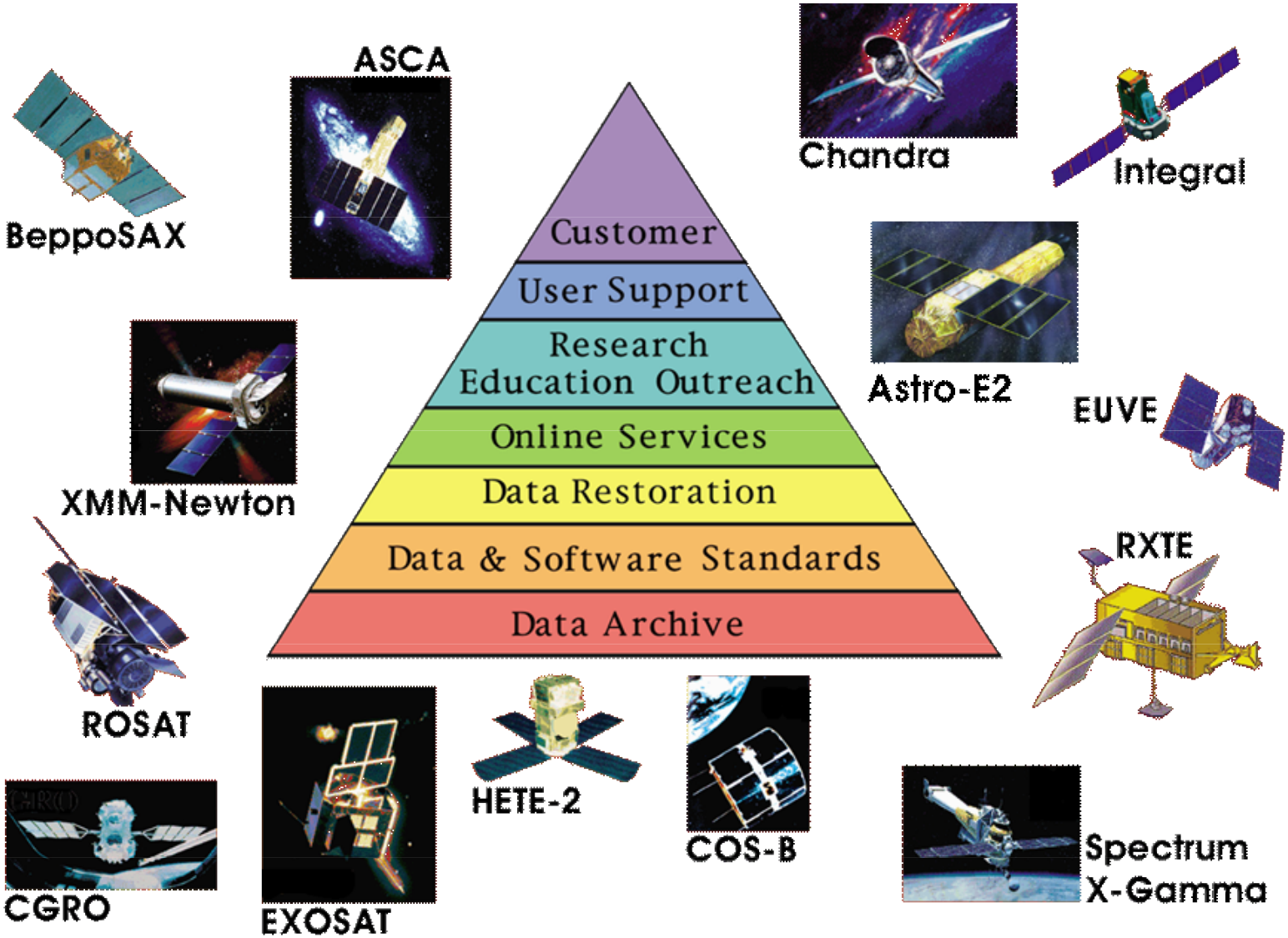
The Heasarc

Established December 1990

The HEASARC Charter:

- Maintain and disseminate data from previous and concurrent high-energy astrophysics missions
- Provide software and data analysis support for these data sets
- Maintain and provide the necessary scientific and technical expertise for the processing and interpretation of the data holding
- Develop and maintain multi-mission analysis and support tools
- Provide catalogs of observations and ancillary information for the data holdings
- Coordinate data, software, and media standards with other astrophysics sites.

Active Mission Support



The Physical Archive

Past Missions

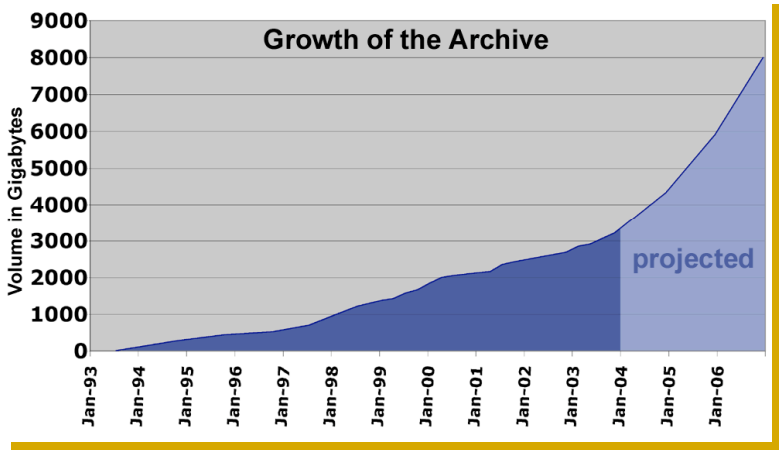
Ariel 5
ASCA
BBXRT
CGRO
Copernicus
COS B
DXS
Einstein
EUVE
EXOSAT
Ginga
BeppoSAX
HEAO 1
HEAO 3
OSO 8
ROSAT
SAS 2
SAS 3
Vela 5B

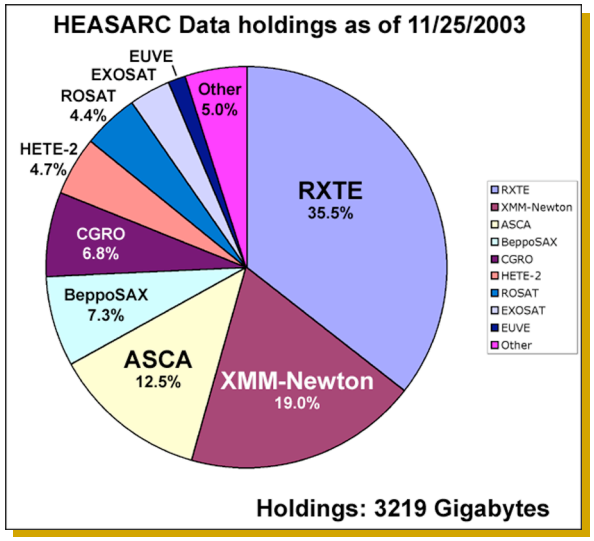
Active Missions

RXTE (1995-)
Chandra (1999-) [data at CXC]
HETE-2 (2000-)
INTEGRAL (2001-)
XMM-Newton (1999-)

Upcoming Missions

Swift (2004 launch)
Astro-E2 (2005 launch)
GLAST (2007 launch)

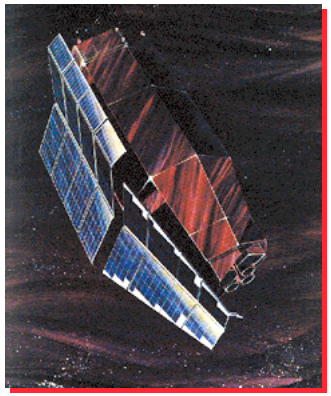


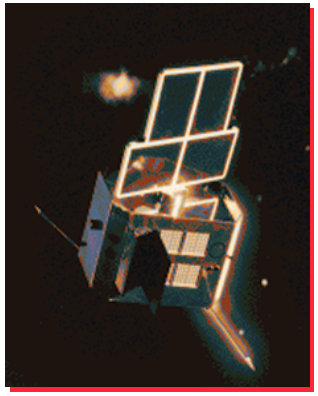


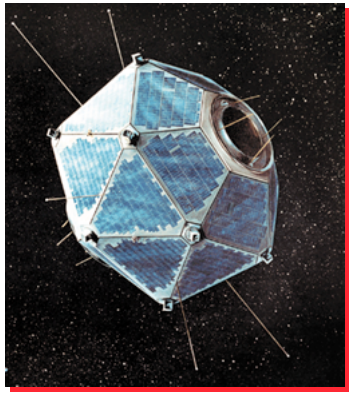
- Data from 24 missions currently in the archive
- 355 astronomical catalogs & mission tables
- The archive volume was 3250 Gigabytes as of the end of 2003

Data Restoration

HEASARC Data Holdings as of December 1, 2003







Mission	Instr.	Raw Data	FITS Raw Data	FITS Products	GIF Products	Calibration	Analysis Software	Data Volume (Gbytes)	Complete?
BeppoSAX			Continually Updated	Continually Updated	Continually Updated	Continually Updated	Continually Updated	235	no
Chandra			External Archive	External Archive	External Archive	External Archive	External Archive		no
RXTE			Continually Updated	Continually Updated	Continually Updated	Continually Updated	Continually Updated	1143	no
XMM-Newton			Continually Updated			Continually Updated	Continually Updated	611	no
Ariel V	ASM			Complete	Complete			< 1.0	yes
	SSI		Complete						
ASCA			Complete*	Complete*	Complete*	Complete*	Complete*	401	no
BBXRT			Complete	Complete	Complete	Complete	Complete	1.1	yes
CGRO			Complete	Complete	Complete	Complete	Complete	219	no
Copernicus			Complete				Partially Available	< 1.0	yes
COS-B			Complete	Partially Available	Complete	Complete	Complete	< 1.0	yes
DXS			Complete					< 1.0	yes
Einstein			Complete	Complete	Complete	Complete	Partially Available	15.9	yes
EUVE			Complete	Complete	External Archive	External Archive	External Archive	42.2	no
EXOSAT	LE	Complete	Complete	Complete	Complete	Complete	Complete	106	yes
	ME	Complete	Complete	Complete	Complete	Partially Available	Partially Available		no
	GSPC	Complete		Complete	Complete	Partially Available	Partially Available		yes
Ginga			Complete	Complete	Complete	Complete		19.8	yes
HEAO-1	A1			Partially Available	Partially Available			9.8	yes
	A2		Partially Available	Complete	Complete	Complete	Complete	2.7	yes
	A3	Complete						6.1	yes
	A4			Partially Available	Partially Available	Partially Available		< 1.0	yes
HEAO-3		Complete						5.6	yes
OSO-8			Complete	Partially Available	Partially Available	Complete	Complete	6.6	yes
ROSAT			Complete	Complete	Complete	Complete	Complete	140	no
SAS-2			Complete	Partially Available	Complete	Complete	Complete	< 1.0	yes
SAS-3		Complete						7.5	yes
Vela-5B			Complete	Complete	Complete		Complete	5.6	yes

Complete | Partially Available | Work in Progress | Continually Updated | External Archive

The Heasarc Web

Assist astrophysicists in all stages of their archival research:

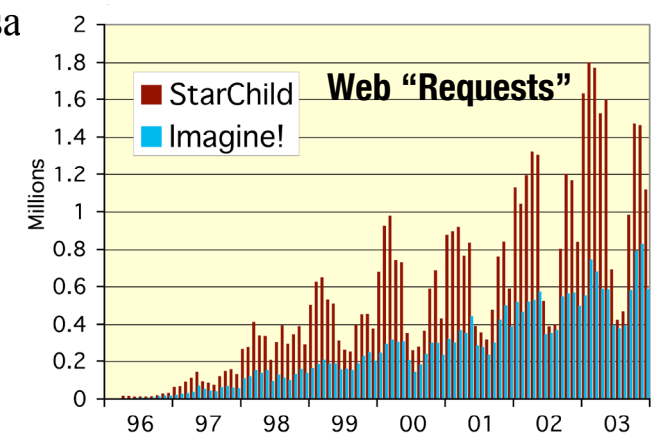
- Information and latest news about HEASARC Catalogs
- Mission information
- Search catalogs & retrieve data
- Download analysis software
- Access documentation
- Astronomical Web site links
- Public outreach & education

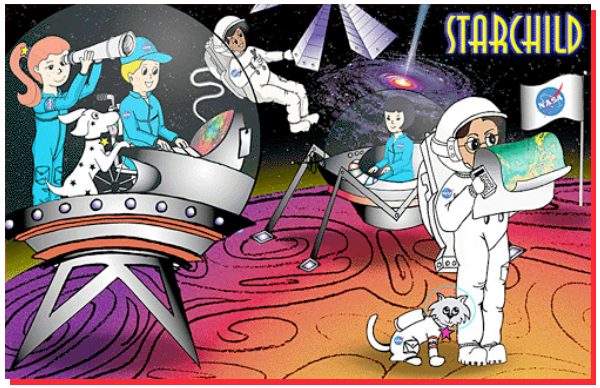
Education & Public Outreach

A service of the High Energy Astrophysics Learning Center

http://imagine.gsfc.nasa

- Multi-level discussion of astronomy
- Lesson plans using actual satellite data
- CD-ROMs, posters
- Support teacher conferences
- Created by HEASARC scientists and programmers collaborating with teachers
- NCTM and NSTS standards listed
- Ask A High Energy Astronomer service





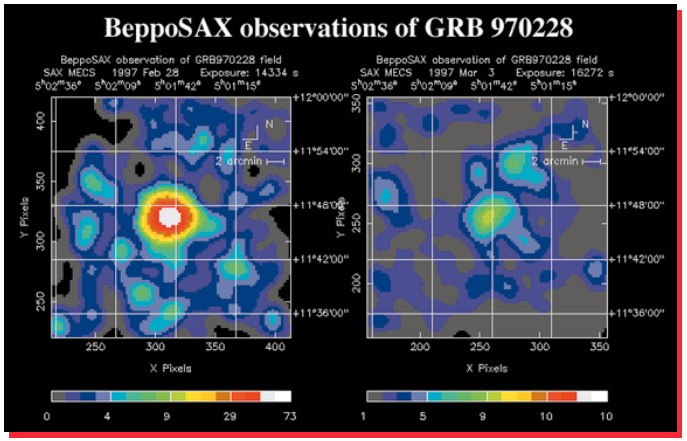
Software: Ftools & Xanadu

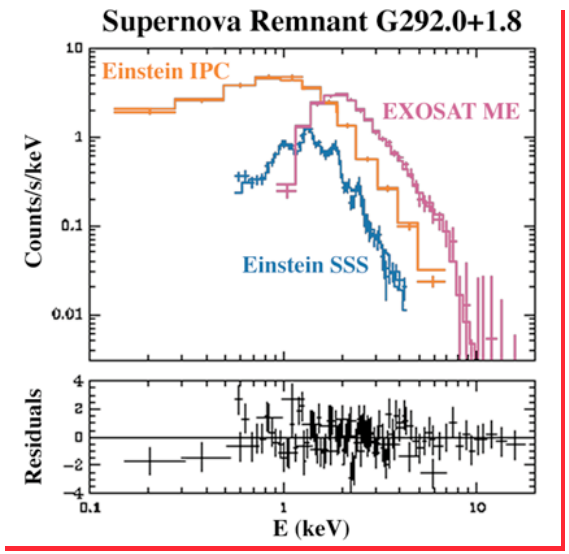
FTOOLS is a general software package which can manipulate any type of FITS files, and can do selection, analysis, and other scientifically useful tasks on FITS files from high-energy astrophysics missions. Currently supported missions include ASCA, ASTRO-E, CGRO, Einstein, EXOSAT, OSO-8, ROSAT, RXTE, and Vela 5B.

XANADU is a software package comprising high-level programs for spectral (XSPEC), timing (XRONOS), and imaging (XIMAGE) analysis of X-ray and gamma-ray astronomy data files.

FTOOLS and XANADU work in an integrated common environment and are distributed (either together or separately, according to the user's requirement) on a common release schedule. This package is called HEAsoft.

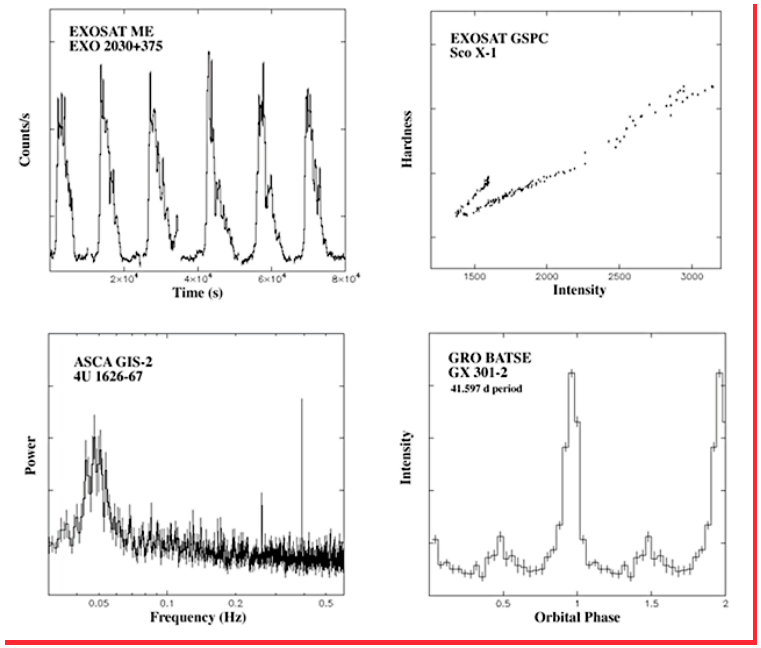
Software: Xanadu



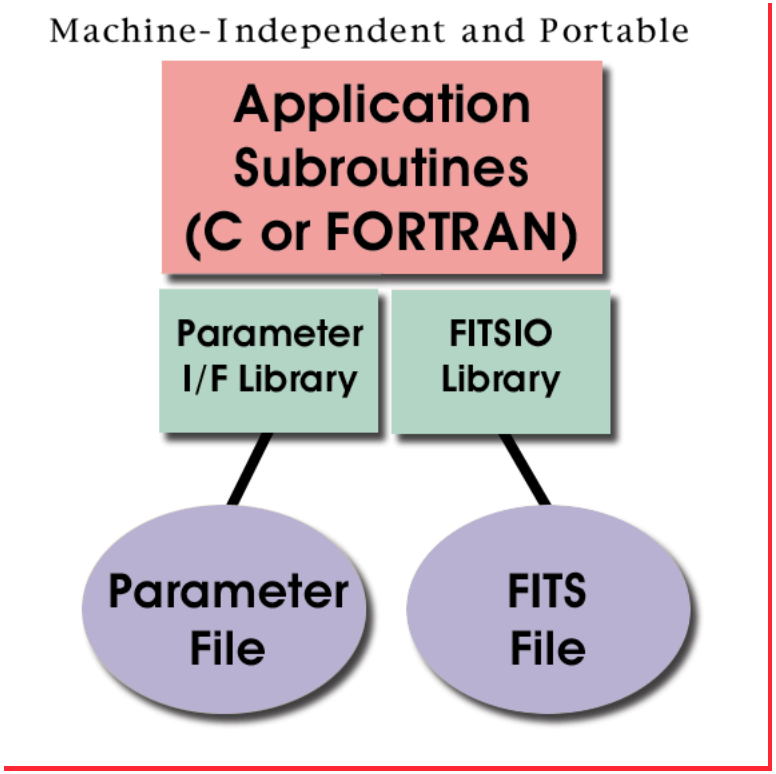


Multi-mission analysis software

- Spectral analysis: XSPEC
- Timing analysis: XRONOS
- Image analysis: XIMAGE



Software: Ftools



All code written in ANSI standard C or FORTRAN. Machine-independent and portable.

All data input/output is in the form of FITS files via the CFITSIO subroutine interface, or occasionally, ASCII files.

All user input to the task is done via a parameter file.

Data Format Standards

Sample FITS File

```
XTENSION= 'BINTABLE'          /  FITS BINARY TABLE
BITPIX  =                  8  /  Binary data
NAXIS   =                  2  /  Table is a matrix
   :
   :
   :
EXTNAME = 'EVENTS  '          /  Table name
TTYPE1  = 'TIME    '          /  Label for 1st column
TFORM1  = '1D      '          /  Data type: Double precision
TTYPE2  = 'RAWX    '          /  Label for 2nd column
TFORM2  = '1I      '          /  Data type: Short integer
```

TIME	RAWX	RAWY	DETX	DETY	X	Y	PHA
24305.2	18	25	19	25	235	344	4
24306.9	211	79	213	78	874	514	7
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..
.....	...	...	...	...	....	....	..

The HEASARC develops, coordinates and promotes standardized FITS formats for use within the High-Energy Astrophysics community.

These standards allow multi-mission analysis packages and encourage recycling of software at considerable cost savings.

The HEASARC publishes these standards on the Web and in its journal, *Legacy*. It also collaborates with new missions to ensure that their data products conform to these standards.

Heasarc Customers

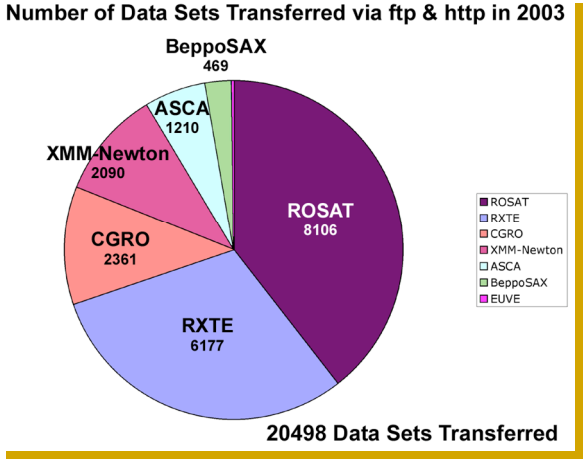
The HEASARC has 4 groups of users:

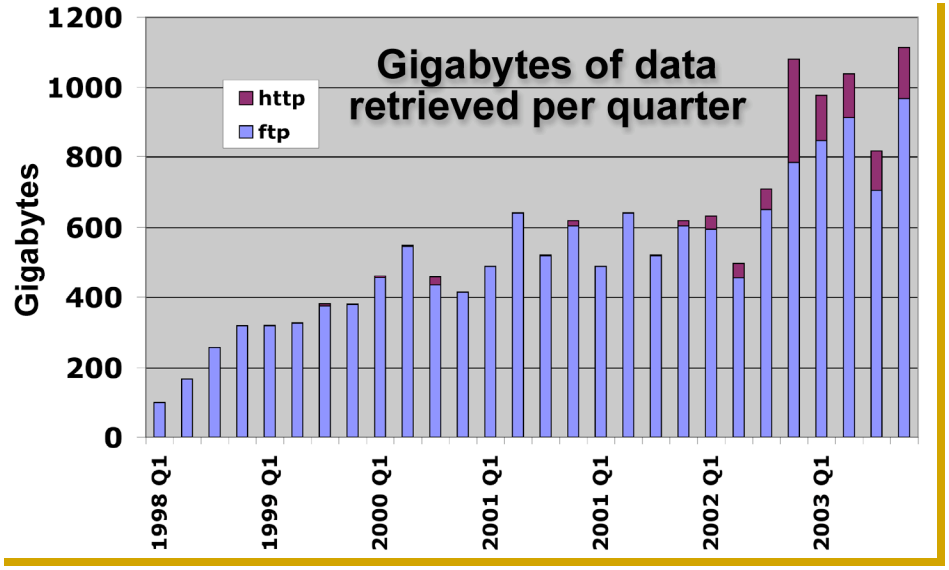
- Investigators selected to use the INTEGRAL, RXTE and XMM-Newton observatories which include scientists
  - at US universities
  - at NASA's GSFC and other government labs
  - from around the world
- Archival researchers
- The general public, who are interested in what NASA is doing
- Teachers, parents, and school children for education and outreach

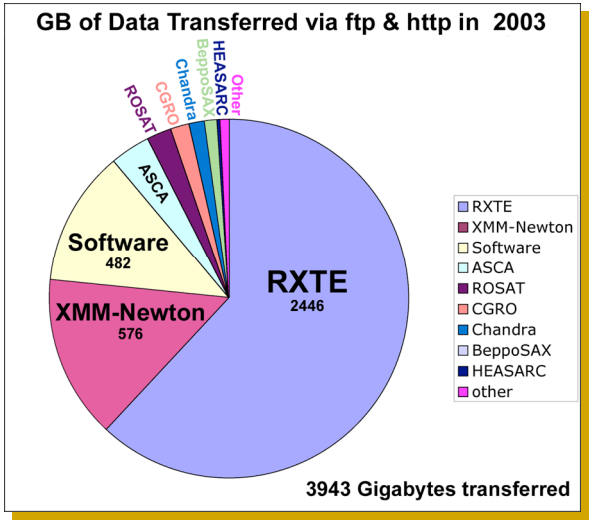
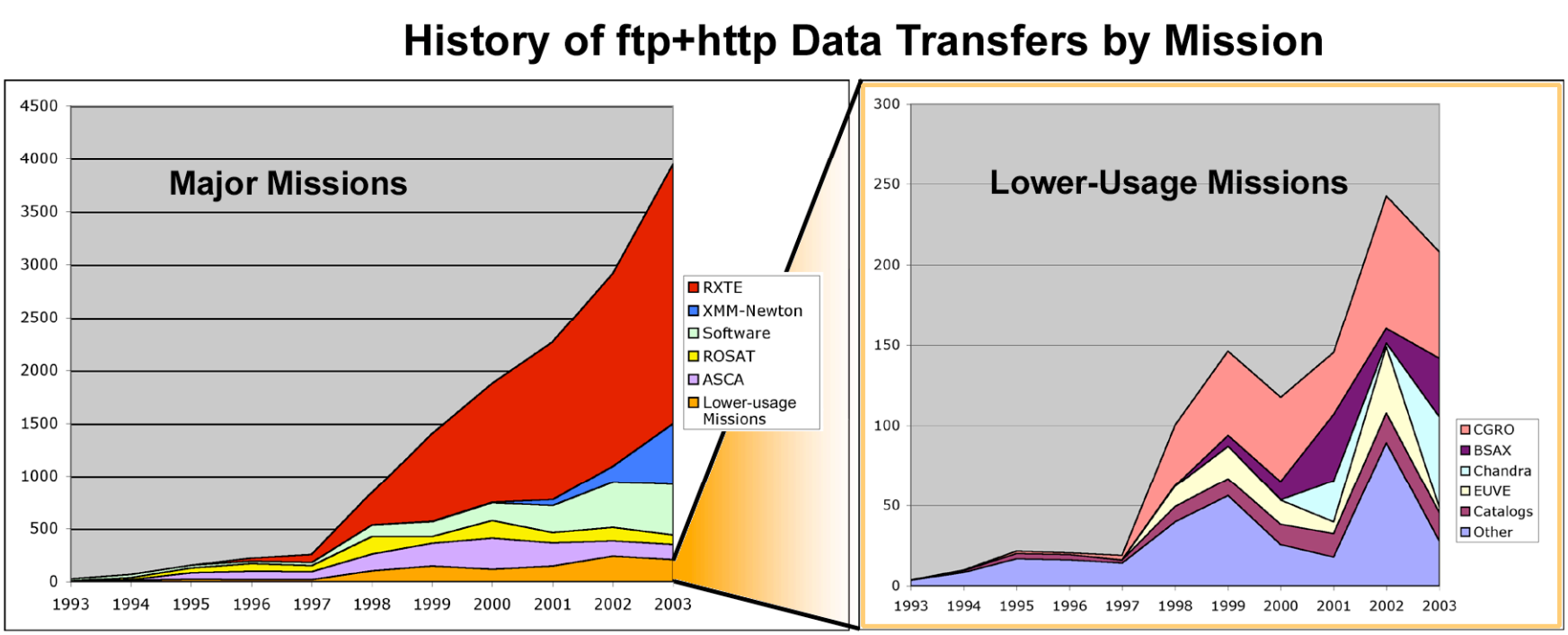
Usage & Data Statistics

Gigabytes transferred per year

	1998	1999	2000	2001	2002	2003
Datasets by ftp & http	844	1406	1880	2270	2917	3943
Science Web Pages & Images	198	234	371	399	580	872
Main E&PO Web Pages & Images	203	358	678	1010	3108	7581







Data Transfers by Mission over Time