



National Optical Astronomy Observatory

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To: Mark Brodwin, Elizabeth Buckley-Geer, Karen Meech, John Moustakas, Casey Papovich, Armin Rest, Christy Tremonti
From: R. Blum
CC: D. Silva, NOAO Executive Committee
Date: April 30, 2017
Subject: NOAO Response the 2016 Users Committee Report

Dear Liz, Mark, Karen, John, Casey, Armin, and Christy,

Thank you for your diligent work in reviewing the NOAO program in 2016. NOAO values your input and appreciates your effort on behalf of the NOAO user community. Below, please see the NOAO responses to your recommendations.

1. Overall Mission

Please comment on the new NOAO mission. NOAO seeks to provide excellence in open access to telescopes, data, catalogs, and tools for the US community. Most helpful will be comments on NOAO's engagement with the community and the new mission.

Recommendation 1: We recommend that NOAO continue to explore new avenues for effectively communicating with the full US astronomical community on the new NOAO, particularly the idea of the "third mountaintop."

Some suggestions include: Short emails "bulleted" with links (not long newsletters). Larger, properly supervised social network presence (Facebook, Twitter). Focused workshops demonstrating the Data Lab, maybe in the form of Webinars or other online seminars.

NOAO continues to connect to the US community vigorously to communicate its program and opportunities. The "Third Mountain Top" was on full display at the January 2017 AAS meeting (where we presented large data sets available through the Data Lab live) and we will make the first public release of the Data Lab in Austin this summer. We also had some success connecting through social media at the AAS meeting both through posts and live video.

Currents continues to provide the latest news, science, and developments at NOAO. Timely messages go out to the Currents email list on focused topics. Our web page continues to be updated. In May, NOAO will host a workshop on LSST Follow Up in collaboration with the Las Cumbres Observatory.

Recommendation 2: NOAO should ramp up strategic planning for telescope and instrument capabilities in the LSST era. In particular, it would be useful if NOAO could

UC response by NOAO 2016 – D4



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Kitt Peak National Observatory • Cerro Tololo Inter-American Observatory • Community Science & Data Center solicit community input and begin to build science cases for moving NEWFIRM to the Blanco; acquiring DESI; swapping DECam and DESI; and moving ARCoIRIS from Blanco to SOAR.

We agree and have started in earnest. As noted above, we will host a workshop in May. NOAO participated with LSST and the Kavli institute to hold a meeting on Maximizing Science in the Era of LSST” in Tucson last May and the report was presented in August: <https://www.noao.edu/meetings/lsst-oir-study/>. NOAO is actively developing a plan with NSF to address specific actions noted in the report. Furthermore, NOAO has started organizing with Las Cumbres, Gemini, and SOAR to develop a “LSST Follow Up Capability.” See more on this during the 2017 meeting. NOAO also participated in the DOE meeting “Future Cosmic Surveys” in Chicago in September, 2016. The meeting highlighted future science within the DOE “dark sector” where both DESI and DECam can play a role.

2. DECam

Please comment on current operations and community engagement with DECam at CTIO. The committee should comment on current scheduling of community time including surveys to ensure the highest productivity.

Recommendation 1: The UC recommends to continue to work with DES and DECaLS on continuing to improve the community pipeline.

NOAO continues to improve the CP with input from both DES and DECam. In the past year, the following improvements have been made:

- *DESDM orchestration framework eliminated and processing efficiency improved*
- *Astrometric calibration and photometric characterization changed to Gaia and PS1/Gaia respectively*
- *Brighter-fatter correction algorithm added but not the default - awaiting study panel evaluation*
- *DES years 2 and on are now calibrated as with all community programs*

In addition, NOAO can report the following progress on pipelines used for MzLS and BASS data to produce science ready images for the community:

- *First production versions completed and used for 2016 campaigns*
- *Minor corrections and improvements underway for 2017 campaigns*



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Recommendation 2: The UC commends NOAO for setting up and beta testing remote observing. The UC encourages NOAO to make remote observing publically available as soon as possible.

NOAO continues to expand remote observing. A new observing room is set up in Tucson and has been used to host DECam and MzLS observers. Several community users have used the capability as well as survey power users for DECaLS. DES observers have also remotely observed from FNAL with NOAO support from CTIO.

3. DESI

Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from DESI given the nature of the key project. Opportunities to consider include a) the imaging data sets from DECaLS, MzLS, and BASS, b) the public release of the key project spectra, Bright Galaxy Survey spectra and Milky Way Survey spectra (all initially proprietary), c) possible bright time community survey (400-500 hr per year), d) the Next DESI Survey.

Recommendation 1: The UC acknowledges NOAO's success in rapidly serving the raw and CP processed data from DECaLS (and, going forward, the MzLS and BASS survey data), as well as the Tractor catalogs produced by the DECaLS team. In order to encourage scientific analyses, NOAO should regularly advertise the existence of these data to the community, especially as the catalogs are enhanced in subsequent data releases (such as the inclusion of WISE light curves in Data Release 3).

NOAO regularly announces data releases to the community via its web page and Currents. We also announce the availability of data sets at the AAS meetings including live demos of the Data Lab with access to survey data sets (we debuted SMASH data live in Texas in January).

Recommendation 2: Although NOAO represents only one voice among many within the DESI collaboration, the UC recommends that NOAO advocate aggressively on behalf of the community for data to be released as early as possible during the DESI survey. These data releases could be incremental in ways that do not encroach on the DESI key project (for example, an early release of redshifts without the selection functions necessary to compute the correlation function) but which would maximize community science from DESI data. NOAO should strongly advocate for the final DESI data releases to include all the DESI data, including the 1D and 2D raw and pipeline processed spectra.

NOAO agrees with this recommendation. The structure of data releases is beginning to emerge. Release timescales are not yet set but we are hopeful we can work with the collaboration to make them available in a timely way.



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Recommendation 3: NOAO should develop a plan on a relatively short timescale (the next 6-12 months) for determining how the community could utilize the ~400 hours of the brightest time with DESI. For example, this process might request white papers from the community, followed by an open call for proposals. Given the need for community users to raise their own funding in order to obtain access to DESI during this time, a large lead time is an important factor to consider.

NOAO convened an internal working group to study this during the year. At this time, NOAO does not have the resources in staff or funding to make an effective program. Elements of the system optimization coming from the Kavli report and from NSF guidance have taken precedence. These elements will be discussed during the meeting.

Recommendation 4: The UC recommends that NOAO starts thinking soon about how the community could potentially gain access to the DESI instrument after the DESI 5-year survey has been completed.

This will likely play out through the Decadal Survey process involving both DOE and NSF communities. We agree it should be a priority.

4. NNEXPLORE

Please comment on how NOAO can best support the community to maximize and prioritize science opportunities from the new NNEXPLORE spectrograph NEID (NNEXPLORE Exoplanet Investigations with Doppler spectroscopy) on WIYN.

Recommendation 1: We encourage NOAO to continue working with the WIYN consortium to improve the telescope's acquisition and guiding capabilities to make WIYN more efficient at carrying out large surveys.

NOAO and its WIYN partners have established a new technical team. The team rebalanced and aligned the WIYN mount in the fall of 2016 and reports a major improvement in tracking and pointing. WIYN current efforts are centering on mitigating windshake.

5. KOSMOS, COSMOS, TripleSpec

Please comment on the ongoing deployment and early use of KOSMOS and COSMOS and TripleSpec.

Recommendation 1: We suggest that NOAO make more of an effort to advertise the capabilities of the new spectrographs and their short and medium term availability as their current usage may not be reflective of community interest.



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NOAO takes every opportunity to highlight KCOSMOS/TS4 science results at the AAS meetings and through the newsletter and Currents. The NOAO Director specifically highlighted these spectrographs and their science results at the January AAS meeting.

Recommendation 2: We encourage NOAO to push the development of exposure time calculators further. In particular, we suggest that they investigate a community developed “universal” spectroscopic exposure time calculator that is currently being used for eBOSS and DESI: <http://specsims.readthedocs.io>

NOAO has not had the staff or funding to make progress on this recommendation. We agree it would be beneficial to have improved ETC's.

Recommendation 3: We encourage NOAO to pursue community based pipeline approaches for (C/K)OSMOS. A first step might be to ask current instrument users for contributions of code to a community Github repository.

NOAO has not had the staff or funding to make progress on this recommendation.

6A. Science Archive

Recommendation 1: NOAO should prioritize the development of effective tools for bulk/batch downloads of data, since this is critical to many science programs.

The current Science Data Archive (SDA) interface provides a tool that facilitates data requests of up to 50,000 files at a time. After a user has filtered his/her search criteria, that selection may be downloaded using any file transfer protocol (FTP) client. A graphical JAVA-based download manager is also provided to enable multi-threaded downloads via the web browser. Most major public data releases of NOAO Survey data are staged directly to <ftp://archive.noao.edu/public/hlsp/>, where users can fetch large quantities of data via their preferred FTP client without limits.

To further bolster NOAO as a major astronomy data provider, supplemental funding has been provided to host a full copy of the SDSS data set. Storage has been procured, and a Globus endpoint will soon be established to begin the process of transferring the data. This Globus endpoint, once established, will provide a further mechanism for efficient download of large data volumes from NOAO by users.

As of FY2016, most of SDA development effort of three FTE was dissolved as NOAO shifted resources into Data Lab. Consequently, the remaining developer time of roughly one FTE has been devoted to mission-critical data management functions which are prerequisite to the user-facing SDA web interfaces. Specifically, development has focused on replacing legacy software and human-driven daily workflows, with a fully-automated, dome-to-archive software system (Telescope Automatic Data Archiver; TADA).



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Recommendation 2: NOAO should prioritize improvements to the frontend archive interface to make it more user friendly. This should include better object search capabilities and modernizing the help feature with a formal ticketing system for requests.

The majority of CSDC development effort has been focused on a major Data Lab development push leading to the first public system release scheduled for June 2017. In parallel, to support ongoing needs for SDA development, DMO has recently hired an archive programmer with NCE funds earmarked through the end of FY2018. This programmer is well-versed in user interface design and will soon begin prototyping new tools to improve SDA functionality. Subsequent to Data Lab system release, this development will proceed in coordination with Data Lab to ensure consistent user experience across both systems.

Help requests through the SDA, initiated via email, are automatically ticketed through a JIRA system, and assigned to appropriate DMO personnel for further action.

Recommendation 3: The UC encourages NOAO to track the usage in the archive and follow up (on 6-12 month timescales) with large users to see how the data is being used, if the users need help, and to solicit feedback.

We track archive usage continuously and publish the data as part of routine reporting to the NSF. Because 80% of NOAO holdings are non-proprietary, most of the large bulk data transfers, outside of the routine transfers to credentialed PIs and known collaborations, are anonymous and can't easily be tracked.

Recommendation 4: The UC recommends that NOAO Data Management Operations go through the exercise to assess the resources that would be required to reprocess all the DECam data through a uniform version of the CP, and to strive to automate the process to the greatest extent possible. Processing could take the form of applying basic image de-trending (e.g., bias subtraction, flat fielding, masking, streak finding) and astrometric calibration to all images along with the creation of inverse variance maps. It probably should not include coaddition of images or catalog generation as these are science specific and potentially difficult for a heterogeneous data set.

NOAO is pursuing this recommendation in two ways. First, NOAO is collaborating with DESI personnel at LBNL to enable scalable automated operation of the DECam CP-derived software system at NERSC. This effort aligns NOAO's user-community interest in uniform DECam processing with the DESI project's interest in uniform processing of DESI targeting data. Second, NOAO has requested supplemental funding support from the NSF to adapt the LSST software stack for automated operation on DECam data. If funded, this effort will be pursued in collaboration with NCSA, which has an aligned LSST capacity-building interest.



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Uniform reprocessing of DECam data entirely “in-house” with the CP would not be feasible on current NOAO base funding without significantly compromising the responsiveness of CP processing for current DECam community PIs.

6B. Data Lab.

Please comment on current plans for the NOAO Data Lab and associated catalogbased research services, with a particular emphasis on desired user tools (both basic and advanced) to be deployed and priorities for deploying those tools and associated data sets.

Recommendation 1: As the Data Lab development continues, the UC recommends that NOAO strike the right balance between basic functionality such as “find all objects passing a selection within a given radius in RA/DEC” and the ability to export the results of selections versus more complex functionality such as being able to perform detailed analyses that might be better done outside of the Data Lab environment with an exported catalog.

The Data Lab team recognizes that it needs to provide basic functionality, with the standard set by SDSS SkyServer, as its highest priority. This recommendation is in keeping with those delivered by our external Data Lab Review Panel. For the initial public release (June 2017), we will provide a searchable and browsable database of catalogs, web-based and programmatic database query interfaces, multiple query result storage options, an image cutout service, and documentation—all introduced through a clean web “storefront”. The more advanced features, such as coordination of compute jobs and performing detailed analysis, will be provided after the first public release.

Recommendation 2: The UC recommends that NOAO investigate ways to advertise the capabilities broadly to the community once the Data Lab’s systems and services are stable (i.e., it is important that users’ first experience with the Data Lab be positive). The demonstrations at AAS meetings are a good beginning. Additional outreach could include summer school programs targeting graduate students (and postdocs), a redesigned REU program, and/or sending NOAO staff to other institutions for “community days” to demonstrate the Data Lab systems and services and to provide hands on assistance.

In addition to the demonstrations at AAS meetings, the Data Lab team has participated in or is planning a number of additional sessions to advertise Data Lab capabilities, including:

- *Presentation and hack session at “Detecting the Unexpected: Discovery in Astronomically Big Data” @ STScI, Mar 1 2017*
- *Participation by staff using Data Lab tools and concepts in two of the LSSTC-sponsored Big Data Science Cafe presentations, an outreach activity aimed at local high school students, Tucson, Feb 18 & Apr 1 2017*



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- *Presentation and hack session at the LSSTC-sponsored LSST Data Science Fellowship program, Tucson, April 28 2017*
- *Data Lab Tutorial for local participants, Tucson, May 8 2017, 27 registered participants*
- *Presentation and hack session at “Building the Infrastructure for Time-Domain Alert Science in the LSST Era”, Tucson, May 23 2017*
- *Hack session at DESI Collaboration Meeting, LBNL, June 23 2017*

The Data Lab also has an official Twitter account (@NOAODataLab) through which it broadcasts news and commentary on data-related posts.

We agree that the additional outreach activities proposed by the UC are also good ideas. CSDC has requested funding to support such activity in NOAO’s Supplemental Funding Request to the NSF.

Recommendation 3: The UC recommends that the Data Lab provides mechanisms to host community developed software and tools (scripts) and user designed queries. The Data Lab should consider a way to store user queries linked to specific publications (linking queries and software to publications that use the Data Lab).

The Data Lab team agrees that the recommendation is a good one, but does not have the resources to consider it for the initial public release. We will consider how such features might be implemented during the next stage of development.

Recommendation 4: The UC recommends the Data Lab consider tools for identifying moving objects in the data.

The Data Lab team is considering deploying such tools in coordination with the DECam NEO Survey, a catalog for which is now available in the Data Lab database. NOAO also plans to explore DECam adaptation of automated moving-object detection pipelines developed for WIYN-ODI. While specific tools will not be available for the initial public release, we will continue to develop support for moving object science cases.

7. ANTARES

Please comment on current plans for the NOAO ANTARES prototype Event Broker, with a particular emphasis on desired user capabilities (both basic and advanced) to be deployed in a full-scale version.

Recommendation 1: The UC recommends establishing a set of real test data to determine efficiency and contamination of the alert system and to track the progress of the system.



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The ANTARES project has incorporated test data from two surveys (NOAO bulge and M31 from iPTF). We will expand this as we go forward to have a data set to act as a testing metric.

Recommendation 2: The UC encourages the ANTARES team to connect ANTARES to one of the public surveys in order to involve the community and battletest the system. It will also help to determine what features the users want to have.

With appropriate resources, ANTARES will ingest and broker public alert streams for community users. This includes CRTS, GAIA, and the public portion of ZTF. Supplemental funding for this effort has been requested from the NSF.

Recommendation 3: The UC encourages the development of a front end for ANTARES that has some ‘standard streams’, e.g. to identify SNe, RR Lyrae, etc, but also has the option for the (advanced) user to define his/her own event stream.

We plan for ANTARES to identify major classes of objects for user consumption. Our level of support for user-defined filters will depend on resources available to provide assistance to users to build such filters, and resource available to ANTARES during operations to support filtering beyond basic levels.

8. SOAR

Please comment on the current level of usage and scientific productivity of the NOAO share of SOAR. Suggestions about “quick wins” to improve scientific productivity would be particularly welcome as would comments on preliminary plans to position SOAR as a key LSST follow-up machine in the era of LSST operations.

Recommendation 1: In order to identify what further obstacles might be limiting scientific productivity at SOAR, NOAO should finish the survey of the user community.

NOAO feels this is a lower priority activity at this point in time.

Recommendation 2: We encourage NOAO to continue to improve the efficiency of observing at SOAR and to think about developing a queue observing capability.

The performance at SOAR has improved markedly over the last year. Queue observing is being assessed currently in terms of an LSST Follow Up capability.

Recommendation 3: We encourage NOAO to continue to develop a science driven strategic plan and a concrete definition of SOAR’s role in LSST follow-up including thinking about how it might operate in a potential network of follow-up telescopes.

SOAR is central to NOAO’s plans for a follow up system for LSST. See response 1.2 above.



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9. Exploiting Gemini

Please comment on how US observers can best exploit the Gemini telescopes. The Committee should comment on how current processes and capabilities can be improved to enhance the user experience, increase the publication rate, and/or maximize science return on investment.

Recommendation 1: One of the keys to producing the highest quality science is good calibration, therefore getting standard stars on different nights from the science observations is not optimal. The NGO should work with the Gemini staff to improve this situation.

NGO staff continue to advocate for science-enabling calibration practices within the context of the Gemini Operations Working Group. Calibration policies and procedures are ultimately determined by Gemini Observatory and are beyond NOAO/NGO control. NOAO anticipates further progress in this area in conjunction with a recently initiated effort to define fully supported observing modes for time-critical LSST follow-up observing, in collaboration with Gemini staff.

Recommendation 2: In order to significantly improve the efficiency of observing and publishing Gemini data, the UC recommends that Gemini implement a level 1 pipeline processing for imaging and simple longslit 2D spectral data (bias subtraction, flatfielding, gain correction, combine chips into a single image, WCS for imaging and wavelength solution for spectra).

NOAO agrees these would be good capabilities to have. Gemini ultimately sets its own priorities for development; however, NOAO is discussing follow up capability with Gemini and data reduction is part of that discussion.

10. Gemini Programs

The committee should comment on relevant merits of individual Gemini programs, fast turnaround queue, and Large Long Programs (LLP).

Recommendation 1 The UC recommends that Gemini investigate whether more time should be allocated to the LLP programs, perhaps by polling the user community. The UC notes that once the oversubscription in the whole individual program gets above around 3, that PIs start to get unhappy with telescope access. The Gemini PI program is one of the cornerstones of the US community.

The balance between survey and PI programs is an important issue for all telescopes on which NOAO currently allocates time, with implications for both proposal-team science productivity and for the development of datasets with high archival science value. NOAO is planning to



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release a request for community input on this topic later in FY2017. This survey is motivated largely by the coming end of the Dark Energy Survey and the anticipated availability of larger community allocations with DECam. This same survey can also solicit community input on the balance of Gemini time between regular and LLP programs.

11. Gemini Next generation instrument

The Gemini next generation instrument RfP will be out by the time of the 2016 UC meeting. The committee should comment on the capabilities represented in the RfP and how they would be prioritized to best exploit new science on Gemini (with an eye to the LSST era).

Recommendation 1: The committee recommends that Gemini investigate the possibility of equipping both Gemini telescopes with the Gen4#3 instrument.

The RfP was for a single copy. The award is in negotiation at the time of this writing.

Recommendation 2: The wide wavelength coverage of the Gen4#3 is good, but the we would also like to encourage Gemini to consider choosing a proposal that offers multi-object spectroscopic capability.

Gemini is in contract negotiations with the winning team. NOAO does not know what features are in the winning design.

12. Other Issues

Recommendation 1 Consider having a presence at the Division for Planetary Science meeting being held in Pasadena from October 16-21 2016.

NOAO cannot afford to support another meeting; however, the AD for Kitt Peak did attend this meeting in order to represent NOAO amongst the planetary community.