

University of Wisconsin Department of Astronomy

SOUTHERN AFRICAN LARGE TELESCOPE
ROBERT STOBIE SPECTROGRAPH
NEAR INFRARED INSTRUMENT

BOARD STATUS REPORT

SUBMITTED
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PROJECT YEAR 7
NOV 2014 – May 2015

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EXECUTIVE SUMMARY

- *Detector, Science Grade (SG) Characterization/Optimization*: The science grade detector has been installed in the instrument Dewar and we have verified that it is functioning. Greg Mosby, UW graduate student, has optimized the detector read noise for faint (16 e-) and bright (20 e-) objects. He has also conducted preliminary optimization of the full well depth and increased the well depth to 120,000 e-, but at the expense of higher read noise. He will be measuring persistence effects as well.
- *Detector, Engineering Grade (EG) Characterization/Optimization*: The engineering grade detector characterization and optimization is complete.
- *Dichroic*: Infinite Optics has completed and delivered the second dichroic. Ken Nordsieck and Marsha Wolf have reviewed the optical performance data and, while it did not meet every specification, it improved upon the first dichroic and was accepted. Specific features reviewed included:
    - *The 40° incidence crossover width specification is 40 nm and the measured value is 83 nm*. The other angles are quite close to meeting the original tight specification of 40 nm from the 10% to the 90% point, and this mirror is certainly much better than the first one.
    - *The "max pol" specification is exceeded by more than 2x for the UV and VIS regions*. This specification was somewhat arbitrary, since no one had listed such a specification before. It was difficult to know what was doable.
    - The flatness is less < 1 wave p-v over the center 100 mm and 4-5 waves p-v at the edges.
- *CO_2 Cooling System:* Mike Smith and Doug Adler are working with a South African vendor to develop an alternative cooling system. They have recently involved Ockert Strydom as a point of contact familiar with the SALT facility. We hope to have a cost estimate soon.
- *Camera Testing:* The camera testing is complete. It will be integrated with the Dewar once the Dewar and science grade (SG) detector testing and optimization is complete.
- *Integration & Testing:* Jeff Percival has been supporting the testing and characterization of the fold mirror tip / tilt mechanism, the startup and recovery initialization, state machine and interlocks, and the command and control of the mechanisms. He has opened a dialogue with Anthony Koeslag to understand how the NIR software will integrate into the current SALT framework.
- *Commissioning:* A more detailed commissioning plan and budget has been reviewed, updated, and submitted to SALT.

De-scoped Systems

Our current schedule has RSS-NIR ready to ship in April 2016. The de-scoped RSS-NIR modes would require about a year to implement into the instrument before delivery. This would be the most efficient path, since some items would require removal of RSS from the telescope to add at a later time. However, there is now no longer time to implement these de-scoped modes in the current delivery schedule. The two items that would require removal of RSS from the telescope are the cooled slit and the cryogenic long wavelength cutoff filters, both of which would allow sky-limited spectroscopy out to wavelengths longer than 1.55 microns. The estimated cost of commissioning the NIR, the de-scoped items, and the Fabry-Perot etalon system are listed in Table 1. The Astronomy Department team member contributions through Washburn Astronomical Laboratories are listed as well.

Budget & Schedule

The NIR financial status is summarized in Table 1. Spending through March 2015 is $8.386M and we estimate the cost to ready the instrument for delivery to South Africa at $713k. The sum of spending and what is required to ready the instrument is $9.037M. The funding available to ready the instrument is $8.826M leaving a deficit of $273k, which is an increase of $41k since the end of the last quarter. The reasons for the growth continue to be the same with one exception. Like last quarter, the growth includes the second and final $15k payment to Infinite Optics for the second dichroic. While not in our budget, we chose to accept Infinite Optic's offer to coat the second substrate for $30k as it provided an opportunity for improved optical performance and an assurance of a spare dichroic. To order one later, would easily be three to four times more costly. The decision appears to have been good as the optical performance of the second dichroic is improved. As before, the project continues to require electrical engineering (detector testing and control system implementation), engineering support of the cooling system design, and project management that was not included in an extremely lean budget to ready the instrument for shipping.

The schedule was updated with the status as of the end of March. The new ready to ship date is April 2016. The critical path is the detail design, fabrication, skin install, and final assembly of the pre-Dewar enclosure. Moving forward with the enclosure is on hold while we work to find a solution to the enclosure cooling system. The CO_2 cooling system bids were far too expensive to implement. We are working with a South African vendor to find another solution. Should that fail to converge, we may have to return to the fluorinert solution presented at the Mid-Term and Critical Design Reviews.

The Dewar development and detector testing continues to make good progress. With the enclosure development stalled, the detector schedule now has ~8 weeks of slack.

Table 1. *The table summarizes the financial state of the RSS-NIR. The left column presents the spending-to-date and budget estimate to get ready-to-ship, commission the instrument, add descoped items, and to add the Fabry-Perot mode (which never has been part of the funded scope). On the right, the source and amount of funding contributions are shown with the funds needed to reach development states or to add scope.*

RSS-NIR SPENDING AND BUDGET SUMMARY

March 2015 (figures in thousands of dollars)

Spending-to-date	$8,386
Budget to get ready to ship	
Apr '14 to Ready-to-Ship	$603
Rescoped Items	
Dewar Cooling System	$20
Pre-dewar Enclosure Cooling System	$90
Sum	$713
Commissioning	
Estimate cost of commissioning	$504
Sum	$504
Descoped Items	
Polarizing Beamsplitter	$138
Cooled Slit Hardware	$54 [1]
Order Blocking Filters (12)	$261
Cryogenic Filters (2)	$56 [1]
Gratings (4)	$250
Sum	$760
Fabry-Perot Etalon	
Fabry-Perot Etalon with controller	$305
Sum	$305

RSS-NIR FUNDING SUMMARY

March 2015 (figures in thousands of dollars)

Sources			
Wisconsin Alumni Research Foundation		$3,300	
National Science Foundation		$1,997	
UW-Astronomy		$2,493	
UW-Astronomy	$1,400		
Washburn Astronomy Laboratories: Ready-to-ship	$768		[2]
Washburn Astronomy Laboratories: Commissioning	$249		[2]
Washburn Astronomy Laboratories: De-scope Items	$54		[2]
Washburn Astronomy Laboratories: F-P Etalon	$23		[2]
SALT		$932	
UW-Space Science & Engineering Center		$429	
Sum of Funding to get Ready to Ship		$8,826	
Total Sum of Funding		$9,152	

Funds Needed to be Ready-to-Ship	$273 [3]
Funds needed through Commissioning (cumulative)	$528
Funds needed to add descoped items (cumulative)	$1,234
Funds needed to include etalon (cumulative)	$1,516 [4]
Balance of $1.4M UW-Astronomy Funds	$140

Notes

1. These de-scope items should be installed before the NIR is installed on the telescope. The instrument will function with reduced capability without them, but it will require that the instrument be removed to install them.
2. Estimated figure based on assumed Astronomy support for project activities. The actual figure may be larger or smaller.
3. This figure includes the Dewar and instrument cooling systems as presented at the Nov '12 Board Meeting.
4. The etalon has never been officially added to the scope of work and therefore has not ever been included in previous budget estimates.