

# **HEASARC Directors Report**

Nicholas E. White  
Astrophysics Science Division  
GSFC

# Outline

1. Recommendations from the NRC review of NASA astrophysics data centers
2. Proposed reorganization at HQ
3. A new thematic approach to the HEASARC and big picture strategy for the 2008 senior review

# Portals to the Universe: The NASA Astronomy Science Centers

Dr. Steven Bohlen, JOI  
Chair, Committee on NASA  
Astronomy Science Centers

# Study Origin

- Study requested in mid-2004 by NASA Astronomy and Physics Division director Anne Kinney.
- Same time that NASA was planning to accelerate the TPF program.

# Statement of Task

1. Conduct a comparative review of current astronomy science centers in terms of
  1. roles and services,
  2. their size (e.g., budget, staff),
  3. the extent to which they utilize centralized or distributed approaches to their architecture,
  4. the roles and status of their staff,
  5. the nature of their host or governing institution,
  6. governance structure,
  7. how they were established by NASA (e.g., sole source versus competition).
2. Identify best practices and lessons learned from experience to date with NASA astronomy science centers.
3. Are there optimum sizes or approaches for science centers, rational break points in levels of service for centers, and what may be significant advantages or disadvantages for different scales of service.

# Committee

- STEVEN BOHLEN, Joint Oceanographic Institutions, *Chair*
- ROGER BARRY, University of Colorado
- STEPHEN HOLT, Olin College
- RICHARD McCRAY, University of Colorado, JILA
- ALEX SZALAY, Johns Hopkins University
- PAULA SZKODY, University of Washington
- PAUL VANDEN BOUT, National Radio Astronomy Observatory

# Center “Ecosystem”

- CXC, STScI, HEASARC, and IPAC have sufficient scientific and programmatic expertise to manage NASA’s current science center responsibilities after the active phases of all current and planned space-based astronomy missions have been completed.
- Embedding GOFs in existing science centers, such as the HEASARC, provides for efficient user support, especially when the scope of a space mission does not require establishing a separate center.

# Recommendation 1

- NASA should establish a large new center only when the following criteria are met:
  - (1) the existing centers lack the capacity to support a major new scientific initiative and
  - (2) there is an imminent need to develop a new infrastructure to support a broad base of users.

# Recommendations 2 & 3

- NASA should adopt a set of best practices as guiding principles to ensure the effectiveness of existing flagship and archival NASA astronomy science centers and to select the operational functions of any future centers.
- ...astronomy science centers [should] cooperate among themselves and with other agencies to develop strategies and plans for
  - Developing common protocols and formats for proposal entry;
  - Developing a universal infrastructure for data formats and metadata, archiving, retrieval and analysis tools; and
  - Providing curriculum materials and professional development programs for K-12 teachers.

# Best Practices

- A set of Best Practices were developed for the following areas:
  - Mission Operations
  - Science Operations
  - Data and Archiving
  - Education and Public Outreach

# BP: Mission Operations

- Have close interaction among scientists, engineers, and programmers. Such interaction is especially important for off-site principal investigator (PI) teams.
- Have research scientists who participate actively in mission operations and in policy decisions.
- Have mission staff knowledgeable about the instrumentation and the satellite in order to provide detailed advice and technical support to the user.
- Provide adequate instrument calibration.
- Provide functional software by the time data first arrive.

# BP: Science Operations (1)

- Support robust, accessible, well-documented software.
- Use common rather than instrument-specific software across missions when possible.
- Maintain adequate online supporting materials and a help desk with adequate staffing and rapid turnaround.
- Provide user-friendly protocols and software for proposal entry, and require minimal technical details for the initial proposal.
- Enable coordinated observations and proposal submission among multiple space- and/or ground-based observatories.

# BP: Science Operations (2)

- Colocate staff to support multiple missions with related scientific objectives.
- Retain key science center staff by providing them with evolving opportunities in either multiple missions or within the host/managing institution.
- Give scientists at science centers guaranteed research time but not guaranteed observation time.
- Have a visiting scientist program.

# BP: Data and Archiving

- Provide rapid (<24 hr) response to requests for data that have been calibrated and archived.
- Support common analysis software and protocols that can be used by all the science centers.
- Maintain mission expertise at the archive centers for the long-term support of active users.
- Ensure that standards for access to all astronomical data archives are coordinated by an entity such as the NVO and that the infrastructure, including formats and analysis tools, is accessible and sustainable.

# BP: Education and Public Outreach

- Involve staff scientists and investigators in education and public outreach (EPO) activities.
- Coordinate EPO efforts of smaller missions with EPO systems of the large NASA astronomy science centers.
- Develop classroom resources that
  - Are designed iteratively through field testing and evaluation in actual classrooms.
  - Include hands-on activities when possible.
  - Support standards-based curricula.
  - Are packaged with protocols for measuring learning effectiveness.
  - Are accessible and cross-linked so that teachers can easily find them.
  - Include teacher support (e.g., Web-based teacher guides, training for master teachers).



# **Astrophysics Division Update**

## **NASA Advisory Council Astrophysics Subcommittee**

Dr. Jon Morse  
Astrophysics Division Director  
Science Mission Directorate  
NASA Headquarters

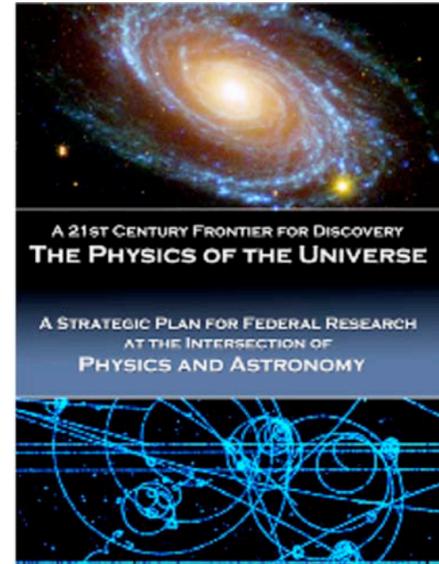
June 20, 2007



# Physics of the Cosmos\*

## Big Question: How does the Universe Work?

- Rationale: Our knowledge of fundamental physics underlies a substantial fraction of the US ~\$13T GDP. PCOS, along with related disciplines, will help define the new physics of the 21<sup>st</sup> Century, enabling very long-term competitiveness and innovation.
- Links to 2004 NSTC/OSTP Interagency Working Group on the Physics of the Universe report: “A 21<sup>st</sup> Century Frontier for Discovery”
- Sample science questions:
  - What powered the Big Bang?
  - What is Dark Matter?
  - What is Dark Energy?
  - What happens at the edge of a black hole?

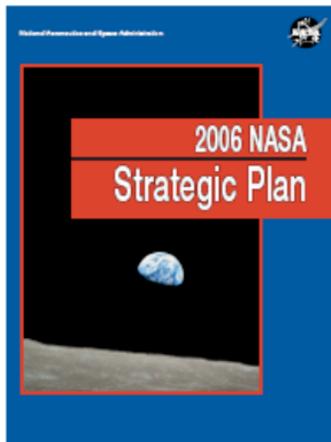


\* Program subsumes Beyond Einstein.



# Astrophysics Re-organization

- Requesting Astrophysics Subcommittee advice on re-establishing intellectual foundation for Astrophysics theme
  - Science-based programs that contain projects
    - Conceptually like previous “Astronomical Search for Origins” and “Structure and Evolution of the Universe” themes
    - Astrophysics currently has 5 one-project programs and looks much different than all the other SMD Divisions



NASA Strategic Plan  
February 2006

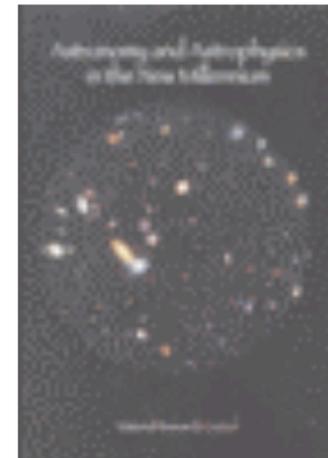
- Science-based grouping of missions is especially useful for forward planning
  - Intellectual framework helps to justify new initiatives and maintain a scientifically balanced portfolio
  - Upcoming strategic planning and NRC Decadal Survey
- Proposed scientific programs: Cosmic Origins, Physics of the Cosmos, Exoplanet Exploration
  - Plus Astrophysics Explorers and Astrophysics Research programs which already exist



# Cosmic Origins

Big Question: How did we get here?

- Rationale: Scientific context for human exploration of the origins of life and existence. Cosmic Origins tells the story of the history of the Universe from the Big Bang to people.
- Sample science questions:
  - How do stars and galaxies form and evolve?
  - How did large-scale structure form and evolve?
  - How were the elements in the periodic table formed?



NRC Astronomy  
and Astrophysics  
Decadal Survey

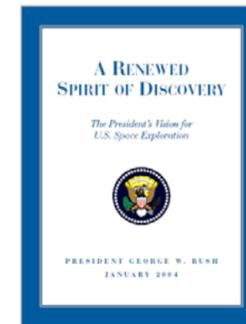


# Exoplanet Exploration\*

## Big Question: Are we alone?

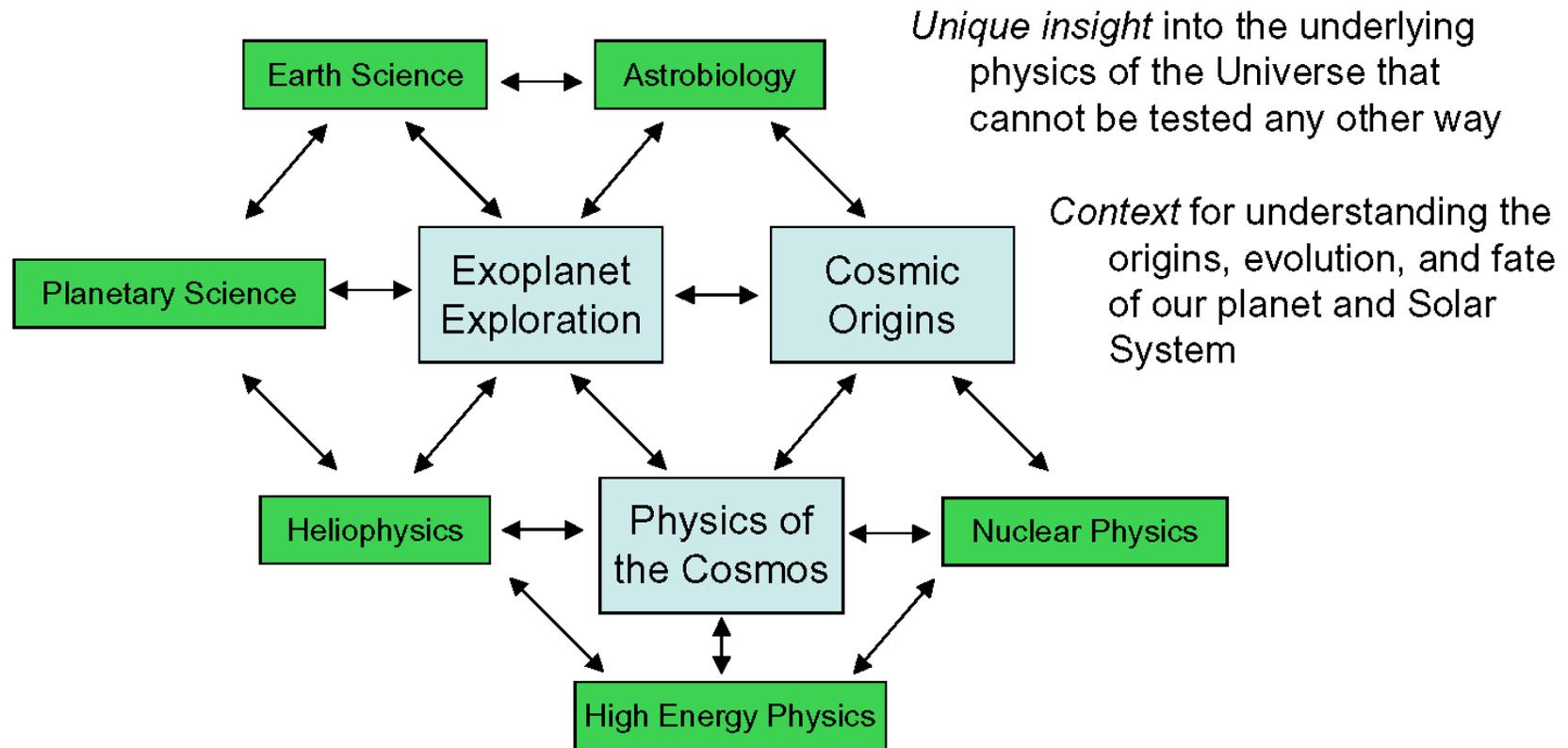
- Rationale: Seeks to determine whether Earth is the only abode for life in the Galaxy or whether we are part of a larger community. Either answer is profound in its implications for the future of human civilization.
- Sample science questions:
  - How do planetary systems form and evolve?
  - How common are terrestrial class planets in the habitable zones around other stars?
  - Is there life elsewhere in the Universe?

\* An explicit objective of the Vision for Space Exploration: “Conduct advanced telescope searches for Earth-like planets and habitable environments around other stars”



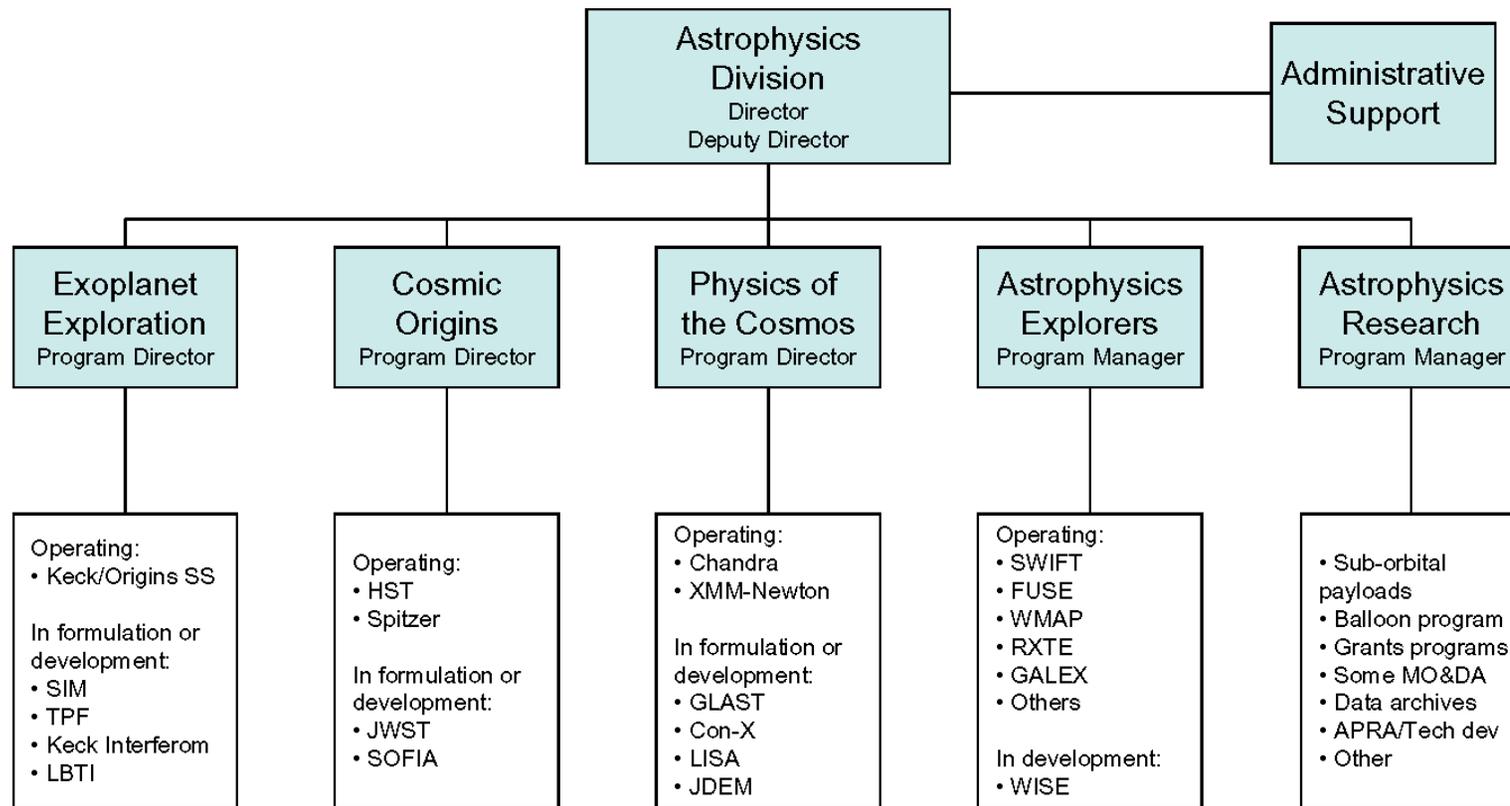
**Presidential Policy Directive  
Vision for Space Exploration  
February 2004**

Observing the cosmos complements, augments and bridges other disciplines by providing:





# Proposed Astrophysics Organization

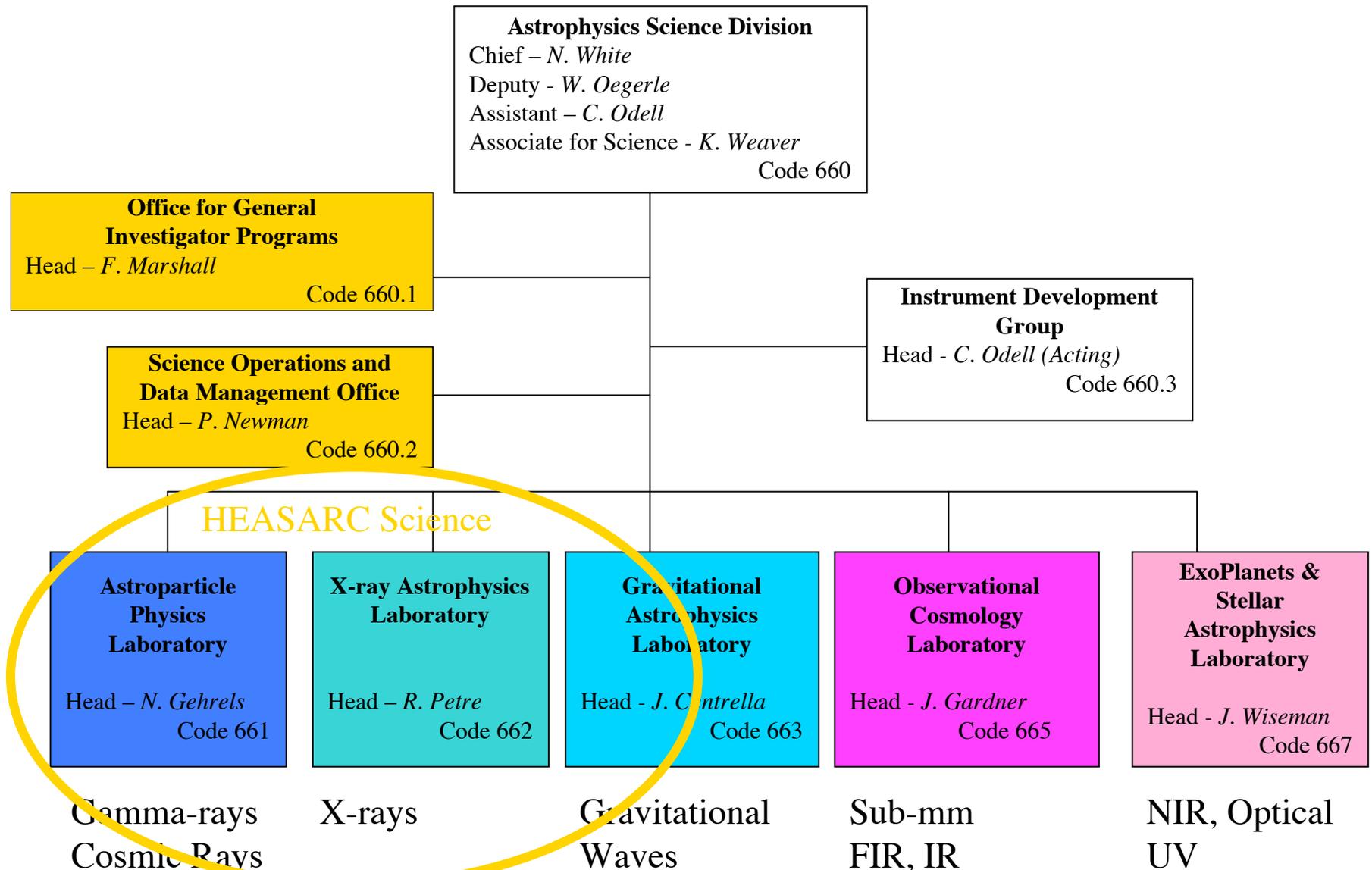


- Program Execs and Program Scientists continue to staff individual projects and R&A
- Deputy DD supervises Program Execs and Admin Support
- Program Directors/Managers supervise relevant Program Scientists
- DD supervises Deputy DD and Program Directors/Managers

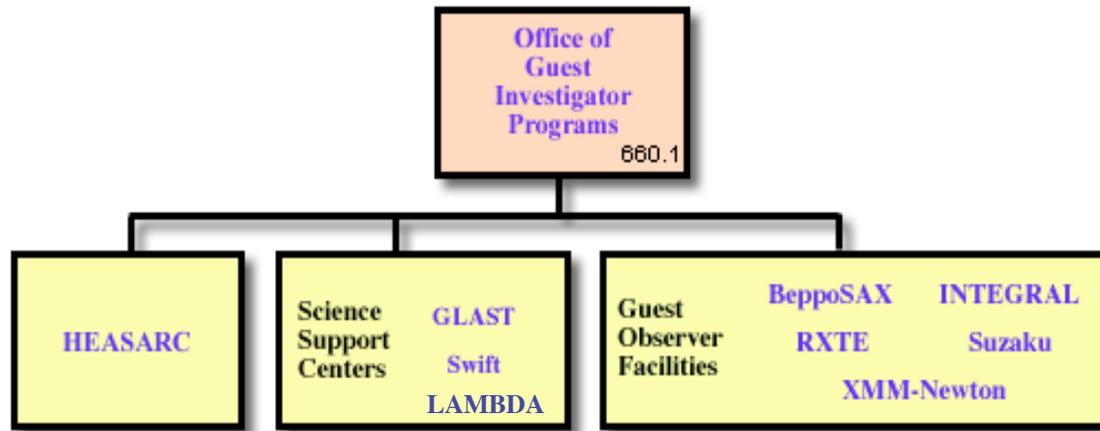
# **A Thematic Approach to the HEASARC**

Nicholas White

# Astrophysics Science Division - Oct 2007



# OGIP Organization October 2007

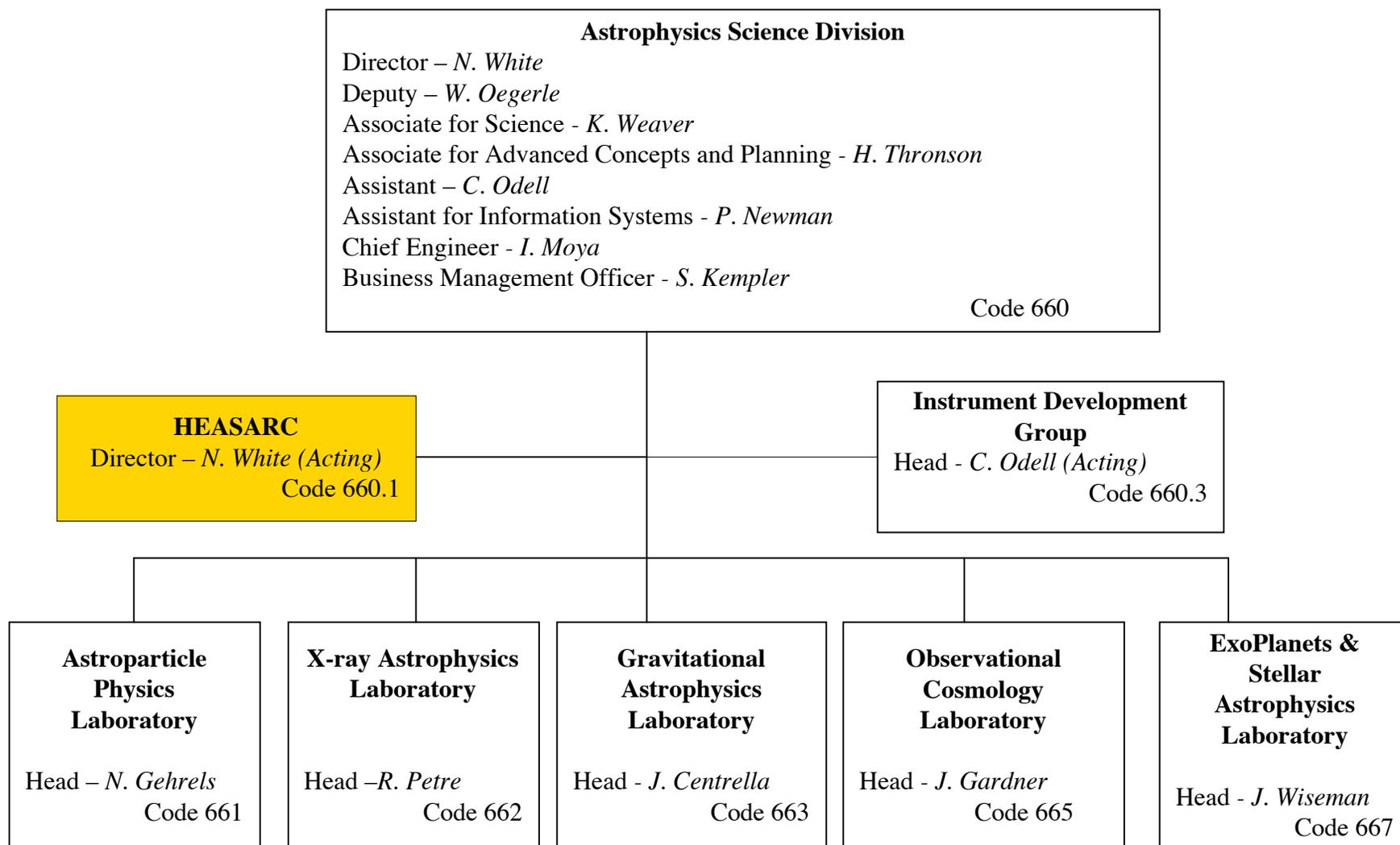


HEASARC provides the **multi-mission infrastructure** that is used by the mission support centers:

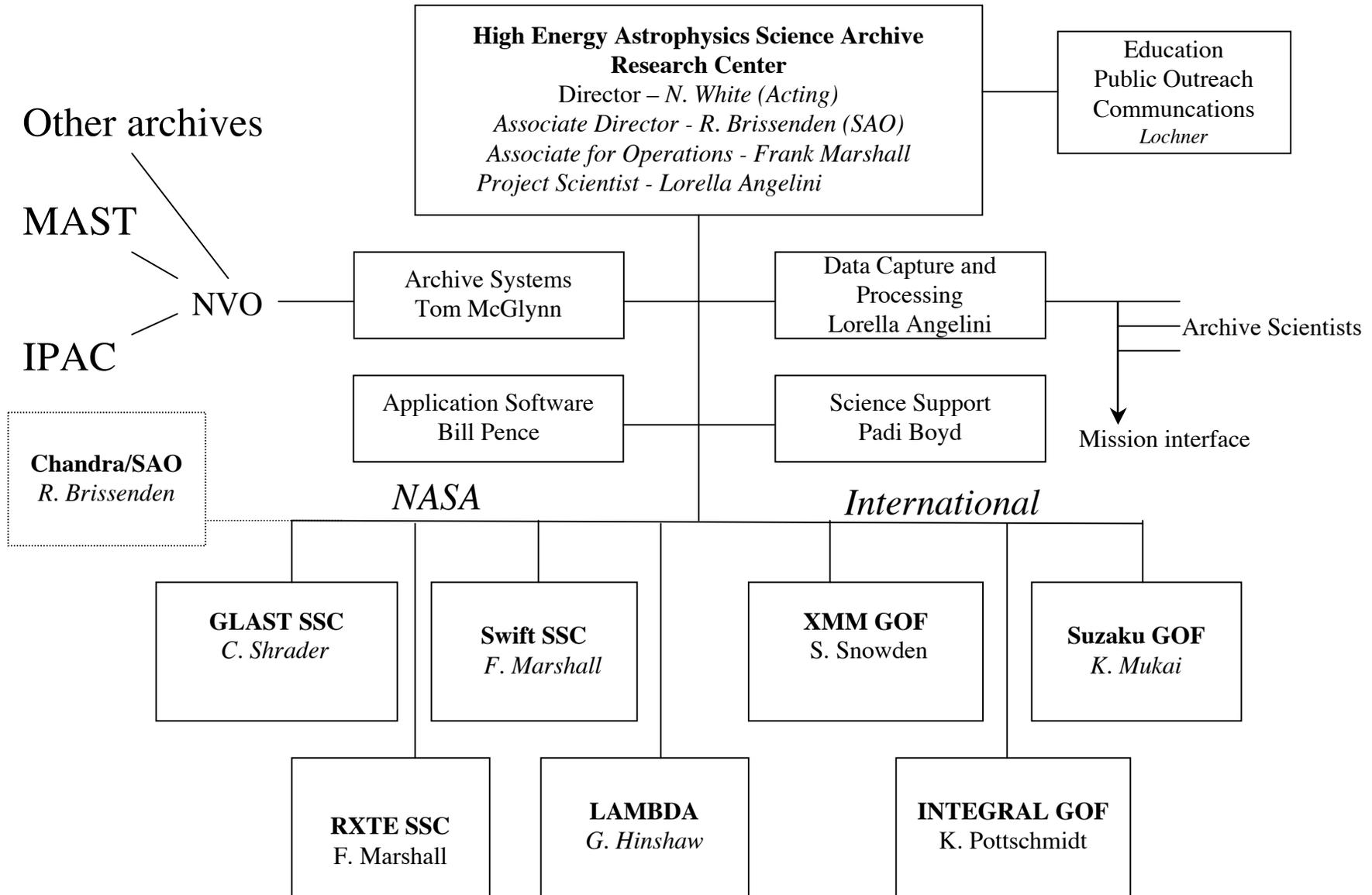
*Archive, database, web services, FITS standards, mission independent software, proposal tools & core science expertise from past missions*

OGIP Scientists are matrixed from the ASD science labs  
Programmers are drawn from the science operations and data management office

# Astrophysics Science Division - DRAFT 2007 REORG PLAN



# The Thematic HEASARC



# **The Refocused HEASARC**

## *Towards a thematic archive center*

The HEASARC would replace/supplant the Office of Guest Investigator Programs (OGIP) and become the central organization to which the associated GOFs, SSCs, and Data Archives report

Transform the HEASARC to a science focus: Physics of the Cosmos

- Use National Virtual Observatory to connect multi-wavelength data sets towards Physics of the Cosmos Science goals
- Transform “High Energy” to mean high energy processes, as opposed to simply X-ray and gamma ray photons
- Retain current wavelength specific mandates of HEASARC, but also allow data from other wavelengths that are relevant e.g. microwave background (LAMBDA)

*Aligns HEASARC with the proposed HQ Physics of the Cosmos theme*

# Einstein Fellows Program

*Einstein fellowship* program to stimulate Physics of the Cosmos research:

- Administered by the HEASARC
- Four new fellows each year, each up to four years, steady state of 16
- Focus on multi-mission research
- Half of the fellowships dedicated to supporting technologies, so as to invest in the people who will develop future instrument and detector development
- One quarter of the fellows located at the HEASARC (GSFC or CFA)
- Include funding for a student and/or procurements

# Thematic HEASARC and the NVO

The new thematic approach to HEASARC would take advantage of and drive the development of the NVO

- Access to all data on Black Holes, links to relevant data at other archives as well as to data resident at HEASARC
- Collections of data sets and results towards science goals e.g. Dark Energy
- Formalizes planning already starting for future archives such as Gravitational Wave data from space missions (e.g. the co-located astrogravs LISA simulated datasets archive)

## Next Steps

- GSFC management and HQ have concurred with the proposed reorganization
- HUG feedback the last step before proceeding with internal paperwork (usually takes 1-2 months)
- November/December 2007 proceed with search for new HEASARC Director
  - Civil service hire, open to all applicants (internal and external)
  - Goal is to get new person in place by Spring of 2008
- Senior review proposal due in April 2008, will capture details of implementing the new thematic approach, Einstein fellows program, and other aspects of the new approach
  - Outcome of senior review will be the final validation and feedback