Project Manager's Report

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Chandra marked over fourteen years of successful mission operations with continued excellent operational and scientific performance. Telescope time remained in high demand, with significant oversubscription in the Cycle 15 peer review, held in June. The Cycle 15 review approved 179 proposals out of 636 submitted by researchers worldwide who requested 106 Msec of observing time, ~ 5.3 times greater than the time available. Among the approved proposals are two X-ray Visionary Projects (XVPs), which were allocated a total of 5 Msec. XVPs are longer observing programs intended to address major questions in astrophysics and to produce data sets of lasting value.

In the Fall of 2013, the observing program transitioned from Cycle 14 to Cycle 15. Due to the gradual evolution of *Chandra*'s orbit, which has reduced the nonproductive time spent in Earth's radiation belts, *Chandra*'s overall observing efficiency has risen to the highest level of the mission. As a result, observing cycles 13–15 have benefitted from a significant increase in available observing time, but the orbit is now evolving back toward less time above the belts. We released the Call for Proposals for Cycle 16 in December, and look forward to the Cycle 16 peer review in June 2014.

In response to NASA's request for proposals for the 2014 Senior Review of operating missions, *Chandra* X-ray Center (CXC) and Marshall Space Flight Center program staff are at the time of this writing preparing the *Chandra* proposal, due in January 2014 and to be followed by a site visit to the CXC by the review committee in March 2014.

In October the CXC hosted the annual symposium for the Einstein Fellowship program. A CXC workshop, "The X-ray View of Galaxy Ecosystems," originally planned for the summer of 2013, was canceled due to NASA restrictions on conferences and travel resulting from congressional sequestration of funds. CXC has rescheduled the workshop for the summer of 2014. As part of the CXC's regular reviews and consultations with outside organizations, NASA reviewed the CXC's operations in April and November, and the *Chandra* Users' Committee met at the CXC in October.

After several years of very low solar radiation, the sun has become more active, requiring the team to interrupt *Chandra* observing 4 times during the year to protect the instruments from solar particles. In addition, eight requests to observe targets of opportunity required the mission planning and flight teams to interrupt and revise on-board command loads. *Chandra* passed through the 2013 spring and fall eclipse seasons with nominal power and thermal performance.

CXC staff completed a study of the Fine Sun Sensors (FSS), which are used to orient the spacecraft during certain non-observing conditions and safe modes. In 2012 the active sensor, FSS-A, began producing erroneous readings near the edge of its field of view (FOV), believed due to reflection of light from nearby thermal insulation. The study showed that the alternate sun sensor, FSS-B, operates properly, and that FSS-A is fully functional for safe modes, which do not require operation near the edge of the FOV. In May 2013 the team swapped primary operation to FSS-B, with FSS-A held in reserve for safe modes. The system is fully functional for both normal and safe mode operations.

In early 2013, one of the four thrusters used for unloading angular momentum showed decreased thrust. The thruster continues to be useable, but its remaining life appears limited. A check-out of the redundant, B-side, thruster set showed that one of its four thrusters was inoperative, likely due to a failed electrical connection. Following a careful assessment, the team swapped the system to the B side for normal operations, with the failed B-side thruster not used and the A-side thrusters reserved for safing. With the new thruster configuration, *Chandra* can properly manage momentum for normal operations and retains full safing capability.

Chandra's focal plane instruments, the Advanced CCD Imaging Spectrometer and the High Resolution Camera, have continued to operate well and have had no significant problems. ACIS, along with the overall spacecraft, has continued to warm gradually due to slow degradation of the spacecraft's multi-layer thermal insulation. All systems at the *Chandra* Operations Control Center continued to perform well in supporting flight operations. *Chandra* data processing proceeded smoothly and data distribution continued to be rapid, with the time from observation to receipt by the observer averaging ~ 30 hours.

The CXC's Data System team released software to support *Chandra* users with Cycle 15 observation proposal submissions, the Cycle 15 Peer Review, and the Cycle 16 Call for Proposals. In addition, in June the team released a major upgrade to the data system

that migrates the *Chandra* Data System's data processing software from Solaris to 64-bit Linux. The *Chandra* Source Catalog (CSC) currently includes about 107,000 individual sources. The CXC is in the process of developing a major new release, expected to triple its size, that will co-add multiple observations and use new source detection and background algorithms to include the faintest (~ 5 net counts) sources.

The CXC Communications and Public Engagement (CPE) group created 12 science press releases, 1 non-science press release and 25 image releases resulting in 2891 articles in print and electronic news outlets. *Chandra* images were used in 15 instances as the HEASARC Picture of the Week, 3 Astronomy Picture of the Day, and 3 NASA Picture of the Week. The group produced 30 podcasts on *Chandra* results as well as special series for children and on fundamental science topics related to astrophysics. In addition, 40 blog entries were posted, including additions to "Meet the Astronomer" profiles with PI's of *Chandra* science results and "Women in the High Energy Universe" to focus attention on women's careers in astronomy.

Although participation in education and outreach activities was constrained by sequestration restrictions, the CPE team presented 23 workshops at conferences and clinics sponsored by the National Science Teacher Association and the National Science Olympiad. The "Here, There, and Everywhere" traveling exhibit continued its national tour of one site per month at small libraries and museums. The training video to support Science Olympiad Coaches was updated. The *Chandra* 3D model of Cas A was chosen as one of the initial offerings of the Smithsonian Digitization initiative and was produced as a hardcopy model through 3D printing. An interactive skymap of *Chandra* sources was released and all *Chandra* images are now available through the Astropix feed. No new printed materials were produced because of sequestration constraints but *Chandra* was able to fill 396 requests for over 28,000 items of educational materials out of existing inventory. A new electronic product line of "infographics" was produced for download from the *Chandra* web site.

We look forward to a new year of continued smooth operations and exciting science results.