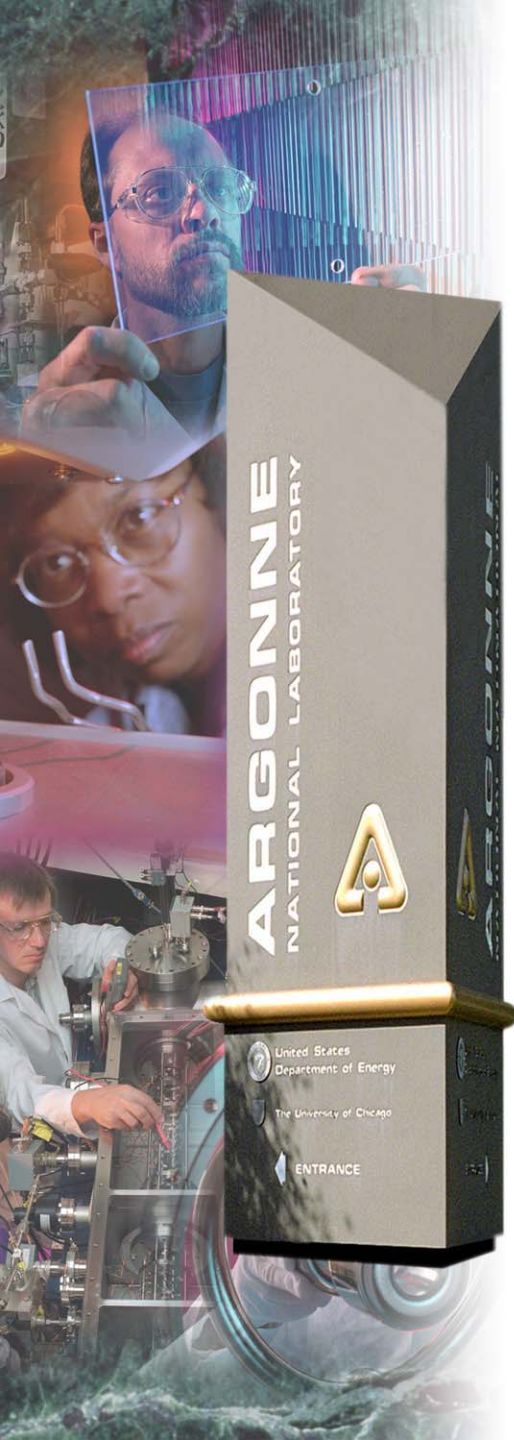


The Advanced Photon Source Overview and Update

J. Murray Gibson

*Introduction for Executive Session
of The University of Chicago Review
for the Advanced Photon Source
at Argonne National Laboratory*

September 17-19, 2003



Office of Science
U.S. Department of Energy

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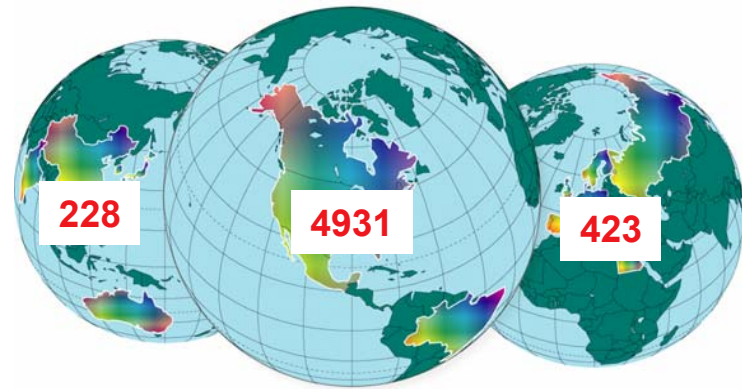
Outline

- **APS introduction**
- **Key points from “Charge to Committee”**
- **Outline of program and review documents**
- **Drivers for change at APS**
- **Summary of changes and current status**
- **Future challenges**



What is APS?

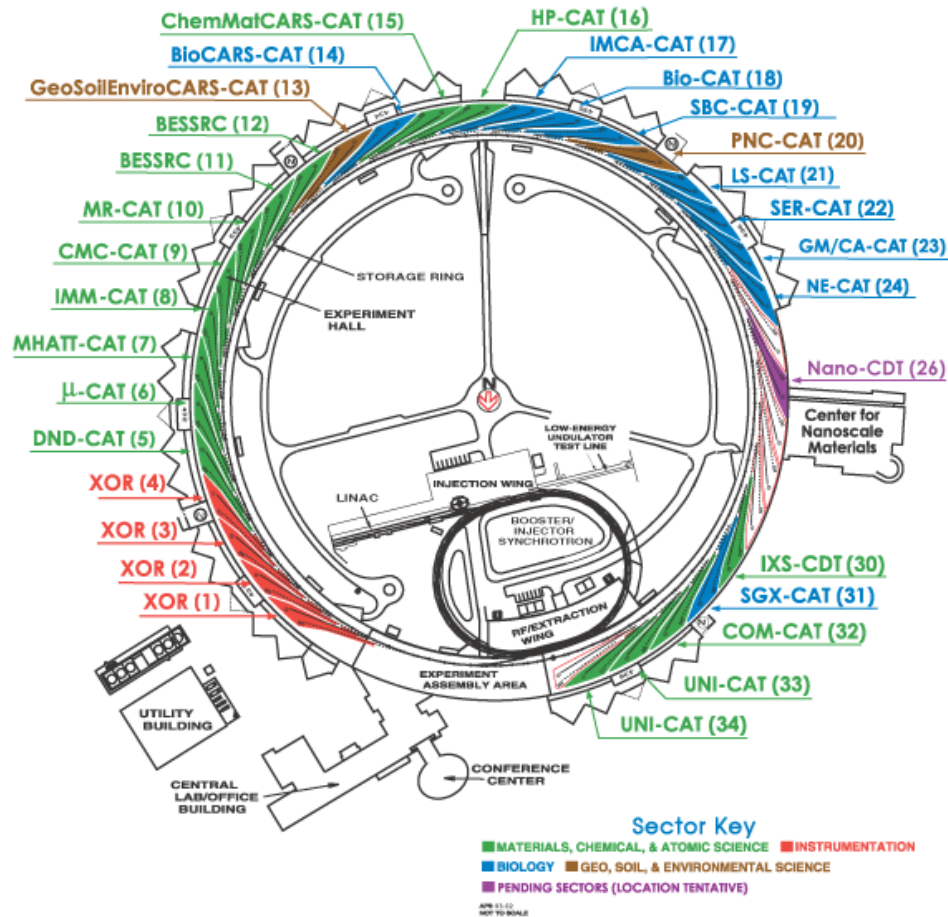
- **One of three third-generation hard x-ray sources around the world**
 - ESRF, Grenoble, France, 6 GeV, (1994)
 - APS, Argonne, IL, 7 GeV, (1996)
 - SPring-8, Harima, Japan, 8 GeV, (1997)



- **Over 5500 badged users**
- **34 available sectors; 25 operating; 5 under construction**
- **Collaborative access teams (CATs) operate majority of sectors with independent funds and external partners**
 - e.g. 145 beamline staff not employed by APS

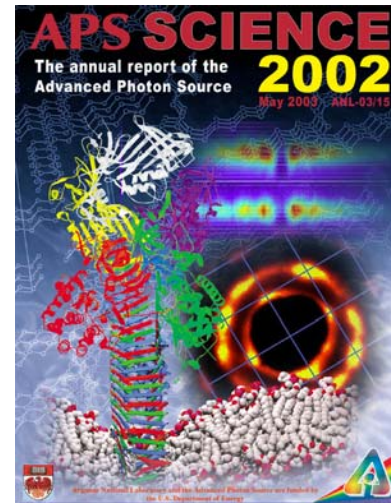
Partnerships for the Future

THE ADVANCED PHOTON SOURCE Sector Allocations (Current & Pending)

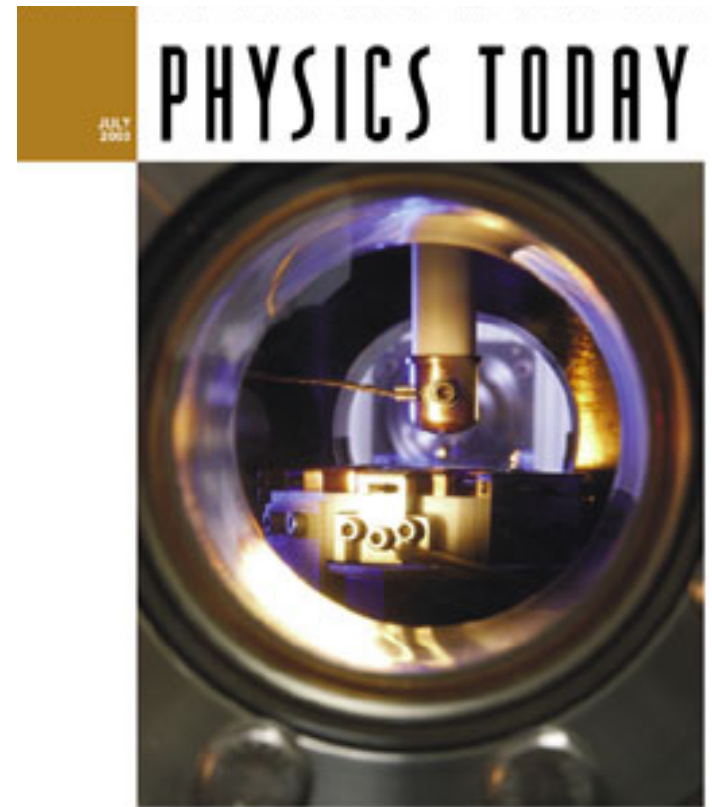


Key Successes of APS

- **Storage ring operates at over 97% reliability**
- **Top-up mode operates 75% of time, to user acclaim**
- **Emittance of 2.5 nm-rad compared with 8.0 nm-rad design**
- **Beam stability of order 1 μm**
- **Users of the facility have published over 2000 refereed papers**
- **Over 1500 additional papers not directly involving x-rays**
- **Most prolific depositor of Protein Data Bank structures**
- **2500 unique users come each year**

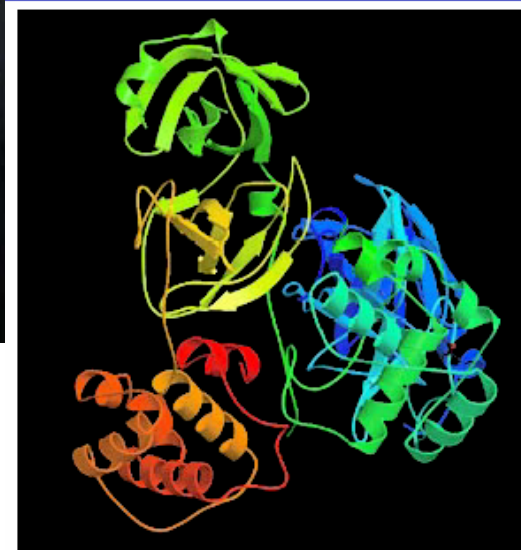
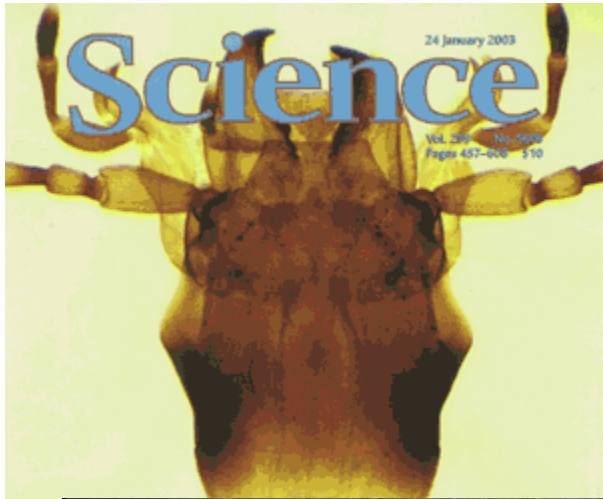


Selected Highlights from Physical Sciences



Targeting molten metals

Selected Highlights from Biological Sciences



X-ray crystal structure of the SARS Coronavirus main protease, as deposited in the Protein Data Bank by Structural Genomix, Inc., on 26 July, 2003.



Key Points from Charge to Committee

- **Transition from construction to operations**
 - Balancing users, operations, and accelerator innovation
- **The CAT system, partner users (PUs)**
 - Renewed flexibility, review, and support
- **General-user access**
- **Research and development programs**
- **Operations, maintenance, and safety performance**



Connections between “Charge” and Program

- **Transition from construction to operations**
 - *APS Update (Gibson)*
- **The CAT system, partner users**
 - *X-ray Operations and Research (Gluskin)*
 - *Time-Resolved Program and BES Sector Development (Wang)*
- **General-user access**
 - *General User Program (Mills)*
- **Research and development programs**
 - *Brief Research Highlights (Hill, Lewellen, Makowski)*
 - *Insertion Device Research and Development (Moog)*
 - *Accelerator Research at ANL and Beyond (Harkay)*
 - *Nanosciences at APS and ANL (Isaacs)*
 - *Linac Coherent Light Source (Milton)*
- **Operations, maintenance and safety performance**
 - *Stability and Machine Performance Enhancements (Emery)*
 - *Accelerator Reliability and Enhancement (Gerig)*
 - *User Operations (Ruzicka)*
 - *Environment, Safety, and Health (Hislop)*



Additional Input for Review Committee

- **Posters**
- **20-year plan and Basic Energy Sciences (BES) response (Gibson, Friday)**
- **View from:**
 - The Science Advisory Committee (SAC) (Mike Rowe, Chair)
 - The APS Users Organization (Paul Zschack, Past Chair)
 - The Partner User's Council (Jim Viccaro, Chair)
 - Opportunity to invite any speakers or others to executive sessions
 - Opportunity to meet with junior staff (Fri. a.m.)
- **“Vision” document; response to BES review; annual report of APS...**

Key Points from Executive Summary Tonight

- **Drivers for changes at APS**
 - Transition from construction to operations
 - New management philosophy
 - Department of Energy (DOE) review
 - BES CAT operations
- **Major changes at APS**
 - Reorganization
 - *Moved resources towards user support*
 - Centralized GU program (tomorrow)
 - Science Advisory Committee
 - Partner user proposals (PUPs)
 - BES CAT support
 - Internal changes at APS
- **Future challenges**
 - Preserving the strengths of the CAT system while overcoming the weaknesses
 - Obtaining sufficient resources for enhanced operation and beamline/ID construction
 - Attracting and retaining top people

Drivers – Transition from Construction to Ops

FY	Unique Users	Experiments	Instrumented Beam Ports Cumulative Total
1995	na	na	2
1996	54	17	18
1997	243	119	24
1998	769	593	31
1999	1202	984	34
2000	1499	1224	36
2001	1976	1463	37
2002	2299	1704	41
2003	2530	2174	43

Table I from *Vision* document



Drivers – New Management Philosophy

- **APS is now better integrated**
- **APS now focuses more on user science**
- **We are striving to give APS staff a better working environment**
- **APS is working to integrate more effectively with Argonne National Laboratory, The University of Chicago and other Universities**



Mission of the Advanced Photon Source

The mission of the Advanced Photon Source is to deliver world-class science and technology by operating an outstanding synchrotron radiation research facility accessible to a broad spectrum of researchers.

Goals:

- Operate a highly reliable 3rd-generation synchrotron x-ray radiation source
- Foster a productive environment for conducting research
- Enhance the capabilities available to users of the APS facility
- Assure the safety of the facility users and staff and the environment
- Maintain an organization that provides a rewarding environment that fosters professional growth
- Optimize the scientific and technological contribution to the DOE and society from research carried out at the APS

Science and accessibility



Drivers – DOE Review

- **Mandates:**

- Centralized GU program ✓
- Change SRI-CAT ✓
- Strengthen ES&H oversight ✓

- **Recommendations**

- Bottoms-up review for efficiency and balance ✓
 - *And adjust staffing for more user support*
- Plan for ops of BES CATs ✓
- Increase user participation in decision-making ✓

- **Other observations**

- *Machine excellent, science lagging*
- Restructure Program Evaluation Board (SAC) ✓
- Move towards more central-support mode for users ✓
- Increase number of general users
- Reduce activities with Low-Energy Undulator Test Line (LEUTL) ✓

Drivers – CAT Operations Issues

- **CAT model has advantages and disadvantages**

- **Advantages**

- Leveraging of funds
- Outside drivers and partners for facility
- Strong connection with universities
- Creative diversity

Entrepreneurship

- **Disadvantages**

- Tendency to avoid specialization
 - *Increased operational burden*
- Challenging to sustain stable operational support

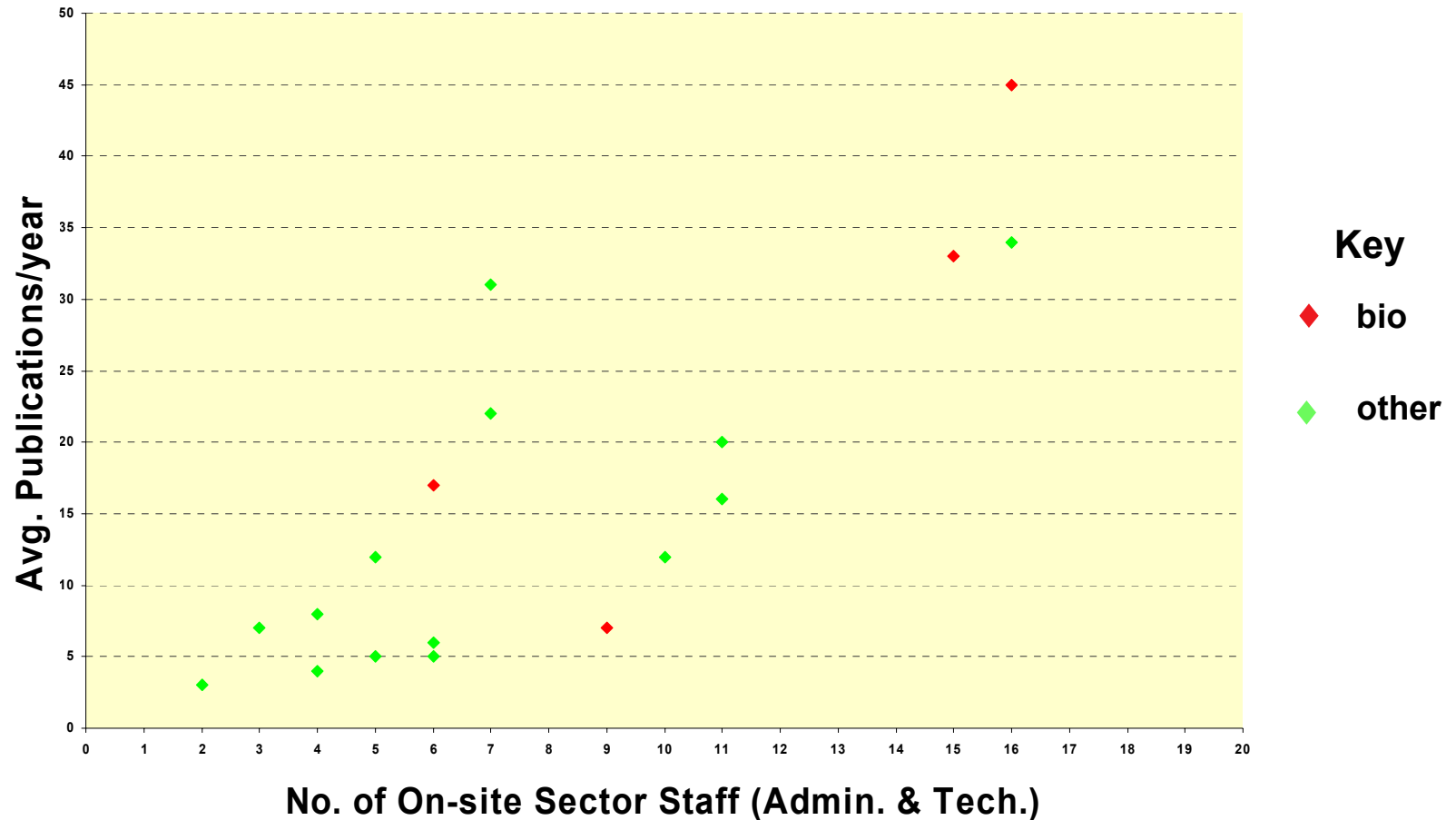
Stability and efficiency

- **BES policy of support for CAT operation changes**

- Expect facility to take responsibility
- With additional resources promised
- CHALLENGE – do this while retaining strong partners



Compelling Need for More Beamline Operations Support



Sector productivity is related to staffing level

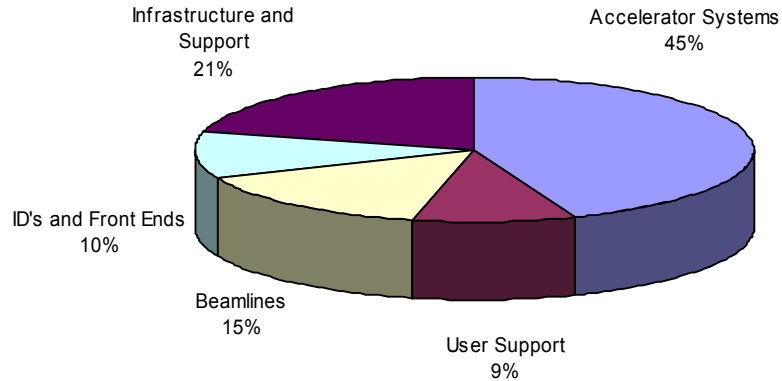
Changes at APS in Last Two Years

- **Reorganization moved 9% resources towards user side**
 - Improving organizational effectiveness
- **Focus on dialog and improved relationship with users**
- **Enhanced user support in many areas**
 - Strengthened experimental safety review (R. Hislop, tomorrow)
- **Centralized GU program (D. Mills, tomorrow)**
- **Science Advisory Committee and sector review process**
- **Partner user proposals**
- **SRI-CAT changed to X-ray Operations and Research (XOR)**
- **Taken on responsibility for operating some BES sectors**

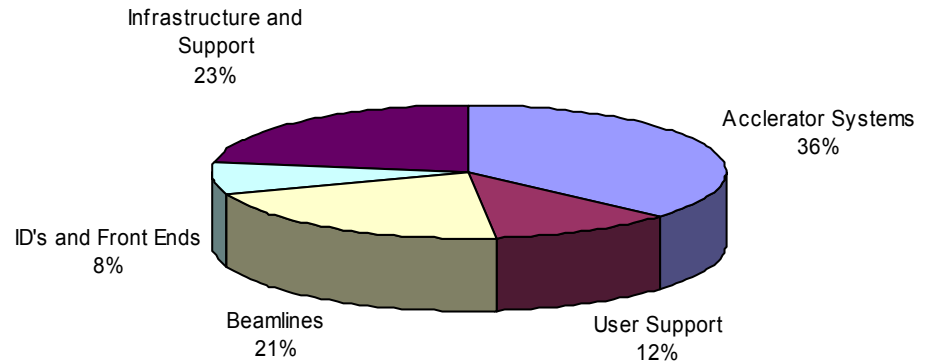


Reorganization to Move 9% Resources Towards User Side in April 2002

APS FY 01 Spending by Function

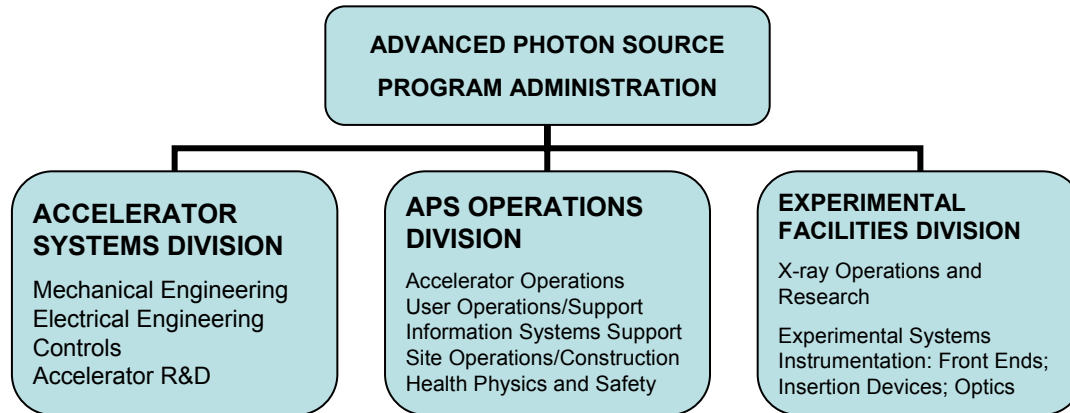


APS FY 03 Spending by Function



Includes reduction of staff by ~40 people

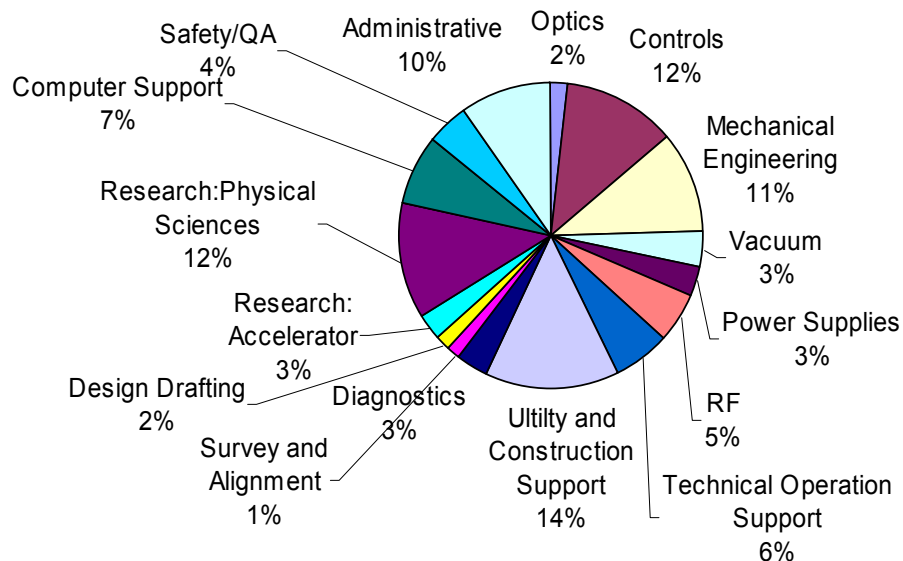
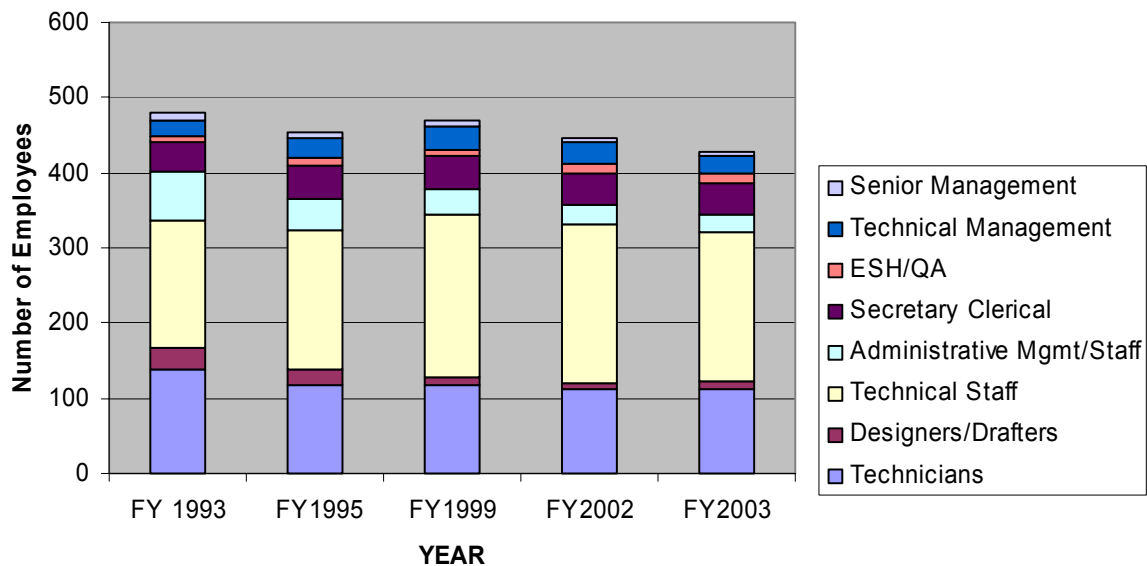
APS Organization Revised in April 2002



- **Reduced to 3 divisions, from 4**
- **Duplication minimized**
- **Centralized activities – e.g., computer support**
- **Consolidated SRI (now XOR) management**
- **Dennis Mills appointed Deputy Associate Laboratory Director**



Staffing History and Profile



Improving Organizational Effectiveness

- **Increase the scientific output of users**
 - Implement a centralized general user program
 - Provide more support to resident users and CATs
 - Operate BES beamlines where required
 - Improve web pages for general user accessibility
 - Establish periodic high-quality publications for outreach
- **Increase the impact of science from APS**
 - Implement a Scientific Advisory Committee and sector review panels
 - Optimize beam-time allocation and use
 - Encourage and support development of specialized beamlines
 - Foster theory activities at APS
- **Deliver high reliability**
 - Ensure availability exceeds 95%
 - Increase the MTBF to at least 35 hours
 - Improve the reliability of beamlines
 - Plan for age and damage-related obsolescence
- **Innovate instrumentation for improved user science**
 - Improve accelerator performance from user perspective
 - Develop new insertion devices for innovative science
 - Improve and innovate beamline performance
- **Improve the efficiency and effectiveness of the APS**
 - Improve the partnership with CATs and users
 - Implement a graded approach to document management
 - Facilitate effective and seamless interactions between APS divisions with clearly-defined interfaces and responsibilities
 - Improve communication within the APS and user community
 - Foster excellent supervision
 - Employ a graded approach to project management
 - Improve partnerships with Argonne and the University of Chicago
 - Improve workplace diversity and working conditions
- **Support Laboratory-wide initiatives**
 - Facilitate the Center for Nanoscale Materials and the x-ray Nanoprobe
 - Support Lab-wide coordination of accelerator physics activities
- **Foster a safe and secure environment**
 - Provide support and oversight for user safety and security issues
 - Improve the safety oversight integration across APS divisions and improve the safety and security of APS employees
- **Invest in the future**
 - Support Linac Coherent Light Source (LCLS) and associated experimental program
 - Recruit outstanding users and staff
 - Increase the number of graduate students and foster training in beamline research
 - Contribute to the development of future light sources and the broader scientific community

APS Annual Goals for FY 03



Focus on Dialog and Improved Relationship with Users



★ *new*

- User reps attend weekly Operations Directorate ★
- Regular monthly APS/User Meeting ★
- Created Partner User Council ★
- Workshops: e.g., Insertion Devices (Dec. 2002) ★
- Weekly User Science Seminars
- Weekly CAT Chat
- Monthly Technical Working Group meetings

Enhanced User Support in Many Areas

- **Detector pool**
- **Beamline controls**
- **Computing**
- **Database management**
- **Mechanical and electrical engineering**
- **User program administration**
- **Environment, safety, and health**

More from Bill Ruzicka, AOD



Science Advisory Committee and Sector Review Process

- Added **breadth** and **depth** to former Program Evaluation Board process
- **14-member committee meets annually to recommend actions**
 - evaluates appropriateness of beam-time allocation to CATs and other partner users
- **Independent sector reviews occur throughout the year, chaired by SAC members**
- **SAC also advises on policy and carries out cross-cutting reviews**
- **Advice on scientific development:**
 - Shenoy-Sinha study on “New Scientific Directions for APS”



Sector Review Panels

Sector Review Panel (SRP) Reviews for 2002

DND-CAT – November 20

CMC-CAT – November 19

MU-CAT – November 21

SRP Reviews for 2003

SER-CAT – June 2

MR-CAT – September 10

BioCARS-CAT – June 3

PNC-CAT – September 11

IMCA-CAT – June 4

IMM-CAT – November 12

SBC-CAT – June 5

ChemMatCARS-CAT – November 13

SRP Reviews Planned for 2004

Bio-CAT

XOR 3

SGX-CAT

XOR 4

XOR 1

UNI-CAT

XOR 2

MHATT-CAT

Sector Review Panel for MR-CAT

Name	Address	Contact Information
Paul Bertsch, Chair	Advanced Analytical Center for Environmental Sciences University of Georgia SREL P.O. Drawer E Aiken, SC 29802	Ph: 803/725-5637 Fx: 803/725-3309 Em: bertsch@srel.edu
William Bassett	Dept. of Geological Sciences Cornell University Snee Hall Ithaca, NY 14853	Ph: 607/255-7502 Fx: 607/254-4780 Em: bassett@geology.cornell.edu
Denis McWhan	8 Gloucester Street Boston, MA 02115	Ph: 617/536-9610 Em: mcwhan@mailaps.org
Dale Sayers	Physics Department North Carolina State University Box 8202 Raleigh, NC 27695-8202	Ph: 919/515-4453 Fx: 919/515-7731 Em: dale_sayers@ncsu.edu
Marion Thurnauer	Chemistry Division Argonne National Laboratory 9700 S. Cass Avenue, Bldg. 200/L174 Argonne, IL 60439	Ph: 630/252-3545 Fx: 630/252-4470 Em: mariont@anl.gov
Glenn Waychunas	Earth Sciences Division Lawrence Berkeley National Laboratory M/S 90-1116 One Cyclotron Road Berkeley, CA 94720 USA	Ph: 510/495-2224 Fx: 510/486-7152 Em: gawaychunas@lbl.gov
Pierre Wiltzius	Beckman Institute for Advanced Science and Technology University of Illinois at Urbana-Champaign 405 N. Matthews Urbana, IL 61801	Ph: 217/244-8373 Fx: 217/244-0987 Em: wiltzius@uiuc.edu



APS Has Developed a More Flexible Partnering Model

- **Attracts and retains intellectual investment from outside**
 - Universities and other research labs
 - Supports strong autonomous CATs
- **Provides appropriate access**
- **Based on competitive review (by SAC)**

Partner users not only do great science but they leave the facility better for the general user...

...e.g., instrumentation development,
new user community development, education and outreach...

Limited-scope partnership proposals are due several months before the next user run – in run 2003-3, we had 18 proposals and accepted 9

Example – “Enhanced Sensitivity of X-ray Magnetic Circular Dichroism Measurements Using Phase Sensitive Detection,” Lang et. al., sector 4, 15%, 2 years

SRI-CAT Changed to X-ray Operations and Research

- **X-ray Operations and Research in APS Experimental Facilities Division**
- **Former SRI-CAT embraces need**
 - To continue innovation in instrumentation
 - To build new user communities
 - And to take more responsibility for operating BES beamlines
 - *To be a model of BES sector operation, with >50% general user time*
 - *As of 2003-03 run, 80% time for competition (e.g., GU or PU proposals)*
 - XOR employees continue to provide dedicated user support (largest number of general users accommodated through XOR) and maintain innovation

Gabrielle Long accepts position as Associate Division Director for XOR



New BES Policy for the Support of CATs

- **BES aims to transfer resources and responsibility for operation to facility *and so increase inadequate support***
 - Attraction: Solve operational problem, economies of scale, and ability to develop specialized beamlines
 - Challenge: Danger of disenfranchisement
- **As APS takes responsibility, more time available for competition**
- **APS operates sectors 1,2,3,4,11,12 and 7,8,20 (*partial*)**
 - In the long-term future we expect to support 6,9,10,33,34,(26,30)
- **New sectors begin as collaborative development teams (CDTs): Nano (26), IXS (30), and Powder Diffraction (11BM)**
- **Strive to retain “partner users” at these sectors as appropriate**

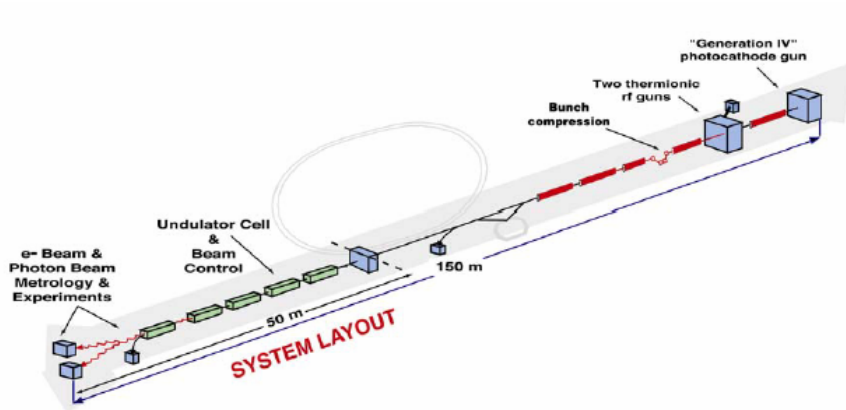
***Aiming for a “win-win” situation
Increased capabilities and support, increased competition***

APS Support of BES CATs

- **Each sector offers more time for competition (including CAT members) – typically 50% general user**
- **Each sector to focus on strengths (*SAC advises*)**
 - Sector 7: Time-Resolved Program with U. Michigan (APS supports 3 staff members)
 - Sector 8: Photon Correlation Spectroscopy (APS supports 3 staff members)
 - Sector 20: Quick EXAFS [bending magnet] (APS supports 3 staff members)
- **Sectors 11,12 (BESSRC) – fully supported by APS, transition plan for 3 years approved as PUP**

Each sector already experiencing higher staffing levels than before
Staff and many users very positive; cost to APS 7,8,20 = \$1.8M total; 11,12 =\$1.6M
Resources for BESSRC from BES; ANL supported \$1M of others

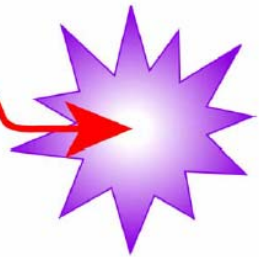
Seeking Independent Long-Term Support for LEUTL



- Free-electron laser lases at ~ 100 nm
- Can be operated at minimal cost during non-top-up
- User experiment “SPIRIT,” Mike Pellin (MSD)
- For $\sim \$5$ M, proposing to set up as vacuum ultraviolet user facility

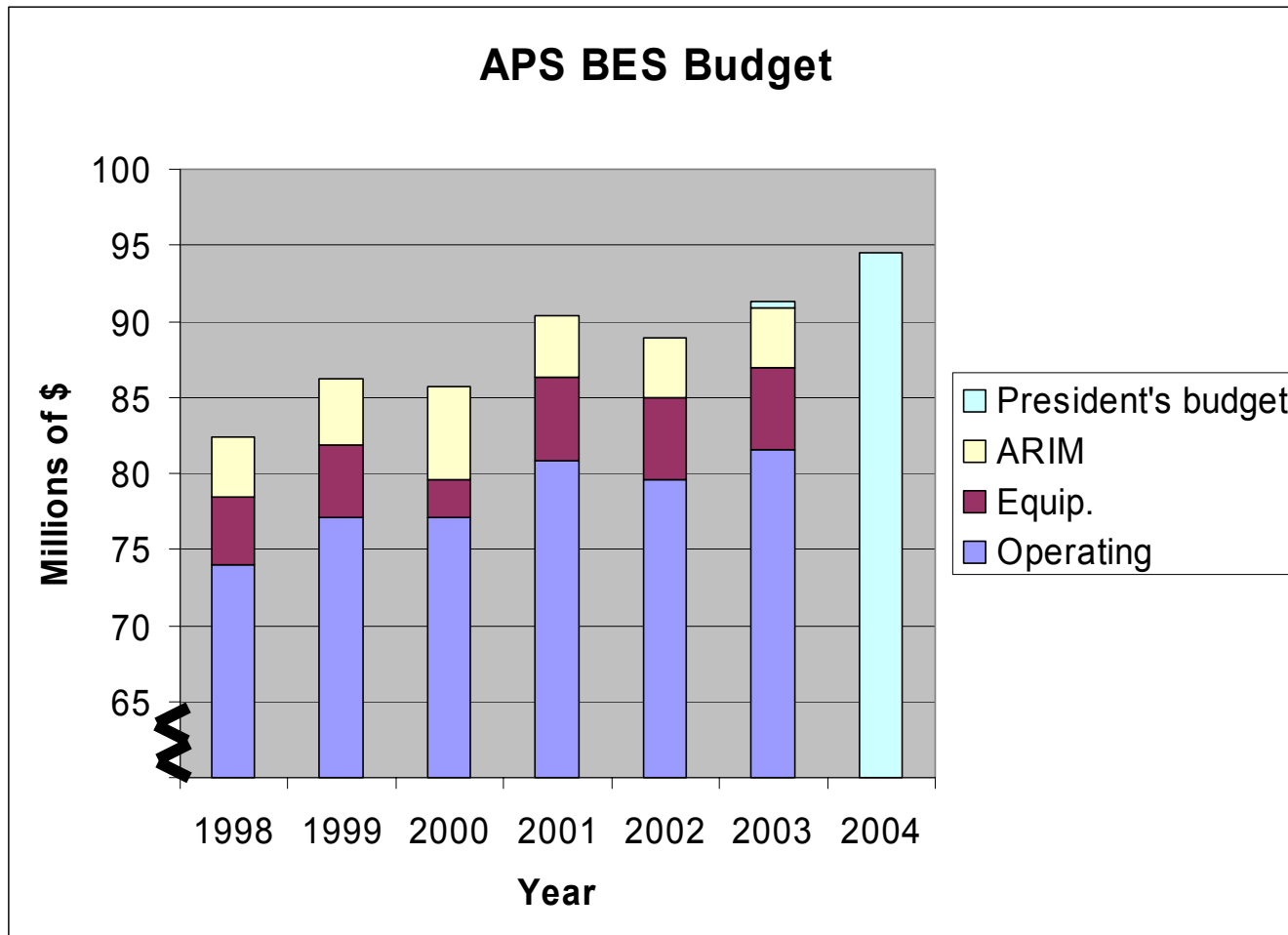
Workshop for Users of the Proposed
Argonne Linear Free-Electron Laser Facility (ALFF)

October 30-31, 2003
Argonne National Laboratory, Argonne, Illinois U.S.A.



APS major partner in LCLS (Steve Milton)

Challenges at APS



FY 05 Facilities Initiative being discussed at DOE (see 20-year-plan presentation by Gibson)

Challenges at APS

- **Need more resources for increased beamline operations, and enhanced user support**
- **Need more resources to develop**
 - Dedicated beamlines
 - Tailored IDs
 - Accelerator innovations
 - Research on next generation sources and experiments
 - Optics, detectors...
- **Long-range strategic planning important, with intimate user involvement – see *20-year plan (Gibson)***
- **Apart from funding, key challenge is retaining flexible partnerships in the future**
- **Must attract and retain outstanding workforce**



Conclusion

- **APS is an excellent machine, with a strong community of users**
- **Several drivers have motivated changes in the last couple of years**
- **These changes position us to surmount our problems and build on our strengths**
 - Aim for the best *science*
 - And the most *accessibility*
 - Retain strong partners while providing more centralized support
- **We are engaged in long-range planning, with intimate user involvement**

