

50 Years of Facility Management or *“It Takes a Village to Support an Observatory”*

The National Optical Astronomy Observatory (NOAO)

Presented by

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Overview

- Organizational Background
- Current Challenges
- A Look at the Future – “The System”
- Facilities Layout, Support and Maintenance Challenges
- Geographically Distributed IT



AURA Mission *“To promote excellence in astronomical research by providing access to state-of-the-art facilities.”*

NOAO Mission

“Promote excellence in astronomical research by providing the interface to state-of-the-art facilities and data for US ground-based astronomy, and thus to fulfill the role of the National Observatory.”

- **AURA Centers**

- National Optical Astronomy Observatory (NOAO)
- National Solar Observatory (NSO)
- Gemini Observatory
- Space Telescope Science Center Institute (STSCI) – NASA Contract

- **NOAO and NSO**

- Managed and operated by the Association of Universities for Research in Astronomy (AURA) through a joint NSF Cooperative Agreement



NOAO Overview

- Multi –Institutional **A Family of Astronomical Relations!**
 - AURA NOAO, NSO, WIYN, SOAR, Smarts, LSSTC, Gemini
 - Multi-Cultural Atmosphere
 - FFRDC
 - Consortiums
 - Public Private Partnerships
- Multi-Geographical
 - Tucson – (U of Arizona Campus)
 - KPNO – Tohono O’odham Nation
 - Sac Peak New Mexico – US Forest Service
 - Chile
 - La Serena
 - Cerro Tololo
 - Cerro Pachon
- Multi-Missions
 - NOAO
 - NSO
 - Projects
 - Consortia
 - Private Groups
 - Community
 - NSF
- Multi-Faceted Research Facility
 - Headquarters -Office
 - Mountain Operations
 - Laboratories
 - Housing
 - Food Service
 - Technical Shops
 - Data Center



NOAO

Kitt Peak National Observatory (KPNO)

Cerro Tololo Inter-American Observatory (CTIO) Chile

NOAO Gemini Science Center (NGSC)

Consortiums -

University of Wisconsin-Madison, Indiana University, Yale University and NOAO (WIYN)

Southern Observatory for Astrophysical Research (SOAR) Chile

Large Synoptic Survey Telescope (LSSTC)

Collaborations –

Small and Moderate Aperture Research Telescope System (SMARTS)

National Virtual Observatory (NVO)

NSO

NSO Sac Peak –New Mexico

NSO KPNO - McMath-Pierce and SOLIS

Synoptic Optical Long-term Investigations of the Sun (SOLIS)

Global Oscillation Network Group (GONG) (International Stations)

The Advanced Technology Solar Telescope (ATST) (Hawaii)

Virtual Observatory (VO)



NOAO Organizational Structure

NOAO North and NOAO South

- Observatories
 - Kitt Peak National Observatory (KPNO)
 - Cerro-Tololo Inter-American Observatory (CTIO)
 - NOAO Gemini Science Center (NGSC)
- Divisions
 - System Division
 - Giant Segmented Mirror Telescope Program Office (GSMTPO)
 - System Instrumentation (SI)
 - Data Products Program (DPP)
 - System Operations and System Development Office (SO)
 - Science Support (SS)
 - Public Affairs and Educational Outreach (PAEO)
 - Large Synoptic Survey Telescope Project (LSST)
 - Administration and Infrastructure
 - Central Administration Services (CAS) (AOSS)
 - Central Facilities Operations (CFO) (AOSS)
 - Computer Infrastructure Services (CIS)
 - Director Office (DO)



Current Challenges – Senior Review

Previously

- Emphasis was on the next generation of very large facilities

Current

- Renovation and re-engaging of the existing facilities
- Small and mid-size telescopes and the infrastructure that supports them.

Ensuring a balance among the entire suite of telescopes, activities and facilities

- Existing
- Various phases of development.

The activities are not limited to maintenance and planning.

- Kitt Peak - NEWFIRM, WHIRC, and QUOTA
- Cerro Tololo -Goodman Spectrograph and Spartan IR Imager

Access to several new instruments

- Gemini telescopes -NICI and Flamingos-2.
- Development work on future capabilities -One Degree Imager, the Dark Energy Camera, and the SOAR Adaptive Module,



Challenges to Facilities Support

- Old vs. New
- Manage Budgets
- Maintenance Plans
 - 5 and 10 year needs
 - Staffing and Core Competencies
- Multi-Facility Needs
- New Building (Wishing on a Star?)
- Cleaning & Greening
 - Working Atmosphere
 - Space Use
 - Storage
 - Re-engineering of Space
 - Future Needs
 - Wellness
 - Greening
 - Recycling
 - Carbon footprint



A Look at the Future – The System

Develop the US System of Telescopes

- Through Time Allocation
- Instrumentation
- Access to Existing & New Facilities
- Develop New Facilities
- Add New Facilities to Existing Sites
- Provide Data Access
 - New Data
 - Archival
 - Virtual



Facilities Support (It Takes a Village)

- NOAO – South
 - La Serena Support Facility
 - Cerro Tololo Inter-American Observatory
 - SOAR Telescope
 - SMARTS and Other Consortia
 - AOSS
- NOAO – North
 - NOAO Tucson Office Facility
 - Kitt Peak National Observatory
 - WIYN Telescope
 - Tenants Support



- 32 Acre Site
- Over 40 structures including residential buildings
- Main office building over 27,000 sf.
- Majority of construction done in 60's and 70's



NOAO – South La Serena Support Facility



NOAO – South CTIO/SOAR Facilities



85,000 Acre Scientific Preserve Site

Over 80,000 sf. of building space
~14 Telescopes operated by NOAO-
South and other organizations
Utility services provided to all structures

- 2,308 Acre Site
- 22+ Telescopes
- 12+ organizations

- KPNO, 2.4 Telescopes
- 40+ structures
- 130,000+ sf of buildings



NOAO-North

Kitt Peak National Observatory

Mountain Operations

Kitt Peak

Essentially operated as small villages.

All major utility systems provided, maintained and supported by NOAO.
Major infrastructure work done during the 60's.

Utility Systems

- Water
- Electrical
- Roadways
- Phone/Data
- Lodging/Food Services



Mountain Issues

- Infrastructure almost 50 years old
- Changing needs affect space usage and building space
- Telescope enclosure maintenance and upgrade needs
- Increased and new instruments impact on buildings
- Increased instrument operational and support demands
- Inadequate electrical distribution system for new needs
- Environmental system and controls for telescopes & buildings
- Tribal regulations for employment and construction support
- Changing environmental regulations and site constraints
- Inflexible building construction
- Increased educational support
- Public Impact
- Emergency response Issues





NOAO – North Tucson Facility

- Total of 8 Structures, Approximately 131,000 sf
- Construction – Masonry, concrete, modular trailer, adobe
- Facility accommodates staff from several organizations
– NOAO, NSO, WIYN, LSSTC, and Visitors



Building Issues and Constraints



- Main Building constructed in the 60's
- 8 expansion projects increased it to just over 108,000 sf
- 10 different floor levels, 17 Rest-Rooms
- Space Utilization:
Offices ~32%, Labs/Shops ~33%, Circulation/Restroom/Common ~35%
- Occupancy Levels:
1969 ~ 251 FTE, 1990 ~247 FTE, 2007 ~ 305 FTE

- Inefficient circulation and space access problems
- Large redundancy of space usage
- Inadequate electrical system for changes in usage
- Support system repair parts not available
- Environmental system operation and control
- Type of construction and hazardous issues



National Optical Astronomy Observatory Future Challenges

- A changing NOAO leads to a need for building modifications
- Increased focus on computer/technology for control over facility operations
- Support to new methods, instruments and observing needs
- Repair, replacement and upgrades to infrastructure
- Site constraints and inflexible buildings
- Staffing changes, retirement and different skill needs



Geographically Distributed IT

How does an organization run an
IT operation spread over two
continents?



In the 1980s

- After 1983 “merger” of NOAO, The Powers-That-Be decided to have a joint IT department covering both Arizona and Chile.
 - Standardize!
 - Save money!?!?!
- Failed!! – Communication and control “bandwidth” insufficient to hold North and South IT groups together
 - Expensive expertise had to be duplicated
 - Standardization of policy, equipment and software became hap-hazard



In the 2000s

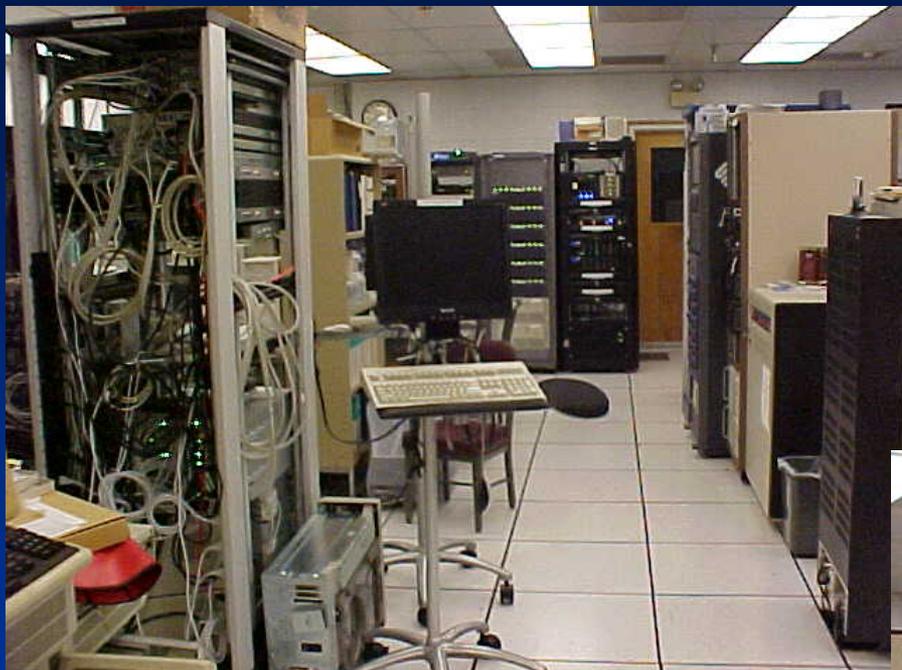
- Data Products Program is a NOAO effort to do data archives, data pipelines and virtual observatories
- IT group of the International Gemini Observatory (Hawaii & Chile)
- Both
 - Run as a North-South collaboration
 - Held together with
 - Lots of video conferencing
 - ssh and VNC between continents
 - Many hours in airplane seats for managers



IT over 3 Continents?!?

- Powers-That-Be are once again pondering reorganization: In a few years it might be Tucson, La Serena and Hilo
- Can we reorganize disparate IT groups into a single organization to
 - save money?
 - homogenize the new combined organization?
 - focus on the combined organization's mission?
- Will have to resolve
 - Ownership Issues (who gets to decide!)
 - Different definitions of “service”
 - Overlapping expertise
- Success will depend on
 - Planning!
 - Upper Management has to force the process
 - Willingness to ignore “save money” mandate in short term (and perhaps long term...)





Tucson Computer Lab

Meanwhile, back in the lab...

- IT has to live in the past and the future
 - Computer Lab built for water cooled, CDC 6400 mainframe now used for dozens of racks full of 1U Linux servers and RAID arrays (with some 15 year old VAXes for flavor)
 - Staff members hired on as CDC operators now happily running Windows, Linux and Mac networks
 - NOAO CyberSecurity Policy
 - 1983: Pat staff on the shoulder and tell them “Don’t do anything stupid.”
 - 2008: Tell staff “Read and initial each of the 50 pages.”
 - Compliance
 - Good thing we have a computer lab with a raised floor to store the paperwork!



When can IT say “No”?

- NOAO is an academic environment: scientific staff and other senior staff want to choose their computing environment. IT has to try and support all of these...seemingly forever!
 - 1983: Punch cards on the CDC Cyber 170/720
 - 1988: Retrographics VT100s on VAXes running VMS or BSD Unix. Building held together by terminal cables
 - 1993: Sun SparcStation-X running SunOS 4.x. Building held together by thick Ethernet cables.
 - 1998: Sun Ultra-X desktop running Solaris. Windows laptop. Building held together by twisted-pair Ethernet cables.
 - 2003: Linux desktop and laptop. Multimode fibers.
 - 2008: Apple Mac desktop and laptop. Singlemode fibers.
- At what point does IT say “NO!”?
 - We HAVE abandoned punch cards!
- At the same time, IT has to support “traditional” computing – Windows networks and domains – for stable parts of the Observatory (Business, Operations, Instrument Design)



Questions?

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