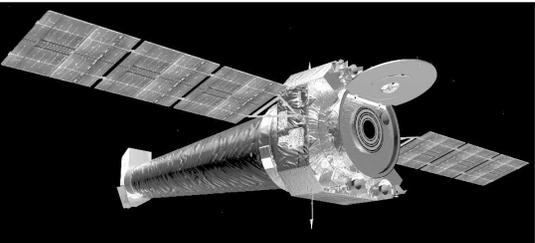


Monitoring and Trends Analysis

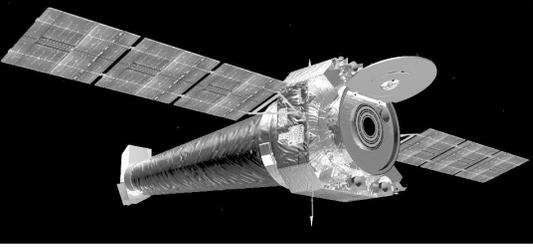
Presented to
Chandra Users Committee
by
Scott J. Wolk CXC/SAO

6/9/2003



What is MTA?

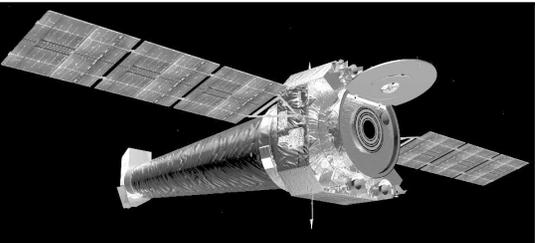
- Objective: To maximize the science return from *Chandra* by monitoring spacecraft performance and predicting future trends.
 - A coordinated approach
 - MTA is not viewed as the function of one scientist.
 - It is a core function of the SOT & CXC with one scientist taking the lead role as advocate.



Roles

- All members of the SOT and TST participate.
- IPI Teams, CAL, DOSS.
 - IPI teams advocate for, monitor and trend their instruments.
 - Cal. designs and analyzes observations with specific goals. These include quantifying temporal and spatial responses.
 - DOSS is responsible for the above and:
 - All non-IPI instruments (ACA, SIM, PCAD, etc.)
 - Data flow (real time and database management)
 - Problem tracking
 - All infrastructure
 - <http://cxc.harvard.edu/mta/sot.html>

Problem Tracking



M&TA PROBLEM TRACKING - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop <http://cxc.harvard.edu/mta/REPORTS/PROBLEMS/track.html> Print

Ⓜ CXO schedule: 2003:145:23:57:53.62 M&TA PROBLEM TRACKING ACIS E0102-72 CALIBRATION S3

 **Chandra X-ray Center** [About Chandra](#) | [Archive](#) | [Proposer](#) | [Instruments & Calibration](#)
[Data Analysis](#) | [Newsletters](#) | [Help Desk](#) | [Calibration Database](#)
[NASA Archives & Centers](#)

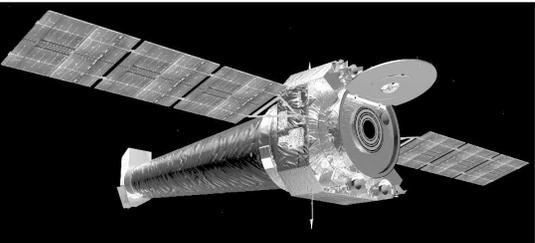
- M&TA PROBLEM TRACKING -

- ◆ ACIS
 - CTI increase
 - [M&TA Analysis](#)
 - [MIT/Catherine Grant Analysis](#)
 - [CXC Pipeline Processing](#)
 - Low Energy QE Drop
 - [Telecon notes](#) (password required)
 - Thermal Issues
 - [MSID limit violations](#)
- ◆ EPHIN
 - Thermal Issues
 - [E-mail discussions](#)
 - [MSID limit violations](#)
- ◆ Radiation
 - RADZONE entry trips
 - [M&TA RADMON Analysis](#)
 - [Radiation Correlations](#)
 - [Telecon notes](#)
 - [May 27, 2003](#)
 - [May 20, 2003](#)
 - [May 07, 2003](#)
- ◆ HRC
- ◆ PCAD
 - MUPS Thruster Performance Degradation
 - [FOT Community Briefing, May 30, 2003](#) (pdf on occweb)
 - IRU-1 Gyro-1 Current

Document: Done (0.388 secs)

6/9/2003

Scott Wolk CXC/SAO



Specific Monitoring

- Emphasis of work early in mission.
- Realtime data
 - Alerts
- Images
 - Including partial ObsIds when needed
- Spectra
- ACA
- Radiation
 - Alerts

Chandra Radiation Monitoring

- **Realtime Pages**
 - Our current orbital profile
 - ACE
 - GOES 8 (primary proton monitor)
 - GOES 10 (backup)
 - GOES 12 (primary magnetometer, X-ray, electron detector)
 - Accrued CTI damage vs. CRMFlx (Chandra Radiation Model flux)
 - SQT home
 - SQT Mirror Site
- **Space Weather**
 - Solar Terrestrial Activity Report
 - Space Weather Alerts page
 - Today's Space Weather
 - Space Weather Now
 - Space Weather dot com
 - Solar images at SDAC
 - SOHO Proton Monitor
 - SOHO images
 - SOHO
 - Tristram Coronal Radio Surveillance
 - GOES-10 five minute average data
 - GOES-12 five minute average data
- **Other Radiation Links**
 - Travel Time of CME vs. Initial Speed
 - Costello Geomagnetic Activity Index
 - Magnetospheric Specification Model Latest MSM Output
 - 2-day archive of the latest ACE data
 - Latest orbital fluence when CHANDRA is above 70kkm
 - History of fluence when CHANDRA has been above 70kkm
 - Fluence on ACIS per orbit
 - Archival fluence in the ACE P3 channel
 - Archival fluence of all ACE channels
 - About our ACE Monitoring and Alerts
 - Real-time magnetopause and bow shock model
- **Summary and Predictive Data**
 - 4-week Solar Wind Predictions
 - Archive of each event which shutdown Chandra
 - Summary of Chandra flux and orbital fluence, updated every 5 minutes
 - Archive of Chandra orbital fluence, updated once per orbit

EXTERNAL CRM Proton Fluence, with DSN and SI schedules

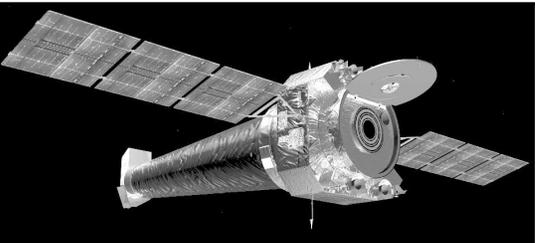
Altitude (Mm)

LETG
HETG
HRC-I

http://umtof.umd.edu/pm

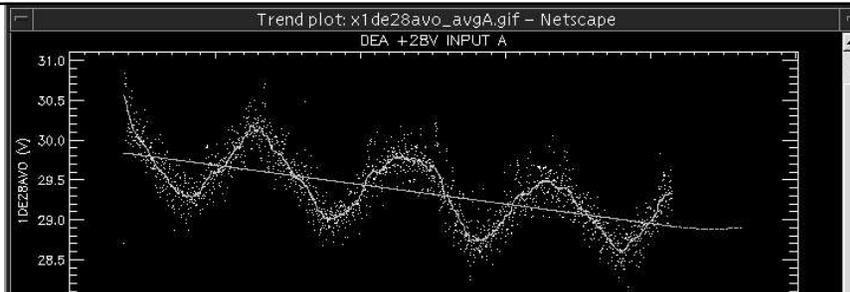
6/9/2003

Scott Wolk CXC/SAO



Trending

- All data are science data.
- Focus on automated trending.
- Created “operational limits” to augment “health & safety limits.”
- Specific attention is given to known problems – (e.g. CTI, Radiation)
- Fidelity issues slow proactive automated analysis of focal plane data.



MTA Trends/Derivatives - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://asc.harvard.edu/mta_days/mta_deriv/ Print

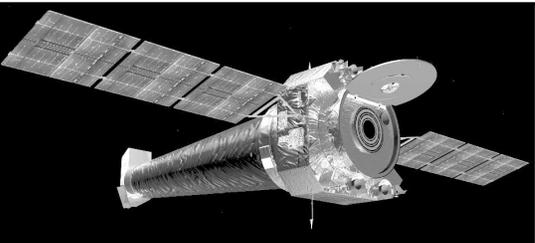
ACXO schedule: 2003:145:23:57:53.62 MTA Trends/Derivatives ACIS E0102-72 CALIBRATION S3

Please select one of the following reports:

	All	Mins	Maxes	Quarter
ACIS				
ACIS Thermal Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Thermal Control by Sun angle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Thermal Control vs. Sun angle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Electronics Side A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Electronics Side B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Mechanism Controller	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DEA HK Temperatures (under development)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DEA HK Electronics (under development)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COMP				
ACIS Electronics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACIS Thermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ephin Key Rates L1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SIM Thermal Side A/B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HRMA gradients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN				
EPHIN Housekeeping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN Temperatures and Voltages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN Temperatures and Voltages vs. Sun angle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN Rates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN Key Rates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EPHIN Rates/Leakage Current vs. Temperature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AXIAL, RADIAL, DIAMETRAL GRADIENTS				
HRMA CAP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HRMA FAP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HRMA AFT Heater Plt.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
HRMA H-Flexure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

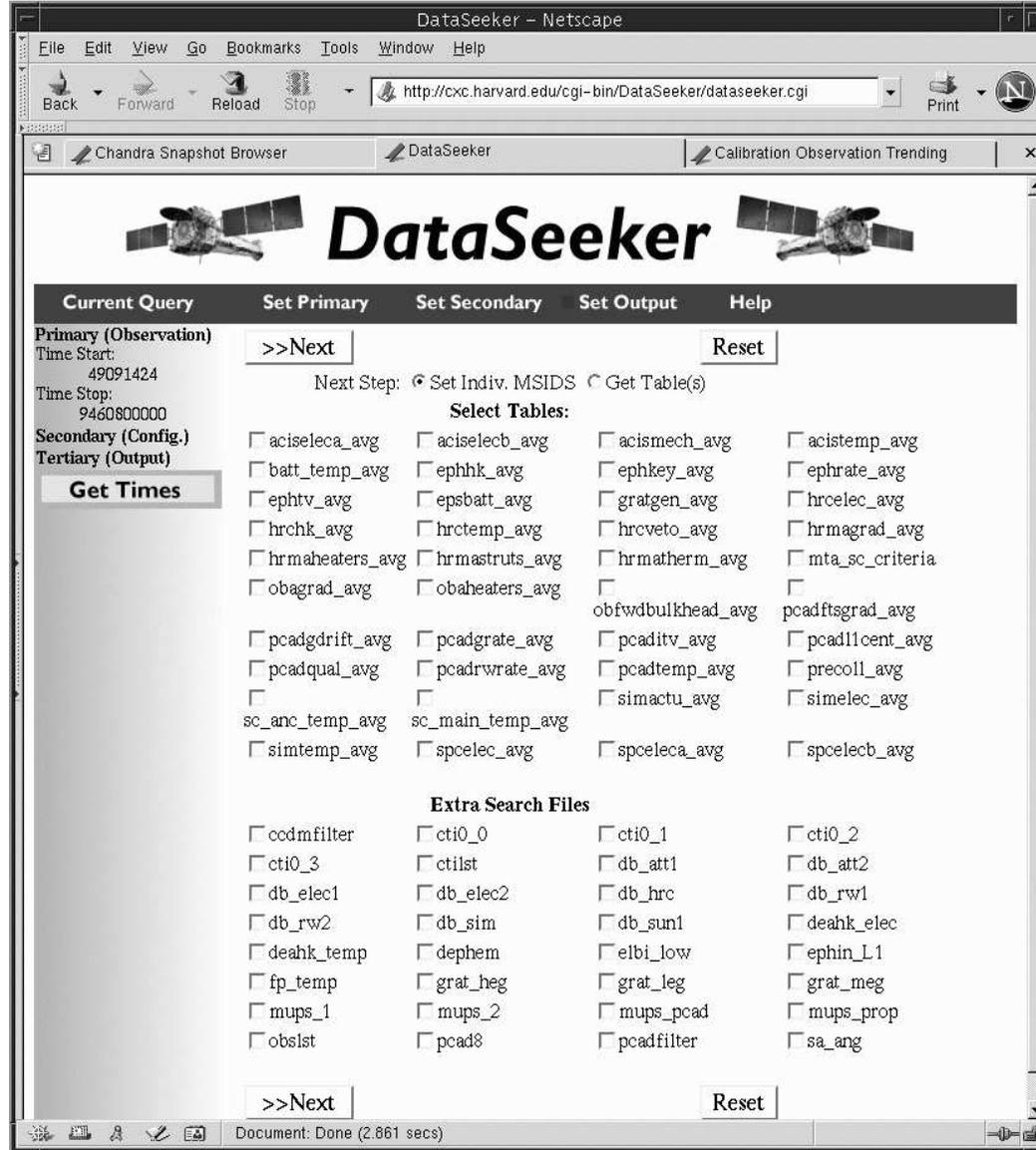
TEPHIN Histogram

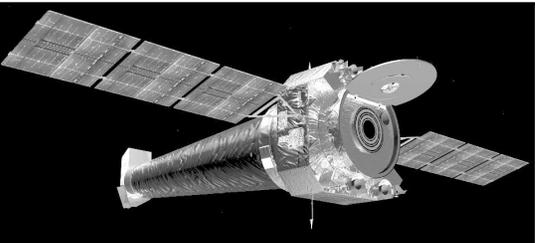
Document: Done (2.126 secs)



Data Products

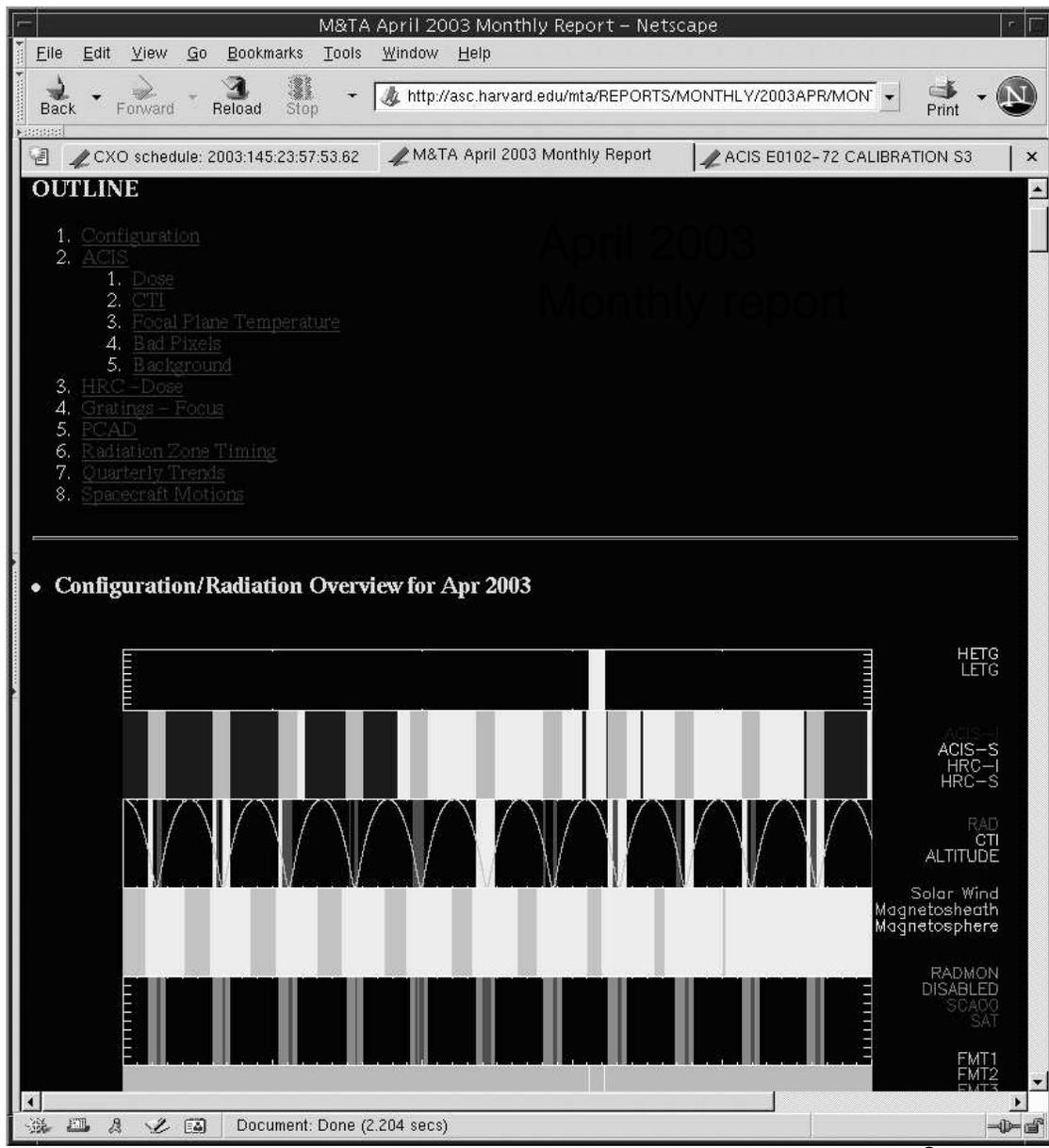
- In 1999, the database consisted of daily averages in RDB tables.
- Upgraded to Sybase and higher fidelity in Feb 2002.
- New databases being added
 - Inc. CTI, ACIS HK, LETG & HETG





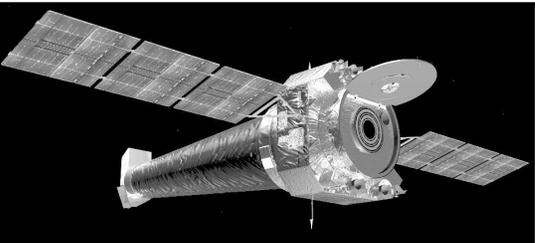
Communication

- **Oversee dataflow to IPI teams.**
- **Alert system**
 - Yellow and Red alerts.
- **Web system**
 - About 100,000 pages.
 - About 800 pages replaced daily.
- **Weekly and Monthly Reports**
 - Can be delivered to CUC.
 - <http://cxc.harvard.edu/mta/REPORTS>
- **Team overlap**



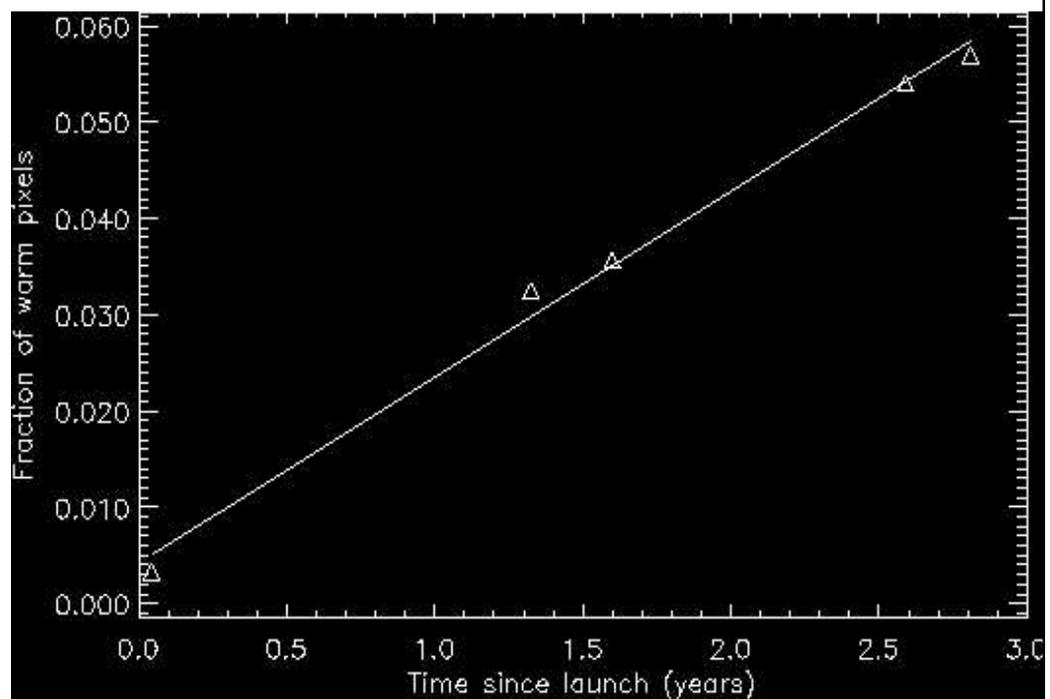
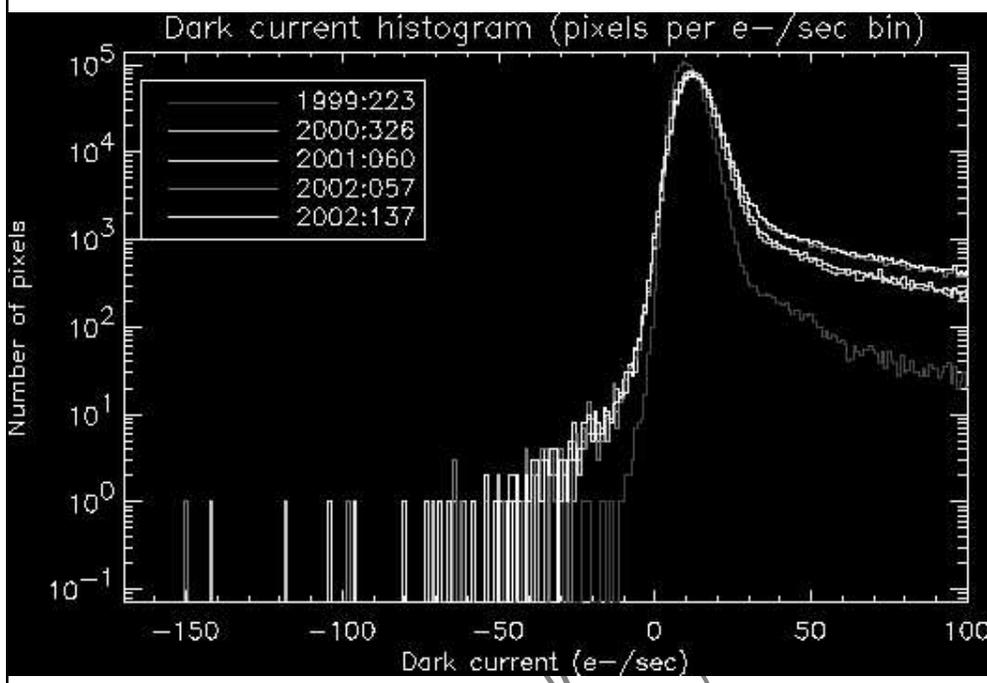
6/9/2003

Scott Wolk CXC/SAO



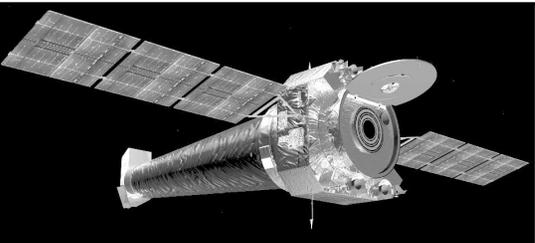
Example: Pointing Control & Attitude Determination

- Celestial Location Monitoring
- IRU – Current draw is higher than expected.
- MUPS – Seem to under-perform when warm.
- Warm Pixels - Increasing at a rate of 2-3% per year.
 - Cooling focal plane to ameliorate.



6/9/2003

Scott Wolk CXC/SAO



Long Term Prospects

- Chandra
 - Focus
 - Resolving Power
- ACIS
 - ⇔ Low Energy QE
 - ✓ CTI
 - ✓ Bad Pixels
- HRC
 - ✓ Dose
- EPHIN
 - ⇔ Thermal
- SIM
 - ✓ Motions
 - ⇔ Thermal
- PCAD
 - ACA
 - ⇔ dark current
 - ✓ offsets
 - ⇔ Gyros
 - ⇔ MUPS

While we may need to change our approach in how we operate the spacecraft, there are currently no issues which indicate that the fundamental capabilities of *Chandra* will change within the next 5 years.