

## Project Manager's Report

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### Reporting Period: January – December 2018

**The *Chandra* X-ray Observatory has carried out more** than 19 years of highly successful and productive science operations. *Chandra* 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. In recognition of *Chandra*'s important role in high-energy astrophysics, NASA has chosen to continue the mission and has extended the contract to operate the *Chandra* X-ray Observatory, potentially through September 2027.

The *Chandra* Operations Control Center (OCC), from which we conduct mission operations, is in the process of moving from its current site in Cambridge, Massachusetts, to Burlington, Massachusetts. With the OCC facility lease ending in 2019, SAO, MSFC and the Smithsonian Institution collaborated to find a new location. After defining requirements and carrying out an extensive search, we identified and leased facility in Burlington, Massachusetts. Construction of the new space has been completed and testing of the data system and operations processes is underway. Following testing and readiness reviews, operations in the new facility will begin in the second quarter of 2019. The *Chandra* OCC was one of the first control centers for a major mission to be established outside of a NASA Center and we are pleased to continue operations for the mission in such an excellent facility.

The Observatory continues to operate extremely well overall, but with a number of incremental changes in performance. The gradual accumulation of molecular contamination on the UV filter that protects the ACIS detector reduces ACIS's sensitivity to low-energy X-rays (but does not affect the HRC). Recent measurements indicate that the accumulation rate of the contamination has decreased over the past year. Overall spacecraft heating due to the slow degradation of *Chandra*'s multi-layer thermal insulation requires extra effort in scheduling observations, but has not significantly affected *Chandra*'s observing efficiency. A 3-second burst of noise from one of *Chandra*'s gyroscopes led to a spacecraft safe mode in October 2018. Although the gyroscope has operated nominally since, to minimize risk the decision was made to hold that gyro in reserve and reconfigure the flight software to use one gyroscope from each of *Chandra*'s two inertial reference units. The need to operate with both units powered on has caused an additional thermal load, adding to scheduling constraints. The safe mode resulted in a loss of ~900 ks of science time. Follow-

ing the safe mode recovery, *Chandra* returned to nominal science operations.

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 for the aspect camera processor software to improve robustness of star tracking.

Release 2.0 of the *Chandra* Source Catalog (CSC) is nearing completion. CSC 2.0 incorporates data from observations made public through 2014 and includes data for ~316,000 unique X-ray sources over the sky. By co-adding observations prior to source detection and using an enhanced source detection approach, CSC 2.0 detects sources with as few as ~5 net counts for low-background observations (about half of *Chandra* observations). This capability translates to about 50% more identified sources per observation than the previous CSC (version 1.1). CSC 2.0 provides tables of measured source properties, including astrometric, photometric, spectral, and temporal variability data. The catalog includes over 30 TB of science-ready FITS-format data products that enable immediate analysis of detected sources without manipulating the underlying data. In addition, the catalog provides the full field of view for each observation, allowing users to carry out their own detailed analyses. Source- and field-based data products, including images, spectra, light-curves, and instrument responses, are accessible through multiple interfaces, including the CSCview data-mining application.

In response to the December 2017 call for proposals for Cycle 20 observations, scientists worldwide submitted 527 proposals, including 431 proposals for observing and 96 for archive and theory research. The observing proposals requested a total of 9.9 Msec of telescope time, an over-subscription factor of approximately 6. The Cycle 20 peer review, held in June 2018, approved 133 observing proposals and 24 proposals for archive and theory research. The call for proposals for Cycle 21 observations was issued in December 2018.

NASA announced the selection of 24 Fellows for the 2018 NASA Hubble Fellowship Program (NHFP), which supports postdoctoral researchers performing research across all of NASA astrophysics. NHFP postdocs are named as Hubble, Einstein, and Sagan fellows, depending on their research topics. Seven of those selected for the 2018 NHFP were named as Einstein Fellows. The Einstein Fellows Symposium was held at the Center for Astrophysics | Harvard & Smithsonian on October 2–3, 2018.

The CXC hosted a workshop, “Accretion in Stellar Systems” at the Sheraton Commander during August 8-10, 2018. The workshop brought together researchers working on accretion, outflows, and related processes in diverse astrophysical objects. The workshop included a special session dedicated to the late Jeffrey McClintock’s legacy to the field.

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, which was released and distributed in April 2018, 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/>.