

DIRECTOR'S OFFICE

NATIONAL OPTICAL ASTRONOMY OBSERVATORY

Creating a Decadal Survey Roadmap

Jeremy Mould

When *Astronomy & Astrophysics in the New Millennium* was written four years ago, it described a vision for the future, complemented by some quite detailed concepts and illustrations of new facilities. However, the Decadal Survey report was careful not to be prescriptive about how its goals should be achieved, although the committee spoke strongly to the national observatory to lead the ground-based optical/infrared project of largest scale, or get out of the way.

For the Giant Segmented Mirror Telescope (GSMT) and Large Synoptic Survey Telescope (LSST), the landscape now features multiple design concepts. The National Virtual Observatory is advancing in its architecture and broadening its grid plans internationally. The Telescope System Instrumentation Program (TSIP) was really the only Decadal Survey program that came ready to implement. ("Just add water.") The National Science Foundation (NSF) added the "water," and we are now in the third cycle of TSIP. The community enjoys access to Keck and other telescopes, and a new generation of instruments in the underbudgeted 10-meter telescope generation is under construction.

With the decade advancing, it is time to think about a proper roadmap for GSMT and LSST, one that links the telescope concepts we have been developing for the last few years. As we heard at the NSF Town Meeting at the January AAS meeting in Atlanta, the GSMT roadmap needs to look out beyond end of the decade. The figure shows how the four processes of TSIP, the Adaptive Optics Development Program (see article on page 9), the NIO (see article on page 11), and SMARTS work together to prepare the road for GSMT.

Currently, both a Thirty Meter Telescope (TMT) and a Giant Magellan Telescope (GMT) are entering a design and development phase. As the GSMT Science Working Group opined last June, there is a sound case for supporting the technology development for both of these concepts in a coordinated way:

- The broad front on which adaptive optics is advancing needs multiple approaches
- Like lightning, we cannot predict where the unique US astronomy community asset—private funding—will

strike next. Since university faculties yearn for telescope shares of the order of 20 percent, placing more than one design project on the roadmap maximizes our chances

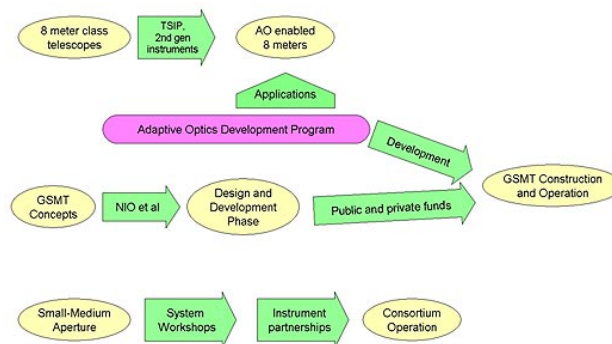
- We need to establish constructive links with Europe. An ALMA-like collaboration will surely be considered by the next Decadal Survey

In merging NOAO's 30-meter telescope concept with CELT's and ACURA's last year, AURA acted to simplify the roadmap. Redundant duplication was removed. As we develop a clear roadmap, more phasing and merging will be needed. But I concur with the view expressed in a recent *New York Times* article on GSMT that "all options are open." The healthiest atmosphere is one in which both TMT and GMT support each other to realize their goals, and in which new concepts, such as an Antarctic Extremely Large Telescope, continue to come forward.

The roadmap for the Decadal Survey's revolutionary survey telescope concept looks a bit different. Thanks to the initiative of the Institute for Astronomy, we have a funded prototype telescope (PanSTARRS) capable of delivering a significant fraction of the planned survey science. Other precursor experiments are already productive, such as QUEST and ESSENCE. The funding agencies are lining up to support this science. Perhaps this should not surprise us after the success of the push on cosmology in the last decade, which, in finding elegant astronomical solutions, asked new fundamental physics questions.

Other important landmarks on an LSST roadmap are the One Degree Imager (ODI) for WIYN and the Joint Dark Energy Mission, the spacecraft formerly known as SNAP. For the LSST roadmap, the key questions to answer along the way concern the single versus multiple aperture question, and the science drivers for LSST in 2011, building on the work of precursor facilities. Work on the second question is under way with the community's LSST Science Working Group. Their soon-to-be published LSST Design Reference Mission sets a high bar for whatever large AO design is chosen, when a construction decision is needed (possibly as early as 2006).

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Creating a Decadal Survey Roadmap continued

A dimension missing from this roadmap is the challenge of interfacing the new digital sky to an astronomy community that has established concepts of the tools with which it wishes to analyze the data. Which agency will support this challenge? We should expect the NSF to play a significant role, as a pioneer in academic information technology research and developer of high-performance computing facilities for the research community.

Let's give some serious thought to roadmaps for LSST and GSMT in the context of the Science Working Groups' discussions during 2004. And we should not forget, that, as we roll out roadmaps for future years, we need to roll up the roadmap that got us to where we are. We need innovative plans to make productive use of the facilities that used to be the frontline. A good example is provided by the SMARTS Consortium, whose first year review can now be read on the CTIO Web site.

In 2004, NOAO wants to engage the community in a strategic planning process focused on our prime responsibility, optical/infrared ground-based facilities. A Second Workshop on the Ground-Based O/IR System, aimed at achieving a better understanding of the current state of the system and near-term options, is planned for May 13–14 in the Washington, DC, area; look for details on the NOAO Web site. Meeting in January at CTIO, AURA's Observatories Council backed the idea that this should be supplemented with a longer-term strategic planning activity, and we are now discussing the approach with other community advisory committees.

We need a roadmap that has wide acceptance, good options, and timely decisions, and one which ensures, in the provocative words of the Decadal Survey, that GSMT construction "starts before the end of the decade."

Adaptive Optics Development Program—First Technology Development Awards and Second Roadmap Workshop

Steve Ridgway & Steve Strom

In 2000, the Decadal Survey panel on Optical and Infrared Astronomy from the Ground recommended that an adaptive optics (AO) technology effort should be supported by funding on the order of \$5 million per year throughout the decade. This work was understood to be an essential element of a larger program to develop an Extremely Large Telescope (ELT), and promised significant benefits for the scientific capability of existing large telescopes as well.

Early that same year, NOAO and the Center for Adaptive Optics sponsored a community workshop to prepare an Adaptive Optics Roadmap directed toward fulfilling this recommendation. The roadmap set out in detail the ELT and large telescope science requirements for AO and the committee's vision for a calendar of technology and facility development. With feedback from the National Science Foundation (NSF), strong community support and endorsements, and further iteration with the Roadmap Committee, additional details of technology requirements and priorities were added, and the plan was published in July 2000 (see www.noao.edu/dir/ao).

The NSF was able to allocate funding to the Adaptive Optics Development Program (AODP) last year, and in the June 2003 *NOAO Newsletter*, we announced the first AODP

funding opportunity at an initial level of \$2.9 million. Seventeen proposals were received and peer reviewed by a community-based panel. Six proposals were recommended for funding, in areas of laser technology, deformable mirrors, detectors, and algorithms. Information about the funded proposals can be found at www.noao.edu/system/aodp.

The AODP program will continue in 2004 and subsequent years with an expectation of increasing the funding toward levels envisioned by the Decadal Survey and the Roadmap Committee. Preparatory to the development of the 2004 Call for Proposals, the AODP will host a one-day workshop in Tucson on April 26 to review recent and ongoing developments in AO science opportunities, requirements, and technology. Participants in this workshop will include the AODP 2004 Roadmap Panel, who will benefit from input and advice from invited speakers as a current context for preparing an update of the roadmap. A program of contributed papers is not planned, but the workshop will be open to the public on a space-available basis and there will be time for open discussion. When the agenda and venue are available, they will be posted at the AODP Web site.



LSST: A Progress Report

Sidney Wolff

First light in the winter of 2011–2012—that ambitious goal for the Large Synoptic Survey Telescope (LSST) project can be achieved, provided that cash flow is not the pacing item.

Design and Development

The Design and Development (D&D) phase of the LSST project will occur over the next three years, and it will produce a fully costed proposal for the completion of the final design and construction of the 8.4-meter survey telescope. The D&D phase will culminate in preliminary design reviews for most components of the telescope and associated facilities, the camera, and the data management system.

The telescope and facility will be challenging to build, given the very fast focal ratio, tight alignment tolerances, the requirement for managing three active mirrors, and the need to maintain system stability while minimizing downtime. Even more challenging are the 2.3-gigapixel focal plane array camera and the data management system. During the D&D phase, we will evaluate both CCD and CMOS imaging devices. The data management system must process and store more than six terapixels per night, a data rate and volume unprecedented in astronomy. A sampling of high-energy physics and astronomy experiments shows that although no single past experiment has simultaneously managed the LSST data flow, analysis rate, database capability, and real-time requirements, all of the LSST requirements have been met individually within different experiments. We expect to draw heavily on the experience of these other data intensive projects, and participants in several of them are already contributing to the LSST.

The LSST project is being carried out by the LSST Corporation, under the leadership of John Schaefer (Research Corporation), President; Tony Tyson (Lucent and the University of California at Davis), Director; and Don Sweeney (Lawrence Livermore National Laboratory), Project Manager. The founding members of the corporation are Research Corporation, the University of Arizona, the University of Washington, and NOAO. We expect to add more members as the project proceeds. NOAO's representatives to the LSST Board are Jeremy Mould and Sidney Wolff.

The LSST Corporation has recently submitted a proposal to the National Science Foundation for funding that would supply approximately half the cost of the D&D phase of the project.

We have pledges of support for the other half of the costs and the human effort needed from 13 different institutions.

Research Corporation and a private donor have made a major financial pledge that will allow the purchase of long-lead-time items, such as glass for the large telescope optics. Steve Kahn will head the effort to design the camera and focal plane, and contributors to this effort include the Kavli Institute of Particle Astrophysics and Cosmology, the Stanford Linear Accelerator Center, and Brookhaven National Laboratory.

Lawrence Livermore National Laboratory is contributing to several different aspects of the project, including project management and data management. Other pledges of assistance in data management have come from the National Center for Supercomputer Applications at the University of Illinois, Microsoft, and Google.

Contributions to scientific planning, oversight, and technical developments will come from Lucent, the University of California at Davis, the Universities of Washington and Illinois, and NOAO. The lead on optics fabrication, testing, and support will come from the University of Arizona. NOAO will take the lead on the telescope, enclosure, and systems engineering for the facility.

In order to maintain its aggressive schedule, the project will have to achieve several significant milestones while the proposal is under review. By October 2004:

- The optical design must be frozen
- The science requirements, functional requirements, and interface requirements documents must all be complete
- The choice of sites must be narrowed to a primary and an alternate
- Glass for the primary mirror must be ordered

The LSST Science Working Group

Major input to the science requirements will be provided by the LSST Science Working Group (SWG), chaired by Michael Strauss (Princeton University). The SWG report should be available shortly. It is already clear that two of the major science goals of a facility with the power of the LSST will be characterization of dark matter and dark energy through measurement of weak lensing over a large area of the sky, and the search for near-Earth asteroids and other small bodies in the solar system.

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LSST: A Progress Report continued

As part of the input for the proposal for the design and development phase, Abi Saha of NOAO developed a simulator that made it possible to assess whether the LSST could achieve the scientific goals of both programs with a single observing protocol and in a finite period of time. His simulations show that the goals of the weak lensing program can be achieved in 10 years if and only if the product of telescope aperture (A) and field of view ($FOV=\Omega$) are approximately equal to 260. This product is achieved by the design that we are currently exploring: an 8.4-meter aperture with a field of view stretching 3 degrees in diameter.

Simulations of the asteroid discovery rate given the same observations as used for the weak lensing program, but with the cadence optimized for discovery of nearby solar system objects, indicate that we can discover approximately 80 percent of the potentially hazardous asteroids down to 140 meters in diameter in the same period of time, with even greater completeness for larger sizes. A goal of discovering asteroids as small as this size was recently recommended in a report prepared at the request of NASA's Office of Space Science.

Alternate Design

In parallel with LSST Corporation's work on the design of

a large-aperture telescope to provide $A\Omega=260$, the Institute for Astronomy at the University of Hawaii is building a prototype facility, called PanSTARRS, based on multiple small-aperture telescopes. A scaled-up version of this facility with approximately 22 telescopes would provide the required $A\Omega$ of 260. Parallel design studies over the next three years should allow a clean choice between the two options.

There are two major issues that will determine the choice. How important is it to optimize the discovery of very faint, rapidly moving objects and short-term transients? And, is it cheaper in the long run to build and operate a single telescope, albeit one that is unique in design and with very large optics, or to clone multiple small telescopes and provide each with a gigapixel camera? Apart from the telescope(s) and enclosure(s), the technical problems faced by the two approaches in terms of building the cameras, obtaining the focal plane arrays, and managing the data are very similar, and each project should benefit from the planning and design work of the other.

More Information

The LSST Corporation will soon have a Web site that will consolidate all of the information about the project and provide up-to-date information about progress. The new site can be found through links from NOAO or directly at www.lsst.org.

A Progress Report from AURA's New Initiatives Office

Steve Strom

The AURA New Initiatives Office (NIO) was formed in 2001 to respond to the Decadal Survey's highest priority ground-based initiative: designing a 30-meter-class Giant Segmented Mirror Telescope (GSMT) in this decade to ensure its availability to the US community early in the James Webb Space Telescope (JWST) era. By drawing on both NOAO and Gemini staff, the NIO has made significant progress toward advancing this ambitious goal by

- initiating studies of the scientific potential and performance requirements for a GSMT through a series of community workshops;
- organizing and supporting a community-based GSMT Science Working Group (SWG)
- developing a "point design" for a 30-meter GSMT and using it to identify key technical challenges, needed technology investments, and to develop initial assessments of cost and risk;
- exploring public-private partnerships to design and build a GSMT, and providing a channel for a strong public voice during all phases of such partnership efforts;

- preparing a proposal to the National Science Foundation (NSF) aimed at supporting technology developments (e.g., detectors, adaptive optics components, high-performance durable coatings, and site evaluation) critical to multiple Extremely Large Telescope (ELT) programs.

Developing Representative Science Cases for a GSMT

Three major workshops involving more than 80 scientists from throughout the United States and Canada examined a wide range of fundamental science problems that would be enabled by a large next-generation telescope capable of delivering diffraction-limited images at wavelengths 1 micron and beyond. Problems in three areas (development of large-scale structure; the formation and evolution of galaxies; and the formation and early evolution of stars and planetary systems) were selected for more detailed study, and were used to develop an initial suite of performance requirements for such a telescope. The results of these community-based studies and the derived telescope system requirements are captured in the "GSMT Book" (see www.aura-nio.noao.edu).

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New Initiatives Office continued

Supporting the GSMT Science Working Group

The GSMT SWG, chaired by Rolf Kudritzki, Director of the Institute for Astronomy at the University of Hawaii, was authorized by the NSF in 2002 and charged with developing a powerful science case to justify the investment needed to develop a GSMT and to provide advice regarding early investments needed to advance ELT programs. The committee membership is broadly representative of community interests (see www.aura-nio.noao.edu/gsmg/index.html). Following a year's study and deliberation, the SWG issued its initial report in July 2003. The SWG concluded that a 20- to 30-meter-class ELT would enable fundamental advances in five key areas:

- Tomography of the Intergalactic Medium (IGM) at $z > 3$ via high-resolution spectra of IGM absorption lines observed against the continua of background galaxies and quasars, and direct at developing a three-dimensional map of the distribution of high-redshift gas and its chemical composition
- Direct observation of the galaxy assembly process via integral field unit spectroscopy of pre-galactic fragments aimed at determining gas and stellar kinematics, and quantifying star-forming activity and chemical compositions
- Direct observation of the constituent stellar populations of galaxies via diffraction-limited imaging and spectroscopy aimed at identifying cohort populations of common ages and chemical abundances—the archaeological record of merger events
- Observations of emission arising from gaseous disks surrounding young stellar objects via high-resolution mid-infrared spectroscopy with the goal of learning where and when giant planets form and what planetary system architectures are common
- Direct observations of large numbers of extrasolar planets via coronagraphic imaging and spectroscopy, enabling characterization of their atmospheric structure and composition and a link to the epoch of formation

The SWG also evaluated the technology developments needed to advance multiple ELT programs and urged (1) immediate federal investment in key technology areas common to these programs so that preliminary designs can be completed during the next several years; (2) that federal dollars invested in ELT technology development result in community access on resulting ELTs; and (3) that the community be involved via the SWG and other mechanisms

throughout all phases of ELT programs. The SWG report “Frontier Science Enabled by a Giant Segmented Mirror Telescope” was presented both to the NSF (July 2003) and to the Committee on Astronomy and Astrophysics (December 2003—see www.aura-nio.noao.edu/gsmg/swg/SWG_Report/SWG_Report_7.2.03.pdf).

Forging a Partnership with ACURA, Caltech, and the University of California

The Decadal Survey noted that rapid development of a 30-meter GSMT would be best accomplished via a public-private partnership that engages the skills and imaginations of scientists and engineers from private institutions and the US national observatory, and that combines funds from federal and nonfederal sources. In December 2002, AURA decided to partner with Caltech and the University of California in the Design and Development Phase for a GSMT. In June 2003, Caltech, the University of California, AURA, and its Canadian counterpart, ACURA, signed Letters of Intent aimed at advancing a Thirty Meter Telescope (TMT) to a formal, costed Preliminary Design.

The Design and Development Phase envisioned by the partners builds on more than eight years of intensive technical study of three point designs (CELT, VLOT, GSMT). Core technical teams are in place and are prepared to move forward rapidly with a goal of completing a Preliminary Design by the end of 2007.

To reach this point will require an investment of \$70 million. Of these funds, \$35 million are already available in the form of private funds provided by the Moore Foundation to Caltech and the University of California. ACURA has requested funds for its share to the Canadian Fund for Innovation, while AURA has submitted a proposal to the NSF.

AURA's roles are (1) to provide a strong public voice—through the GSMT SWG and through NOAO—in shaping the design of the telescope; (2) to provide funds aimed at developing or evaluating technologies that are critical not only for advancing the TMT design, but to other ELT programs; and (3) to contribute manpower to the joint Design and Development Phase activities. By agreement with the partners, federal dollars invested in TMT will result in public access in the resulting telescope.

Though partnered with TMT, AURA's NIO continues to work closely with other ELT programs by providing both direct support for site evaluation activities, and indirect

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New Initiatives Office continued

support through open sharing of key studies (e.g., the effects of wind buffeting on large telescopes) and design tools (e.g., integrated modeling). Our goals remain to ensure public access to one or more ELTs and to advance ELT designs rapidly so that the US community can be certain of having access to a next-generation telescope early in the JWST era.

AURA's Proposal to the National Science Foundation

AURA has submitted a proposal to the NSF aimed at technology areas identified by the GSMT SWG as essential to multiple ELT programs (detectors, gratings, and specialized AO components), and at supporting a site evaluation program aimed at providing common data for a range of sites in North and South America. We are currently working with the GSMT SWG and ACCORD to reach agreement on an implementation plan that would ensure the following outcomes in return for federal investment:

- Provide community feedback during the design phase for ELTs
- Ensure public access to a resulting ELT
- Provide open access to the results emerging from technology development programs
- Provide open competition for key technologies in order to engage the best minds from throughout the US and international community

Community Interaction with the NIO

AURA is committed to providing multiple channels for community input as the design efforts for TMT and other ELT programs proceed—via the GSMT SWG, through workshops that NOAO plans to organize over the next several years, and via direct interaction with NIO staff. Progress reports for ELT programs will be posted periodically on the GSMT SWG Web site. We very much welcome community commentary regarding the direction of ELT programs and the capabilities they plan to provide; such commentary should be addressed to me (ssstrom@noao.edu) and to Rolf Kudritzki (kud@ifa.hawaii.edu), so that we can provide a forum for views that should be discussed by the SWG, and via the SWG, with ELT groups.

Scientists involved with the NIO (Steve Strom, Joan Najita, Bob Blum, Knut Olsen, and Ron Probst) are also prepared to visit institutions throughout the United States to discuss the status of TMT and other ELT programs, and to solicit input. Please contact ssstrom@noao.edu to arrange for a presentation.

NOAO Helps Rebuild Mount Stromlo's Library

Jessica Bryant

In January 2003, Australia's Mount Stromlo Observatory suffered devastating losses due to fire. The summer bush fires that ravaged nearby Canberra also decimated most of the Observatory's facilities. Workshops, houses, a spectrograph intended for Gemini North, and all five of Mount Stromlo's telescopes were destroyed. The research library, which was housed in the fire-gutted administrative building, was among the heavy losses.

As news of the destruction spread, librarians around the world began expressing the desire to help Mount Stromlo rebuild its library. Messages peppered the listserv of the Physics, Astronomy, and Mathematics Division of the Special Library Association. By the end of January, the American

Astronomical Society (AAS) had stepped in and volunteered to organize the donations of materials from the United States.

The first goal of the AAS was to assemble a master inventory list of donation offers. While Ed Anderson, a volunteer working with the AAS, took on that heady part of the project, NOAO geared up to assist. NOAO applied for and received a National Science Foundation grant to cover some of the project's inevitable shipping costs. And, after working internally to find storage space, NOAO found it could offer itself as the central receiving point. This meant that all of the donations would be sent to NOAO, where they would be stored until ready to ship to Australia in one bulk shipment. (Given that we weren't

sure how much material was really at hand, this was quite a commitment!)

Kevin Marvel at the AAS worked to confirm what materials Mount Stromlo wanted and, after some delay in sorting out what would be needed (monographs) versus what would not be needed (most journals), the call came across for donors to send items to NOAO. At first, the boxes trickled in rather slowly...one or two at a time, mostly from personal donors who had found a few items to spare. Then, some of the libraries that had offered to send multiple copies of monographs in their collection started shipping multiple packages. Boxes began piling up and the process was underway!

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Mount Stromlo's Library continued

The collection process continued here for four months. Some days, the packages were overwhelming—like the day we received a 1,300-pound shipment from a private donor in Washington state (who had, we assumed, generously cleaned out his personal library). Luckily, NOAO found the space to store over 3,000 pounds of books, although it

did require a bit of shuffling around (as our initial storage space filled, we found we had to expand into a sort of storage annex). In the end, NOAO shipped six large packages to Canberra, Australia. Five of the packages were sized 41×29×25 inches and the sixth stood at 55×27×60 inches. The total shipping weight was a whopping 3,271 pounds—clearly a lot of books!

NOAO bids a fond adieu to the books as they travel to their new home, and we are happy to have played a role in helping Mount Stromlo rebuild. Thank you to all of the donors, volunteers, and, in particular, the AAS for making this worthwhile project happen. We wish Mount Stromlo all the best in their reconstruction.

Postdoc Experience at NOAO South: Rewards and Extra Challenges

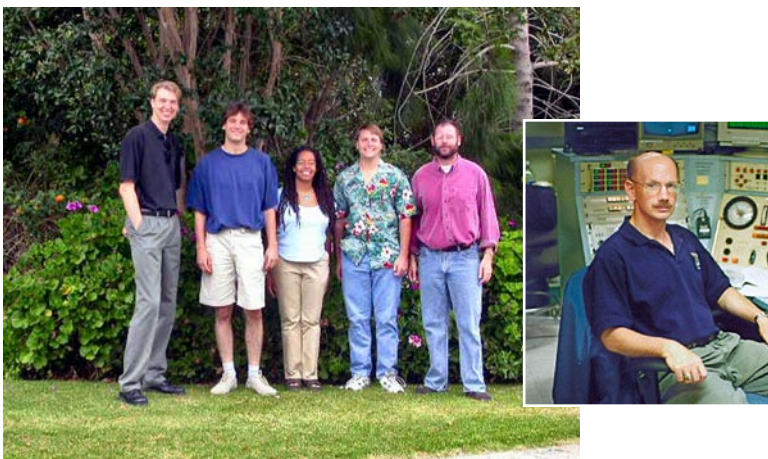
Douglas Isbell

Part Two of a Two-Part Series

NOAO South postdocs seem to face many of the same challenges and rewards as their counterparts in the north, accentuated by a few geographical and cultural differences.

The relatively small size of the scientific staff at NOAO South (15 people) means “it is very easy to get involved with existing projects,” said Dara Norman, who received her PhD from the University of Washington. Norman is a National Science Foundation Astronomy and Astrophysics Postdoctoral Fellow (AAPF) in her third year at NOAO South working with the Deep Lens Survey Team and ISPI instrument support. “However,” she added, “if you want these opportunities, like at many places, you have to seek them out.”

Being a postdoc anywhere with an active science program can lead to a very busy schedule during peak times. From his previous work with the SuperMacho and ESSENCE survey teams, Armin Rest knew that the pace of the work could be demanding. “During our three-month observing run last fall, there were some days of nothing but working, eating, and sleeping, since rapid time domain follow-up observations are demanded by these surveys.” Now “more routine software tools are in place,” and “it should be easier” during the next observing run this fall, said Rest, who received his PhD from the University of Washington.



NOAO South postdocs, from left to right: James de Buizer, Armin Rest, Dara Norman, Marcel Bergmann, Sean Points, and Alan Whiting.

Postdoc Alan Whiting encourages new postdocs looking into a position at NOAO South to consider whether their research interests “can attach to something that is already being done down here [because] it can be a bit lonely if it doesn’t.” Though in some cases, opportunities arise in surprising places—postdoc Sean Points, who received his PhD from the University of Illinois at Urbana-Campaign and was a Postdoctoral Research Fellow for two years at Northwestern University before taking the position at NOAO South, said he was recently asked to join a collaboration with NOAO

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Postdoc Experience at NOAO South continued

Director Jeremy Mould, as a result of his work with Chris Smith on the Magellanic Cloud Emission-Line Survey.

The nature of the national observatory, with outside astronomers visiting often for observing runs or meetings, lends itself to meeting new colleagues, the postdocs have found. "I've been pleasantly surprised with the amount of contact with outside astronomers," said Norman.

Most of the six postdocs at NOAO South have more than two-thirds of their time to dedicate toward their own research, with the remaining fraction to be used on service duties. These duties are varied, and in some cases the postdocs have found themselves working on projects they hadn't anticipated when they started the job.

Whiting—who received his PhD from the University of Cambridge, toured with the US Navy, and taught for the US Naval Academy before coming to NOAO South—voluntarily coordinates the Research Experiences for Undergraduates program at Cerro Tololo, and serves as the science interface with the SMARTS consortium, which now operates the small telescopes at the observatory. "SMARTS has got me into things that I had not expected," such as technical discussions in Spanish with the CTIO engineering staff, said Whiting.

NOAO staff compete for telescope time in the same general pool as all US observers. This can make it challenging for NOAO postdocs to get time on "their own" telescopes for their research. Nonetheless, many of the NOAO South postdocs have been awarded time on the national telescopes, and the quality of these observing experiences seems quite high. Gemini South and the new SOAR telescope provide additional observing opportunities. NOAO Gemini Science Center postdoc Marcel Bergmann, who received his PhD from the University of Texas at Austin, said that the amount of Gemini science time available in the formal Time Allocation Committee process is growing as new instruments arrive and finish their commissioning. "I have gotten time with GMOS on Gemini, and I am very happy with the data," said Bergmann, who is using the data to study the evolution of the Fundamental Plane scaling relationship in cluster galaxies out to high redshifts.

Norman said she has benefited from the proximity of Gemini South astronomers. "I am collaborating with staff at Gemini South, which has helped me to write better proposals, one of which has been accepted for GMOS IFU

science instrument verification time. These collaborations are both rewarding and a good path to obtaining new research data."

In addition, the presence of the new Gemini South headquarters building next to the NOAO South building is encouraging more interaction between Gemini and CTIO staff, the postdocs said, especially with the weekly scientific colloquium being hosted there.

The comforts of day-to-day living in La Serena have improved noticeably in recent years. "Today, if there is something you *need*, it is here," Whiting said. "If you *want* something, you may have to go to Santiago, a five-hour drive or an hour flight." Tofu has recently become available and although the value of the dollar has dropped lately, it is still not low enough to make detailed tracking of grocery store purchases a worthwhile endeavor. Chilean wine retains its world-renowned appeal and there are several nightclubs around town that feature, salsa, cumbia, and jazz music. Staff participate in weekly basketball and soccer games with local Chilean players as well as the occasional Ultimate Frisbee game on the beach.

CTIO will pay for Spanish lessons once you arrive in Chile, but going down there with some advance knowledge is very helpful. "Chileans are very patient, and they definitely appreciate it when you try" to speak the language, Rest says. The postdocs suggested that NOAO South consider a more formal program or staff coordinator for new arrivals to get past the "word of mouth" that reigns in figuring out the local environment.

However, the Chilean culture outside of NOAO remains challenging for women. "It is the case that, as a woman, some people will overlook you and talk instead to a man that you might be with, and there is the 'hooting and hollering' on the beach," Norman says. "It can be frustrating."

Overall, the cultural experience and the work involved in being a postdoc at NOAO South seems to combine to make it a rewarding personal and professional passage.

"Of course Chilean culture isn't identical to American or German culture but that's part of the great experience of living in a foreign country, as long as you stay open-minded," Rest said.

Note: NOAO South postdoc James de Buizer, who is on loan to Gemini South, was unable to participate in this interview.



Richard Joseph Elston (1 July 1960 – 26 January 2004)

Richard J. Elston, beloved husband of Elizabeth Lada Elston and well-loved father of Joseph Lada Elston, died January 26 in Gainesville, Florida.

All of NOAO joins his family and friends in celebrating the warmth, humor, and optimism that Richard always shared so selflessly. Richard married Elizabeth in 1996. Their son Joseph, born in 1999, remembers Richard as a wonderful father who shared with him his love of life and nature. NOAO remembers him as a talented, productive, and supportive colleague as he served NOAO and the general community during his tenure as a Kitt Peak postdoctoral fellow (1988–1991), Cerro Tololo scientific staff member (1992–1996), productive user of our facilities, and member of numerous NOAO review and advisory panels.

A scientist with unusually broad interests and knowledge, Richard was well known for his development of innovative astronomical instrumentation and observational techniques. He played a leading or major role in the design, construction, and commissioning of landmark astronomical instruments that have been used by himself and hundreds of other astronomers at observatories around the world. These observatories include KPNO, CTIO, the Smithsonian Institution and University of Arizona's MMT Observatory, and Gemini South. In over 100 publications, Richard used the technological advances he had fostered to make significant contributions to the study of the formation and evolution of galaxies and the Universe.

His most recently completed instrument was the FLoridA Multi-object Imaging Near-IR Grism Observational Spectrometer (FLAMINGOS) instrument, funded by the National Science Foundation and supported by the University of Florida. Designed and constructed by Professor Elston and a talented team of coworkers at the University of Florida, FLAMINGOS serves as both a wide-field infrared imager (20 arcmin diameter field of view when used at the Kitt Peak 2.1-meter telescope) and multi-object spectrograph.



Successfully used at the MMT, Gemini South, and KPNO's 2.1-meter and Mayall 4-meter telescopes, FLAMINGOS allows scientists to perform in one night infrared spectroscopy observations that would previously have required a hundred nights. FLAMINGOS is the primary instrument for several NOAO Survey Programs that are

studying topics ranging from how individual stars form to how the largest structures in the Universe evolve. New instruments using the innovations pioneered with FLAMINGOS are under construction to be used at several of the world's largest telescopes.

Astronomer Richard Elston was an expert SCUBA diver, SCUBA instructor, skier, hiker, pilot, and sailor, but he will be best remembered as a wonderful father, beloved husband, loving brother, son, uncle, friend, and inspiration to all whose lives he touched.