

# CUC Meeting Report 10/23/14

## Chandra Status Report

Roger Brissenden summarized the current status of the the Chandra mission. We are delighted to hear about the continued spacecraft health, robust operations, and the potential for a 25-year mission as assessed by Northrop-Grumman. The 15-year Symposium is a much-anticipated celebration of Chandra's contributions, and an opportunity to discuss future directions. We are enthusiastic about the CXC's efforts to gather community input, and especially recommend consideration of how to adapt to modest spacecraft constraints and emerging fields of interest.

In this presentation and those that followed, the evolution of the thermal stability of the spacecraft and the quantum efficiency of the detectors emerged as key issues that affect the long-term planning of Chandra science directions.

### Observations and recommendations:

1. Thermal stability of some spacecraft components has been addressed thoughtfully and in great detail, ensuring optimal observing efficiency even under strong spacecraft operation constraints. In particular, continuous changes in the pitch angle have been employed in scheduling the observations such that the temperature of spacecraft components can be maintained within acceptable limits. This has required and will continue to require an increasing number of carefully planned split observations. Both the software and the source catalog teams have already developed techniques for dealing with this. We encourage them to consider this to be the standard observing mode for the future, and to make the user community more aware of this reality. In addition, we strongly endorse maintaining the staffing levels in the current science and flight mission planning teams since this is essential for the optimal operation of Chandra and for ensuring broad science returns.
2. The loss of low-energy response due to the contamination of the ACIS filters has been significant. This might indicate that observations requiring these wavelengths should be performed sooner, rather than later. This development could be highlighted during the community discussions and peer review.
3. In light of the strategies required to maintain thermal stability, supporting the ToO and constrained observations now requires more effort. We recognize the difficulty this causes in scheduling and highlight the importance of maintaining staffing so that the current ability to execute ToOs and constrained observations is sustained. In a period when the community is likely to move increasingly towards time-domain investigations,

the potential demand for more such observations should be a topic of discussion in the upcoming symposium, and the CXC should consider the additional resources and trade-offs which would be necessary to support these science directions.

4. The CUC strongly endorses the current public outreach program, which continues to have an impressive visibility on social media, via award-winning podcasts, traveling exhibits, and through a highly engaging website. We also strongly support the efforts by the CXC Management to restore funding for outreach, which was inadvertently cut in FY14 along with Education funds. This program is a crucial component of the scientific mission and should be funded at a level which preserves our ability to inform the public of new discoveries and teach a new generation.

### **Chandra Source Catalog Version 2**

Ian Evans updated the CUC on progress toward the release of version 2.0 of the source catalog. This next version of the catalog will differ from the prior catalog in numerous ways, but most importantly that it will dive deeply into stacked observations to enable robust detections of faint sources.

The project is far behind schedule. It has slipped another 6 months within the last 12 months. The CUC learned that *algorithm development* is “mostly finished” and that production would start in December 2014, with an eventual full release in late 2015. This schedule, and others presented to the CUC, assume that no difficulties or bugs will arise with various algorithms and the production process. Other projections, e.g., the time required for quality assurance prior to release, seem equally optimistic.

### **Comments and Recommendations:**

1. The CUC feels that this project has been very ambitious in scope from its inception, and that opportunities to revise goals or to adopt faster strategies have not been pursued. Within the constraints of a flat budget, it is not clear that the current approach can reach a conclusion before competing pressures cause it to be abandoned.
2. We recommend that the CXC consider focusing an initial release on large contiguous programs where the data are obtained in a homogeneous manner and therefore easier to process to source catalogs. There may also be fields that have *not* been observed multiple times, obviating difficulties of stacking etc. The CXC should also consider processing these simple fields as part of a separate and/or rapid-release catalog.
3. The CXC Management should identify means of making sure that the catalog personnel are full-time on the catalog. The CXC Management should also identify

personnel that can help to speed along completion of the catalog without requiring significant training. Sherpa and CHIPS development can reasonably wait until the catalog has advanced.

4. We recommend that the catalog team report directly to the mission director at a high cadence.
5. The volunteer team that is looking into the quality of the output for 150 sources from a very early trial should be retained, and should also be asked to help speed along the any rapid-release catalogs. Once this QA is finished, a wise decision can be made as to whether any algorithmic changes are truly necessary before a catalog release. We recommend allowing for a significant period of time after release to respond to critiques and suggestions from the community and possibly an updated minimal catalog release before continuing on to develop more complex data products. This period will provide a powerful assessment and functional improvement of the catalog by the most committed users.
6. The CUC expects that production should be underway by April 2015 and requests a telecon at that time, to discuss and assess progress on the catalog.
7. We recommend advertising the upcoming catalog release at the 15 years of Science with Chandra Symposium, at the Winter 2015 AAS, and then widely to the community (depending on the outcome of the April 2015 progress report).

## **Mission Planning**

The CUC heard a report from Pat Slane on mission planning. Chandra now accepts up to 15% of constrained observations and up to 80 ToO observations (8 very fast, 20 fast, 26 medium, 26 slow). These restrictions on constrained and ToO observations are dictated by the complexities of scheduling the observations, which, in turn, are related to managing the attitude of the spacecraft so that it cools effectively while continuously pointing its solar panels towards the sun. In practice, the longest continuous exposures are 50 ks for a broad range of pitch angles (70-120), but longer exposures are possible for large pitch angles.

## **Recommendations**

1. The CUC feels that the current level of ToOs and constrained observations accepted by Chandra is good and that it is important to maintain this level. With this in mind, we endorse maintaining the staffing levels in the current science and flight mission planning team since this is essential for keeping up with the ToO requests as well as planning constrained observations. We also note the general trend in the community to

undertake more time-domain projects. This trend will probably increase the demand for ToO or other types of time-critical observations in future proposal cycles.

### **The Einstein Fellowship Program**

The CUC wishes to acknowledge Andrea Prestwich for her excellent guidance and oversight of the Einstein Fellows program over the past several years.

An update on the Fellows program was given by its new director, Paul Green.

The CUC took a broad view of the program in this meeting. In the view of the CUC, the following things are clear concerning the Einstein Fellowship:

- The program is highly valued by the community, with 180-200 applications arriving annually for just 10-12 fellowships.
- The program managers and panelists have done an excellent job of ensuring that the selected fellows include a broad representation of the diverse science that is done with all of the Physics of the Cosmos missions.
- The program is essential to helping young scientists to develop science that supports the PCOS missions, and to personally develop as scientists. A very high fraction of past Chandra and Einstein fellows are now active and influential scientists, driving PCOS science forward. The contrast between this success rate and general placement rates within the field serves to demonstrate the importance of this program in fostering both science and emerging scientists.

### **Recommendations:**

1. The CUC endorses the Einstein Fellows program in the strongest possible terms. It is an unqualified good, and is essential to the scientific future of the field in every sense.
2. The CUC maintains that spreading expertise and promoting PCOS science and scientists broadly is very important. The limit of one fellow per host institution per year serves to help PCOS science diversify and grow, and limits destructive competition between fellows. We oppose any changes that would concentrate fellows at only a few institutes.
3. We recommend the collection and publication of the statistics of applicants' career success; this would help to sustain the funding for this program.

4. We recommend that the program continue to pay attention to gender balance and other criteria for the selection committee, and look into encouraging minorities to apply for the fellowship.

### **Proposal Cycle Results and Future Plans**

Andrea Prestwich has ably taken over management of the proposal review process from Belinda Wilkes, and she presented the CUC with numerous updates and questions.

Importantly, the over-subscription of the mission remains high, at 4.8, though this number is artificially low owing to the fact that some Cycle 17 time was allocated to make room for an X-ray Visionary Projects (XVP) category.

It is also impressive that about 8% of the proposals in each cycle are submitted by first-time Chandra users. This demonstrates that Chandra continues to connect with new fields and new scientists.

#### **Recommendations:**

1. Proposal pressure in the Large Programs (LP) category remains higher than in the XVP category, and, in fact, the over-subscription of the XVP category has declined. We recommend that another round of XVP not be considered earlier than Cycle 19. This will allow the most pressing science projects in the LP category to be carried out. We also recommend that there be no limit on the size of LP proposals so that strong, ambitious programs can still be proposed and considered by the science panels and big-projects panel (BPP). We feel that the current practice of having LPs reviewed by the science panels and then re-considered by the BPP, which then makes the time allocation, is a good one and we recommend that it be continued. Leading up to Cycle 19, we urge a careful evaluation of scientific returns from the LP and XVP categories, in consultation with the CUC, before initiating a new XVP call.
2. We strongly endorse the continuation of archival and theory programs, at their current funding levels. These programs return critical science at a modest cost to the mission that cannot be covered by other programs or funding agencies.
3. The CUC reviewed the way in which funding is allocated to observing programs, and find that the formula is reasonable. The “level of difficulty” assessed by the TAC could be misinterpreted as a comment on the feasibility of the observation, rather than the level of effort required to analyze the observation. We request that wording be adopted and a verbal clarification made to peer review panels to communicate that this is an assessment related to effort and funding, not observational feasibility or importance.

4. We endorse the CXC Management recommendations for updating the evaluation of GTO proposals on conflicted targets in order to streamline this process. We approve of the submission of GTO proposals to the peer review panel without being “disguised” as GO proposals. As before, only the fact that there is a competing proposal with the same target(s) should be communicated to GTO teams and not the specifics of the conflicted GO observation. The GTO teams should continue to have 2 weeks to write a proposal for a competing target.
5. The Senior Review recommended the creation of “Key Programs”. While Chandra has traditionally encouraged “legacy” projects, or those that require lengthy observations, creating “Key Programs” at the CXC Management level would mark a break from the way that Chandra has achieved these goals in the past. The XVP and LP categories have fulfilled this role to a large extent in past observing cycles. In the view of the CUC, these categories have the advantage of allowing the community to decide which science is most pressing, rather than taking that decision at the level of the CXC Management. In addition to continuing with current practice, the CXC Management could solicit input on key science topics at meetings, and perhaps through a call for white papers from the community.
6. We strongly endorse the continuation of the DDT program at its current level. Presentations made to the CUC show that the DDT program greatly enhances the reach of the mission and supplements science programs that are highly time-sensitive. Accepted DDT proposals from the past year targeted a broad array of science, including: exoplanets, young and main sequence stellar science, AGN, supernovae, gamma-ray bursts, and a variety of compact objects.
7. We encourage Chandra to continue the pursuit of a joint program with ALMA, and with the coming Astro-H observatory.
8. Finally, we strongly encourage the mission to protect the overall level of GO funding, and only consider reduction as a last resort.

### **Calibration**

Larry David gave a comprehensive review of the calibration updates over the past year, as well as of the plan for future calibration activities. The range of ongoing activities is impressive. It shows once again the need for a continued monitoring of the instrumental performances to ensure the highest reliability of the scientific results yielded by Chandra. The CUC was extremely pleased to see reports of new results stemming from continuous efforts to:

- Characterise the time-dependence, spatial, and spectral properties of the contaminant on the ACIS filters. The recent updates of the contamination model represent a major achievement, given the challenging nature of this problem - that the CUC fully appreciates.
- Implement the calibration of a ACIS temperature-dependent gain correction to cope with the new operational constraints imposed by the thermal stability of spacecraft components.
- Refine the LETG/HRC-S effective area by releasing new QE maps in the near future.
- Provide clear guidelines on how to reduce and analyse ACIS CC Mode data. This will ensure the optimal scientific exploitation of data taken in this mode.
- Achieve a full understanding of the internal cross-calibration status

Recommendations:

1. The list of future calibration activities presented by Larry David is truly impressive. The CUC encourages the Chandra project to pursue investigation on all these areas. Should the future evolution of the CXC staffing impose the need for priorities, the CUC recommends that higher priority shall be given to:
  - Continuation of the efforts to monitor the evolution of the ACIS filter contamination, and achieve a full characterization of its spectral and spatial properties.
  - Investigation of the ACIS energy resolution and plate scale at high temperature, and implement a calibration thereof if required.
  - Publication of the results of the internal cross-calibration study (ideally in a refereed journal), and of the associated residual effective area uncertainties, in order to provide the user's community with a project-wide status of the systematics associated with the effective area absolute calibration. In this framework, the calibration team may consider the results derived from the multi-mission cross-calibration campaigns on PKS2155-304 and 3C273, running continuously since 2007.
2. Additionally, the CUC recommends completion of the calibration of the arc-like PSF feature visible in observations of bright sources: (cf. [http://cxc.harvard.edu/ciao4.4/caveats/psf\\_artifact.html](http://cxc.harvard.edu/ciao4.4/caveats/psf_artifact.html)). This feature may affect the interpretation of data of moderately extended sources such as PWN and SNR, a core science for Chandra.

3. The CUC feels that some additional effort should be spent to streamline the user's access to the calibration status. The CUC recommends that a single "calibration status document" for each instrument be published on the public CXC website, summarizing the overall calibration status per instrument. These entry-point documents should serve as loci of vital basic information and metrics, and provide links to more detailed information.

## **CIAO**

The CUC reaffirms its appreciation for CIAO, a powerful, user-friendly and thoroughly documented software, that has been crucial to Chandra's scientific success. Jonathan McDowell's presentation confirms that the project's development continues to be driven by scientific priorities, adapting swiftly to the changes imposed by the evolution of operations, and to the evolution of hardware platforms and operational systems. The CUC is especially pleased with the creative efforts (e.g. youtube videos) to make CIAO usable by non-experts and scientists new to the field.

CUC commends the initiative to have a one-day workshop on CIAO before the 15-year Chandra symposium, as well as the swift response by the HelpDesk to user inquiries.

Sherpa has been a crucial piece in this success story. However, the CUC expresses some reservations on the ultimate scope of the project to make of Sherpa a standalone task. While decoupling Sherpa from CIAO may help the future maintenance, the CUC is concerned that resources are being spent to make Sherpa available to a wide astronomical community without a verified potential "customer's market".

## **Recommendations**

1. The CUC asks that a detailed outlook on the future of Sherpa is presented at the next CUC meeting.
2. The CUC reiterates its advice to the CXC Management to perform a careful evaluation of the current priorities in CIAO development, and consider reallocating resources to scientifically higher priority tasks (e.g., the source catalogue), if this can help with achieving them.