A kick-off meeting of this group was held on Saturday 1 May, following the SALT Board meeting. In attendance were:

Chris Anderson (Wisconsin)
David Buckley (Chair)
Peter Cottrell (New Zealand)
Richard Griffiths (CMU)
Darragh O'Donoghue (South Africa)
Larry Ramsey (HET Board)
Romek Tylenda (Poland)

a.) Larry Ramsey started the session by giving a summary of the HET status, mentioning that 2 commissioning runs had been completed: for the fibre instrument feed and the LRS. He presented some LRS results, which were obtained with the new SAC (which replaced the SSAC). The light scattering and sky background are now lower than before. Typical image sizes are 2", although image stacks with the CCAS give <1" images. Science commissioning will continue through June, with a summer shutdown planned. The IR array, JCAM, will be the next commissioned instrument, followed by the HRS in September.

Other HET issues were discussed (edge sensors, truss model, mirror alignment) and Larry undertook to review the first draft of the SALT Science Requirements in light of the 'as-built' HET experience.

b.) Darragh O'Donoghue presented results in two areas of investigation:

i.) Spherical Aberration Corrector
Darragh presented the results of his attempts to design a spherical aberration corrector with better performance than that used on the HET. A 2-mirror system was described with similar performance to the 4-mirror HET system but with one mirror required to be 700 mm in diameter (vs 500 mm for the largest of the HET mirrors). Catadioptric systems comprising 2 mirrors + 3 (or 4) lenses were also presented with good performance. Two problems with these systems were the backward curving field at the fibre feed (making the feeding of the fibres more difficult) and the lack of a well-defined telescope pupil for baffling of stray dome light.

ii.) Photometry with SALT
Darragh also presented results of simulations of the likely accuracy of photometry with SALT in view of the gaps between the individual components of the primary mirror. The simulations showed that photometric variations due to the gaps were substantially less than one per cent, and could be calibrated out. Concern over the potentially more serious effects of mirror re-coating were expressed.

c.) Each of the SSWG representatives present discussed their science drivers for SALT, as based on local user interest. Darragh O'Donoghue mentioned the questionnaire used to canvas South African astronomers. This will be made available so that other groups can similarly ask for input from their potential user community.
Summaries of these reports are given here. Details provided later have been appended to the minutes of this meeting.

i.) **Poland (Romek Tylenda):**
Not a lot of thought from the wider community has happened at this time. Current concerns are more to do with raising funds. Science projects from the Polish community will be wide ranging: stellar astrophysics to cosmology. Nebular spectroscopy of OIII/SII lines will require good blue & red performance.

ii.) **Rutgers (Ted Williams):**
One science group meeting has been held to date, although serious discussions have not yet occurred. Two more observers will be joining the Rutgers faculty soon, and their inputs will be important. Current feeling is that IR performance (1.5-2 microns) is important. The blue is also of interest for Magellanic Cloud work and X-ray source follow-up.

A suggestion was made to consider 'red' and 'blue' optimized SACs, which could be interchanged for dedicated campaigns. There was interest in all 3 resolution regimes covered by HET instruments, and the ~10 multiple object capabilities.

A larger field should be considered, but weighed against increased costs. Imaging is important, although it should not directly compete with SOAR/WIYN or Gemini. Good seeing conditions (sub-arcsec) should not be sacrificed when it comes to SAC design, and 0.6” images should be the goal. Maybe a tip/tilt provision should also be considered.

There was interest at Rutgers for high time resolution observations, photometry and deep drift scanning observation. CCD systems (and controllers) should be standardized for all instruments.

iii.) **New Zealand (Peter Cottrell):**
Peter discussed the email canvassing of the NZ community, which has so far resulted in little substantial feedback. The draft Science Requirement document and 'Science with SALT' book had been distributed for comment.

Peter discussed the HERCULES instrument, a fibre fed echelle currently being built at Canterbury University. This instrument could well serve as a prototype high-resolution instrument for SALT, and was probably the best way in which the NZ community could be involved, given their historical science interest in high-resolution spectroscopy.

iv.) **Carnegie Mellon University (Richard Griffiths):**
Much of CMU's interest focuses on cosmological studies, particularly high-z clusters and surveys (HST Medium Deep, X-ray surveys). The major facility instrument of interest to CMU will be the low resolution instrument, and an HET LRS-like instrument (of similar capabilities) should be the priority instrument for SALT. It was also felt that improved IR performance (e.g. for high redshift galaxies) is important.

v.) **South Africa (Darragh O'Donoghue):**
The results of the questionnaire were tabled. There were 16 replies from a total of 45 sent out. Interest was fairly evenly spread over desired spectral resolution (e.g. as offered by the HET’s LRS, MRS and HRS instruments). About a third of respondents were interested in imaging and high time resolution photometry. Most would be satisfied with a 4 arcmin field. The SA questionnaire will be used as a baseline to produce a second version, which all the groups can use so as to get a uniformity of approach.

vi.) **Wisconsin (Chris Anderson):**
There was interest in an LRS-like instrument, but with higher resolution capability. A polarimetric mode was also considered an important option that should be available.
The use of holographic gratings on the fibre-fed echelle's was suggested as a means of increasing the number of objects, at the sacrifice of less spectral coverage. IFUs were discussed, and Chris showed the HET IFU developed by Matt Bershady.

Chris presented some of the science interests of Wisonsin, and discussed recent work on comets.

David Buckley  
1 October 1, 1999

APPENDIX 1: Reports from individual members

1. Rutgers University (Ted Williams)

Rutgers Science Interests for SALT  
Salt Science Working Group  
May 1, 1999  
Ted Williams

Rutgers astronomers have scientific interests in all three spectral resolution ranges (LRS, MRS, HRS) currently being considered for SALT instrumentation. We also have strong interests in multi-object (fibers and/or slitlets) and imaging spectroscopy (Fabry-Perot and integral field). The discussion below is organized around telescope design issues, with typical science projects as illustrations.

Image Quality
Many of the projects we envision will be strongly impacted by the telescope's image quality. Examples include studies of Magellanic Cloud star clusters, high-redshift galaxies and supernovae, dynamics of the nuclei of galaxies, and planetary nebulae in early-type galaxies. Hence is is important to do everything feasible to assure good image quality. We are encouraged by the reports of significant periods of sub-arcsecond seeing at the prospective sites for SALT, and this strengthens our desire to design the telescope and enclosure to minimize image degradation. Perhaps we should investigate which forms of active and adaptive optics can be suitably employed on SALT, and certainly should ensure that the telescope design does not preclude future adaptive optics enhancements. Is the tracker capable of fast guiding and/or tip-tilt correction? If the prime-focus instrument is fed by a fold mirror (as in HET), can that mirror do tip-tilt or higher order correction? We might want to investigate two-dimensional charge sloshing CCDs for fast-tracking imaging (and possibly for spectrograph applications also).

Wavelength Ranges
We have science interests throughout the optical and near-IR wavelength ranges. Some of these (ISM, X-ray follow-ups, SNR, and LMC/SMC blue star clusters) need blue response, preferably down to the atmospheric limit. There is also interest in near-IR imaging and spectroscopy for high-z objects, IR survey follow-ups, brown dwarf investigations, etc. Although SALT will never be an IR telescope, we are interested in studying what the practical IR limit will be. We support the investigation of alternate spherical aberration corrector designs, to minimize the number of reflections in the telescope. If a 4-element SAC is required, perhaps we should consider organizing the use of the telescope in multi-year campaigns, optimizing the mirror coatings in each campaign for a particular wavelength region.

Multiple Object Spectroscopy
We expect that a moderate number (10 to 20) of fibers (MRS) or slitlets (LRS) will be sufficient for the projects that we plan for SALT (dwarf spheroidal kinematics, globular cluster binary stars, and follow-ups to SIM, GAIA, and other astrometric/proper motion surveys). Since it is likely that the smaller SAAO telescopes will be used to prepare target lists for SALT, an effort to astrometrically map the focal planes of all these telescopes would enhance the efficiency of positioning fibers and slitlets.

**Imaging Spectroscopy**

We are interested in an integral field fiber unit for the MRS, with both simulated slits and full two-dimensional modes. We are also interested in a Fabry-Perot imager in the prime focus spectrograph. We have carried out a preliminary investigation of the feasibility of including an etalon in the collimated beam portion of the current LRS design; the only potential problem is mechanical clearance on the grating/etalon mount mechanism, and further investigation is needed. Queensgate Instruments makes an appropriate size etalon (clear aperture 150 mm), with a price of $105,000; the required controller is $49,000. We might consider using three etalons of different spectral resolutions for various programs: R = 500, 3000, and 13000 (only one controller is needed). It would be very useful for the Fabry-Perot system if the PFIP acquisition/guider camera could be designed to provide photometric monitoring information while tracking - this should not be difficult if taken as a design goal. We may want to examine the entire LRS design, in conjunction with possible SAC modifications.

**High Speed Photometry**

We have several interests in moderate to high speed photometry, and we support D. O'Donoghue's investigations of the photometric performance of SALT. We hope that he can extend them to include the effect of primary mirror coating degradation, with simulation of the effects on a near-by reference star.

**Drift Scanning**

It is interesting to consider the possibilities of drift-scan mode (TDI) surveys with the SALT prime-focus imager. The shortest exposures (at the equator) would be 16 seconds, and could reach 25 magnitude objects with S/N > 4 in a broad band. Assuming a 1024x1024 pixel CCD with dual readouts, pixel readout times would be a moderate 30 microseconds.

**Other Considerations**

a) Should we attempt to have a unified science CCD system for all instruments? This could ease maintenance. It might be appropriate for one of the partners with appropriate expertise to undertake this task.

b) How do we handle targets of opportunity to assure that the observing queue can be reorganized as rapidly as possible?

2. **CMU (Richard Griffiths):**

Short Summary of CMU Requirements for SALT instrumentation:

1) The CMU group is focused on cosmological studies, and we are therefore primarily interested in high-redshift objects, both from the perspective of imaging and spectroscopy. Our highest-priority instrument is an LRS which can be operated in the direct imaging and multi-object spectrograph mode (LDSS at the AAT/WHT is also a good example of this kind of instrument).

2) In view of the importance of the above kind of instrument for faint-object work, we would suggest that such an instrument
be considered as a 'facility instrument' and therefore as a vital 
and integral part of the basic telescope rather than something which is  
'added on' later.

3) In view of the epoch of operations of SALT and the considerable overlap 
with the NGST, the extension of LRS sensitivity into the infrared  
(or LDSS++) is highly desirable.

3.  **Wisconsin University**

**Wisconsin SALT Science and Instrumentation**

Science programs (planetary, stellar, ISM, IGM and extra-galactic / cosmology) and supporting instrument concepts for SALT. These programs represent new departures or significant extensions of on-going research that would not otherwise be possible without SALT. At the same time, these programs capitalize on existing studies with WIYN or other extant facilities, such as WHAM, and space-based missions, e.g. HST and the Cosmic Origins Spectrograph. SALT instruments for these science programs conveniently span the current suite of first-light instruments for the HET, however, with major modifications in two cases. In order of increasing resolution, and decreasing modification:

"LRS" + polarimeter + higher dispersion and blue/UV capability. This will be a major driver for the primary/corrector optics coatings, and should motivate a reinvestigation of the 2-element corrector design.

MRS with modified fiber-feed (MOS-IFU) and spectrograph design (holographic). This should provide higher throughput, greater versatility, and hence improved performance. There is a demand for good image quality with this instrument of order 0.5-0.7 arcsec FWHM.

HRS (a clone of the current HET instrument)

In addition to these three basic instrument concepts is the possibility of coupling WHAM to the SALT focal plan. If this can be realized, it would represent an unmatched capability for the detection and study of faint diffuse emission lines.

A summary of the science programs and their salient instrument requirements are listed immediately below. The balance of this document contains brief summaries of each program.

b.)  **Science and Instrumentation**

<table>
<thead>
<tr>
<th>Program</th>
<th>Feed/Instrument type</th>
<th>Resolution (dl/l)</th>
<th>Wavelength range (microns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 15 cm Diameter Fabry-Perot Fiber Optically Coupled to the 9 m SALT for faint emission line spectroscopy and imaging</td>
<td>fiber-fed Fabry-Perot (WHAM)</td>
<td>1500 - 25,000</td>
<td>0.5-0.7</td>
</tr>
<tr>
<td>High Precision/ High Resolution Spectropolarimetry of dynamic envelopes</td>
<td>Prime focus spectropolarimeter</td>
<td>1000 - 10,000</td>
<td>0.32-0.5</td>
</tr>
<tr>
<td>Omega and Evolution</td>
<td>fiber-fed MRS MOS-IFU</td>
<td>3000-10,000</td>
<td>0.45-1.6</td>
</tr>
<tr>
<td>Observations of Heavy Element Evolution over 10 Billion Years of Cosmic Time: QSO Absorption line Spectroscopy from SALT and The Cosmic Origins Spectrograph</td>
<td>fiber-fed HRS single object</td>
<td>40,000+</td>
<td>0.36-?</td>
</tr>
<tr>
<td>High Precision Radial Velocity Surveys of Open Clusters</td>
<td>fiber-fed HRS single object (?)</td>
<td>20,000-40,000</td>
<td>?</td>
</tr>
</tbody>
</table>

Programs advocating study of individual, extended sources (e.g. comets and nearby galaxies) will be forthcoming. A particular niche exists for high-etendue integral-field spectroscopy on single, extended sources where high
APPENDIX 2: Questionnaire for potential South African SALT users (supplied by Darragh O'Donoghue)

Date: 1999 March
From: Darragh O'Donoghue
To: Potential SALT Users from the South African Astronomical/Scientific Community

Subject: Science With SALT

I have recently been asked to serve as South African representative on the SALT Science Working Group (SSWG). This body is intended to formulate specifications for the telescope and its instrumentation.

I see my responsibilities as:

(1) To represent the interests of the South African SALT potential user community (which, for brevity, I will refer to as the "SA users") on the SSWG, and to communicate the community's views to the SALT Board, the governing body of SALT. (South African representation on the SALT Board is still to be decided by the FRD/NRF and DACST).

(2) To report back news about SALT, and in particular the results of the SSWG's efforts, to the South African users.

The first meeting of the SSWG will be held at the end of April 1999, and is aimed at achieving progress on definition of the telescope capabilities and first light instrument package. This message is therefore designed to solicit first opinion from the SA users. With the completion of SALT five years away, it may be tempting to postpone worrying about SALT science for some time. However, I would urge you to start considering the issues now so that the facility, when completed, will best serve your scientific needs. Further it is hoped to strike a deal with the HET Board so that SALT users can gain access to HET well in advance of SALT completion.

Therefore, please complete the questionnaire listed below. Most questions are formulated as multiple choice and you are asked to place an 'x' in the appropriate place. Some questions may be asked twice (from a different point of view). Moreover, should you have further comments to make, feel free to add these immediately below the relevant question. Add general comments at the end if you wish. THE IDENTITY OF RESPONDERS, AND ANY IDEAS OR OBSERVING PLANS MENTIONED, WILL BE KEPT CONFIDENTIAL. As all of you are aware, SALT is likely to be very similar to the Hobby-Eberly Telescope (HET) so its capabilities are being adopted "for talking purposes". Modifications/extensions will be seriously considered and implemented if there is sufficient demand and the cost implications are not serious.

Although it is likely that the majority of the SA users will be astronomers, no other scientist or person with a competitive observing program will be excluded. Thus any interested party with South African affiliation can be considered as a potential user. Please pass this questionnaire on to any interested person not on the e-mailing list which I append at the end.

Please send me corrections to this e-mailing list if you see erroneous or outdated addresses.

Finally, this questionnaire is only the first such solicitation of your opinion. However, try and
answer as fully as you can because as time goes by, the design of SALT will become more fully specified and therefore less capable of incorporating a specific requirement. In addition, SALT instrumentation is likely to be expensive (up to $1M per instrument is a typical rough estimate) so selection of the "first light" instrumentation package is also very important.

Information which may help you with the questionnaire can be found at:

SALT Home Page:  
http://www.sao.ac.za/~salt

Hobby-Eberly Telescope Home Page:  
http://hyperion.as.utexas.edu/mcdonald/het
with links to its instruments etc.

Very briefly, HET provides a 4 arcmin FoV, and 3 spectroscopic instruments are being constructed:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Resolution (nm)</th>
<th>Wavelength (nm)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Resolution Spectrograph</td>
<td>600-3000</td>
<td>400-1000</td>
<td>Imaging, long slit &amp; multi-object capability</td>
</tr>
<tr>
<td>Medium Res. Spectrograph</td>
<td>3500-21000</td>
<td>450-900</td>
<td>10 fibre-feed. (Extension 900-1300 later to 1800 nm envisaged)</td>
</tr>
<tr>
<td>High Res. Spectrograph</td>
<td>30000-120000</td>
<td>420-1100</td>
<td>&lt; 10 m/s long-term stability</td>
</tr>
</tbody>
</table>

**SA SALT Potential User Questionnaire No. 1**

Name :  
Affiliation :

1. **Scientific Area**

   Place an x against each of the broad areas of observational astronomy for which you might use SALT:

   1. Solar system studies  ( )
   2. Hot stars & stellar corpses  ( )
   3. Cool stars  ( )
   4. Binary stars  ( )
   5. Young stars  ( )
   6. Star clusters  ( )
   7. Stellar populations  ( )
   8. Interstellar/galactic medium  ( )
   9. LMC/SMC/Local group galaxies  ( )
   10. Galaxy clusters & populations  ( )
   11. AGNs  ( )
   12. Observational Cosmology  ( )
   13. Other (please specify)  ( )

Would you like to provide a few sentences on the kind of scientific programs you envisage in so far as they might affect decisions on SALT capability (as mentioned above, details will be kept strictly confidential)?
2. Required Instrumentation
Place an x against each technique of which you would like SALT to be capable:

Place an x if multi-object fibre capability is important

1. Low resolution spectroscopy (up to R=1000) ( )

2. Medium resolution spectroscopy (R=1000 to 20000) ( )

3. High resolution spectroscopy (R>20000) ( )

4. Imaging (best quality) ( )

5. Imaging (modest quality, suitable for photometry) ( )

6. High time resolution (20 sec or less) sampling capability ( )

7. Other (please specify) ( )

3. Wavelength Of Interest
Place an x against the wavelength interval which will best address your scientific requirements:

1. Optical UV & Blue (350-550 nm) ( )

2. Optical Red (550-1000 nm) ( )

3. Full Optical (350-1000 nm) ( )

4. Infrared (1000-2500 nm) ( )

5. Full range (350-2500 nm) ( )

6. Extensions? (specify) ( )

4. Field Of View and Fibre Capability

1. Is a field of 4 arcmin sufficient for your science?
   Yes ( ) No ( )

2. If not, what FoV would you wish SALT to deliver:

3. Is multi-object (fibre-fed) spectroscopy important for you?
   Yes ( ) No ( )
4. If so, how many fibres would you wish SALT to provide:

5. Sky Access

1. Is access to the SMC (requiring SALT to tilt to 37 deg compared to 35 deg for HET) important for you?

   Yes ( )    No ( )

2. At a tilt of 37 deg, SALT will access declinations in the range -75°22' to +10°37'. Does this meet your expectations?

   Yes ( )    No ( )

   If not, please comment:

6. First Light Instrument Package

Project Scientist David Buckley has produced a document, SALT Observatory Science Requirements, which should soon be available on the SAAO Web Site under the SALT home page. In this, he mentions that the first light instrument package may comprise fibre coupled low and medium resolution spectrographs, along with imaging capability (perhaps in the low resolution spectrograph) over at least a 4 arcmin FoV.

Would this satisfy most of your scientific requirements?

   Yes ( )    No ( )

Any comments (especially if No to last question): 

7. Missing Items

Please provide information which is important to your requirements and which the above questions do not address. Please also provide any general comments here.