

Twenty Years of *Chandra* Peer Reviews

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A lot has changed since the first *Chandra* proposal deadline on February 2 1998. In 1998 *Chandra* was still called the Advanced X-ray Astrophysics Facility (AXAF) and the first call for proposals was issued by NASA, not the CXC, and was titled “NASA Research Announcement for AXAF Cycle 1”. 779 proposals were received and the peer review was held in Waltham, MA. Proposals were delivered to reviewers on paper and reviewer comments were typed by a team of dedicated secretaries who saved the results of their labor on floppy disks! Hard copies of reviews were hand-carried to panelists who made revisions using pen and ink. There were stacks of paper in panel rooms but no laptops. Although the technology used to process proposals has since changed, the time requested per cycle and the oversubscription has remained remarkably constant over the lifetime of the mission.

As the mission matures, there has been a trend towards larger and more complicated programs. In Cycle 1, the median approved proposal exposure time was 30 ks whereas in Cycle 20 the median is more like 100–200 ks. Large Projects (> 300 ks) were introduced in Cycle 2 in recognition of the fact that many important science programs require larger chunks of time—for example, surveys and deep exposures of a single object. The trend continued with the introduction of Very Large Projects in Cycle 5 and X-ray Visionary Projects in Cycle 13. The “golden years” of XVPs lasted 4 years during a period when *Chandra* spent significantly more time above the earth's radiation belts, resulting in an increase in science observing time (see the jump in available time in Figure 2). *Chandra* programs have become more complex over time. Despite increasing challenges with thermal management of the spacecraft, the mission planning teams routinely coordinate *Chandra* observations with multiple ground-based and space-based observatories, including initiatives like the Event Horizon Telescope and even solar system missions (e.g., New Horizons). *Chandra* is doing excellent target of opportunity (TOO) science, including gamma ray bursts, supernova, changing states in black hole and neutron star binaries, and the famously detected X-ray emission from GW170817 - a feat that would fall into the “in my wildest dreams” category in Cycle 1!

Cycle 20 Proposal Statistics

The programs approved for *Chandra*'s 20th observing cycle are now underway. The Cycle 21 Call for Proposals (CfP) was released on 13 December 2018 and the proposal deadline was 14 March 2019. Cycle 19 observations are

close to completion.

Cycle 20 proposal statistics can be found in Figures 1-7 and on the CXC website at:

http://cxc.harvard.edu/target_lists/cycle20/cycle20_peer_results_stats.html

The distribution of science panels is shown in Table 1 and Joint Program statistics in Table 2.

Cycle 20 included a call for Very Large Proposals (VLP), a category requiring > 1 Ms of observing time. The total amount of time allocated in Cycle 20 was 17.3 Ms including 4.3 Ms to 7 approved LPs. No VLP proposals were approved in Cycle 20.

Cost Proposals

PIs of proposals with US collaborators were invited to submit Cost Proposals, due in Sept 2018 at SAO. Each project was allocated a budget based on the details of the observing program (see CfP Section 10.4). Awards were made at the allocated or requested budget levels, whichever was lower. The award letters were e-mailed in December, in time for the official start of Cycle 20 on 1 Jan 2019.

Table 1: Panel Organization for Cycle 20

| Topical Panels | |
|-------------------|--|
| Galactic: | |
| Panels 1,2 | Normal Stars, WD, Planetary Systems and Misc |
| Panels 3,4 | SN, SNR + Isolated NS |
| Panels 5,6 | WD Binaries + CVs, BH and NS Binaries, Galaxies: Populations |
| Extragalactic | |
| Panels 7, 8, 9 | Galaxies: Diffuse Emission, Clusters of Galaxies |
| Panels 10, 11, 12 | AGN, Extragalactic Surveys |
| Big Project Panel | |
| BPP | Large and Very Large Proposals |

Table 2: Time awarded by the *Chandra* Peer Review on other facilities

| Observatory | # Accepted Proposals | Total Time |
|-------------------|----------------------|-------------|
| Hubble | 7 | 37 orbits |
| <i>NuStar</i> | 3 | 210 ks |
| NRAO | 7 | 50.5 hours |
| <i>Swift</i> | 3 | 157 ks |
| <i>XMM-Newton</i> | 2 | 248 ks |
| NOAO | 4 | 6.03 nights |

Table 3: Chandra Time Awarded by other facilities

| Observatory | # Accepted Proposals | Total Time (ks) |
|-------------|----------------------|-----------------|
| Hubble | 4 | 254.0 |
| XMM-Newton | 1 | 22.0 |
| NRAO | 4 | 136.2 |

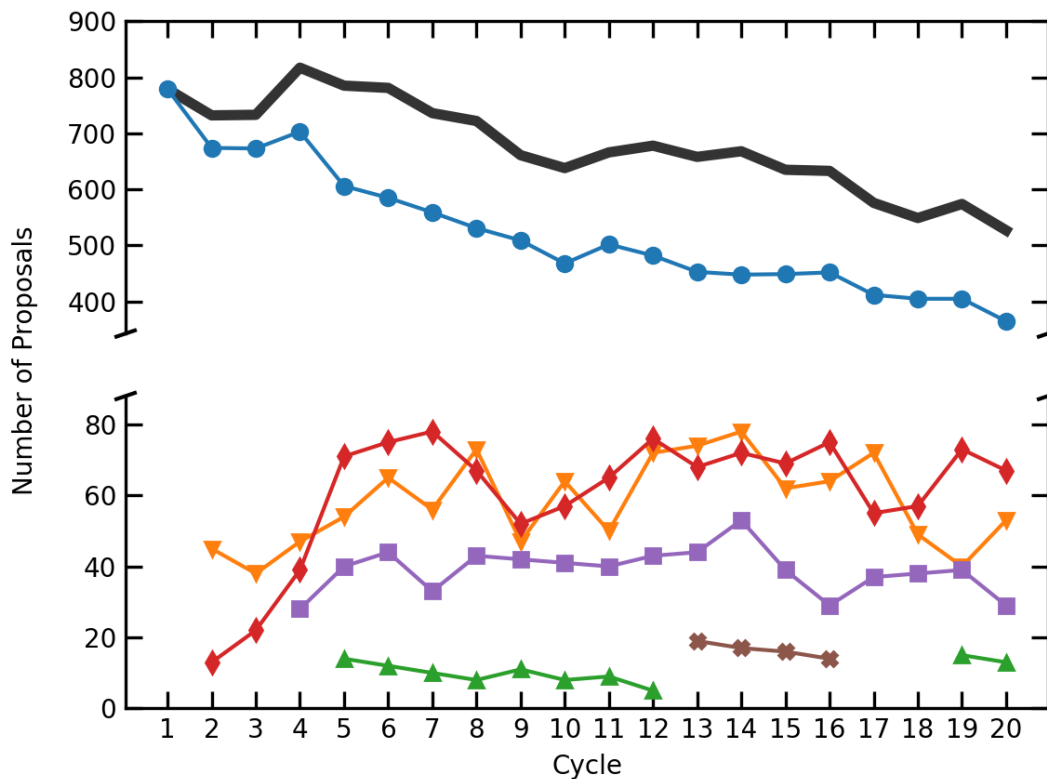
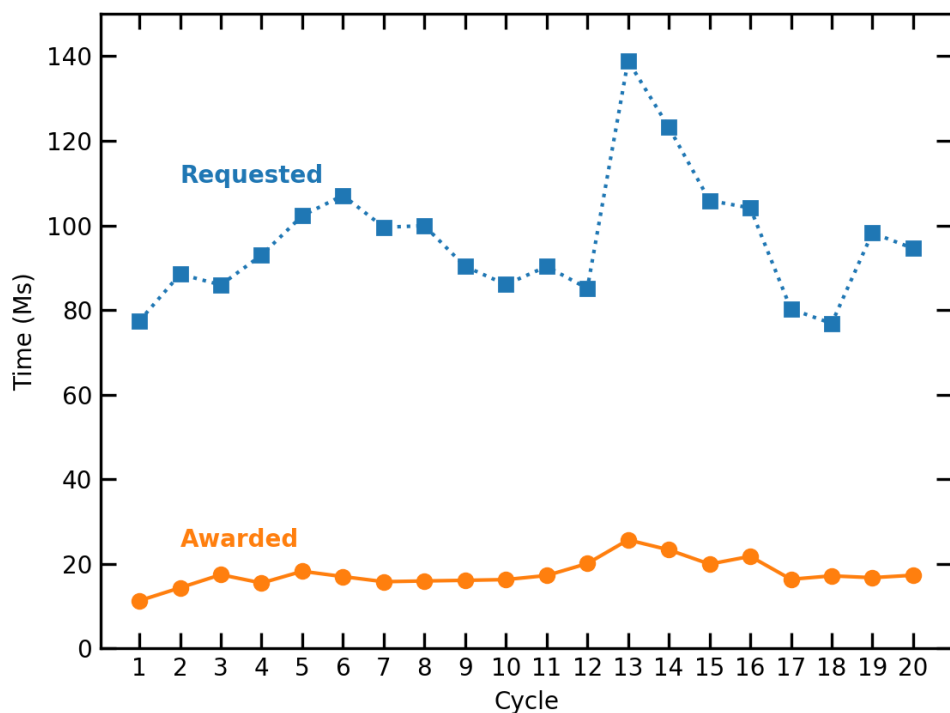


Figure 1: The number of proposals submitted in each proposal category (e.g., GO, LP, Archive etc.) as a function of cycle; note the vertical axis is broken at ~400 proposals to better show the individual proposal categories. Since more proposal categories have become available in each cycle, the number classified as GO has decreased as others increased. The total number of submitted proposals (solid black line) is remarkably constant. Proposal category legend found in Figure 3 on page 53.

Figure 2: The requested and approved time as a function of cycle in ks including allowance for the probability of triggering each TOO. The available time increased over the first three cycles, and in Cycle 5 with the introduction of Very Large Projects (VLPs). The subsequent increase in time to be awarded due to the increasing observing efficiency and the corresponding increase in requested time in response to the calls for X-ray Visionary Projects (XVPs) in Cycles 13-16 is clear.



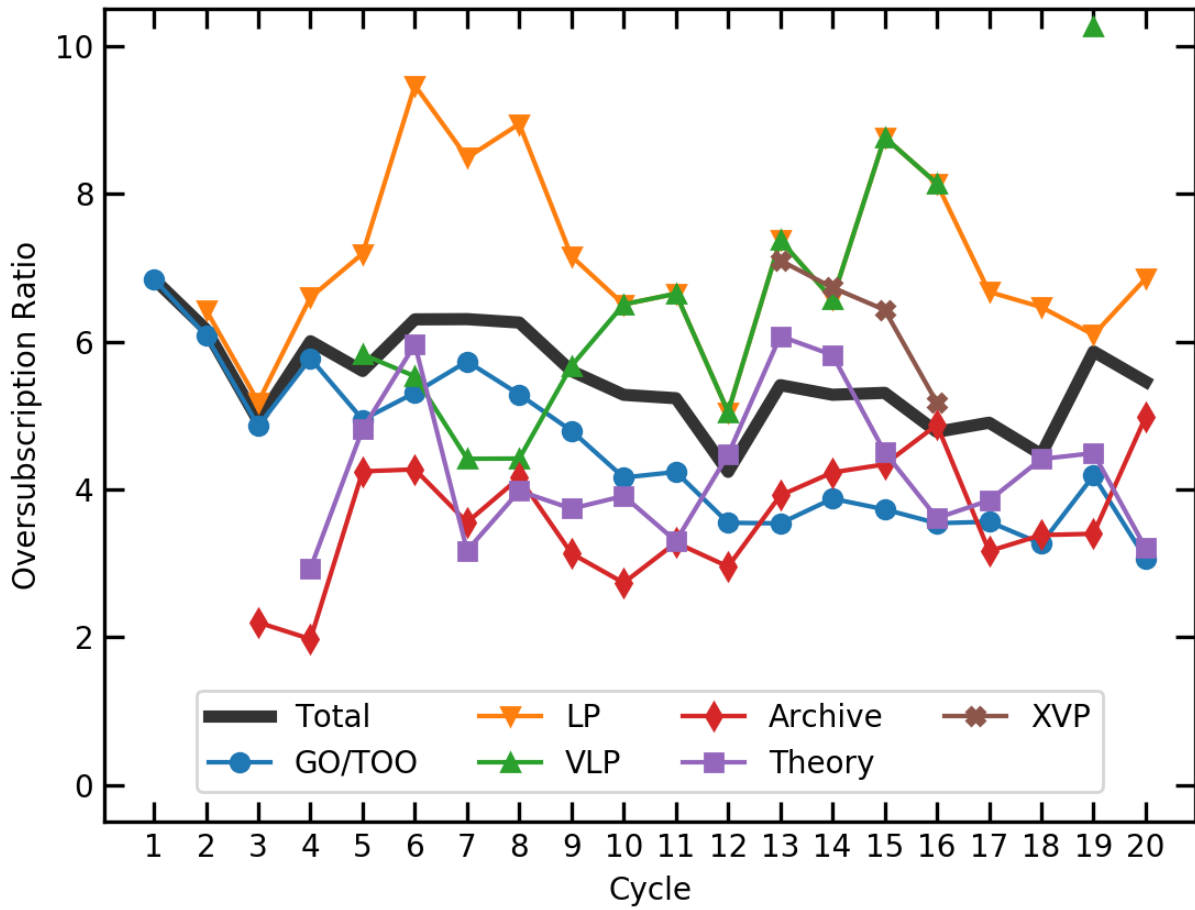


Figure 3: The effective oversubscription ratio in terms of observing time for each proposal category as a function of cycle. Note that some of the fluctuations are due to small number statistics (e.g., Theory proposals).

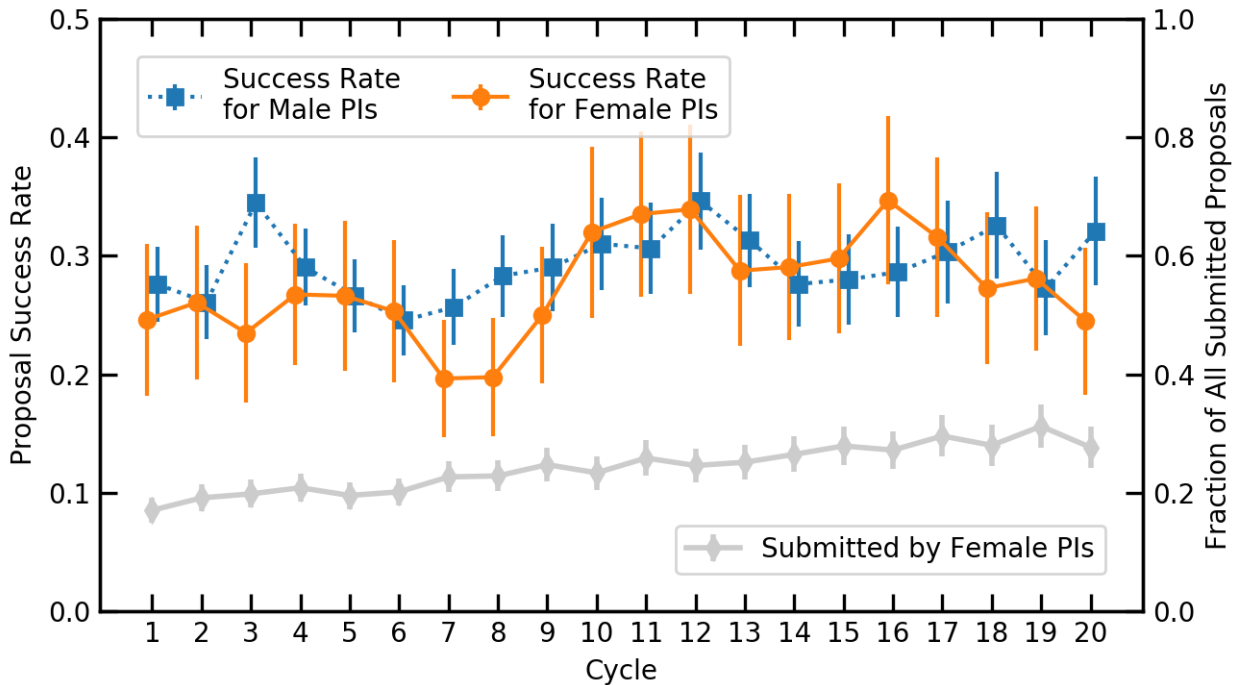


Figure 4: The success rate of male (blue) and female (orange) *Chandra* PIs as a function of cycle, and the overall fraction of female PIs (gray). Since Cycle 10, the success rate for female and male PIs has been statistically indistinguishable.

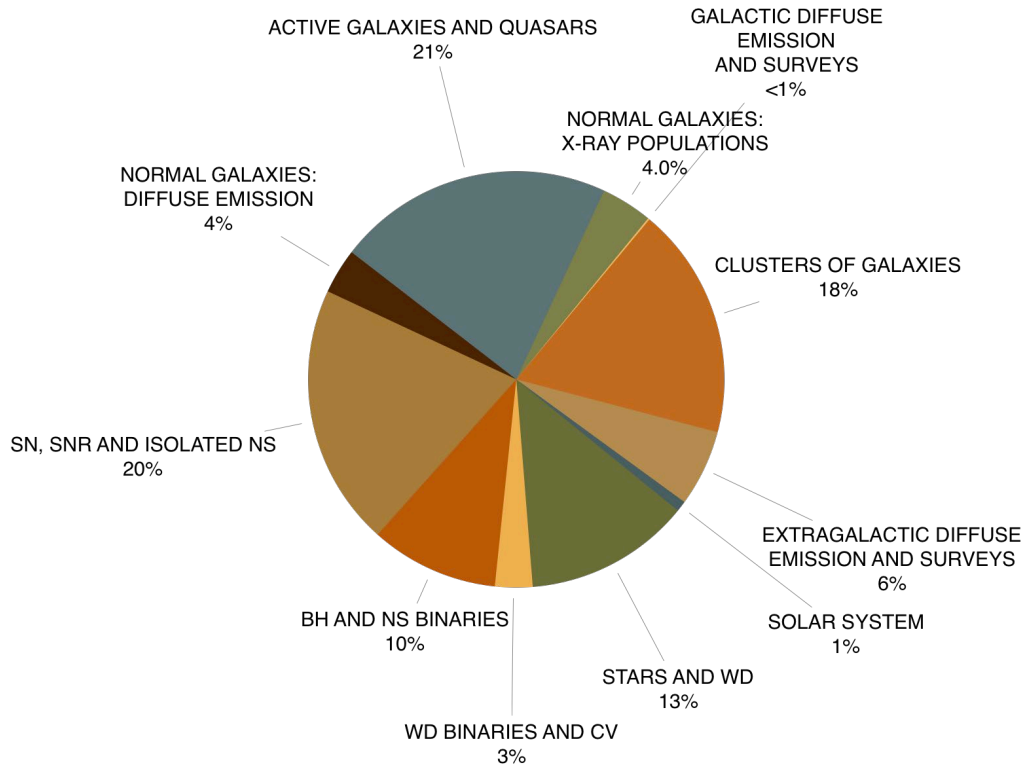


Figure 5: A pie chart indicating the percentage of Chandra time allocated in each science category. Note that the time available for each science category is determined by the demand.

Table 4: Requested and Approved Proposals by PI Country

| Requested | | | Approved | |
|-----------|-------|---------|----------|------|
| Country | #Prop | Time | #Prop | Time |
| Belgium | 2 | 570.00 | | |
| Bulgaria | 1 | 100.00 | 1 | 100 |
| Canada | 7 | 1497.00 | 2 | 362 |
| China | 7 | 520.00 | | |
| France | 2 | 480.00 | | |
| Germany | 19 | 5623.30 | 6 | 386 |
| Greece | 2 | 414.40 | 1 | 150 |
| India | 6 | 934.00 | | |
| Israel | 1 | 450.00 | | |
| Italy | 27 | 8210.00 | 6 | 1272 |
| Japan | 10 | 1320.00 | 3 | 150 |
| Korea | 1 | 85 | | |
| Mexico | 1 | 400 | | |

| Requested | | | Approved | |
|----------------------|------------|-----------------|------------|-----------------|
| Country | #Prop | Time | #Prop | Time |
| Netherlands | 10 | 1230 | 5 | 480 |
| Russia | 1 | 130 | | |
| Serbia | 1 | 125 | | |
| South Africa | 1 | 120 | | |
| Spain | 4 | 385 | 1 | 60 |
| Sweden | 2 | 350 | | |
| Switzerland | 2 | 280 | | |
| Taiwan | 1 | 83 | | |
| Turkey | 2 | 200 | 1 | 50 |
| UAE | 1 | 24 | | |
| UK | 22 | 6482.53 | 7 | 1392 |
| USA | 394 | 68487.55 | 124 | 15655.36 |
| Total Foreign | 133 | 30013.23 | 33 | 4402 |

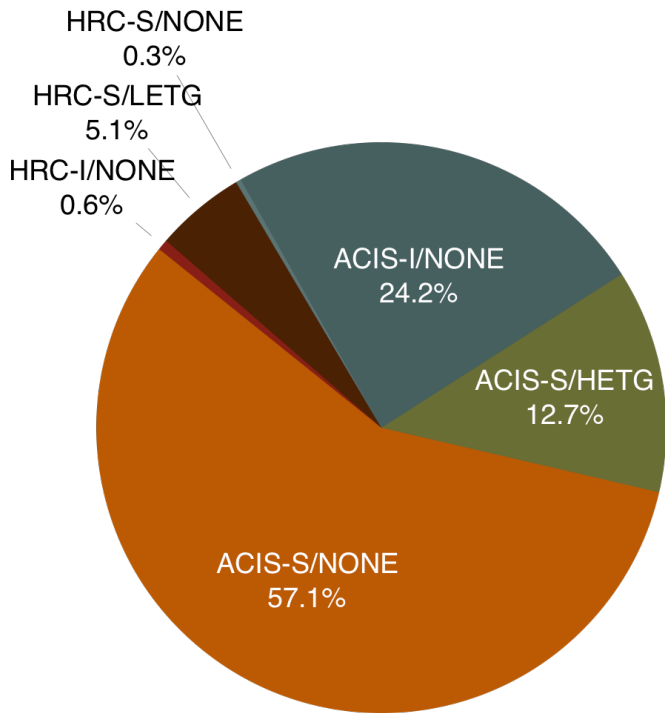


Figure 6: A pie chart showing the percentage of Chandra time allocated to observations for each instrument configuration.