SMALL TELESCOPE COMMITTEE RECOMMENDATIONS

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1. Introduction

In making these recommendations we were guided by the following principles:

- SAAO astronomers should direct most of their research to science which can be done on SALT. Research which requires the use of only the small telescopes is to be discouraged because it directs efforts away from SALT.
- SAAO needs the small telescopes principally to support observations made with SALT.
- The major expense of running a small telescopes are the salaries of the astronomers and observers.
- Usage of small telescopes which do not impose a burden on SAAO resources or provide income to SAAO should be encouraged.

If all four SAAO telescopes are to be manned for 50 percent of the time by SAAO staff, then 720 man days per year are required. Assuming that each astronomer undertakes to observe for two weeks a quarter (a rather heavy burden), it follows that at least 13 astronomers are required. This bit of simple arithmetic shows that to man all four telescopes to the full SAAO allocation will consume all astronomical resources, leaving very little for SALT. It follows that unless the SAAO astronomical staff is greatly increased, some of the telescopes will lie idle for a considerable part of the year. The need to rationalize resources is evident.

The papers presented at the Small Telescope Meeting is the major source of guidance on the recommendations.

2. Telescope Control Upgrade

The 1.9-m telescope is the oldest telescope on site and has undergone several upgrades to its control and pointing system. The present system dates from the late 1970's when the encoders were first installed. The control electronics is very much outdated to the extent that spares are no longer available. For continued operation of the telescope a new control system is essential, and for this reason an initiative to upgrade was begun in 2002. The plan is to use programmed logic controllers (PLC's) to replace the current system and for additional functionality. This upgrade is under way mostly driven by Geoff Evans and Piet Fourie, who will be programming the PLC's.

The 1.0-m telescope is need of a similar upgrade and the system devised for the 1.9-m will also be installed on the 1.0-m.

In conjunction with this upgrade, an upgrade to the XY-slides and autoguiding software is under way. This project is managed by Tom Williams. It consists of the replacement of the XY-slides by a new, more compact, design and the replacement of the DOS-based software by more functional Linux software.

These upgrades are essential for proper functioning of the 1.9- and 1.0-m telescopes and therefore rank as top priority. An immediate problem is that Tom Williams is due to resign soon after completion of the XY-slides/Autoguider project. This is a serious affair since there is no clear successor to his position. Whoever takes over will be faced with the need for debugging and maintenance over a period of a year or two and the possibility of minor modifications to the software/hardware. Ideally, this requires someone to work closely with Tom before he leaves.

There are very few people on the SAAO staff who are capable of undertaking this task and these persons are already fully committed to SALT work. Ideally, this person should be an astronomer as he/she needs to understand and use the telescope. We suggest that the optimum solution is to pass this task to the new Instrument Scientist. The time factor is, however, rather critical as it is unlikely that the new appointee will be in a position to take over before Tom leaves.

3. Software development

It is our opinion that SAAO urgently needs more persons for software development. For example, someone who is proficient in DSP code needs to be employed to work with Dave Carter in maintaining the CCD software on SALTICAM and PFIS. One possibility is to actively recruit students from University departments who could be attracted by the challenges and opportunities and who would not be too concerned about the salary. Finding such a person, or anyone else from outside the astronomical community, might not be that easy. We recommend that the highest priority be given to recruiting persons proficient in software development. The SAAO cannot function as a research institute without such staff.

In designing software for astronomical use, anticipating the user's requirements is very important. We feel that the experience of using software in the dome at night is probably more valuable than lots of programming experience when it comes to producing user-friendly software. For this reason, we recommend appointing an astronomer for software development whenever possible.

4. Instruments for SALT Science Support

The primary function of the small telescopes will be in support of SALT science. The 1.9-m will, no doubt, be the most important telescope for this purpose. The existing 1.9-m instruments and the responsible scientist are as follows (in order of present-day usage):

- The CCD spectrograph (Kilkenny).
- Giraffe (Buckley).
- IR Mark III (Glass).
- UCT CCD (O'Donoghue).
- Polarimeter (Potter).

4.1. The CCD spectrograph

The role of the CCD spectrograph in the SALT era is not clear. It could be used to survey possible spectroscopic candidates for SALT (for example, finding out the spectroscopic state of an object to determine the best time it should be observed on SALT). But the most likely use is for time-intensive observations. The maintenance of the spectrograph is a problem at the moment. A considerable sum of money was spent by SAAO in the design and manufacture of a new camera. A new cryostat needs to be designed and built for the new optics to be utilized. Because of the uncertain role of the CCD spectrograph, we recommend that this upgraded be shelved unless somebody suitable is willing to do the job.

Support for the CCD Spectrograph is in jeopardy. Dave is due to retire in a few years and does not have the technical capacity to upgrade the instrumentation. This is a problem which needs to be addressed if we are to maintain the spectrograph on the list of instruments for the 1.9-m. We recommend that new astronomical staff be trained to use and support the CCD Spectrograph. Failure to do so will probably mean that the spectrograph will be taken off the list of supported instruments.

4.2. Giraffe

David Buckley is pursuing the possibility of using Giraffe on SALT with an externally dispersed interferometer (EDI) which is a promising new technology. We believe this needs to be encouraged as the potential of EDI could be significant for HIRES and other SALT spectrographs. Outside of this usage, we forsee very little demand for Giraffe. We recommend that support of this instrument on the 1.9-m be dropped.

4.3. The IR Mark III

The major problem with the IR photometers is that the control software is obsolete and requires obsolete PCs to run. Our recommendation is to remove support from all single-channel IR photometers. In other words, to decommission the instrument in the event of a major failure.

4.4. The UCT CCD

The UCT CCD will be the major instrument for rapid photometry. In the immediate future, one can keep using the DOS-based software, but at some stage this needs to be upgraded. We suspect that by that time there will be a need for a new CCD. Perhaps the most cost effective solution is to plan a new instrument which will make use of the existing CCD hardware, in which case much of the

software can be ported from existing applications. In the meantime, the DOS-based UCT CCD will be the only available option. Since there is substantial interest among SAAO astronomers for observations of Cataclysmic Variables on SALT, it seems to us that the UCT CCD and the polarimeter must rank high on the instruments that should be supported.

4.5. Polarimeters

There is strong interest in the study of Cataclysmic Variables with SALT among SAAO and UCT astronomers. Such observations are far more valuable if supporting photometry and/or polarimetry is obtained. Therefore a strong case exists for ensuring continued support of photometry and polarimetry. The new photoelectric photometer/polarimeter is required for high time resolution polarimetry, while the newly-acquired Durham polarimeter has imaging capability. The two polarimeters compliment each other and both should be supported. However, a substantial software effort is required on both instruments, presumably by Stephen Potter.

4.6. New instruments

One of the important roles that the 1.9-m should play in support of SALT science is to obtain images of sources too faint to have measurable positions on the various sky surveys. This also includes multiple object spectroscopy for which accurate positions (better than 0.2-0.4 arcsec). To obtain these positions one needs to image the field to sufficient depth, a task for which the 1.9-m is suited. However, no suitable instrument exists at present for this task. The Cassegrain focus has too small a field of view and is poorly matched to the CCD pixel size, so it is necessary to use the Newtonian focus. The possibility of purchasing an "off the shelf" CCD imager, as mentioned by David Buckley in the Proceedings, should be carefully considered. At the same time, it is desirable that such a system should be compatible with existing CCD systems at SAAO so that it is more easily maintained.

If we are to go ahead with a Newtonian CCD, we need to realize that this job is a major one which will almost certainly require a financial contribution from SALT. We do not think it can be a simple "off-the shelf" solution and it should be adapted to the job at hand. Unless there is a dedicated effort by someone, we cannot see such a task being undertaken in the next few years due to other, more pressing commitments. We suggest we wait to find out how important such a system will be for SALT.

5. The 1.0-m Telescope

The telescope control system upgrade on the 1.9-m will be duplicated on the 1.0-m, including replacement of the XY-slides and associated software. The problem of succession is the same. The most persistent problem on the 1.0-m is the poor imaging which seems to be associated in some unknown way with temperature. Repeated efforts at solving this problem have been made over many years with little success. Clearly, there does not seem any point in expending more effort on this problem at this stage.

The most commonly used instruments are the SAAO CCD and the UCT CCD. DANDICAM does not belong to SAAO and its future is uncertain. To a large extent its IR imaging capability has been superseded by the IRSF. The STAP and polarimeter are also sometimes used on the 1.0-m.

The CCD control software is obsolete, but matters should be rectified in the near future with an implementation of a RTLinux system currently under development by John Menzies. The software problem for the UCT CCD remains, of course.

CCD imaging with the SAAO CCD may play an important role in SALT in much the same way as the proposed Newtonian imaging on the 1.9-m. The problem is, of course, that the imaging will not be as deep and may fail to detect the sources to be observed on SALT. Nevertheless, imaging on the 1.0-m is available, whereas developing such a capability on the 1.9-m is a major effort. In the immediate term, therefore, the 1.0-m CCD's remain the only viable means of imaging for SALT purposes.

It is to be expected that the 1.0-m will fulfill an important role in obtaining photometry for sources observed with SALT. In particular, it is probably the only means of calibrating photometric observations on an absolute scale. It will be a huge waste of resources to do this with SALT, and in any case the constantly varying aperture size of SALT probably makes this impossible to do. The combination of spectroscopy and photometry has usually proven to be particularly powerful at resolving astrophysical problems and this will surely continue with SALT and the 1.0-m. In this regard, the 1.0-m may prove more important for SALT support than the 1.9-m.

We suggest that the imaging capacity of the 1.0-m may be of greater importance for SALT support than anything currently available on the 1.9-m. Therefore an effort should be made to complete the hardware and software upgrades to the telescope, autoguider and XY-slides as well as the SAAO CCD before SALT is ready for use. This brings us once again to the lack of astronomers with the necessary skills who have capacity to take over John's software. We again iterate the necessity of making available at least one post for such a person. One assumes that the person who will ultimately be responsible for the autoguiding and acquisition software on the 1.9-m will perform the same job on the 1.0-m. In the meantime, we recommend that conversion of the SAAO CCD data acquisition program to RTLinux should be given priority. This should be followed up by training of a successor to take over responsibility for the SAAO CCD.

Although there will be a demand to use other instruments on the 1.0-m apart from the SAAO CCD, we think that making the 1.0-m a single-instrument telescope should be carefully considered. This will reduce the burden on maintenance and provides the stability necessary to obtain good photometric calibrations.

6. The 0.75-m and 0.5-m Telescope

Considering the shortage of astronomers at SAAO, and the fact that all will be working for most of the time on SALT projects, it is highly unlikely that the 0.75 and 0.5-m telescopes will be in much demand. There does not appear to

be a distinct role for these telescope in SALT support. At present, the 0.75-m is being used mostly for IR and UCT CCD work. The future of single-channel IR photometry at SAAO is in doubt, while one can foresee that most of the UCT CCD work will in future be done on the 1.0- and 1.9-m.

There could be a role for both the 0.75- and 0.50-m in public outreach and student training, but the demands on SAAO staff should be factored into any potential gain. If student training is deemed to be the role of the two smallest telescopes, then one needs to provide each with a suitable instrument. We recommend that the 0.75-m be made a single-instrument telescope and have the IR Mk II permanently on. As in the past, the modular photometer should remain on the 0.5-m.

We believe that one could operate the 0.5-m and 0.75-m telescopes for service observing and public outreach with three FTE observers. Assume Fred and Francois are allocated 50 percent each to SALT. That leaves 1 FTE observer for the other SAAO telescopes. A brief scan of the rota indicates that Fred and Francois split their time between 1.9-m night assisting and observing on the two smallest telescopes in the ratio 1:2. So we have 0.67 FTE of effort available for those two telescopes. It does not seem realistic to recruit another 2.3 FTEs to make both telescopes fully operational, because priority should be given to appointing staff with software development capability. Thus it may be possible to have a low level of service observing on these two telescopes in addition to student training.

7. The APT

We believe the APT could play an important role in the SALT era. The great value of the APT is that it requires no manpower to operate apart from maintenance. Thus the costs per observation are considerably lower than on the 0.75- or 0.5-m telescopes. For this reason we feel that an effort should be made to modernize the APT. For example, the instrument needs to be fully networked, which requires replacing DOS by Linux. Also serious consideration should be given to replacing the photomultiplier by a science grade CCD. The first aim, replacing DOS by Linux will lead to a more reliable and easily controlled system.

8. Conclusions

In our opinion the most important objectives for the SAAO telescopes are as follows:

- Employment of one or more astronomers with software experience to maintain and develop software on a number of instruments and the two largest telescopes. In-house training will be essential. Consideration should be given to assigning an instrument project to post-doc recruits.

- Continued maintenance of the UCT CCD, the polarimeters and, possibly, the CCD spectrograph on the 1.9 m. The possibility of using Giraffe on SALT with an EDI should be pursued.

- Restricting the 1.0-m to using only the SAAO CCD. Conversion of the software from DOS to Linux should be a priority.
- Restricting the 0.75-m telescope to the IR Mark-II photometer and encouraging its use for student training and public outreach. Occasional service observing can be continued.
- Using the 0.5-m for student training and public outreach with occasional service observing.
- The APT software should be changed to Linux as speedily as possible.
- The IR photometers should be decommissioned as soon as a major fault occurs. The STAP should be decommissioned.
- Someone needs to investigate and develop a system for preparing images to be used for multiple-object spectroscopy on SALT using imaging on the 1.0-m or from survey databases. Software needs to be obtained or developed for performing this task in an automated manner.
- We feel it is important to obtain clarification on SAAO use of the IRSF. With the demise of the single-channel photometers the importance of IRSF will be increase sharply. Steps should be taken to incorporate the allocation of SAAO's IRSF time into the SAAO allocation system. We recommend that re-negotiation of the IRSF agreement should be considered.