Program Manager's Report

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Chandra has carried out more than 17 years of highly successful and productive science operations and remains unique in its capability for producing the sub-arcsecond X-ray images that are essential to accomplish the science goals of many key X-ray and multi-wavelength investigations in current astrophysical research. Telescope time remains in high demand, with significant oversubscription in the Cycle 18 peer review, held in June. The Cycle 18 review approved 168 proposals (including observation, archive and theory), of 547 submitted by researchers from 25 countries.

NASA has announced its decision to continue the *Chandra* program, potentially through 2030, by extending the *Chandra* X-ray Center (CXC) contract with the Smithsonian Astrophysical Observatory.

In support of NASA's biennial Senior Review of operating missions, *Chandra* X-ray Center and Marshall Space Flight Center (MSFC) program staff submitted the *Chandra* Senior Review proposal in January 2016, and the NASA review committee conducted a site visit at the CXC in March. The committee's report, released in June, praised *Chandra*'s scientific productivity and the program's stewardship of the observatory. The program has submitted to NASA headquarters a plan for responding to the review committee's recommendations.

The Observatory continues to operate extremely well overall but with several incremental changes in performance, due primarily to the gradual accumulation of molecular contamination on the UV filter that protects the ACIS detector, and to progressive degradation of the spacecraft's thermal control surfaces.

Condensation on the UV filter reduces ACIS's sensitivity to low-energy x-rays (but does not affect the HRC). The *Chandra* Project Science group at MSFC, together with CXC staff, continue to consider the possibility of baking out the ACIS filter to remove condensed contamination.

The decline in spacecraft insulation effectiveness results in thermal constraints that require extra effort in scheduling observations and the use of special strategies to ensure continued safe operation in the evolving thermal environment, but has not significantly affected *Chandra*'s observing efficiency.

The combined effects of accumulated radiation damage and increasing temperature on *Chandra*'s aspect camera CCDs have begun to affect the camera's ability to detect faint stars. Left unchecked, this trend would present difficulty in acquiring and tracking guide stars, which could decrease mission efficiency. Several mitigation strategies have been successfully implemented, and further options are under investigation, including a long-term program of testing to assess the feasibility of annealing the CCD detectors.

Science data processing, archiving, and distribution have proceeded smoothly during the year, with average time from observation to data delivery to observers remaining at about a day. Six Targets of Opportunity or Director's Discretionary Time observations required interrupting *Chandra*'s observing activities and uploading a new command load to carry out the new observations. On three occasions the spacecraft transitioned to a safing configuration due either a calibration error in the sun sensor or to an excessive attitude error due the aspect system tracking "warm" camera pixels in place of guide stars. All cases were benign, with no impairment to the spacecraft, and science observations were resumed promptly.

The CXC's Data System team released software to support *Chandra* users submitting Cycle 18 observation proposals, as well as to aid the Cycle 18 Peer Review process. In April the team released a new version of the CIAO data analysis package, and in December software to support the Cycle 19 Call for Proposals.

Release 2 of the *Chandra* Source Catalog (CSC2), which is in production, contains (as of January 2017) approximately 300k source detections, of an estimated 350k total detections expected. We plan to publish a FITS-formatted detection list during the first half of 2017, and to complete the matching of detections across sets of stacked observations and the processing of source properties later in the year. Full release of CSC2 is planned for the fourth quarter of 2017.

In August, the CXC held a workshop "*Chandra* Science for the Next Decade" to provide an opportunity for the scientific community to help guide future *Chandra* scientific programs. The annual Einstein Fellowship Symposium, at which current Einstein Fellows present their recent research results, was held in Cambridge, MA in October. The program is available at: http://cxc.harvard.edu/fellows/program_2016.html. NASA conducted its regular reviews of CXC operations in April and November, and the *Chandra* Users' Committee met at the CXC in September.

The CXC Communications and Public Engagement group has been active in issuing image releases, science press releases and other communications of *Chandra* research results, including 13 *Chandra* science press releases, 3 non-science press releases and 24 additional images that resulted in 3229 articles in print and electronic news outlets (through November 2016). *Chandra* images were used in 19 releases of HEASARC Picture of the Week, 1 Astronomy Picture of the Day and 7 releases of NASA Picture of the Week. The CXC produced 33 podcasts on *Chandra* results, as well as the Space Scoop special series for children, and material on science topics related to sports in the Olympics and Paralympics. The group posted 42 blog entries, including additions to "Meet the Astronomer" profiles of Principal Investigators of *Chandra* science observations. A complete listing is available at http://chandra.harvard.edu/press. ▪