WFI Overall Status

• WFI fully integrated at Ball Aerospace and completed first of two 60-day instrument thermal vacuum test campaigns (TVAC1)

• Goals of TVAC1:
  – Test the functionality of all instrument systems
  – Establish a pre-environmental (vibration, acoustics) instrument performance baseline with a focus on optical performance
  – Perform risk reduction activities for further characterization and performance tests in the second TVAC campaign in Spring 2024 (TVAC2)

• In the current schedule, WFI will undergo environmental testing over the next few months and start TVAC2 in March 2024
What goes in the TVAC chamber?
What goes in the TVAC chamber?

Most of this is Ground Support Equipment (GSE) to enable a realistic test environment.
• Stimulus of ray cones (SORC)

• Key Capabilities
  – **Projector** to place point sources at any point on focal plane.
  – **Diffuser** to illuminate across the field.
  – **Blackbody** to block/thermally illuminate WFI.
  – **Metrology** to register SORC to WFI, WFI element wheel.

SORC in the Space Environment Simulator at GSFC, 3/23
Wide Field Instrument – Key Subsystem Overview

Focal Plane System
- Focal Plane Electronics (FPE)
- Sensor Control Electronics Assembly (SCEA)
- Detector Focal Plane Array

Alignment Compensation Mechanism

Optical Bench

Calibration System

Incoming Light

Element Wheel

Cold Baffle
WFI moving to SORC/fixture
WFI mated to SORC with radiator exposed
WFI+SORC moving to face cold target in Titan chamber
Another view of WFI+SORC moving into the Titan chamber
Completed TVAC1 test profile
TVAC data volume planning

- **Goals:**
  - Verify GSE+WFI system meets requirements or is requirements capable
  - Establish instrument cryo performance baseline prior to environmental tests
  - TVAC1 performed risk reduction tests to further prepare for TVAC2
    - Key for TVAC2 tests that are used to verify science requirements and produce calibration reference files
- **Types of Science Data obtained:**
  - Focal Plane System performance
  - Optics performance – backgrounds, element blocking, and stray light characterization
  - Calibration system (sRCS) performance
  - Risk reduction tests
- **High heritage tools used for data acquisition and analysis**
  - Test Planning Tool (TPT) / Optical Test Procedure (OTP from JWST testing for test scripting
  - Quicklook and longer-term analysis tools from WFI subsystem testing (e.g. SCAs, FPS, sRCS)
- **270 data collects performed during TVAC1, longest script ran for 9 hours**

Excellent fidelity for data volume requirements and test plan

Comparison of pre-TVAC data volumes per test plan and schedule to actual accumulated test volume.
WFI TVAC1 Highlights

1. **FPS performance and reliability was remarkable**
   - Multiple WFI level requirements met
   - Performance baseline established

2. **In-band stray light performance is excellent**
   - Multiple WFI level requirements either met or data demonstrates that system is requirements capable
   - Some thermal leaks were identified, review board convened, and corrective action in progress
   - Performance baseline established

3. **sRCS flat field smoothness appears excellent**
   - Data demonstrates system is requirements capable
   - Performance baseline established with full characterization planned for TVAC2

4. **Confocality between elements across the field is excellent**
   - All elements focus in the same plane, except for prism which might be slightly out of tolerance (also a bit more forgiving – analysis underway)

5. **Focus-corrected wavefront error performance is excellent**
   - Sensing the instrument wavefront with SORC went well beyond expectations.
   - Overall performance is met with margin for all elements

6. **Executed a very successful campaign of risk reduction tests**
   - Data demonstrates that system is requirements capable
   - Data is immensely helpful and critical for developing final characterization plans in TVAC2
Preliminary test highlights

- Some examples of early TVAC1 results

Snapshots of going in and out of focus for wavefront error analysis

Flight FPA total noise mosaic from TVAC1
What's next?

- Full analyses of TVAC1 data ongoing in parallel with preparations for environmental testing and TVAC2
- Working with the Science Operations Center (Space Telescope Science Institute) to host and archive these integration and test (I&T) data for community use, stay tuned
- TVAC1 results are precursors to full characterization from TVAC2 that are important ingredients for instrument performance reference files and calibration

**Longer term:**

delivery of WFI back to Goddard next year

followed by integration into the Instrument Payload Assembly!