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# **Chandra Users' Committee**

## **CXC Manager's Status Report**

**For the period October 2015 – September 2016**

**Roger Brissenden  
CXC Deputy Manager**

**27 September 2016**

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# Topics

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- **Program Management**
- **Mission Operations**
  - Spacecraft
  - Science Instruments and Calibration
  - Mission Planning
  - Operations Control Center
- **Science Operations**
  - CXC Data Systems
  - Calibration
  - Data Processing
- **Chandra Director's Office**
  - GO Program
  - Einstein Program
- **Education and Public Outreach**



# Top Level Summary

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- **Spacecraft and instruments are performing superbly**
  - There are no known spacecraft limitations due to degradation, aging or consumables that would prevent our meeting Level 1 requirements over the course of a 25-year mission
- **NASA Senior Review**
  - Submitted 2016 Senior Review proposal 22 Jan 2016
  - SR committee site visit at OCC 22 – 24 Mar 2016
  - SR Report issued by HQ 31 May 2016
- **CXC contract extension**
  - Contract currently runs through Sept 2019 (mission ops through Sept 2018)
  - NASA is proceeding on an extension through Sept 2030
- **Staff**
  - Scott Wolk has been certified as a Flight Director



## Senior Review Committee Report (excerpts)

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“The 2016 Senior Review Panel enthusiastically endorses the recommendation to extend the mission through 2020 and beyond.”

“The CXC continues to be highly successful in their support of the scientific community in all phases of participation in the use of the CXO and in monitoring the Observatory and maintaining its health and safety.”

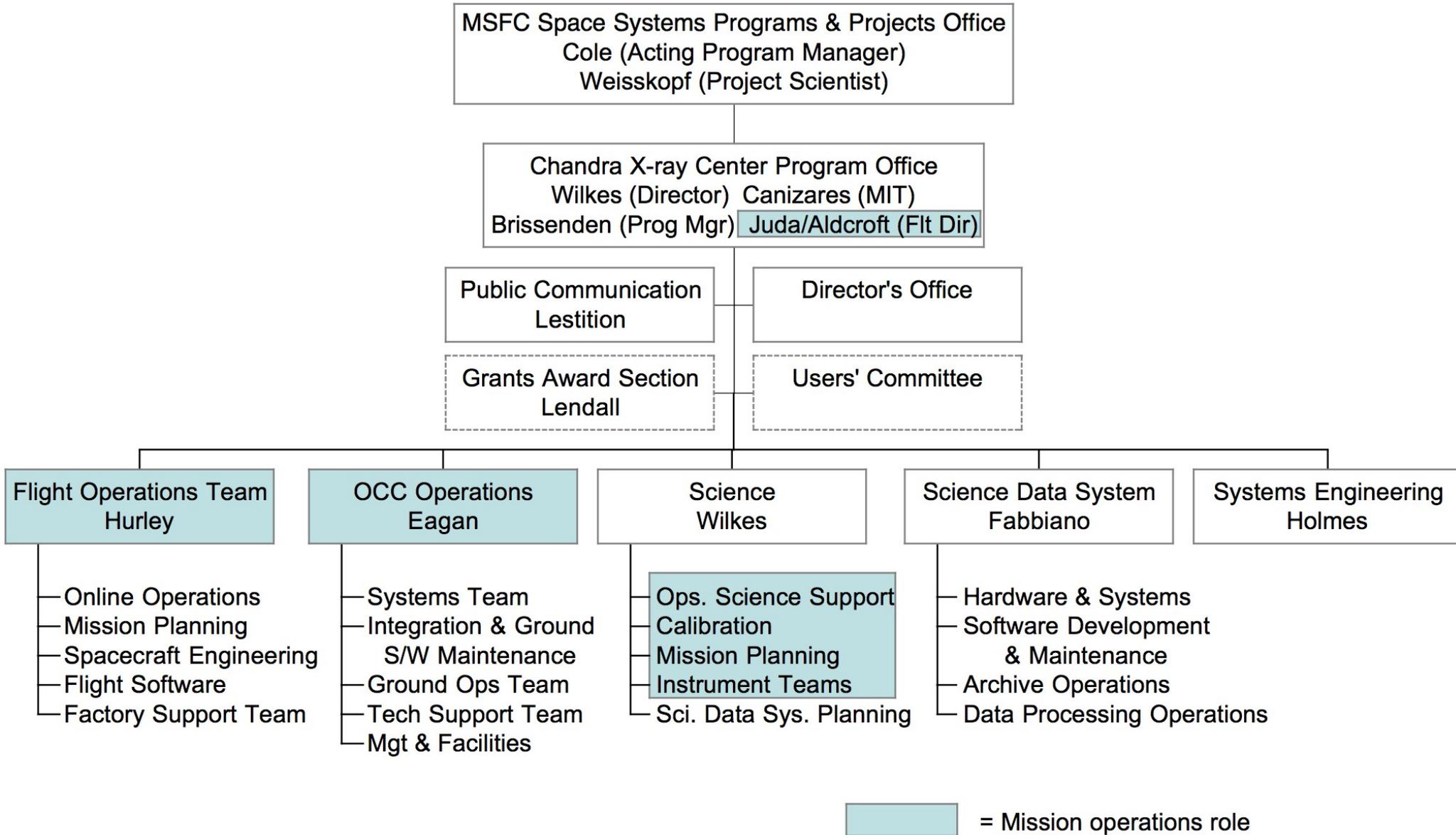
“The stewardship of the observatory remains exemplary. The Project's highest priorities are to maximize the scientific return of the observatory while maintaining the health and safety of the instruments and spacecraft.”

“The release of the second Chandra Source Catalog ... is an extremely important effort that will provide the scientific community with an important and valuable tool.”

- Submitted plan to HQ in response to panel’s findings on 24 Aug 2016



# Program Management





# Program Management

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- **CXC Contract Extension Status**

- NASA has begun the process of extending the CXC contract through 2030
- 3-year baseline (10/1/18–9/30/27) plus 2, 3-year options, plus 3-year closeout period
- NASA HQ has approved master procurement plan delegating responsibility to MSFC
- MSFC issued presolicitation announcement 30 Aug 16
- Sole-source justification in approval cycle at MSFC (expected Nov)

Future activities (dates are current goals):

- Formation of Integrated Acquisition Team (IAT) (~Dec)
- IAT activities (~Jan – Jun 2017)
- SAO submits proposal (~Jul 2017)
- Proposal evaluation and negotiation (~Oct 2017)



# Program Management

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- **Budget and Staffing**

- The CXC's budget and expenditures are in line with the PPBE-17 plan
- Current staffing profile is consistent with PPBE-17
- CXC is funded through 15 Dec 16; Einstein program through 31 Mar 17
- Provided information to HQ for their review of the funding level of the NASA named fellows programs, including Einstein.

- **Other**

- Complying with NASA travel restrictions, which have increased administrative burden at CXC and MSFC



# Program Management

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- **CXC-organized Conferences and Reviews**
  - Chandra Users' Committee meeting 29 Sep 15
  - Einstein Fellows Symposium 27-28 Oct 16
  - Cycle 18 Peer Review 21-24 Jun 16
  - CIAO workshop 15-16 Aug 16
  - Chandra Science for the Next Decade workshop 16-19 Aug 16
  - Chandra Users' Committee meeting 27 Sep 16
  - Future: Einstein Fellows Symposium 18-19 Oct 16



# Mission Operations

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- **Spacecraft**

- Continues to operate extremely well
- Safe mode on 03/03/16 due to attitude drifting outside of sun-position monitor limit. No hardware problems. (79.5 ks science time lost)
- Bright-Star Hold triggered after a maneuver on 08/21/16 due to gyro-bias glitch. No hardware problems. (75.9 ks science time lost)
- Modified on-board parameter to improve guide-star tracking

- **Science Instruments**

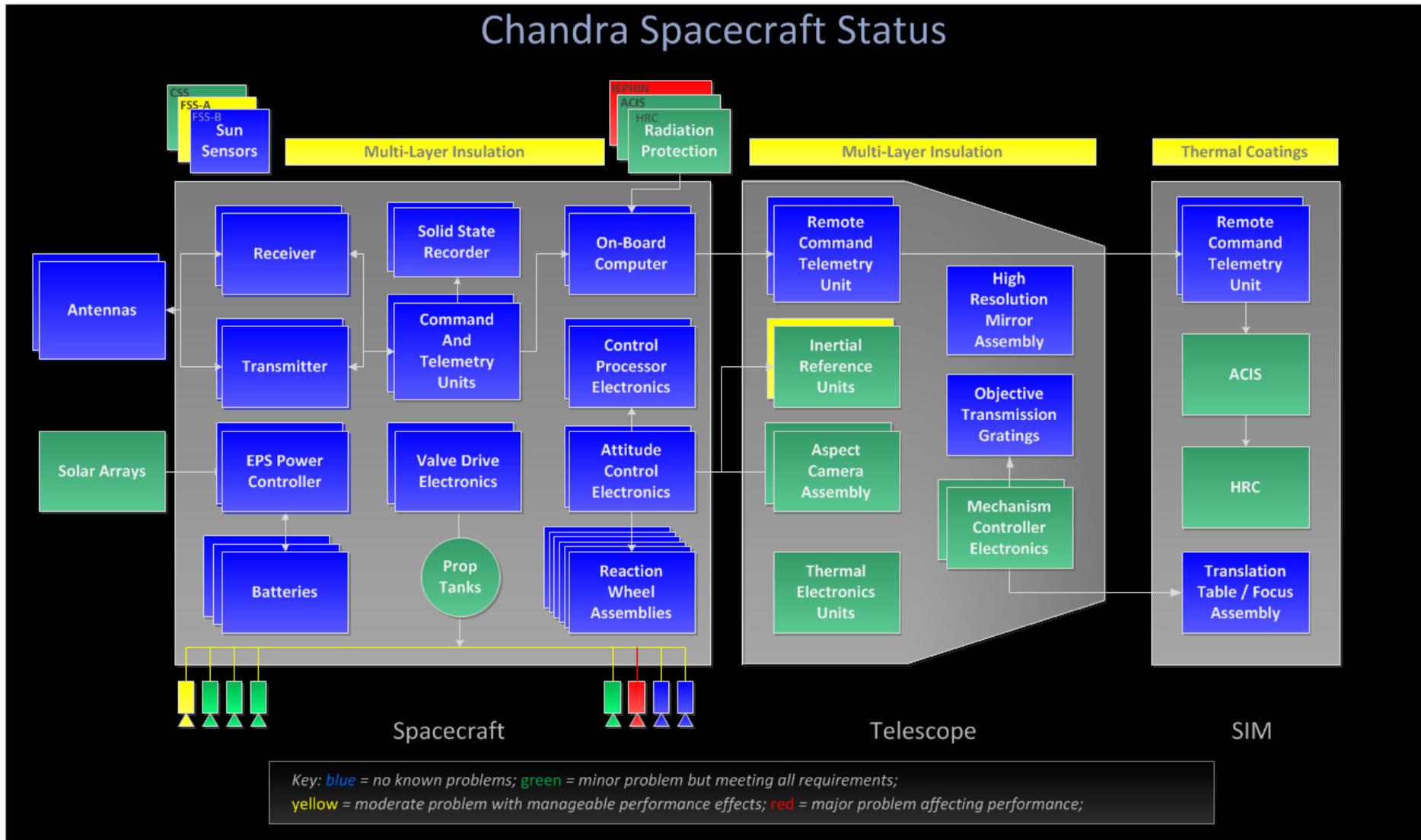
- Instruments are operating extremely well
- Conducted Aspect Camera Assembly (ACA) annealing measurements on 09/13/16. Raised CCD temperature to +20 °C from -19 °C to study possible reduction in warm-pixel density. Calibration on 10/4 will measure effect.



# Spacecraft Subsystem Status

## No change from previous report

### Chandra Spacecraft Status



- Subsystem functioning perfectly
- Minor problem but subsystem meets all requirements
- Moderate problem but manageable
- Serious deficiency; mitigated



# Mission Operations

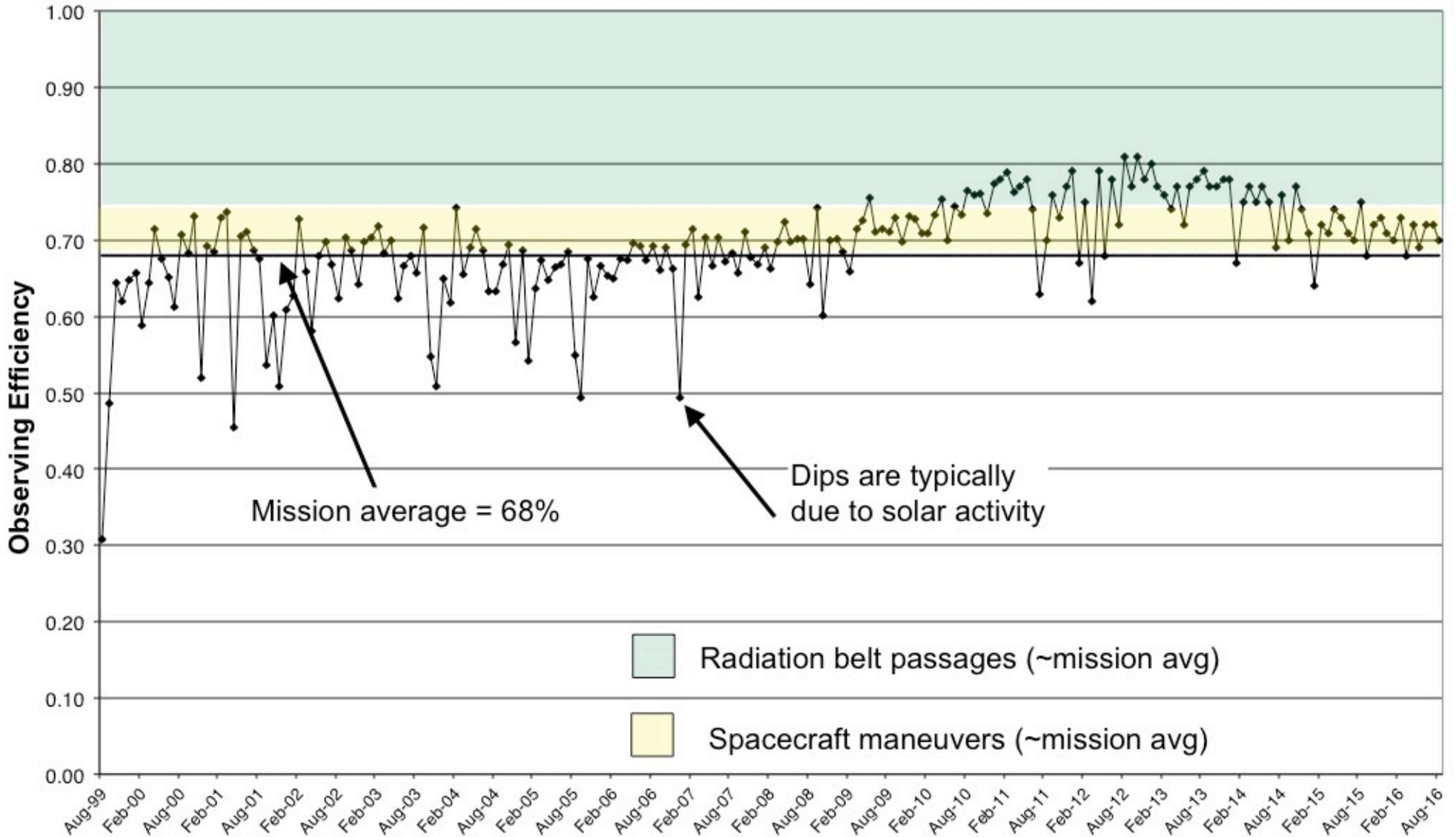
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- **Operations Control Center**
  - Smooth operations
  - 2 Backup OCC tests performed successfully
  - Off-line and On-line system upgrades installed; scheduler improvements and on-line enhancements
- **Mission Planning**
  - 9 load-interrupting TOOs during this period



# Mission Operations – Observing Efficiency

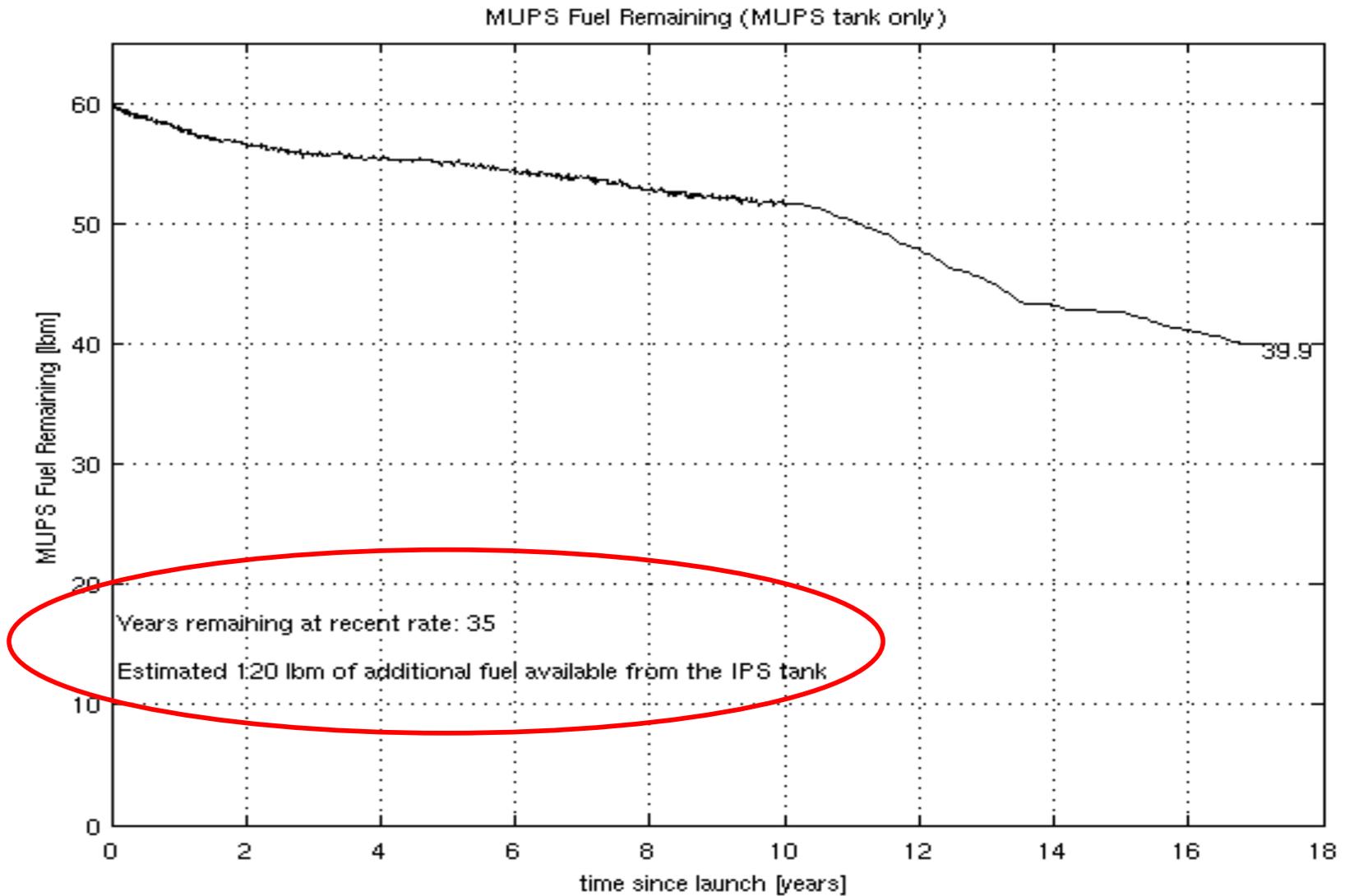
Observing time has changed due to evolving orbit





# Mission Operations – Consumables

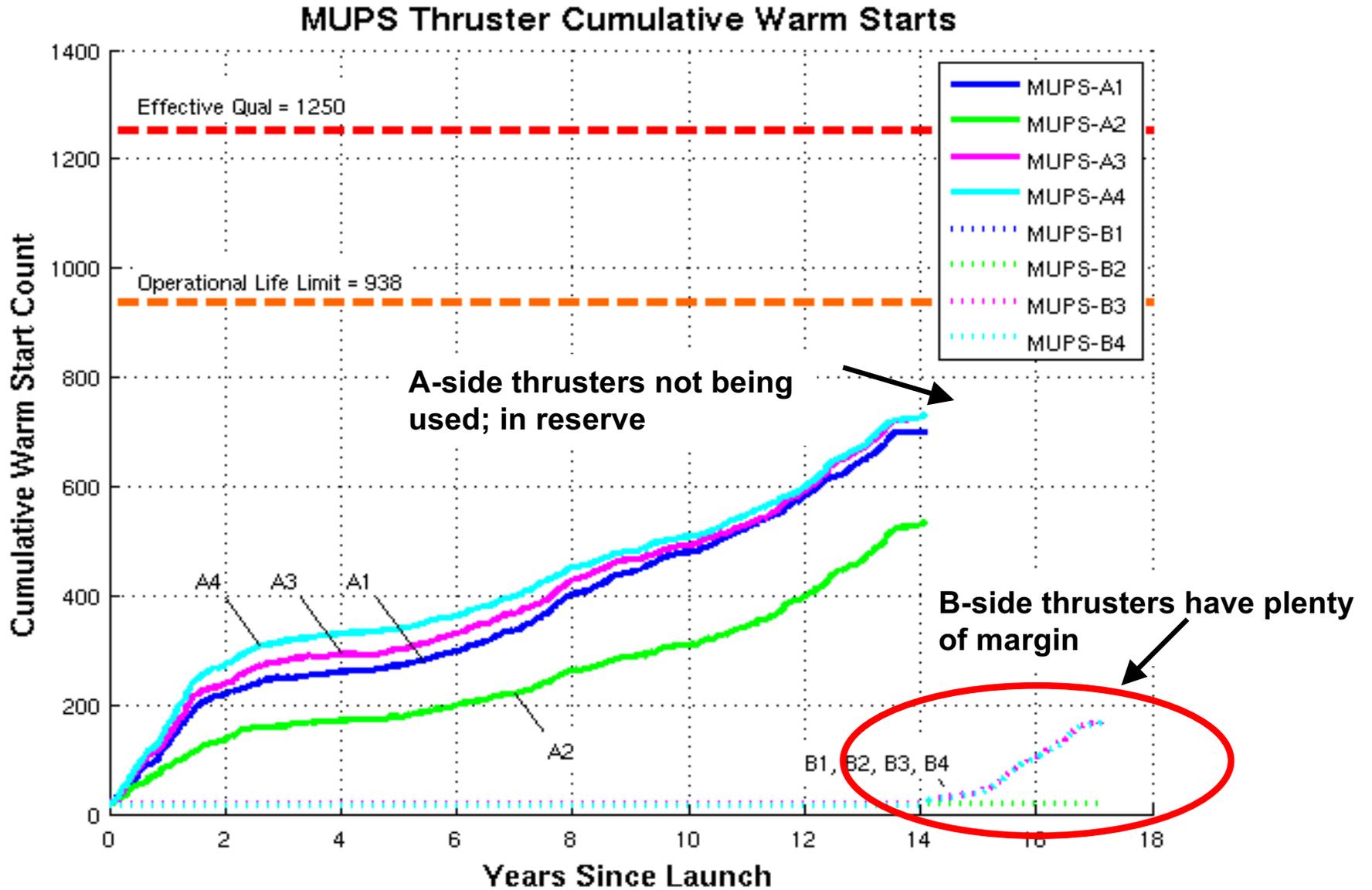
## Momentum Unloading & Propulsion System (MUPS) Fuel Usage





# Mission Operations – Consumables

## MUPS Thruster Warm Starts





# Science Operations

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- **CXC Data System Releases**

- DS 10.4.3      12/15/15    Proposal Cycle 18 Support
- DS 10.4.3.1    1/26/16    Bug fixes MTA/V&V/Mail (Systems)
- DS 10.4.4      4/5/16     Chandra WebReports enhancements
- DS 10.4.5      5/12/16    Peer Review GUI    annual upgrades
- DS 10.5        6/15/16    Annual DS Release
- DS 10.5.0.1    6/17/16    Archive server bugfix
- DS 10.5.0.2    7/20/16    Archive support of aimpoint transition plan
- DS 10.5.1      8/12/16    Mission Schedule Comparator aimpoint changes
- DS 10.5.1.1    8/24/16    Special Processing bugfix

- **CIAO/Sherpa Data Analysis Releases**

- CIAO 4.8        12/15/16    CIAO annual release
- CIAO 4.8.1     2/10/16    acis\_process\_events bugfix; ds9 v7.4 release
- CIAO 4.8.2     2/28/16    El Capitan fix
- Sherpa 4.8.1    4/15/16    Sherpa Patch: bugfixes, enhancements
- CIAO 4.9 B1    6/21/16    OTS/OS updates; bugfixes, enhancements
- CIAO 4.9 B2    9/13/16    CIAO Python 3 migration
- Sherpa 4.8.2    9/23/16    Sherpa Python 3 support, bugfixes



# Science Operations

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- **Chandra Source Catalog Releases**

CAT 4.3.15	9/15/15	Addressed Pipeline issues
CAT 4.3.16	3/3/16	CAT Rel2 Re-start (PreCALDet->SVD)
CAT 4.3.17	4/5/16	CAT Rel2 MLE->Stacker: Low count source support
CAT 4.3.18	5/3/16	QA; wav/mkvtbkg issue
CAT 4.3.19	5/6/16	Stack pipeline bugfix
CAT 4.3.20	5/19/16	QA Feedback
CAT 4.3.21	6/3/16	AP/QA Upgrades
CAT 4.3.22	8/2/16	Improve QA; Pipeline fixes for errored pipes
CAT 4.3.23	8/8/16	QA threshold refinement
CAT 4.3.23.1	8/26/16	Added reviewer option to QA

- **Plans**

- Source Catalog project strongly endorsed by the Senior Review
- Replan of the CSC production and deliveries conducted to optimize the schedule. Plan is based on substantial production experience to date



# Science Operations

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- **Data Processing**

- Automatic processing is current; mean time from end of observation to delivery to user remains at about one day

- **Calibration Products Released**

- Quarterly and semi-annual ACIS detector gain maps
- Annual HRC detector gain map
- Revised HRC-I and HRC-S QE files to increase self-consistency between HRC-I imaging data and LETG/HRC-S gratings data
- Alternate ACIS-S QE file to be used exclusively with HETG data taken in graded mode



# Science Operations Data Delivery

As of middle of following month						As of 9/7/16			
<u>Month</u>	<u>Number of Obs</u>	<u>Days to Data Delivery</u>			<u>Number Deliv</u>	<u>Number Outstanding</u>	<u>Number Deliv</u>	<u>Number Outstanding</u>	<u>Comments</u>
		<u>Min</u>	<u>Avg</u>	<u>Max</u>					
Sep-15	43	0.2	1.5	8	43	0	43	0	
Oct-15	61	0.1	1.6	8	61	0	61	0	
Nov-15	78	0.1	1.2	8	78	0	78	0	
Dec-15	91	0.0	1.1	7	91	0	91	0	
Jan-16	77	0.0	0.9	5	77	0	77	0	
Feb-16	71	0.0	0.8	6	71	0	71	0	
Mar-16	68	0.2	1.9	15	68	0	68	0	
Apr-16	72	0.1	1.4	8	72	0	72	0	
May-16	104	0.1	1.2	8	104	0	104	0	
Jun-16	55	0.1	1.3	5	55	0	55	0	
Jul-16	73	0.1	1.1	11	73	0	73	0	
Aug-16	56	0.1	1.1	9	56	0	56	0	

Avg delivery ~1 day from observation



# Grant Awards

Month of Data Delivery	Federal Grants <sup>(1,3)</sup>	SAO Grants <sup>(2)</sup>						
		<u>As of the middle of following month</u>				<u>As of 9/7/16</u>		
		Non-Federal Grants <sup>(3)</sup>	No. Grants Awarded	No. Outstanding	Avg days to award <sup>(4)</sup>	No. Grants Awarded	No. Outstanding	Outstanding Awards Proposal no, Comments
Sep-15	0	8	6	2	7	8	0	
Oct-15	1	11	10	1	12	11	0	
Nov-15	0	5	5	0	11	5	0	
Dec-15*	0	0	0	0	N/A	0	0	
Jan-16*	5	80	64	16	41	80	0	
Feb-16	1	12	11	1	9	12	0	
Mar-16	0	10	6	4	7	10	0	
Apr-16	1	8	7	1	6	8	0	
May-16	1	12	8	4	10	12	0	
Jun-16	0	9	6	3	7	9	0	
Jul-16	3	9	4	5	6	9	0	
Aug-16	1	10	7	3	7	7	3	17500165, 17500746, 17700582

<sup>1)</sup> Grants awarded to scientists at Federal institutions as interagency transfers through MSFC.

<sup>2)</sup> Grants awarded to scientists at non-Federal institutions through SAO Contracts and Grants Department.

<sup>3)</sup> Number of grants eligible for award, for which data were delivered to the observer in the month.

<sup>4)</sup> Average days from data delivery to grant award does not include grants outstanding as of the middle of the following month.

\* Approval from MSFC to issue grant funds was received after some observations were made and data were distributed, delaying issuance of awards.

Grants are typically awarded within ~2-3 weeks of observation



# Public Communication

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- **Selected Public Communication Activities**
  - 12 science press releases, 14 image releases resulting in > 2600 web and print articles
  - Public web site attracts ~11 million hits/month; podcasts ~ 300k downloads/month
  - Social media growing: ~93k Twitter. ~267k Facebook, >1.66M YouTube views
  - Launched AstrOlympics in conjunction with US State Department. Shown in ~85 sites in South America & U.S. Planning development for ParaOlympics. X-Games.
- **Informal Education and Outreach (“Universe of Learning”)**
  - Awarded Co-I contract (STScI PI) for public outreach and informal education
  - Developed astronomy-focused Pencil Code workshop. 10 presentations at after-school and out-of-school youth programs, particularly for girls.
  - Supported National Science Olympiad competitions and coaches’ clinics reaching ~200,000 students on >6000 teams. Started DC “Urban Initiative” to add schools serving low-income communities to Olympiad participation.
  - Continued public exhibits: Here, There & Everywhere; Light: Beyond the Bulb



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# Backup



# Spacecraft Engineering: Unit Performance

## ACA Trends – CCD Annealing

- Warm pixels are main source of image centroiding noise
- Annealing is the “repair” of hot/warm pixels on a CCD by increasing its temperature to/above ambient temperature for a period of time
- Expect increased star acquisition success and improved guide star tracking, reducing risk of safing actions
- HST uses scheduled maintenance time to regularly anneal instrument CCDs (~12 hrs/month)
- On 9 Sep 2015, successfully checked out pointing technique that could be used for annealing
  - Remained in NPM tracking bright Pleiades stars while raising ACA CCD temperature to about +7.5 C (from -14.5 C)
- The 18 hour ACA CCD anneal during 2015:264 Safe Mode “bought back” ~8 months of warm pixel fraction degradation
- Additional ops concept development and investigation actions in work

