NSF’s National Center for Optical-Infrared Astronomy (NCOA)

Science Possibilities and Planning Updates
• NCOA Context and Background
• Emerging science connections across NOAO, Gemini, and LSST
• Status of NCOA planning
NSF’s National Center for Optical-Infrared Astronomy

Foundation for NSF-sponsored scientific leadership in observational OIR astronomy in 2020s and beyond

LSST Operations, Gemini Observatory, and NOAO within a single organizational framework
Complimentary Capabilities at 8-m and 4-m Aperture in Both Hemispheres

SOAR
- Goodman
- STELES
- TripleSpec4.1
- SAM (GLAO)

Mayall
- DESI

Blanco
- DECam
- COSMOS

LSST (2022)
- High-level calibrated imaging data products

Gemini-N
- GMOS-N
- GRACES
- GNIRS
- NIRI
- NIFS
- Altair

Gemini-S
- GMOS-S
- FLAMINGOS-2
- GPI
- Phoenix
- GSAO/GEMS

Slide made by Heathcote and Vivas (CTIO)
Community Science and Data Center (CSDC)

NOAO's Community Science and Data Center (CSDC) facilitates and supports community open access to telescopes operated by NOAO, Gemini, and other organizations through the US O/IR System. As part of that mission, CSDC is involved in a range of O/IR System development activities.

CSDC also facilitates and supports community open access to NOAO data holdings and services.
NOAO’s CSDC

• Support for data-intensive astronomy research by a broad-based user community.

• Community access, advocacy, and optimization for the US OIR astronomy system.
NCOA Numbers (FY23)  (All numbers approximate)

NCOA Employees
- Hawaii, 75
- Arizona, 200
- Chile, 250

Annual Spending
- NSF, $75M
- Other, $50M
- Then-Year Dollars

Total People: 525
Total Annual: $125M (FY23)
NCOA Motivations

• “LSST will be the [NSF OIR] flagship...through the 2020s, and NSF must endeavor to ensure the successful delivery of LSST-enabled science.”

• “In that context, NSF has determined that the reorganization of the NSF-funded OIR capabilities under a single administrative organization is needed to provide the operational support necessary for successful LSST science delivery, to give NSF the flexibility to prioritize key programs at critical times, and to ensure continuing support necessary for the high priority capabilities of the NSF-funded OIR assets.”

• NCOA must be “[funding] neutral”, i.e., must respect previous established funding profiles...which are subject to change by Congress, etc.

From NSF Guidance memo to AURA, Sept. 2016
NCOA Motivations

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**Improved research infrastructure coordination**

**Improved science-driven strategic development and foundation for partnerships**
NCOA endorsed by
U.S. National Science Board in February 2018

Also
AURA Board of Directors (Sep 2017)
Gemini Board of Directors (Nov 2017)
NCOA as a Matrix Organization

Flowchart:
- **NCOA Directorate**
  - LSST Operations
  - Gemini Observatory
  - Mid-Scale Observatories (MSO)
  - Community Science & Data Center (CSDC)

- **Services**
  - Engineering Operations Services (EOS)
  - Science Operations Services (SOS)
  - Center Operations Services (COS)

- **Labor pool**
  - Services (e.g. Safety, IT Ops, Facilities Ops)
NCOA as a Matrix Organization

Current NOAO functionality

NCOA Directorate

- LSST Operations
- Gemini Observatory
- Mid-Scale Observatories (MSO)
- Community Science & Data Center (CSDC)

Labor pool

Service pool

Engineering Operations Services (EOS)
Science Operations Services (SOS)
Center Operations Services (COS)

Services (e.g. Safety, IT Ops, Facilities Ops)
NCOA as a Matrix Organization

Current NOAO functionality

MSO contains CTIO and KPNO

NCOA Directorate

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Labor pool

Engineering Operations Services (EOS)

Science Operations Services (SOS)

Center Operations Services (COS)

Services (e.g. Safety, IT Ops, Facilities Ops)
Integrating the U.S. Optical-Infrared System

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Services (e.g. Safety, IT Ops, Facilities Ops)

MSO contains CTIO and KPNO
An International Community Resource

NCOA Directorate

- LSST Operations
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Current NOAO functionality

Engineering Operations Services (EOS)
- Labor pool

Science Operations Services (SOS)
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Center Operations Services (COS)
- Services (e.g. Safety, IT Ops, Facilities Ops)

MSO contains CTIO and KPNO
An International Community Resource

NCOA Directorate

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US-ELT Program?

- Engineering Operations Services (EOS) Labor pool
- Science Operations Services (SOS) Labor pool
- Center Operations Services (COS) Services (e.g. Safety, IT Ops, Facilities Ops)
An emerging time-domain ecosystem

Street et al 2018 SPIE proceeding
Optical Counterpart of GW170817

Independent discovery and follow-up photometry
Blanco+DECam

Optical Spectra from SOAR

Near IR Spectra from Gemini

Follow-up effort involved many “NCOA” facilities
• Blanco + DECam
• Gemini-S + Flamingos II & GMOS
• SOAR + Goodman
• SMARTS 1.3m+Andicam
• KTMNET, Las Cumbres, PROMPT 5

Multi-wavelength Light Curve. Blanco+Gemini
I 848,L17

Slide from Vivas and Heathcote
NCOA centers are collaborating on data reduction tools

- Gemini has developed real-time image processing in the Gemini Python astrodata and recipe system data reduction infrastructure (DRAGONS)

- SOAR has been working on spectroscopic data reduction using Python

- SOAR and Gemini are now combining these efforts:
  - SOAR instruments are now supported by the Gemini DRAGONS framework

https://github.com/GeminiDRSoftware/DRAGONS
https://github.com/soar-telescope/dragons-soar
Gemini and NOAO are discussing proposal systems

- Gemini is planning to create a new proposal tool and database as part of the OCS upgrades program
- NOAO is also thinking of designing a new proposal system
- We are keeping each other updated on our work with an eye to how we might collaborate or make the systems work together.
- Representatives of Gemini and NOAO attended a workshop on proposal systems at ESO in June 2018.
Gemini/NOAO/SOAR are working towards developing a unified NCOA MOS mask design software

- Gemini, SOAR, and NOAO have different software for designing masks for GMOS/F2, Goodman, and COSMOS
  - They have different strengths/weaknesses
  - None are very good pieces of software and are hard to install and maintain
- Gemini, CTIO, and SOAR staff have written user stories, basic requirements, and a project plan for developing a new mask design tool that will support all NCOA MOS instruments.
  - Common interface
  - Incorporate the best features from the current tools
  - Do in a modern language and w/o 3rd party dependences for maintainability
Mid-Scale Observatories NCOA synergies

• Large area, multi-use surveys are discovery machines
  - e.g. DECaLS/BASS/MzLS

• LSST Follow-up
  Fraction of LSST sky available from Kitt Peak with airmass < 2.0
Other example value-added possibilities

• Success metrics
• Publication tracking
• Technology and user-experience alignment between the CSDC Data Lab and the LSST Science Platform
• Coordination between Gemini and Data Lab in hosting of high-level science products
• Coordinated user Helpdesk system across NCOA programs
• Data-processing software collaboration across NCOA programs
• Communications - Press releases and public outreach
The US Extremely Large Telescope Program

- A joint program by NOAO, TMT, and GMT for presentation to the 2020 Decadal Survey and to the National Science Foundation

- Two telescopes, two hemispheres, one system: diverse capabilities and all-sky coverage enable integrated science programs beyond the scope of a single ELT

- Open access to ≥ 25% of observing time at each facility for the U.S. community
  - Key Science Programs requiring 10s to 100s of nights of GMT+TMT observing time
  - Discovery science: smaller, PI-class projects

- NCOA and the U.S. ELT Program:
  - Enhanced TMT/GMT synergy with LSST, wide field spectroscopy, time domain follow-up system
  - U.S. ELT Science Center for user support, data management and archiving
The US Extremely Large Telescope Program

Key Science Programs (KSPs):  A central element of the U.S. ELT Program

• Address problems of fundamental scientific importance
  • E.g., the dark Universe; first galaxies; exoplanet characterization; outer solar system, etc.
• Open collaboration model to encourage broad, diverse participation
• Opportunities for collaboration with international TMT and GMT partners

Join the KSP development effort!

• Community-based teams to develop exemplar KSPs for Astro2020. **We need your help!**
  • Actual KSPs will be selected by peer review when observatories are operational
• **Sign up by 30 July:** [https://www.noao.edu/us-elt-program/](https://www.noao.edu/us-elt-program/)
• U.S. ELT Program workshop in Tucson, Oct/Nov: **Details soon!**
NCOA Planning Status – Core team members

Phil Puxley (AURA VP for Special Programs) is leading NCOA planning efforts as the Interim Director for NCOA, supported by Beth Willman as his Deputy.

Dana Lehr (AURA VP for Programs) and Debbie Johnson (AURA CFO)

Adam Bolton (CSDC Director)

Bob Blum (Designated LSST Ops Director, current NOAO Deputy Director)

Laura Ferrarese (Gemini Interim Director) and Henry Roe (Gemini Deputy)
NCOA Planning Status

• Current planning priorities include: Project and Program Management, Risk Management, Change Management.

• Other priorities include increasing staff communication and engagement, identifying resources necessary for a successful launch.

• We have started to identify leads of NCOA management groups (IT and Safety first, Communications/Engineering/Science will come soon) who will be charged with leading inclusive planning processes for the launch of those parts of the organization. Largely internal recruitments.

• We are working closely with NSF as we develop and implement a roadmap towards their approval for NCOA to launch sometime in Calendar Year 2019.
NCOA’s excellence will come from the people who work for our facilities and the people who use it.

We are excited to work with staff and science users as we continue planning for this big step in the integration of three world-class astronomical facilities.

NCOA will be more than the sum of its parts, and will be a Center that serves an international community of users.