Project Manager's Report

Roger Brissenden

Reporting Period: January–December 2017

Chandra has carried out more than 18 years of highly successful and productive science operations. The *Chandra* X-ray Observatory is 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. The Project is looking forward to many more years of scientific productivity. NASA has chosen to continue the mission, and SAO and Marshall Space Flight Center are working to extend the contract to operate the *Chandra* X-ray Center with options through September 2030.

In conjunction with the *CXC* contract extension, the *Chandra* Operations Control Center (OCC) will move to a new location. Since the start of the mission, the control center has been located at a Draper Laboratory building in Cambridge, MA. Because the Draper lease will not be extended, a new location has been selected in Burlington, MA. The lease for the new property has been signed, and following buildout over the summer, the team will outfit and test the new facility with the necessary operations equipment, with a plan of transferring operations to the new OCC in the spring or early summer of 2019.

The Observatory continues to operate extremely well overall but with a number of incremental changes in performance, due primarily to the gradual accumulation of molecular contamination on the UV/Optical blocking filter that protects the ACIS detector, and to progressive degradation of the spacecraft's thermal control surfaces. Condensation on the UV/Optical blocking filter reduces ACIS's sensitivity to low-energy X-rays (but does not affect the HRC). The *CXC* calibration group continues to monitor the contamination layer and to update calibration files as needed so that Observers can analyze their data properly.

The decline in insulation effectiveness requires 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 CCD 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 or preclude observation of some targets. Several mitigation strategies have been successfully implemented, including development of an update to the aspect camera processor software that improves the robustness of star tracking.

The Operations team responded extremely well to anomalies on four occasions since December 2016, when the spacecraft failed to acquire the expected aspect guide stars following a maneuver. In these cases, *Chandra*'s science program was stopped but the spacecraft redundancy configuration remained unchanged, allowing for rapid diagnosis and return to science. Two independent root causes for the anomalies have been determined, the first relating to the effect of increased noise in the gyro bias rate during a maneuver, and the second, to the aspect camera tracking hot pixels during the prior observation. Neither of the causes relates to a new concern about the hardware, but rather, are typical of the engineering trends being managed by the operations team as the spacecraft ages. A number of near-term mitigations have been implemented in order to minimize recurrences and the team is working on strategies to address the issues over the longer term.

During September the Observatory interrupted science observing on two occasions due to increased solar radiation, resulting in a total of 290 ks of science time lost but no harm to *Chandra*'s instruments. One of the interruptions occurred shortly after *Chandra* emerged from the Earth's radiation belts, revealing the need for a revised radiation safing protocol to protect the High Resolution Camera in such an unusual situation. Appropriate processes have now been put in place.

The *Chandra* Source Catalog team published on-line an updated preliminary detection list for *Chandra* Source Catalog 2.0 (list *CSC 2.0 pd2*, see *http://cxc.cfa.harvard.edu/csc2/*). The list provides an initial set of key data, including positions, likelihoods, amplitudes and associated errors, for all of the ~374,000 detections that will be included in the full catalog to be released in early 2018. A pre-release source list including ~316,000 unique X-ray sources on the sky was published in November. In December, the team began preparing source properties, such as fluxes and spectral measurements, of fully processed sources for public dissemination. As of the end of the year, properties for ~110,000 sources were available, about a third of the expected total.

In response to the December 2016 call for proposals for Cycle 19 observations, scientists worldwide submitted 574 proposals, including 462 proposals for observing and 112 for archive and theory research. The Cycle 19 peer review, held in June 2017, approved 122 observing proposals, including 7 Large Projects and 2 Very Large Projects, and 33 theory and archive investigations.

The call for proposals for Einstein fellowships attracted 163 applications for 2017. The 8 Fellows selected in January by the Einstein Fellows peer review began their three-year terms in Fall of 2017. Because NASA is in the process of consolidating its named fellowships programs under the administration of the Space Telescope Science Institute, this is the final group of *CXC*-administered Einstein Fellows.

The *CXC* held a workshop, "From *Chandra* to *Lynx*: Taking the Sharpest X-ray Vision Fainter and Farther", in August 2017. *Lynx*, formerly known as the X-ray Surveyor, is one of the large strategic mission concepts being studied by NASA in preparation for the 2020 U.S. Decadal Survey. *Lynx* is the first future X-ray mission concept planned to match the spatial resolution of the *Chandra* X-ray Observatory. This workshop sought to leverage *Chandra*'s legacy and maximize its impact on the development of *Lynx* science and design objectives. Information about the workshop is available at *http://cxc.harvard.edu/cdo/cxo2lynx2017/*.

The *Chandra* Press Office has been active in issuing image releases, science press releases and other communications of *Chandra* research results. A complete listing is available at *http://chandra.harvard.edu/press/*.

The annual Newsletter (#24), which was released and distributed in April, can be found online at: *http://cxc.harvard.edu/newsletters/*. Information about the *Chandra* Observatory and the *Chandra* X-ray Center can be found at *http://cxc.harvard.edu/*. ■