>Notes</th>
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<tbody>
<tr>
<td>PM Low Freq/PMSSA-PMSSA Alignment</td>
<td>Y</td>
<td>N/A</td>
<td>N/A</td>
<td>2 (critical)</td>
</tr>
<tr>
<td>PM Mid Freq</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>PM High Freq</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
</tr>
<tr>
<td>PM Asigmatism</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
</tr>
<tr>
<td>PM I/C</td>
<td>Y</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
</tr>
<tr>
<td>PM Conic</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>O</td>
</tr>
<tr>
<td>SM WFE</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>SM I/C</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>SM Conic</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>TM WFE</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>TM I/C</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>TM Conic</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>FSM Figure</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>SI WFE</td>
<td>N/A</td>
<td>Y</td>
<td>G</td>
<td>0</td>
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## Alignments

<table>
<thead>
<tr>
<th></th>
<th>Y</th>
<th>N/A</th>
<th>N/A</th>
<th>2 (critical)</th>
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<tbody>
<tr>
<td>PM to AOS Alignment</td>
<td>Y</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>SM to AOS Alignment / SM Actuator Range</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>Internal AOS Alignment (TMI, FSM, Mask, Aperture)</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>ISIM to AOS Alignment</td>
<td>Y</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
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<tr>
<td>SI to ISIM Pupil Shear</td>
<td>N/A</td>
<td>Y</td>
<td>G</td>
<td>0</td>
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<tr>
<td>SI to ISIM Focus</td>
<td>N/A</td>
<td>Y</td>
<td>G</td>
<td>0</td>
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## Other

<table>
<thead>
<tr>
<th></th>
<th>D</th>
<th>N/A</th>
<th>N/A</th>
<th>Y</th>
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<tbody>
<tr>
<td>Thermal Distortion – PM WFE &amp; ROC Change</td>
<td>D</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
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<tr>
<td>Thermal Distortion – OTE Alignment Change</td>
<td>D</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
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<tr>
<td>PM Collection Area</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>O</td>
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<tr>
<td>Rogue Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>PM to FSM Mask Alignment / Trajectory Path</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>Plate Scale</td>
<td>N/A</td>
<td>Y</td>
<td>Y</td>
<td>K</td>
</tr>
<tr>
<td>WFS&amp;C Algorithms/Processes</td>
<td>G</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>WFS&amp;C Influence Functions</td>
<td>D</td>
<td>N/A</td>
<td>N/A</td>
<td>Y</td>
</tr>
<tr>
<td>WF Control Signal Path (PMSSA, SIMA motion control align check test)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>G</td>
</tr>
<tr>
<td>WF Control - Hexapod performance</td>
<td>G</td>
<td>N/A</td>
<td>N/A</td>
<td>O</td>
</tr>
</tbody>
</table>

**NOTE:** All low frequency terms and PMSSA asigmatism factor into actuator range.
ISIM I&T Flow

- Receive Flight ISIM Electronics Compartment Structure with Backbone Harness
- FLT IEC Integration (FLT E-box)
- Deintegrate For Vib and Mass Props
- IEC Sine & Random Vibe Test
- ISIM Gravity Release Test
- ISIM Mass Properties
- IEC Mass Properties

- Alignment Metrology
- System Functional Test
- TST-20600
- TST-20700
- dI
- TST-20910
- TST-21000
- rI
- TST-20900
- TST-20900

- Cryo Thermal Vacuum Test w/TMS and OSIM
- EMI/EMC Test
- Acoustics Test (ISIM & IEC)
- Sine Vibe Test (ISIM Only)
- TST-20300
- TST-20800
- TST-21100
- dI
- TST-21300
- TST-30000

- Clean, Inspect, Pack & Ship
- OTE Integration & Test Program
- OTE Cryo Vac At JSC
- rI – Re-Integrate ISIM and IEC
- dI – De-Integrate ISIM and IEC
ISIM Cryo Test Timeline

ISIM Cryo-Vacuum Test General Flow and Timeline – CVAC #1