Chandra Users Committee Meeting Report #51 - Nov 28, 2022

Summary of CXC Reports

Chandra Status Report

The Chandra Status Report was given by the CXC Deputy Manager, Mark Weber. In the 2022 Senior Review (SR) Chandra was rated ‘Excellent’ over all, and the Panel and Subcommittee recommended that NASA fund the over-guide budget to maintain the observatory’s and program’s abilities. The over-guide requested adjustment of operation costs for inflation and funds for 2 additional Flight Operations engineers to meet the rising demands of planning and operations due to the thermal issues. The SR 2022 also had augmentations to fund IDEA, enhancements to the processing pipeline to identify varying targets, and adjusting Chandra grants for inflation. NASA awarded funds for the overguide in 2023, but did not include funds for the augmentations. For 2024 and beyond, NASA approved a partial over-guide budget without augmentations. With these funds CXC are proceeding with the 2 hires, and will be able to maintain staffing levels and mission capabilities through FY23.

In 2022 there were a couple of changes in the leadership. Martin Weisskopf retired as the Chandra Project Scientist and Steve O’Dell has taken over. Andrea Prestwich is on assignment to NSF, and Belinda Wilkes retired. Flight Operations Team Sabina Hurley from Northrop Grumman stepped down as FOT manager and her position has been taken over by Megan Lin (NG).

The spacecraft and instruments are performing well under the increasingly strict thermal constraints, and the HRC is expected to resume science operations in Feb 2023. Aside from the thermal issues of the spacecraft, the majority of resources on the spacecraft are doing well. There is a healthy margin on the solar panel power, and there is still more than 60% fuel left. There have been some major operational improvements to preserve these resources, and a META algorithm to minimize operational risk to the thrusters and optimum thruster selection has been developed and put into use. A dynamic background algorithm for the aspect camera, which increases its sensitivity, is in Beta testing and close to deployment. There were about a handful of interruptions to the observing schedule, totalling around ~800ks.

In Cycle 24, for an *available* time of 17.7 Ms, there were 428 proposals with a total oversubscription factor of 4.2. The peer review was dual anonymous. The Einstein Fellowship program had 446 applications and 31 offers were made. SAO will host the NHFP symposium in September 2023. The outreach and public communication office are doing very impressive work, with social media growing steadily. From May 2022 - Oct 2022 there were 5 science press releases, 2 with Webb, and 7 image releases, 4 with Webb.

Director's Report

The Director of the Chandra X-ray Center, Dr. Patrick Slane, reported that the observatory and the data processing and delivery are all functioning nominally. The exception is the HRC, which is anticipated to return to science in February 2023. The 2022 Astrophysics Senior Review was published in June and rated Chandra in the top Tier 1 (Excellent) category. The Chandra over-guide budget request included funding to support current staffing levels with accommodations for inflation, two additional staff positions for the Flight team, inflation adjustment for the GO program, funding for a time-domain initiative recommended by the Time Domain Working Group and the CUC, and funding for a diversity initiative. All items were endorsed by the Senior Review, but NASA funding was allocated to all but the last two items: the time-domain and diversity initiatives.

The Senior Review offered specific recommendations for developing a strategic plan for Diversity, Equity, and Inclusion, including an increase in staff diversity, accessibility of data, and inclusiveness of relations with the scientific community. Many of such programs are already in place, but it was noted that a formal evaluation and plan will be carried out over the next year with input from the new CfA Associate Director for Internal Relations. The Senior Review also encouraged Chandra to consider mission-directed observations to contribute to its science legacy. Such an initiative may include partnership with GTO team and DD time. This initiative is currently on hold until the HRC returns to science, but is expected to unfold with internal studies and community input (see CUC recommendations section).

As noted above, the funding augmentation for Time Domain initiatives recommended by the Time Domain Working group was not approved by NASA, so the majority of the Working Group's recommendations have not been implemented due to a lack of funding and resources. The CUC recommended that the instructions for identifying and reporting transients in their data are relayed to the proposer. This is still on the to-do list.

Previous CUC recommendations include removing the reference section from the proposal page limits. This will be implemented subject to final software checks. The CUC also recommended that the CXC review the possibility of creating a tool or thread for procedures equivalent to those performed by ACIS Extract. This is being investigated (see the CIAO Update section).

The Director discussed a number of proposal review issues and/or changes regarding TOO proposal evaluation, archive proposals, and multi-cycle proposal restrictions. The CXC proposer for the TOO proposals to be ranked in topical panels, without strict panel allocations, and then selected in the Big Project Panel. This would provide a more direct comparison of science versus resources and avoid duplication of science. Changes in the TOO resource costs are also being evaluated in order to differentiate between the difficulty of short and long observations. There is also a concern that the large archive proposals are unlikely to be funded due to the small archival budget (~ $1M - 1.3M in total) and that the proportional distribution of this funding to panels results in only small proposals being awarded funds. Lastly, issues have been raised about the requirement that multi-cycle proposals must be justified by a time-domain component

considering that there are non-time-domain proposals that that cannot be completed in a single Cycle due to resource limitations, such as the High Ecliptic Latitude (HEL) time. The suggestion to eliminate the time-domain requirement from multi-Cycle proposals. The CUC is making a recommendation for each of the proposed changes (see the CUC recommendations section).

Mission Planning Update

Scott Randall gave the update on behalf of SOTMP. The goal of mission planning is to maximize science in presence of observation constraints and engineering constraints. The engineering constraints continue to be challenging since there are 11 different components that heat and cool as a function of pitch angle and they collectively place constraints at *every* pitch angle, so there is always something that limits the amount of dwell time at a certain pitch. Further, maintaining thermal balance for each component requires being at a cooling pitch angle for a specific component for a certain amount of time, but that can be limited by other components getting too hot at that pitch.

Although the Aspect Camera Assembly (ACA) has presented the most challenging constraints in the past, constraints from other components at other pitch angles have tightened such that the hot ACA pitch range of about 90 to 130 deg allows relatively long dwell times, and observations in this pitch range are now useful for cooling other components. Another source of significant challenge are the MUPS thruster limits, which place tight limits on the maximum dwell time below 85 degrees; these limits are permanent and will be in place for the rest of the mission. As time goes on, that pitch limit (85 angle) will get more restrictive, and the maximum dwell time will decrease. Thermal balance is no longer dominated by the ACA; the main constraints now are balancing MUPS vs ACIS. The higher new default temperature limit for ACIS (-109) will provide significant relief for weekly scheduling.

The impact of all of these constraints is that constructing the long term schedule is extremely challenging. Each week, there is a thermal balance and momentum balance that must be maintained. Auto-scheduling software developed with a team at STScI, allows generation of efficient schedules, which is being done much earlier than in the past.

Some consequences of running the ACA at higher temperatures were presented. Some star fields are now extremely difficult to solve and have narrow yearly windows when they are observable, and there may already be (or likely soon will be) some star fields that are unobservable with Chandra. To mitigate this, a star field checker tool for proposers is coming for AO25, which will return the roll angle ranges where the star field is acceptable. If no acceptable roll angles are found, the user will contact the HelpDesk for a by-hand check. Ultimately, this will be incorporated into the CPS. Additionally, the dither amplitude has been increased to 16"x16", which improves star acquisition and guide probabilities; this will make it easier to get solutions for difficult fields, and there will be fewer star constrained fields.

Because the ACA's dominance on thermal balancing constraints has been decreased, an investigation was performed on the availability of time for High Ecliptic Latitude (HEL) targets

(>55 degrees). That study concluded that an increase in the limit for HEL targets from 3 Ms to 4 Ms will be feasible.

Despite all of the constraints, there is a good distribution of targets in the sky. The Chandra Cool Target time is being used, and the usage was higher in cycles 22 and 23, which was partially driven by some normal sun modes related to operational events. Despite the increasing difficulty of meeting science constraints, there is still a high level of success in meeting them. The mission efficiency has hovered around 90% throughout its life, but it has been dropping and is now around 85%; it is unclear if this will level off or continue to decrease. In summary, the heating issues are being mitigated as much as possible, and observing metrics remain impressively high. The ToO historical performance shows a pretty steady average of total ToO time observed each year, and the anticipation is that ToO capabilities will remain at their historical levels.

Going forward, the Resource Cost of observations will need to be updated every cycle, to reflect the conditions of the satellite, e.g. the evolving thermal constraints as a function of pitch angle. Further, and more significantly, there is a potential resource-cost-like scoring for ToOs in the works. Historically, a 10 ks ToO and a 100 ks ToO had the same "expense" to a peer-review panel, but that does not reflect reality.

An accurate Resource Cost is important because peer-review panels can run out of Resource Cost allocation before running out of time allocation. When this happens, notes are sent to the CDO, and horse trading ensues among the panel chairs, especially when ToOs are involved. An alternative to this process would be having the ToOs reviewed in the topical panels and then sent to a merging panel to assess their scientific merit in light of their (now more accurate) Resource Cost.

Proposal Cycle and Future Plans

Cycle 24 featured 423 proposals, a slight drop from 517 in Cycle 23. Demand for time remained strong and highly competitive with an average oversubscription rate of 4.3 across all proposal types. Oversubscription rates were lower for GO (3.0) and Theory (2.6), and higher for Archive (3.8), LP (5.9), and VLP (16.5). Relatively few proposals were received in Theory/Archive, perhaps reflecting the low funding rates for these categories (0.6M$,1M$). However the fluctuation in the number of Theory proposals is consistent with past fluctuations and the number of theory proposals were not anomalously low. In response to rumors that large Archive proposals are no longer well-received, data were provided to show that within the small number statistics there have been no significant shifts in distribution over time. Panels still tend to pick one “top” archive/theory project and then fill in with smaller ones to spend the remainder. What has changed is the buying power of the available budgets, so that large archive efforts are no longer feasible. This is an unfortunate turn as the mission archive grows. Some 24% of GO proposals have foreign-based PIs.

Long-term trend of fewer proposals-per-year continues linearly from a high point of ~800 early in the mission to some 400+ in Cycle 24. Curiously this is balanced by an increase in requested time per proposal, driven by the steadily deteriorating low energy sensitivity of ACIS, which continues to be (by far) the most-requested instrument. The effect is that the oversubscription rate by time remains as competitive as ever.

The fraction of proposals led by Female PIs has steadily increased to 30%. However the data shows this is not due to any increase in the number of female proposers, which has remained steady throughout Chandra's 20+ year mission. Instead the number of male proposers has declined. This finding deserves to be investigated further. Success rates for Male and Female PIs have not shown any significant imbalance over time (within year to year statistical fluctuations).

The Cycle 24 peer review was held online, featuring 61 reviewers in 7 topical panels, plus the big proposal panel composed of chairs, deputy chairs and pundits. NASA HQ has studied the impacts of online peer review, concluding that participation by under-represented groups and obtaining the required diversity of technical expertise are both vastly improved. Therefore all NASA peer reviews, including Chandra will be virtual going forward. However the strain on reviewers, panel chairs (in particular), and CXC staff is exacerbated by the doubling in length (in terms of work days) of the review that comes with the online model. There is concern that the pool of scientists willing to serve as chairs (and deputy chairs) for a 2 week long review will rapidly be exhausted. Statistics were presented that show somewhat shockingly two-thirds of Chandra PIs have never served on the peer review (including a number of power-users). This imbalance is troubling, and CXC staff report it is very difficult to engage a pool of suitably qualified reviewers. The CUC recommends that these figures be widely shared with the community, and endorses measures suggested by CXC to encourage review participation by PIs. Up to and including mandating review service as a condition of proposing for repeat PIs.

In response to these two pressures (unequal participation, move to online review), the CXC has begun to study alternate ways to run the peer review, focussing on the so called "distributed peer review" model. Proposals would be distributed among the proposers themselves to review and rate, there would be no panel discussion, and the CXC would be in charge of ranking and allocating observing time. Questions include: how to deal with PIs submitting multiple proposals (would they be required to review a proportionate number of proposals, or not?), how to handle dual-anonymous in this situation where all reviewers are inherently reviewing their own competitors?, how is feedback to PIs handled? The CUC strongly recommends further study of already-deployed examples including ALMA and Gemini.

New programs: A joint proposal arrangement with JWST will see 150 hours of JWST allocated by the Chandra panel in cycle 25, and 300 ksec of Chandra time allocated by the JWST panel, with a maximum of 1 JWST TOO.

A summary of dual anonymous violations was presented, with infractions classified in 3 grades. I: did not use numbered references format, several PI's were warned but no further action taken,

CXC requested advice on whether such format should even be considered a violation. II: Use of the words “we” or “our” in a sentence that also includes a reference. It was found that in 3 cases the sentence referred to the proposers’ own work, and these proposals were rejected. In a further 8 cases the sentence referred to the work of others, and these proposals were kept. III: Directly naming a PI, team member or institute. 9 proposals named a person and were rejected. 3 proposals mentioned an institute in a budget or supporting element and were kept. CXC noted that in all cases the infractions appeared accidental and likely resulted from the adaptation of a prior-cycle proposal. It is hoped that non-compliance will diminish rapidly as old proposals age out.

Hubble Fellowships: 2023 will be the last year for eligibility extension (4 years post PhD) due to COVID19 impacts. There were 457 applicants for 24 total positions.

HRC Anomaly Update

The HRC is currently powered by the +5V LVPS on the side-A electronics. The +-15V LVPS and anticoincidence shields remain powered off unless the HRC detectors are actively taking science data. Four observations – two HRC-I and two HRC-S – were conducted to check the situation of HRC between June and September. An operation limit of 10 degC on MSID 2CEAHVPT was imposed for all observations. All observations approached 10 degC. The last observation was for 15 ks, which will be the maximum duration of the upcoming HRC observation. Science and engineering data looked normal.

The first anomaly happened on August 25, 2020 (Side-A anomaly - A1). +-15 V voltage dropped down to low values with high noise in +-15 V buses. The second anomaly happened on August 27, 2020 (Side-A anomaly - A2). The symptom was the same as A1. Then, the operation was switched to use Side-B and ran for 16 months. The third anomaly happened on February 9, 2022. +-15 V voltage dropped to low values, but this time +15 V bus showed a "two-step" behavior - rapid drop to ~4.5 V followed by a decrease to 3.5 V. The restart attempt of Side-B on March 11, 2022, was unsuccessful. The team thinks Side-B has a more severe issue than Side-A.

There are two possibilities for the anomaly based on the root fault analysis. The first possibility is a solder joint failure of the DC-DC converter. The second possibility is a shorting between plate layers and Multi-Layer Ceramic Capacitor (MLCC) due to "whisker" growth.

Based on the anomaly analysis, the HRC Anomaly Working Group recommends the following. "Given that the A-side anomaly re-occurred after the CEA heated to above 12 degC, the HRC should be operated with thermal constraints in place such that critical components do not heat above temperature where a known failure has occurred. Additionally, minimum durations between HRC activities shall be set such that critical components can cool down. HRC cooling is currently not well characterized, suggesting a conservative lower limit on the cooling time."

The new HRC operation guidelines are 1. the predicted HRC CEA temperature not exceeding +10 degC while the +-15C LVPS is powered on, 2. the maximum HRC on-time duration not exceeding 15 ks, and 3. the minimum HRC off-time duration should not be less than 30 ks. Furthermore, the HRC background data will not be stored. And the data from the HRC anticoincidence shield, while the HRC is not operational, will not be stored. The HRC is expected to return to a science operation by early March 2023.

ACIS Update

The ACIS instrument continues to produce spectacular results, despite the challenges of continuing buildup of contaminants on the detector and the increasing thermal constraints on the observatory as a whole. The Chandra X-ray Center and MSFC Project Science have extensively studied the possibility of doing a bakeout to attempt to reduce or eliminate the contaminant. For a variety of reasons, mostly boiling down to the uncertainty level of both the effectiveness and the risk of such an operation, the CXC is not currently considering a bakeout for ACIS. The CUC supports this decision at this time.

Currently, there are 3 focal plane temperature limits at -109, -111, and -112 C, with the majority of observations taking place at <-112 C. Colder temperatures limit dwell time, so the CXC is currently conducting calibration observations at -105 C, a temperature which dramatically increases the dwell time. If this warmer limit is found to be acceptable, at least some science observations may be carried out at this temperature. The CUC supports the continued study of this warmer temperature.

With the infrequent operation of the HRC anti-coincidence detector and the upcoming increase in solar activity, expected to peak in 2025, the CXC and the MIT ACIS team have modified the ACIS flight software to serve as a radiation monitor for the observatory, with the ability to put the instruments into safe mode in the case of high radiation events. The CUC lauds this effort.

CIAO Update

The Science Data Systems staff continues their strong support of the scientific community utilizing Chandra and CIAO, including support and development of CIAO and its yearly releases, user support, and continued evolution, updates, and additions to analysis codes, threads, and scripts.

Downloads of new CIAO versions are high and fairly constant across versions. Usage of CIAO is relatively evenly distributed between Linux and Mac (roughly 60/40). Support of the ever evolving Mac operating system is challenging and takes significant time, but continues to be important to the community. The ciao_install script continues to be used by about a third of users compared to installation with conda. While it is clear that many people still favor ciao_install, the CUC noted that it is likely these users could migrate to conda if needed.

A number of updates have or are being made to documentation to improve the user experience, including use of color, sections, and organization by context. Some specific developments mentioned include the creation of a “Merging Central” organizing documentation related to combining observations and planned updates to srcflux to support users of the (non-CIAO) acis_extract code. The latter was a previous request of the CUC. SDS reports that src_flux already does much of the basic analysis in acis_extract, and they have developed a thread “Guide to using srcflux for acis_extract users”. Some gaps have been identified, and SDS will work to update srcflux to fill these gaps.

Helpdesk usage and support remains strong with a couple hundred tickets per year, which are generally closed quickly. Helpdesk queries are also helpful in revealing bugs and spur updates in documentation that improve clarity. CXC is rethinking how they do community outreach. Recent planned CIAO workshops have been poorly attended and current plans are to do video calls rather than an in person workshop. CUC recommends the development of youtube tutorials and example jupyter notebooks as a potential way of reaching young scientists.

Updates to CIAO in 4.15, contributed scripts, Sherpa, grating analysis, and ds9 were also presented. One important update is the addition of a warning for observations made at warm temperatures. The CUC noted the importance of ds9 to the broad astronomy community including students in classes and getting involved in research for the first time. This is an amazing resource being provided and supported by a small staff. The CUC noted that ds9 already includes a lot of functionality that even CUC members were unaware of, and we recommend efforts to further document ds9 functionality and increased outreach to the astronomical community showcasing this functionality.

Chandra Source Catalog & Data Systems

The overview of the CSC was given by Pepi Fabbiano. The catalog development team is currently working on the CSC Release 2.1, and since the production started in April 2020, 80% stacks have completed processing, which includes 80% of ‘new sky’ stacks. The expected release date is in the first half of 2023.

There have been several improvements to the algorithm for 2.1: the astrometry has been tied to the Gaia frame, and in 2.1 this has resulted in 70% of sources having less than 0.1 arcsec separation, up from 20% in CSC 2.0 in the Orion region; a new MCM algorithm has improved convergence for low count sources, which means better flux determination; characterization of overlapping sources has been significantly improved.

The CSC has several interfaces. CSView enables browsing, extraction, and manipulation of tabular data, while VO interface allows data visualization and manipulation with VO tools. World-Wide Telescope visualization will show footprints of all observations that are part of the catalog and give info about detected sources. The tools are compatible with International Virtual Observatory Alliance (IVOA) standards, allowing standard VO access and workflows for

VO-enabled tools (e.g. TopCAT, DS9, Jupyter notebooks). The tabulated properties and data products from CSC 2.0 can be accessed from Python sessions (atrophy, Sherpa, and other analysis tools can be combined in a single session). CSC 2.0 documentation pages will be updated regularly with new Jupyter notebooks showing examples of analysis procedures

The CSC has been endorsed as Legacy Chandra Products by two Senior Reviews, and it will be promoted to the community with demos at the Jan 2023 AAS, and with a special session at the HEAD 20 meeting.

Digital object identifiers (DOIs) as standard identifiers have been adopted, and landing page mechanism enhances discoverability and reproducibility of scientific results. These landing pages for CSC full-field data products are still in development.

Calibration: Goals, Priorities, and Plans

Dr. Larry David gave the update on the Chandra calibration goals, priorities, and plans.

ACIS contamination model and limits on the focal plane temperature for ACIS were presented. In AO-24, the required ACIS-I3 and ACIS-S3 focal plane temperature was limited to < -109 C if number of counts < 2000 for ACIS-S and < 1000 counts for ACIS-I. For AO-24, approximately 60% of approved ACIS observations meet the limitations on counts.

Next the gain calibration for ACIS at warm temperatures was presentented. CXC made recommendations to use simulations to determine the maximum number of counts in warm ACIS observations for correctly evaluating the calibration effects.

To calibrate the ACIS above > -109 C, GX 3+1 will be observed with the HETG/ACIS-S at three different values of chip-y (SIM_Z). These observations, which will be used to determine if HETG/ACIS-S observations can be done at -105 C, will measure the gain and the energy resolution on a finely spaced energy grid.

CXC also presented an observing plan to calibrate ACIS at -105 C. Nine observations (3 x 3 raster scan) of Cas A for 2 ks on each detector to calibrate the gain, energy resolution, and possibly the QEU map. And five observations of Cas A for 5 ksec at the read-out of I3 to measure the intrinsic line widths in Cas A.

The calibration team has observed the isolated neutron star RXJ1856 every year since 2011 with the LETG/ACIS-S to monitor the build-up of contamination on the ACIS filters and determines its effect on the ACIS PSF at low energies. The build-up of contamination on the ACIS filters is likely responsible for the observed broadening of the 0th order image of RXJ1856 over the recent past. Broadening is the most significant near the C K-edge.

SDSS-V Project Update

Paul Green reported on follow up of the Chandra Source Catalog in SDSS V. SDSS V is an all sky spectroscopic survey with different thrusts including black hole mapping and Milky Way mapping programs. SAO joined SDSS V with half of the funding coming from CXC. About 50% of the CSC has opt/IR bright enough for SDSS-V targeting. CXC intends to serve SDSS-V data products in CSC, though this is currently unfunded. CXC provided a source catalog to SDSS-V from CSC 2.0, matching to optical/IR. This gave 148k candidates, which are prioritized by X-ray S/N. So far SDSS has obtained 5k new spectra. The SDSS team is working to update the target list with CSC 2.1 and now expect 180k matches for SDSS-V possible targeting and perhaps will get 50k spectra total.

CUC recommendations

Adjust grants for inflation

The CUC agrees that adjusting the grants to account for inflation would be very desirable and justified by the rising costs on everything from publication fees to conference travel. It is not sustainable to expect proposers to subsist and perform the same amount of work on shrinking grants.

ToO Proposal Evaluation Procedure

The CUC agrees with the CXC that to enable a more direct comparison of science vs. resources, and to avoid potential duplication of science, that ToO proposals should be ranked in topical panels, without the panel allocating the time, and be passed on to BPP or an equivalent merging panel for allocation. The CUC recommends that this be implemented on a trial basis for Cycle 25.

Presently there is no difference between the resource cost per ksec between a long and short ToO despite there being significant difficulties associated with longer ToOs. The CUC agrees with the CXC that they should look into implementing a new resource metric for evaluating the difficulty in executing long ToO over a shorter ToO.

Archive and Theory

The CXC asked the CUC to evaluate if the success-rate data of Archive proposals supported a claim of a tendency for “<$50k” proposals to be favored over large proposals “>$100k”. It was the CUC opinion that because of the relatively small number of “<$50k” and “>$100k” proposals, the data was inconclusive, but that it was the experience of the CUC, from having served on panels, that in general the panels do seem to be biases towards smaller programs as they are often easier to fit into the allocation given to the panel. It is also a concern of the CUC that because a few number of proposals are scattered across many panels, the selected proposals may not accurately reflect the quality,i.e., low quality proposals may be all in the same panel and all high quality proposals in one panel.

The CUC therefore thinks that the science return for Theory and Archival could benefit from being evaluated by a merging panel in the same way as is proposed for the ToO. The CUC understands that this will put additional burden on the BPP, and the CUC leaves it to the CXC to determine if they believe they can implement it alongside the ToO allocation. Priority is on the ToO, with Archive and Theory proposals being secondary.

As a compromise and short term solution, the CXC could consider allowing the panels to allocate time for their top Archive or Theory proposal, and pass on the second tier of Archive and Theory proposals on to the BPP.

Distributed Review

The CUC agrees with the CXC that there is a lot of burden on the review panels, especially in the virtual environment, and that it is becoming increasingly hard to obtain reviewers. In addition, the statistics show that the participation in the review is not evenly distributed among the Chandra user base. On these grounds, the CUC supports and encourages the CXC to look into the challenge of turning the traditional review into a 'Distributed review' in the format that is currently being used by ALMA and Gemini.

The CUC recognizes that this will not be a simple task and offers a couple of additional thoughts on which part of the review process to pay particular attention to:

- In the format where each proposing PI has to review 10 proposals, a proposer with multiple proposals may potentially end up reviewing a lot of proposals. This will have to be considered and potentially mitigated for.

- In the same way that the GO program ensures that a diversity of science topics are maintained in each cycle, the Distributed Review will have to ensure that all science topics in the GO program get their fair share of time.

- Considerations should be made on what 'products' the reviewers are returning to the CXC. The CUC thinks that it should at the very least be a score and a summary. Potentially, there could be a second round of evaluation by reviewers, where they get to read the summaries from other reviewers and are given a chance to adjust their score + summary based on what they read.

- Considerations should be made on what the PI gets back in from the review.

In the short term, the CUC recommends that the CXC make the Chandra community aware of the great disparity in the number of PIs that have never served on a panel despite having had accepted proposals. Some suggestions made are:

- Presenting the statistics at meetings such as AAS and HEAD. This could be done through the XRSIG or PhysPAG.

- Make potential panelists aware of the disparity by including a paragraph of the problem in the invitation solicitation.
- More extreme measures could be to identify the users who have not served on a panel despite being awarded time and make them aware of their lack of professional service.

Multi-cycle restriction

The CUC supports the suggestion that the time domain requirement be removed from the multi-cycle proposals such that all sources are eligible as long as there exists a compelling reason for why the program needs to be a multi-cycle proposal, i.e., due to operational or scientific restrictions that would exclude it from being completed in a cycle.

Non-compliance policies

The CUC thinks the CXC handled the non-compliant proposals in cycle 24 fairly and that they should continue to follow the DAPR guidelines.

The CUC suggests that the CXC review the instructions given to reviewers on how to look for non-compliance. It concerned the CUC that the reviewers might try too hard to find non-compliant issues, and that it should be emphasized to reviewers that non-compliance is not a fishing expedition. The CUC also recommends that non-compliance should not be discussed in the panel, but that the CXC should either resolve the non-compliance before the panel meets, or, if that is not possible, to carry on the review as if it was compliant (judged for science) and resolve the non-compliance issue later.

The CUC recommends that the CXC consider setting up a very simple check in CPS for non-compliance, which is run on the main text, separate from the references (now that the references will no longer be counted in the page number). It would show up as a warning to the PI when they submit the proposal, suggesting that there might be a non-compliant issue.

Legacy initiative

The CUC agrees with the Senior Review that the ‘Legacy Initiative’ is very important:

“Given the aging observatory, Chandra should consider a mission-directed observation or set of observations to contribute to its science legacy. This might include a partnership with GTO teams and GTO time, in combination with DD time, or leverage other creative solutions.”

The CUC thinks this should be given a high priority, and that the call for white papers should go out in 2023. Based on the response to the call and evaluation of the program, which the CUC recommends be peer reviewed, the feasibility of carrying out the effort should be assessed with respect to the science return.

CIAO, DS9, and *srcflux*

The CXC asked for the CUC's opinion on the importance of continuing support for both the ciao-install (the traditional way) and conda-install (the new way) methods for installing CIAO. While the majority of the CUC members use ciao-install, and the data show that many still use ciao-install, the CUC is not opposed to discontinuing ciao-install if it frees up resources better used elsewhere.

The CXC asked the CUC opinion on new ways of reaching users, and recommendations or ideas for how to best teach CIAO to the new generations (if classic workshops are not the way any more). It is the CUC's impression that youtube tutorials and Jupyter notebooks are how many younger scientists learn, and that making such products available and more visible on the CIAO webpage would help towards that goal. The CUC notes that some of this content already exists but that it is not particularly visible on the CIAO webpage, and the CUC recommends including these products on the thread pages and making them more visible from the main page.

The CXC asked about the balance between general community and Chandra specific support for DS9. The CUC noted that there was a lot of functionality in DS9 that does not seem to be known by the larger community. The CUC recommends that the CXC consider devoting a campaign to update documentation and showcasing the current DS9 functionality to the user base through newsletters (Chandra and other observatories), demonstration at meetings, one-paper list of DS9 functionality that could be handed out at conferences, and information pushed out through other avenues such as HEAD.

The CUC were pleased to hear that the functionality of the *acis_extract* suite could be covered by the tool *srcflux* and recommend that the CXC continue with implementing the *acis_extract* functionality into *srcflux*.

Time Domain

The CUC was disheartened to hear that the request for funding for an automated search for transients in new data was not awarded by NASA. The CUC recommends that the CXC continue to pursue avenues for getting funding for the time domain tasks identified in the other CUC reports:

From May 2022 report: "*The CUC reiterates its past recommendation to provide an automated search of new data for transients. While the committee understands that addressing this specific recommendation currently is dependent on the results of the Senior review, we recommend that in the interim until such funding is made available, that instructions are relayed to proposers on how to go about identifying and reporting transients in their data. This could be in the form of a data analysis thread in CIAO and/or clear step-by-step instructions to PIs receiving new data.*"

The CUC would like to see a prioritized list for what resources could potentially be freed up to write code for the transient search algorithm.