Agenda

- New Structure of the Team
- SMGT
- SMOV
- TV & Ground Testing
- Ground System
- User Support
- Miscellaneous
COS/STIS Team

- New organization of the Instruments Division in place
- Old COS and STIS Teams have been jointed together
  - Optimization of resources
  - Technical cross-fertilization
- COS/STIS Team Lead responsible for personnel and technical work
- COS (Tony Keyes) and STIS (Charles Proffitt) technical leads appointed
SMGT Rationale

- Demonstrate end-to-end readiness of the ground system to support SMOV
- Test and demonstrate readiness of operational COS instructions and PDB elements
  - Does not exercise all combinations of allowed modes and setups, but does exercise all command paths
- Test all special commanding required on-orbit for SMOV
  - Examples include: first-time NUV detector turn-on; NUV detector recovery from anomaly; NUV fold test, first-time FUV detector turn-on
SMGT Activities

- STScI SMS generated through proposal 874
- First COS SMGT (26-27 July 2007)
  - Started on 26 July 2007; STScI SMS portion planned to last ~ 24 hours
  - Anomalous NUV HV shutdown occurred after ~ 4 hours of SMS execution during MAMA fold test
  - A couple of errors present and corrected in the SMS
- Second COS SMGT (7-8 September 2007)
  - Dry-run executed 21-23 August 2007
  - Real test executed 7-8 September 2007
  - All special commanding executed successfully
  - Test data delivered successfully to STScI
SMGT Liens

- NUV Fold test re-run required
  - Data sampling did not return sufficient signal for analysis
  - Data was sampled via engineering telemetry
  - Science exposure added at the end to capture all the data

- Target Acquisition macro instruction timing
  - Some timing pads in commanding will likely be modified

- Mechanism relative-move macro modification required
  - Aperture mechanism moves are not always made in preferred direction

- Currently in the process of clearing the SMGT liens *against bench* and *against SI* (26 November 2007)
SMOV4 Activities

- Successful SMOV4 “delta” requirements review by HSTP on 21 March 2007
  - COS requirements expanded and updated for this review
  - No significant changes to COS requirements
- Successful SMOV activity summary (Phase I) review by HSTP on 12 October 2007
  - Mapping of requirements to programs, assignment of resources, and program description (STScI and COS IDT)
- SMOV Program (Phase II) generation: Nov 2007 – July 2008
SMOV4 Plan Overview

- 36 activities currently identified for both NUV & FUV
- Sequence and duration established
  - NUV will start first, followed immediately afterwards by FUV
  - In current very conservative draft COS SMOV will terminate around end November (~ 1 month later than any other SI)
  - In the process to shorten the total SMOV period for COS
- Total of 145 (internal) & 100 (external) orbits currently estimated

<table>
<thead>
<tr>
<th></th>
<th>external</th>
<th>internal</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUV</td>
<td>84</td>
<td>75</td>
</tr>
<tr>
<td>FUV</td>
<td>61</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>145</td>
<td>100</td>
</tr>
</tbody>
</table>
COS SMOV4 NUV Sequence

COS-01
Recovery from SAFE

COS-02
Onboard Memory Check

COS-03
Science Data Buffer Check

COS-04
NUV Initial HV Turn-on/Ramp-up

Internal pressure <20 micro-Torr

Internal pressure <10 micro-Torr

COS-05
NUV Dark Measure

COS-06
NUV Internal Functionality & Operation

COS-07
NUV Fold Test

COS-08
OTA to FGS Alignment (NUV)

COS-09
NUV Optical Alignment /Focus visit 1-3

COS-10
Internal NUV Wavelength Meas Vis 2 – lamp 2

COS-11
NUV Imaging Acq Verify

COS-12
NUV Dispersed Acq Verify

COS-13
NUV Imaging Performance

COS-14
NUV Int/External Wavelength Scales

COS-15
NUV Imaging Acq Verify

COS-16
NUV Ext. Spectr. Perf. Part 1

COS-17
NUV Ext. Spectr. Perf. Part 2

COS-18
NUV Flat Fields

COS-19
NUV Spectr. Sensitivity

COS-20
NUV Structural & Thermal Stability

COS-21
NUV High S/N Veriﬁcation

FUV SMOV sequence

Do NOT Require Wavelength Scale Update

Require Wavelength Scale Update

Alignment OK

Alignment OK

Real-time uplink; Poss. update SIAF

Update SIAF

Update SIAF

Patchable Const. Update

Wavelength Ranges OK

Wavelength Ranges Not OK

BEA Complete

HST release

MAMA LV on

Rapid data turnaround required

<20 micro-Torr

<10 micro-Torr

Internal pressure

External Observations

Special Commanding

May require wait

Alignment Not OK

Update SIAF

Internal pressure

Internal pressure
COS SMOV4 FUV Sequence

HST release

XDL at OPER

Outgassing Concern?

Internal Pressure <100 micro-Torr

COS-01 COS-02 COS-03

COS-22 FUV Detector Door Open

Internal Pressure <10 micro-Torr

COS-23 FUV Initial HV Turn-on/Ramp-up

Rapid data turnaround required

COS-01
COS-02
COS-03

NUV SMOV sequence

BEA Complete

COS-09 NUV Optical Alignment /Focus

Update SIAF

COS-24 FUV Dark Measure

COS-25 FUV Internal Functionality & Operation

Pressure Gauge OFF

Enable FUV ERO and Science

Wavelength Ranges OK

Wavelength Ranges Not OK

COS-27 Internal FUV Wavelength Meas Vis 2 – lamp 2

Patchable Const. Update

COS-26 FUV Optical Alignment /Focus visit 1

Alignment OK

COS-29 FUV Int/External Wavelength Scales

Does NOT Require Wavelength Scale Update

COS-27 Internal FUV Wavelength Meas – Vis 1

COS-30 Internal NUV Wavelength Verify

COS-31 FUV Ext. Spectr. Perf. Part 1


COS-33 FUV Flat Fields

COS-34 FUV Spectr. Sensitivity

COS-35 FUV Structural & Thermal Stability

COS-36 FUV High S/N Verification

Require Wavelength Scale Update

Real-time Commanding

Special Commanding

External Observations

May require wait

10 October 2007
Thermal-Vacuum & Ground Testing

- Successful TAGFLASH test conducted at COS TV II in December 2006
  - Exercised flashes for all gratings and wavelength settings
  - Identified modest updates to commanding due to lamp turn-on characteristics
  - Ongoing assessment and verification of OSM drifts

- TV II data processed by OPUS to be ingested in MAST
  - Header keyword verification ~ 90% complete

- Reference file delivery from IDT currently undergoing
  - About half of the files (10/19) delivered

- New functional and grating efficiency tests performed on 8-10 October 2007
  - Confirmed trend for degradation of NUV gratings (up to ~ 25% at launch)
  - No plans at this point to change COS gratings
Ground System Activities

- Proposal and Scheduling System
  - All science exposure and calibration commanding is complete

- CALCOS (Pipeline) Development
  - Most pipeline steps tested against instrument data (screening, thermal distortion, geometrical correction, dead-time correction, flatfield, 1-d extraction, wavecal processing, etc)
  - TAGFLASH coded and partially tested - Final testing with TV II and SMGT exposures
  - Verification of pipeline and reference files on TV I/II and SMGT data will start in November 2007
  - Post-pipeline tools in development
User Support

- COS Instrument Handbook in preparation
  - Updated version provided to IDT for second review
  - To be distributed with Cycle 17 Call for Proposals (Dec 2007)
- COS Data Handbook to be started in Nov 2007
- COS input provided for Cycle 17 CP and Primer
- COS ETCs
  - Spectroscopic ETCs in final acceptance testing (except 2nd order issues)
  - Imaging and Target Acquisition ETCs under development
  - To be distributed with Cycle 17 Call for Proposals (Dec 2007)
- STScI COS Website in transformation: suggestions welcome
  - http://www.stsci.edu/hst/cos/
Miscellaneous

- COS Team is supporting SM4 simulations at GSFC for training purposes (~ 4 STScI members + IDT):
  - First COS SIM on 11 October 2007
  - Second COS SIM on 28 November 2007
  - Third COS JIS currently scheduled for 29 May 2007
- STScI will be hosting the next COS Science Team Meeting on 26 October 2007
- COS Team is going to heavily support the Austin AAS meeting and the Bologna Workshop in January 2008
Limiting flux as function of exposure time to reach S/N=10 with spectral resolution $\lambda/\Delta\lambda=20,000$ at 1600 Å

- $F_\lambda$ (erg cm$^{-2}$ sec$^{-1}$ Å$^{-1}$)
- $T_{exp}$ (orbits)

Discovery potential:
- QSO (Reionization)
- QSO ($z \sim 0.5$)
- Starburst galaxies
- Brightest QSO (3C 273)
- OB stars in the Magellanic Clouds

Unexplored discovery space
## Cosmic Origins Spectrograph
### Detector Characteristics

<table>
<thead>
<tr>
<th></th>
<th>FUV MCP</th>
<th>NUV MAMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocathode</td>
<td>CsI (opaque)</td>
<td>Cs₂Te (semi-transparent)</td>
</tr>
<tr>
<td>Window</td>
<td>None</td>
<td>MgF₂ (re-entrant)</td>
</tr>
<tr>
<td>Wavelength range</td>
<td>1150 – 2050 Å</td>
<td>1700 – 3200 Å</td>
</tr>
<tr>
<td>Active area</td>
<td>85 x 10 mm (two)</td>
<td>25.6 x 25.6 mm</td>
</tr>
<tr>
<td>Pixel format</td>
<td>16384 x 1024 (two)</td>
<td>1024 x 1024</td>
</tr>
<tr>
<td>Pixel size</td>
<td>6 x 24 μm</td>
<td>25 x 25 μm</td>
</tr>
<tr>
<td>Spectral resolution element size</td>
<td>6 x 10 pix</td>
<td>3 x 3 pix</td>
</tr>
<tr>
<td>Quantum efficiency</td>
<td>26% at 1335 Å</td>
<td>10% at 2200 Å</td>
</tr>
<tr>
<td></td>
<td>12% at 1560 Å</td>
<td>8% at 2800 Å</td>
</tr>
<tr>
<td>Dark count rate</td>
<td>~0.5 cnt s⁻¹ cm⁻²</td>
<td>~34 cnt s⁻¹ cm⁻²</td>
</tr>
<tr>
<td></td>
<td>~7.2 x 10⁻⁷ cnt s⁻¹ pix⁻¹</td>
<td>~2.1 x 10⁻⁴ cnt s⁻¹ pix⁻¹</td>
</tr>
<tr>
<td></td>
<td>~4.3 x 10⁻⁵ cnt s⁻¹ resel⁻¹</td>
<td>~1.9 x 10⁻³ cnt s⁻¹ resel⁻¹</td>
</tr>
<tr>
<td>Detector global count rate limit</td>
<td>TTAG</td>
<td>~21,000 cnt s⁻¹</td>
</tr>
<tr>
<td></td>
<td>ACCUM</td>
<td>~21,000 cnt s⁻¹</td>
</tr>
<tr>
<td></td>
<td>~60,000 cnt s⁻¹ segment⁻¹</td>
<td>~170,000 cnt s⁻¹</td>
</tr>
<tr>
<td>Local count rate limit</td>
<td>~100 cnt s⁻¹ resel⁻¹</td>
<td>~1800 cnt s⁻¹ resel⁻¹</td>
</tr>
<tr>
<td></td>
<td>~1.67 cnt s⁻¹ pix⁻¹</td>
<td>~200 cnt s⁻¹ pix⁻¹</td>
</tr>
</tbody>
</table>
COS Spectral Resolution and Bandpass Summary

- **FUV channel**
  - G130M \( R > 20,000 \) \( \lambda \lambda 1150-1450 \)
  - G160M \( R > 20,000 \) \( 1405-1775 \)
  - G140L \( R > 2,000 \) \( 1230-2050 \)

- **NUV channel**
  - G185M \( R > 16,000 \) \( 1700-2100 (3x35) \)
  - G225M \( R > 20,000 \) \( 2100-2500 (3x35) \)
  - G285M \( R > 20,000 \) \( 2500-3000 (3x41) \)
  - G230L \( R > 1,700 \) (most of bandpass) \( 1700-3200 \)

- **Bright Object Aperture (BOA) resolution degraded**
  - Wedge in ND filter degrades resolution by factor of \( \sim 2.5 \) for FUV modes and \( \sim 4 \) for NUV modes.