

Project Manager's Report

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*C*handra has marked over 16 years of successful mission operations with continued excellent operational and scientific performance. Telescope time remained in high demand, with significant oversubscription in the Cycle 17 peer review, held in June. The Cycle 17 review approved 175 proposals, out of 578 submitted by researchers worldwide who requested ~4.9 times more observing time than was available. Among the approved proposals are 13 Large Projects (>300 ks each), which were allotted a total of 6 Ms.

We released the Call for Proposals for Cycle 18 in December, with proposals due in March 2016 and the peer review in June 2016.

As part of NASA's 2016 Senior Review of operating missions, *Chandra X-ray Center* (CXC) and Marshall Space Flight Center program staff submitted the *Chandra* Senior Review proposal in January 2016, and the NASA review committee held a site visit at the CXC in March 2016.

In May 2015 the CXC conducted a review of our mission operations processes, in response to a recommendation by the 2014 Senior Review committee to seek advice from other missions on approaches to increasing the efficiency and sustainability of *Chandra* mission operations. A panel of experts familiar with a range of missions came to the *Chandra* Operations Control Center (OCC) to review our processes, staffing, and planning for the future. The panel's report was positive in its assessment of the CXC's stewardship of *Chandra*, saying, "...the *Chandra* Operations Team has done an excellent job in operating the spacecraft over the last 15 years, maximizing the science return while being excellent custodians of the spacecraft. They have been proactive in making substantial and beneficial modifications to operations during this time period, in order to adapt to hardware issue[s] on the vehicle and funding constraints from NASA. There are no 'low hanging fruit' or 'quick fix' updates that can be made today that will save substantial funding in future years, while maintaining the current risk posture and present level of science return. Given the age and complexity of the spacecraft, the coming years of operations are likely to see an increase in the operations level of effort." The panel made several recommendations that we are acting on, in part by visiting multiple missions

to learn from their experiences with efficiency improvement and automation.

The CXC hosted a number of events and reviews in the past year including a workshop, "The Universe in High Resolution X-ray Spectra," held in August 2015, the annual symposium for the Einstein Fellowship program held in October 2015, and NASA's regular review of the CXC's operation in April and September 2015. The *Chandra* Users' Committee met at the CXC in October 2015 and held a telecon in April 2016 to discuss the *Chandra* Source Catalog (CSC) with a focus on an update to the already released early detection list and plans for the final release.

Storms of solar particles caused the operations team to interrupt *Chandra* observing twice during the year to protect the instruments from solar particles. In addition, 15 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 2015 eclipse seasons with nominal power and thermal performance. *Chandra* transitioned to safe mode twice (the sixth and seventh safe modes of the mission) due to a trip of the sun position monitor. The safe modes caused no adverse effects, and procedures have been put in place to avoid a similar trip in the future.

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. The observatory has continued to warm gradually due to slow degradation of the spacecraft's multi-layer thermal insulation. This warming results in added complications in scheduling observations, but no significant decrease in observing efficiency. 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 availability of data to the observer averaging ~30 hours.

The CXC's Data System team released software to support *Chandra* users with Cycle 17 observation proposal submissions, the Cycle 17 Peer Review, and the Cycle 18 Call for Proposals. In addition, in June the team completed a multi-year plan to migrate the entire data system from Solaris to 64-bit Linux for all *Chandra* data system operations. CSC (release 2.0) produc-

tion is in full swing with an estimated 350,000 source detections expected for the catalog that will be published in the fall. An automated system is processing the data that co-adds multiple observations and uses new source detection and background algorithms to include the faintest (~5 net counts on-axis) sources.

During 2015, NASA began implementing structural and funding changes in the way that the activities formerly known as “Education and Public Outreach” are carried out. That reorganization and associated activities will be described in the article on pp. 42-44. This article will be limited to activities carried out under the term “Communications and Public Engagement” (CPE). CXC CPE accomplishments included 12 *Chandra* science press releases, 2 additional in conjunction with other telescopes, 4 non-science press releases (including announcement of the death of HRC PI Steve Murray) and 36 additional images (some releases with multiple images) resulting in 2338 articles in print and electronic news outlets. *Chandra* images were used in 22 releases of HEASARC Picture of the Week, 4 Astronomy Picture of the Day and 7 NASA Picture of the Week. The CXC also produced 42 podcasts on *Chandra* results as well as special series for children, fundamental science topics related to astrophysics, and the International Year of Astronomy. In addition, 44 blog entries were posted, including additions to “Meet the Astronomer” profiles of Principal Investigators of *Chandra* science observations.

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