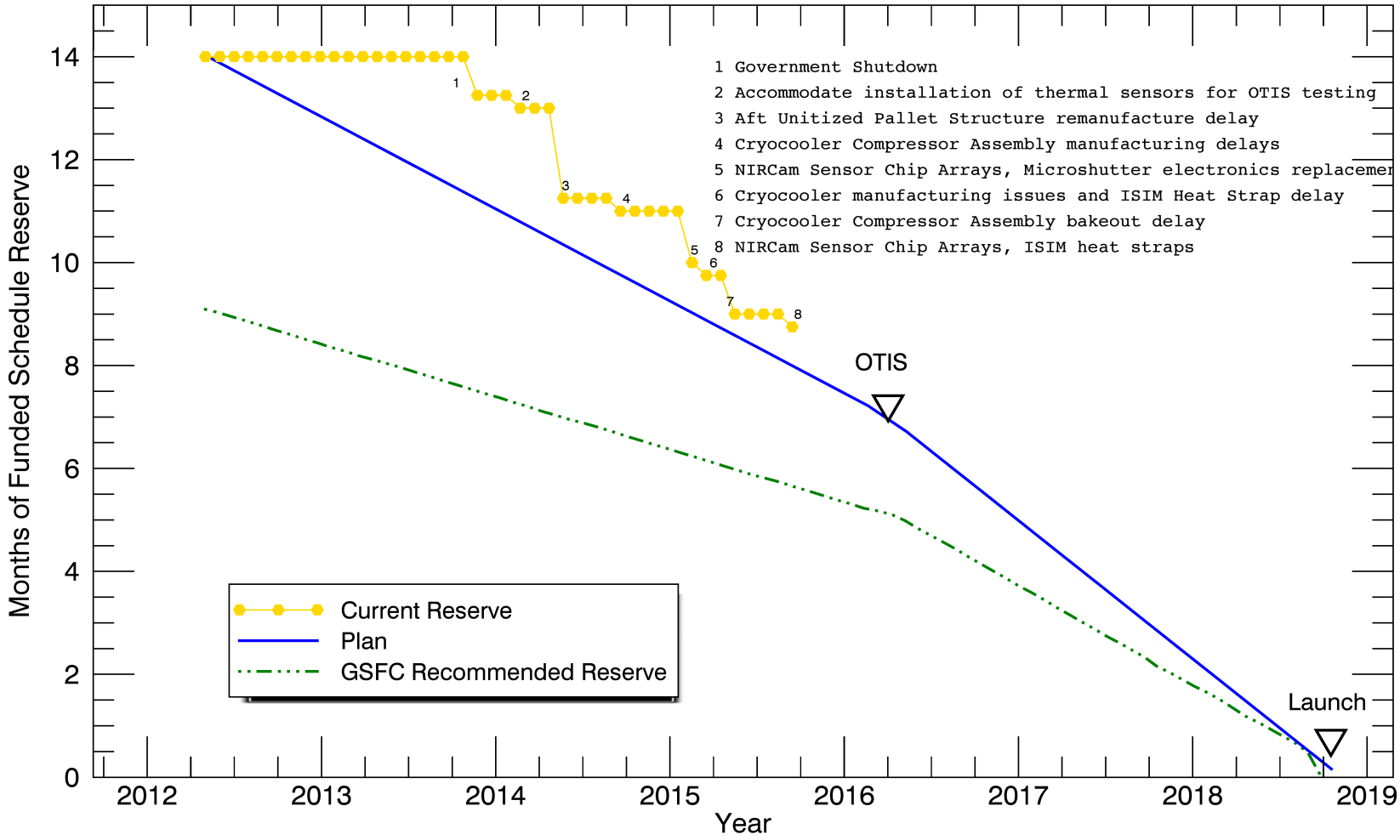
JWST Monthly Science Telecon

19 October 2015

Cleared for release.

Funded Schedule Reserve



GSFC-1/Observatory (+ other) Updates

Mal Niedner
JWST Deputy Sr. Proj. Scientist/Technical

October 19, 2015

JWST's predicted scientific performance is excellent

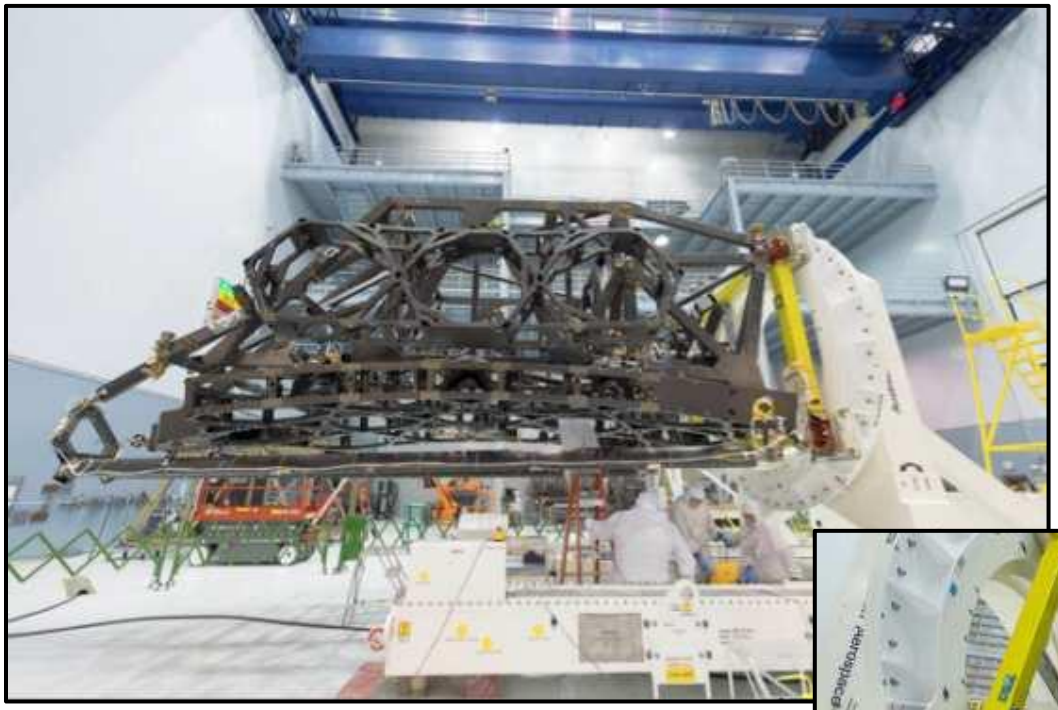
- All Technical Performance Metrics (TPMs) kept by Mission Systems Engineer M. Menzel continue to have positive margin. No red (req't not met) in current TPMs
- TPMs are not a static set…
- Last month, Mission Systems Engineering completed a "mini" Integrated Modeling Cycle to update Image Quality performance prediction (later chart gives a few details)
  - Results were excellent, in conformance w/ requirements

OTE operations in the SSDIF - 1

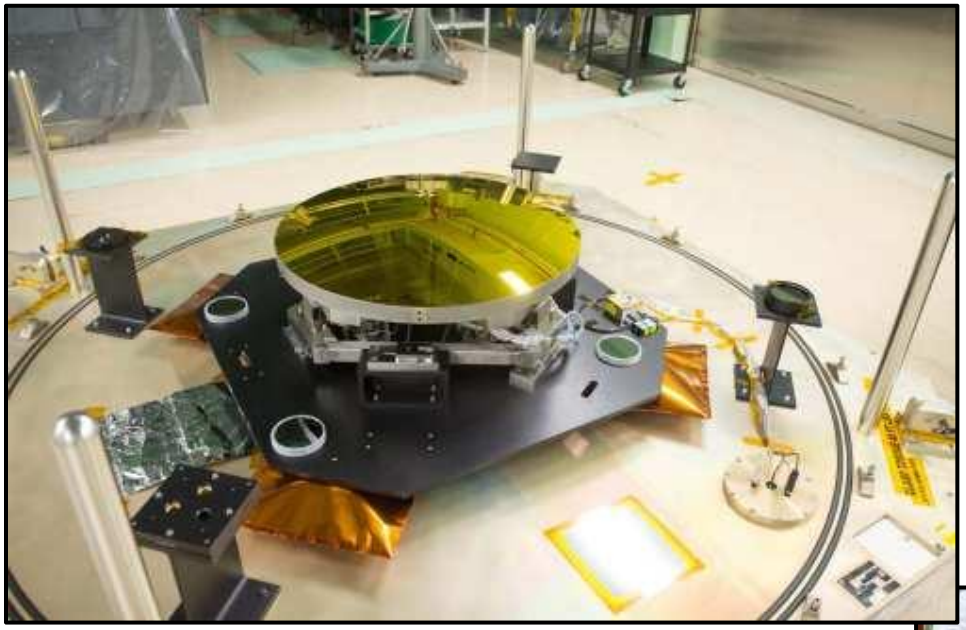
- Flight backplane was delivered by NGAS to GSFC on 8/24
- Preceding installation of primary optics (18 PMSAs + SM) at GSFC/SSDIF is harness installation: there are 76 of them
- Status as of 10/7: 47 harnesses rough installed

- PMSA installation begins Nov. 2015
- Aft Optics System (AOS) & Secondary Mirror installed by/in Feb. 2016

OTE operations in the SSDIF - 2



Operations in the CIAF at GSFC: all primary optics now shimmed, ready for installation



- Flight SMA, in Calibration, Integration and Alignment Facility (CIAF) for shimming (happened since last SWG Science Telecon)

- Preparing a PMSA for shim measurement (several months ago; cf. 8/10/15 telecon)

Cryocooler Accomplishments & Status

- Flight Cryocooler Compressor Assembly (CCA1) undergoing enhanced performance testing at JPL and making good progress, with excellent performance comparable to the already-reported testing done at NGAS prior to ship to JPL

- CCA1 and Flight cryocooler electronics assembly (CCEA) integrated and successfully working together at JPL: a major accomplishment for the Cooler Team

- Spare flight compressor unit (CCA2) under construction at NGAS. Delivery to JPL scheduled for February 2016

Flight CCA1 @ JPL →

Flight CHA on ISIM →

"Mini" Integrated Modeling Cycle for Image Quality

- Warranted due to a radiator shade design change and design/model updates in a number of systems:
  - OTE backplane
  - OTE & IEC harnesses
  - reaction wheel isolator assembly
  - cryocooler jitter attenuator assembly
  - etc.
- Updated analysis of thermal distortion (slews) and deployed dynamics (jitter due to cryocooler and reaction wheels) resulted in continued green boxes in optical performance TPMs, e.g., Strehl @ 2 and 5.6u , EE stability @ 2u over 24 hours and 14 days.

GSFC-2/I&T Update

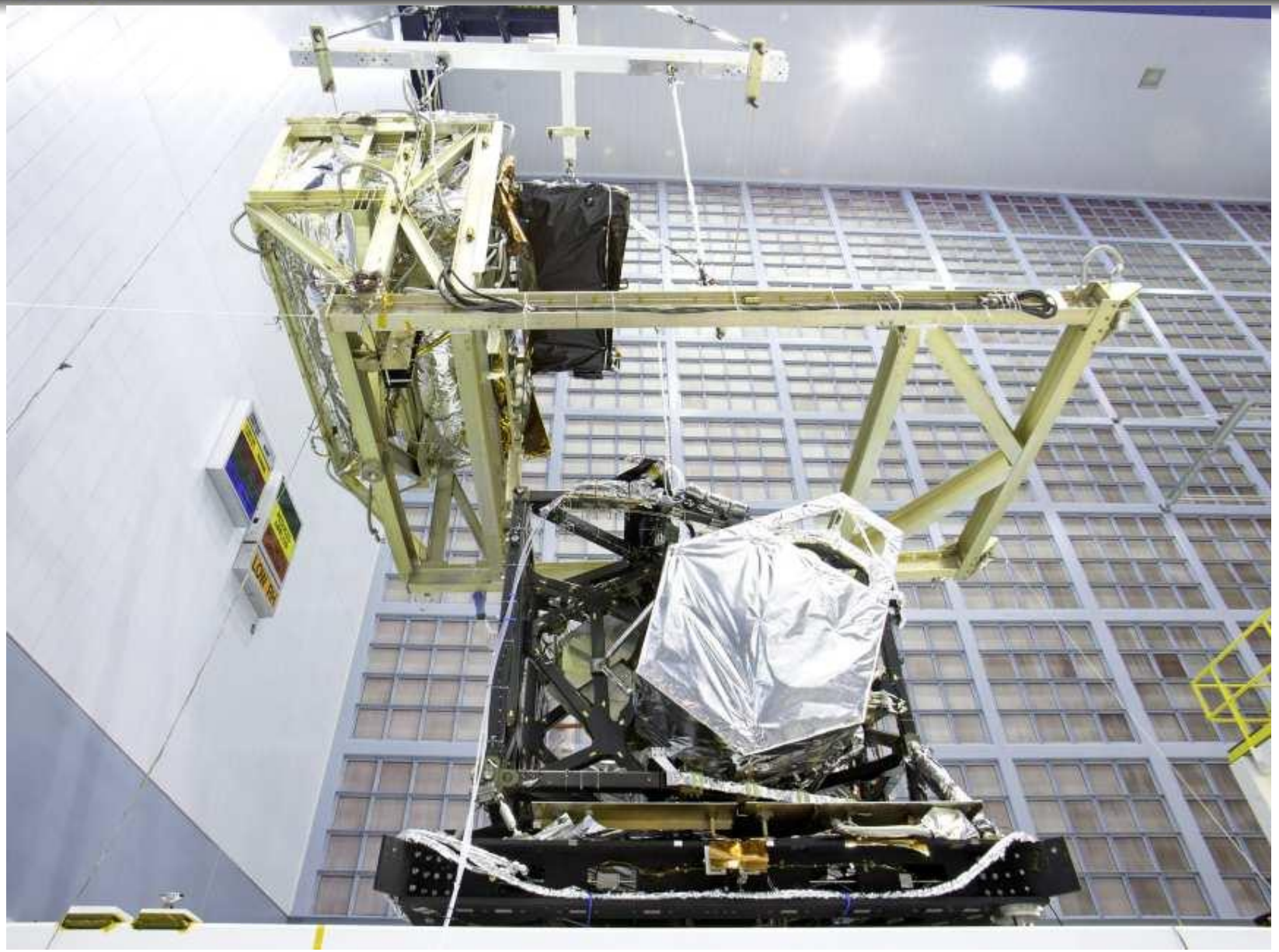
Randy Kimble
JWST I&T Project Scientist

October 19, 2015

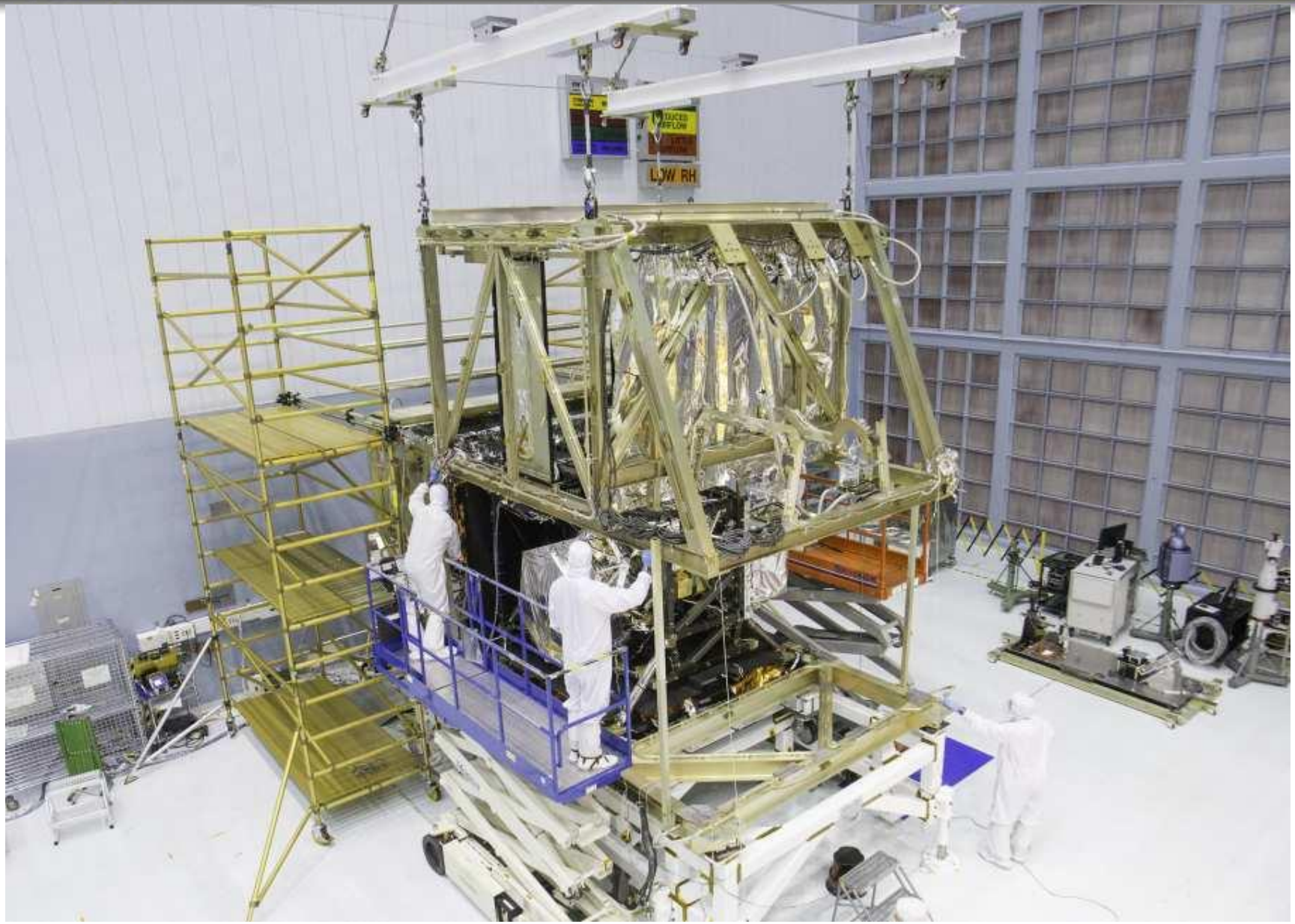
Closeout of ISIM Ambient Test Program On to CV3!

- Data Reviews confirmed successful completion of ISIM ambient environmental test program:
  - **EMI** Data Review – September 16th; no waivers required
  - **Acoustics and Vibe** Data Review – September 29th; no re-tests required, ready to move on to CV3
- While a series of successful Test Readiness Reviews set the stage for CV3:
  - **Optics** Pre-TRR – September 17th
  - **Ground Segment & Operations** Pre-TRR – September 28th
  - **General** CV3 TRR – September 30th
- **Close-out** Review scheduled for October 21st, to close out actions from all of the above: e.g. confirming readiness of final procedures, reference documents, closure of relevant PR's

Meanwhile, Hardware Preparations for CV3 Proceeded in the SSDIF – 1



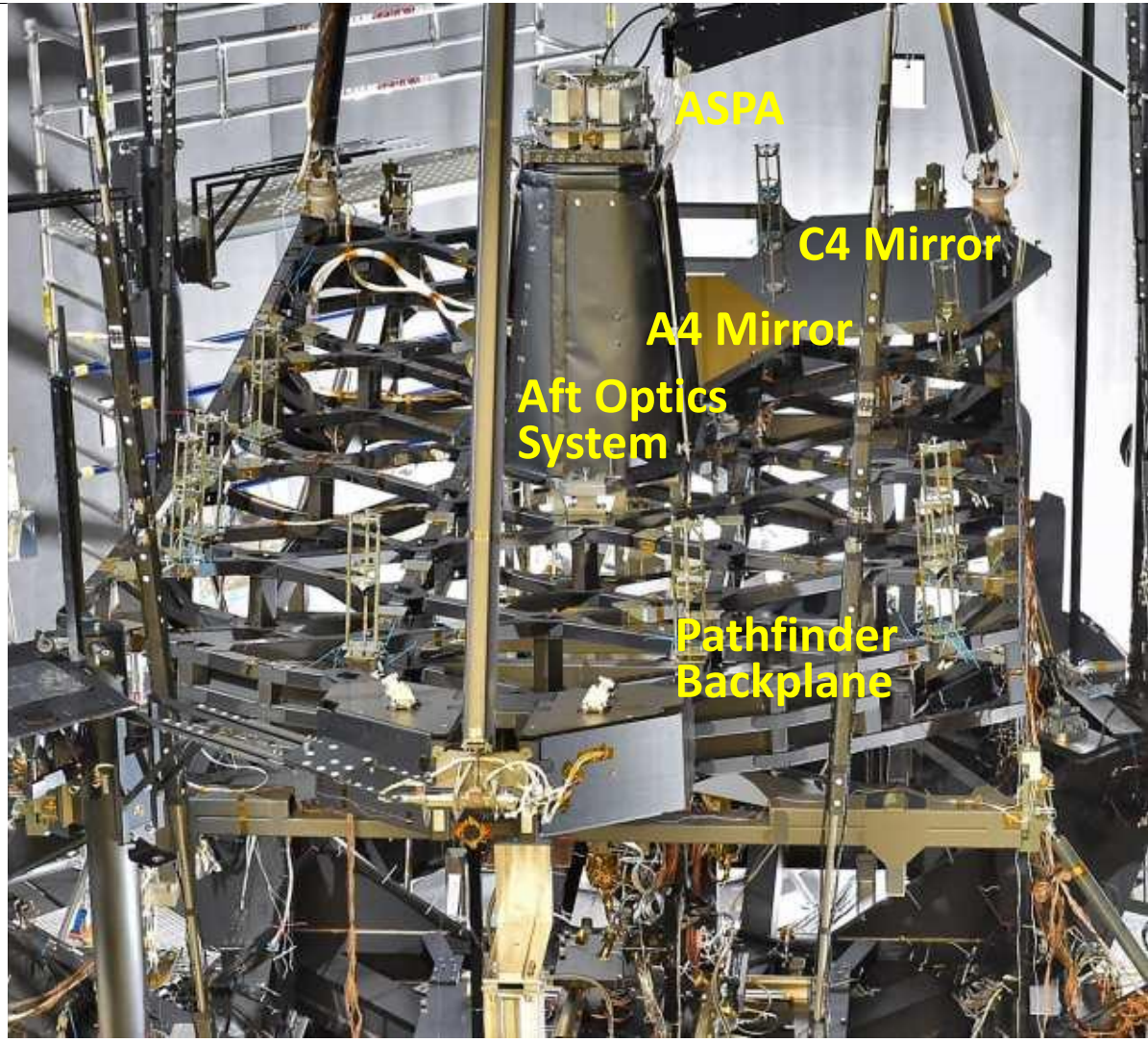
Meanwhile, Hardware Preparations for CV3 Proceeded in the SSDIF – 2



And Were Completed in Preparation for the Move into the SES Chamber on October 13th

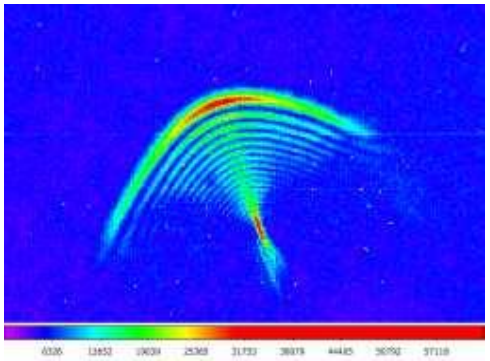
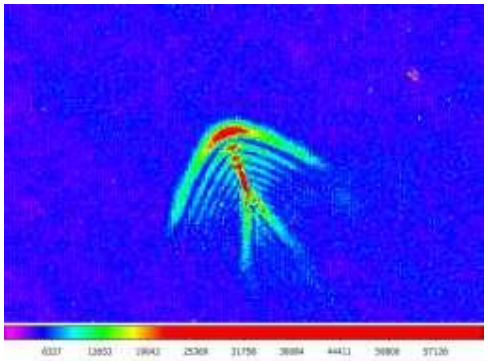
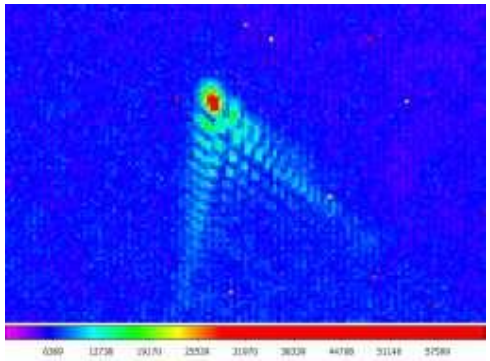
- Pumpdown expected ~October 27 for a ~100-day test, with ~60 days at cryo operating conditions

OGSE-2 Test in the Pathfinder Series Began September 25th in Chamber A at JSC

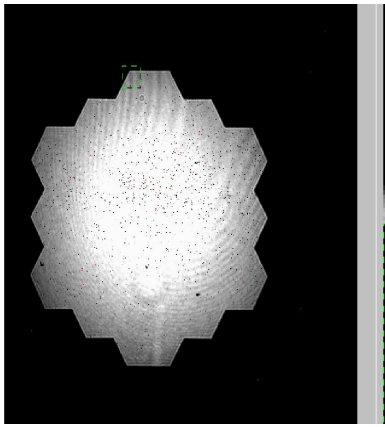


OGSE-2 Test Progressing Well

- Facilities operating very well, good leak rate, smooth cooldown
- Half-Pass calibrations of ASPA sources complete, went well

Half-pass focus sweep (yes, that's what they're supposed to look like!)



HP Pupil Image

- Pass-and-a-Half (PAAH) testing ongoing
  - Vibration levels significantly higher than expected, despite fix of the mechanical short experienced in OGSE-1
  - Effectiveness of Hartmann Sensing and Phase Retrieval approaches for analyzing PAAH data being assessed
  - With the goal of optimizing the approaches for the OTIS test program, which is the point of the Pathfinder activities
- Warmup expected to start ~October 20

JWST/NIRSpec





JWST SWG monthly science teleconference
October 2015

NIRSpec in ISIM

- **The ISIM-level acoustic testing was successfully completed.**
  - Critical test for NIRSpec given the sensitivity of the micro-shutters to this type of testing.
  - Visual inspection of the micro-shutters (high-resolution photos taken looking back into the instrument) did not show any damage to the micro-shutters.

➔ This gives us confidence that we are in good shape but the real test will be when we are at operating temperature and operate the micro-shutter array. ➔ ~ mid-November.

- **NIRSpec like ISIM and the other instruments are undergoing the final preparation steps before the start of ISIM CV-3.**

  ➔ Quite an exciting time (once more!).

Preparation for scientific operation
Contributions to the JWST calibration summit

- **JWST calibration summit 2-4 September 2015**
  - Organised by STScI. Very interesting and productive meeting.
  - Good interactions / discussions with the STScI teams and groups.
  - Good opportunity to see the work of the other teams.
- **Multiple contributions from the ESA NIRSpec team (among others).**
  - NIRSpec Status Update & Calibration/Pipeline Challenges – S. Birkmann.
  - NIRSpec instrument parametric model – G. Giardino.
  - The NIRSpec calibration pipeline – C. Alves de Oliveira.
  - NIRSpec flat-fielding strategy for MOS spectroscopy. – Tim Rawle.
  - NIRSpec – IRS^2 (Improved Reference sampling & Subtraction) – M. Sirianni.
  - Overview of NIRSpec simulator capabilities – P. Ferruit.

➔ **Variety of contributions highlighting the work of the team with a strong focus on the support to the development of the official STScI NIRSpec pipeline.**

All these activities are conducted in close collaboration with the NIRSpec group at STScI

Preparation for scientific operation
Improved Reference Sampling & Subtraction = IRS^2

- **The origins…**
  - In the faint object regime and for the vast majority of its spectral configurations, NIRSpec is detector noise limited.
  - As a consequence, NIRSpec has the most stringent detector noise requirement among JWST's near-infrared instruments.
    - 6 electrons, total noise for a ~1000 s ramp.
  - In 2011, it was recognised that the SCA+ASIC pairs had difficulties meeting this requirements and this was threatening our compliance to NIRSpec sensitivity requirements.

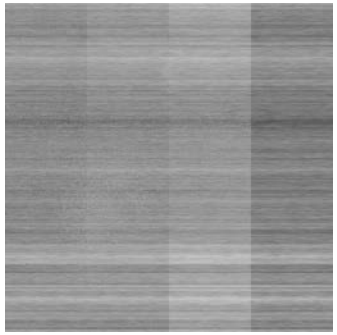
In 2011, GSFC started looking for a solution : IRS^2

IRS^2 team: Bernie Rauscher, Harvey Mosley, Dale Fixen, Richard Arendt, Markus Loose, Donna Wilson, Ed Lander, Chris Xenophontos.

Slides based on the presentation of M. Sirianni at the JWST 2015 calibration summit.

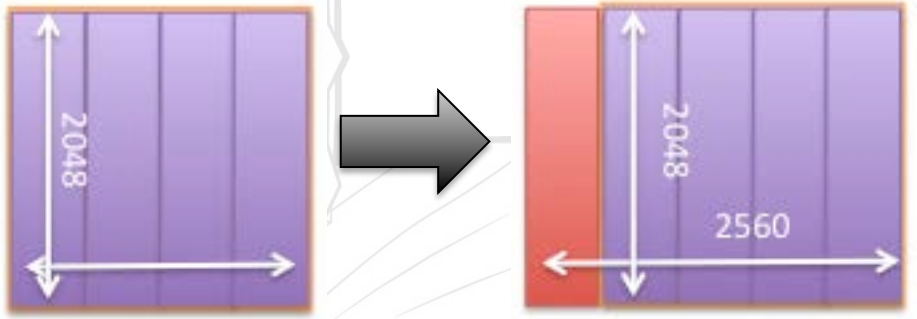
Preparation for scientific operation
Improved Reference Sampling & Subtraction = IRS²

- **Noise analysis (Moseley et al. 2010, SPIE 7742)**
  - main noise components: 1/f noise, alternating cols patter noise.

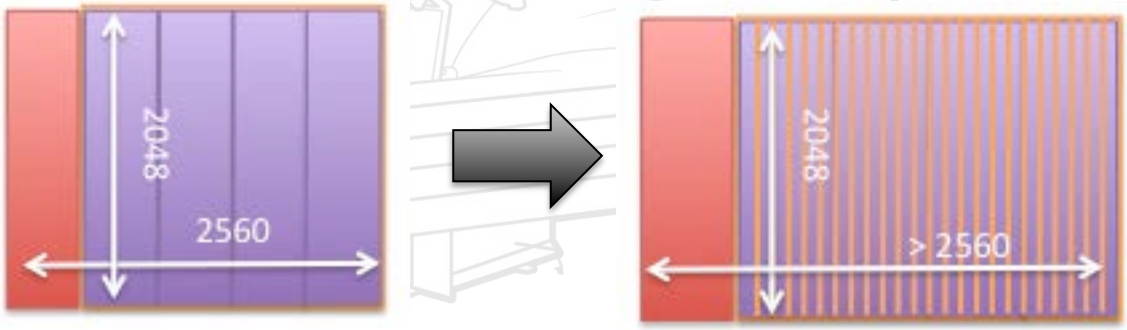


➔ **This analysis identified two sources of noise that could be eliminated by changing the readout scheme.**

Change #1: bring the reference output to the ground for optimal subtraction.



Change #2: read reference pixels more frequently.



Slides based on the presentation of M. Sirianni at the JWST 2015 calibration summit.

Preparation for scientific operation
Improved Reference Sampling & Subtraction = IRS^2

- **Two main results:**
  - Reduction of the total noise (this was the goal!).
  - Strong reduction of the correlated noise levels (very attractive).

➔ **Very attractive new readout scheme. Has the potential to become the baseline scheme when acquiring full-frame exposures.**

Results of testing on our two flight detectors:

TOT NOISE e-rms	491	492 *
standard	6.30	7.62
IRS2	5.34	7.09
IRS2+pedestal	4.99	5.93

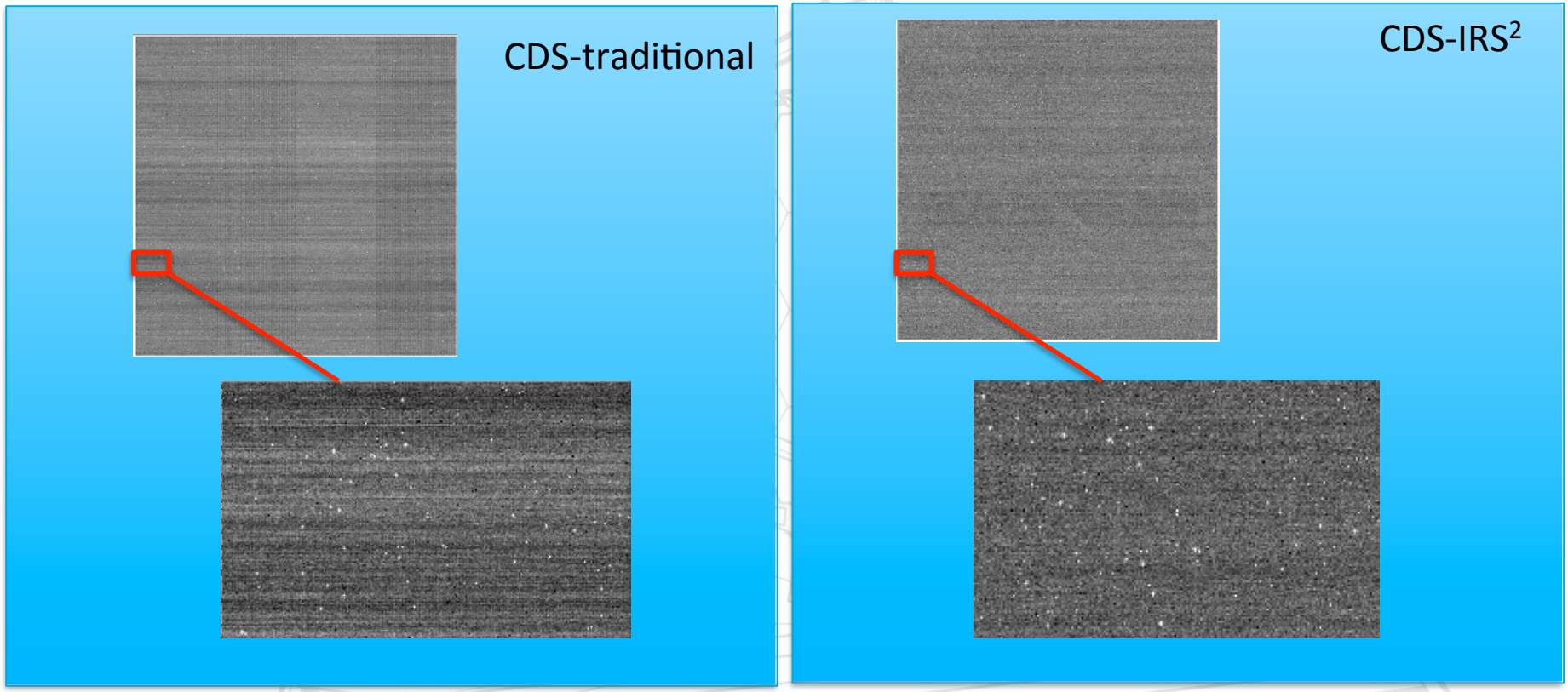
* An additional noise source is present in 492 (non stationary component) – If confirmed during CV3 this may require to add a pedestal correction as a baseline.

➔ **A significant reduction of the total noise level is achieved.**

➔ One of the detectors may require the implementation of a pedestal correction. To be confirmed.

Slides based on the presentation of M. Sirianni at the JWST 2015 calibration summit.

Preparation for scientific operation
Improved Reference Sampling & Subtraction = IRS^2



Slides based on the presentation of M. Sirianni at the JWST 2015 calibration summit.

Preparation for scientific operation
Improved Reference Sampling & Subtraction = IRS^2

- **Status and next steps**
  - IRS2 is available and will be thoroughly tested during ISIM CV3 with the new flight detectors integrated in NIRSpec.
  - We will confirm the choice of IRS2 as the baseline based on the results of the CV-3 testing.
  - The "traditional" readout mode remains available (we have a fall back solution if we end up discovering issues for this new readout mode).

References:

NIRSpec SCA noise properties, IRS2 readout and data processing:
Mosley et al. 2010 SPIE 7742, 77421B-1
Rauscher et al. 2011 SPIE 8155, 81550C-1
Rauscher et al. 2012 SPIE 8453, 84531F-1

Explicit derivation of IRS2 equation: Robberto 2012 JWST-STScI-002896

Algorithm for processing IRS2 data Rauscher et al. 2014 EIDP JWST-EIDP-0252

Slides based on the presentation of M. Sirianni at the JWST 2015 calibration summit.

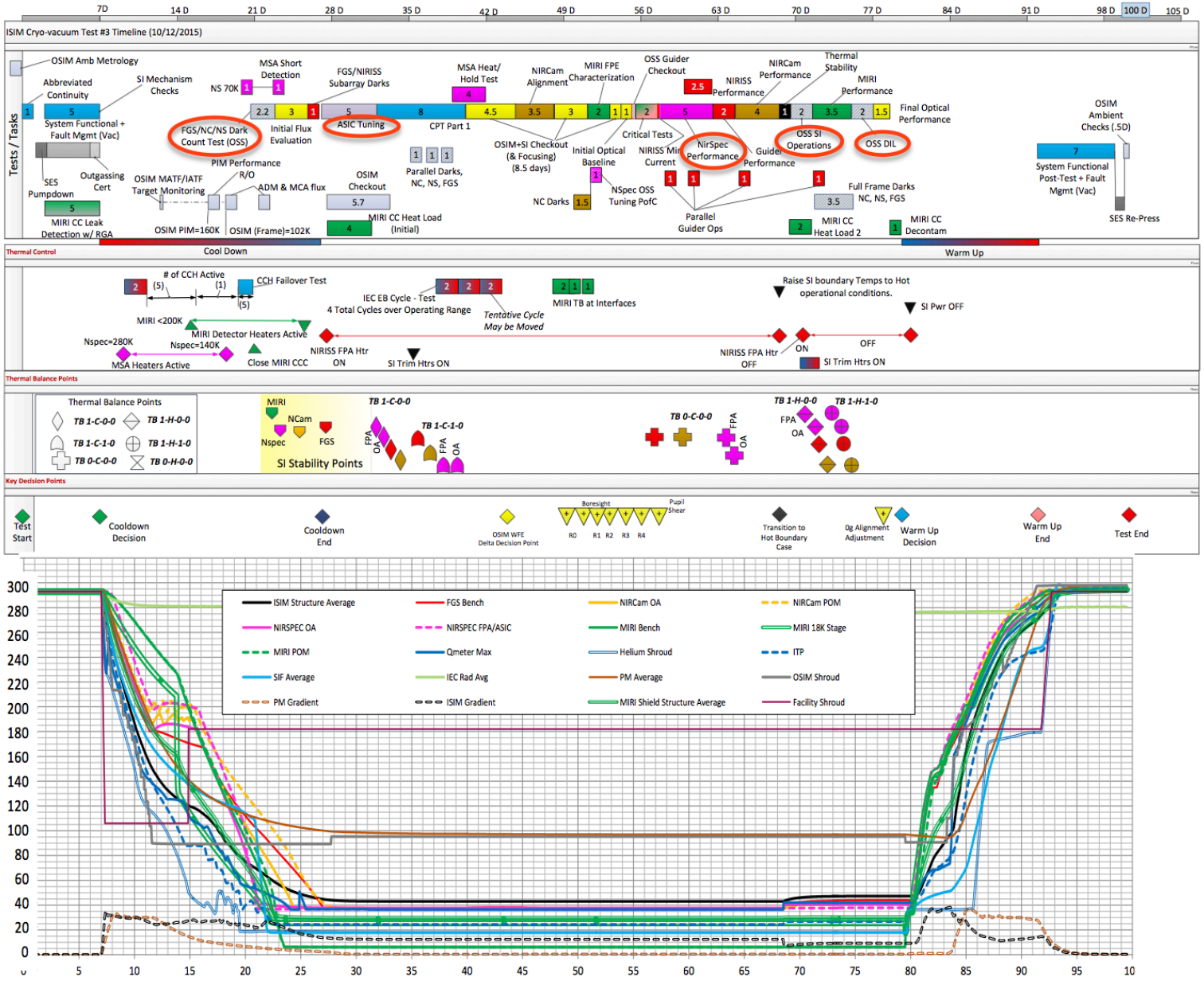
Science Operations Report (STScI)

Use of the Operations Script Subsytem (OSS) in CV3

- OSS is the commanding system used for most science observation activities
- OSS permits the efficient execution of observations through the use of event-driven operations
- Planned OSS activities in CV3:
  - Warm darks – during cooldown starting at ~80K
  - ASIC tuning – for NIRCam, NIRISS, and FGS. NIRSpec tuning to be verified.
  - NIRSpec performance test – multiple MSA configurations
  - FGS guiding – from star ID to fine guide. Robustness to acq failure.
  - Science instrument characterization (SIC) – verification of OSS requirements
  - MIRI performance test – imaging and spectroscopic trending analysis
  - Day in the Life (DIL) test – “similar” to normal science operations

Science Operations Report (STScI)

(Timeline subject to change)



Science Operations Report (STScI)

Day in the Life test (partial list)

These programs test the full ground system from the Proposal Planning System (APT) to the Data Management System to Calibration System pipeline products.

- Mosaic test – 4-point mosaic with multiple "stars" in each SI (only 1 in MIRI)
- NIRSpec MOS test – Prism & R=1000 spectroscopy of high z galaxies
- NIRSpec bright object time series – simulates exoplanet observations
- NIRSpec IFU – R=2700 spectroscopy of spatially resolved high z gals
- NIRSpec MSA – R=1000 spectroscopy of ices in molecular clouds
- NIRSpec fixed slit spectroscopy of transiting planet
- NIRCam coronagraphic imaging. Simulation of roll dither.
- MIRI+NIRCam and NIRCam+NIRSpec parallel observations
- FGS guiding in parallel with NIRSpec
- NIRSpec fixed slit in parallel with NIRCam darks
- NIRSpec IFU and MIRI MRS in parallel with NIRCam flats

Science Operations Report (STScI)

Day in the Life test (continued)

- MIRI and NIRCam imaging in parallel with NIRSpec darks
- NIRSpec fixed slit in parallel with MIRI darks
- NIRISS imaging in parallel with NIRCam darks
- NIRISS imaging in parallel with MIRI darks
- NIRSpec internal spectral calibration with G140H grating
- NIRSpec internal spectral calibration with G395M grating
- NIRSpec darks with various numbers of groups
- MIRI low resolution spectroscopy to test DMS associations
- NIRCam fine phasing wavefront sensing and control
- Real-time visit
- Non-pointed visit

THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

Northrop Grumman JWST Program Updates

October 2015

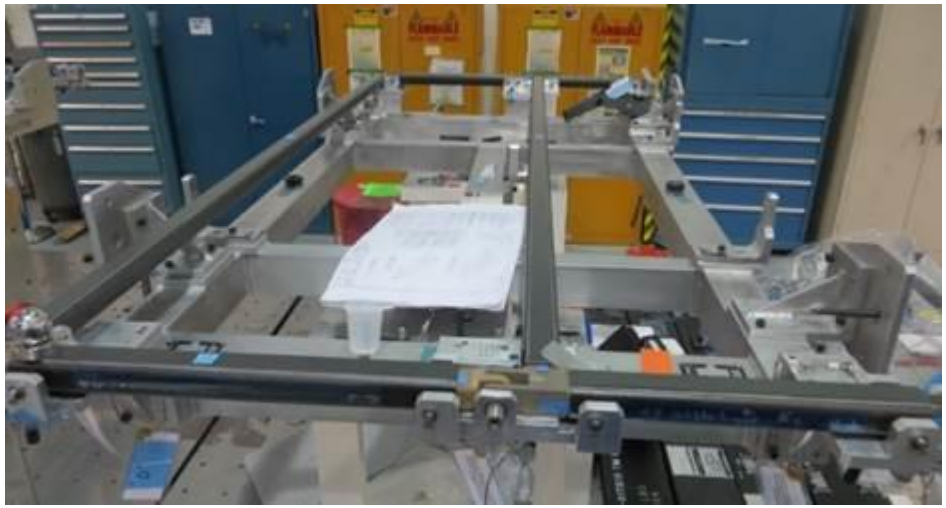
Scott Willoughby
Vice President and JWST Program Manager

Program Updates

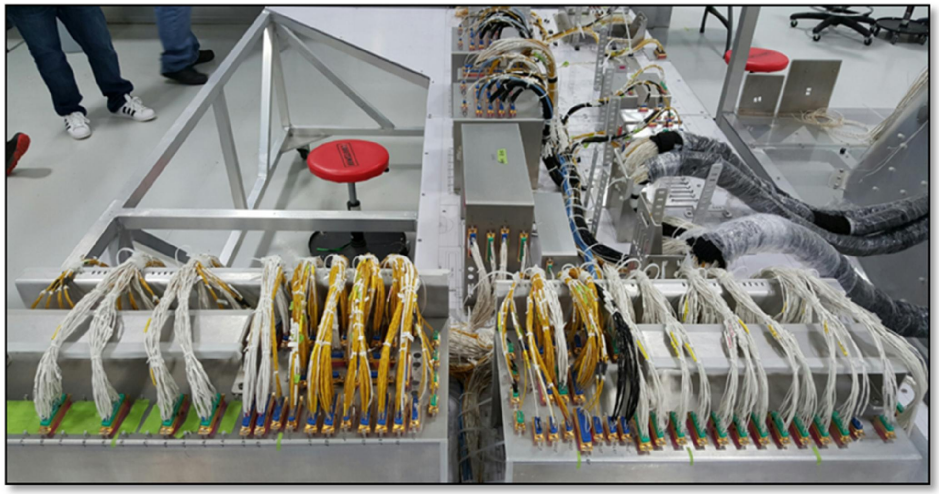
- Preparations for Optical Ground Support Equipment (OGSE) 2 Complete
- Spacecraft Equipment Panels delivered to I&T
- All 6 Reaction Wheel Integrated Assemblies (RWIA) have completed their Acceptance Test
- Aft Unitized Pallet Structure (UPS) has been transferred to Roll Over Fixture

UPS Manufacturing / Sunshield Update

Mid-Elbow



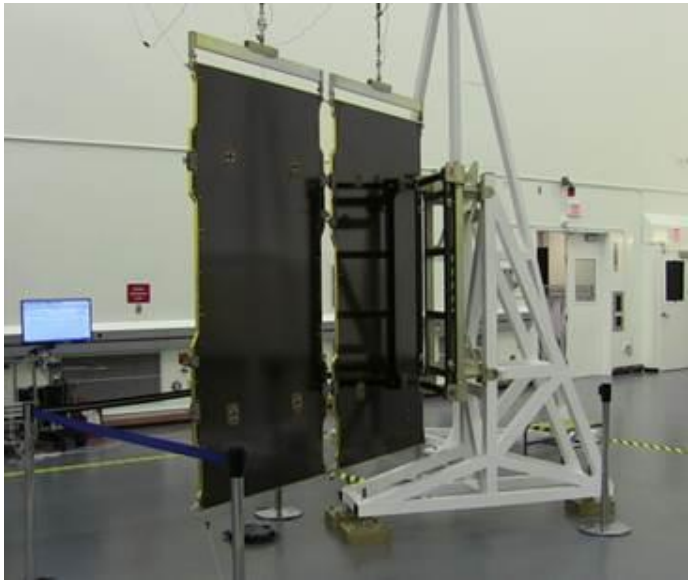
4-Bar Tube Assembly



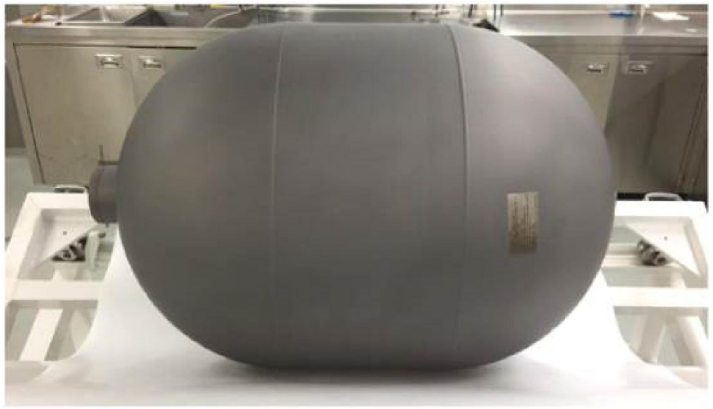
W60 Harness on –J2 Panel Fabrication Fixture

Star Tracker Support Assembly nearing completion

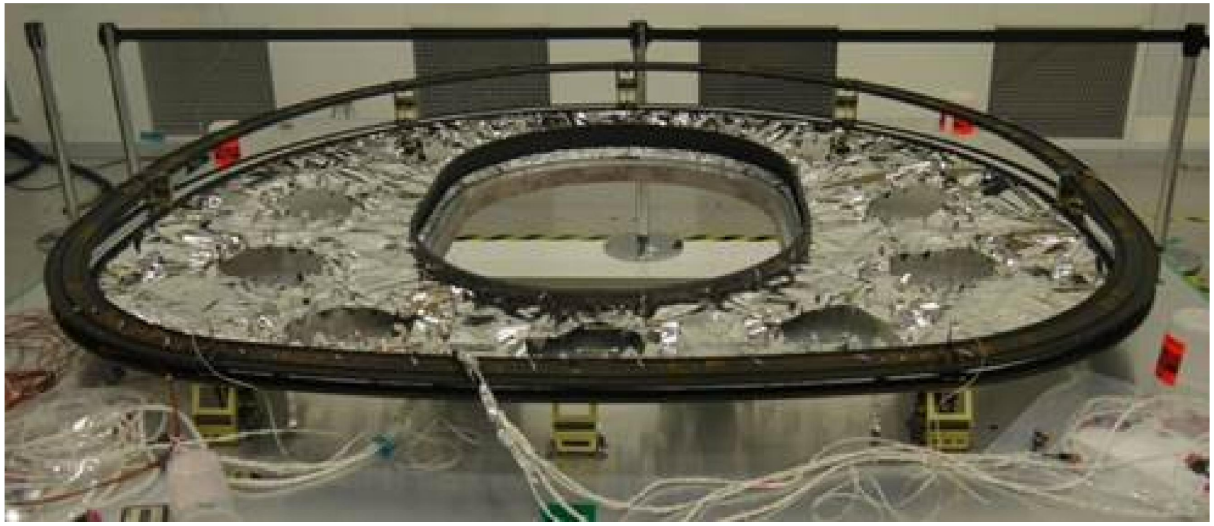
Additional Miscellaneous Progress



Solar Array partial wing assembly



Hydrazine Tank



Rim and Hub assembly


NORTHROP GRUMMAN