Minutes of the 5th SALT Science Working Group meeting

19 April 2001

Indian Lodge Conference Room, Fort Davis
Texas, USA

D. A. H. Buckley
Project Scientist

30 September 2001

The fifth meeting of the SSWG took place on Wednesday 19th April 2001, at the Indian Lodge, Fort Davis, and hosted by McDonald Observatory.

1. Participants

**Members:**
David Buckley (Project Scientist, Chair)
Gerald Cecil (North Carolina)
John Hearnshaw (NZ, proxy for G. Mackie)
Klaus Fricke (Goettingen)
Richard Griffiths (CMU)
Ken Nordsieck (Wisconsin-Madison)
Darragh O'Donoghue (South Africa)
Larry Ramsey (HET)
Anne Sansom (UK Consortium)
Ted Williams (Rutgers)

**Ex-officio attendees:**
Matt Bershady (Wisconsin)
Chip Kobulnicky (Wisconsin)
Leon Nel (SALT Payload Manager)
Tetsuya Nagata (Nagoya University)
Kobus Meiring (SALT Project Manager)
Jeff Percival (Wisconsin)
Bob Stobie (Chair of SALT Board)
Gerhard Swart (SALT Systems Eng.)
2. **Agenda items discussed**

1. Welcome and Minutes of the previous SSWG meeting (29 & 30 August 2000).
2. Status of SALT System Specification and Error Budget (Gerhard Swart).
3. Progress on the SALT Prime Focus Platform/tracker payload (Leon Nel).
4. SALT Operational Requirements (David Buckley / Gerhard Swart).
5. Requirements for the guiding/commissioning instrument (David Buckley).
7. SAC issues (Darragh O’Donoghue).
10. The Fabry-Perot mode of PFIS (Ted Williams).
11. Progress on the design for UCHRS (John Hearnshaw).
12. Reports from SALT partners (SSWG representatives).

Participants were welcomed, particularly Gerald Cecil (North Carolina), who was attending for the first time, and Tetsuya Nagata, who was attending as an ex officio observer from Nagoya University.

Apologies for absence: Janucz Kaluzny (Poland)

Matter arising from previous minutes (August 2000): none
Action items arising: instrumentation questionnaires were distributed to SSWG representatives by instrument PIs.

3. **System Specification and Error Budget Report (Gerhard Swart)**

Gerhard Swart (SALT Systems Engineer) reported on the SALT specification status and the current version of the error budget.

He outlined, chronologically, the procedures in the specification development, the review processes and acceptance testing:

1. analysis of top level requirements
2. define system specification
3. trade-off system concepts
4. define sub-system specifications
5. trade-off design concepts
6. specification reviews
7. detailed specifications and contracts
8. specification reviews
9. final designs
10. critical design reviews
11. manufacture and assembly
12. integration at supplier’s premises
13. acceptance testing with respect to specs in 7.) above
14. sub-system commissioning
15. acceptance testing with respect to subsystem spec in 4.) above
16. system integration and commissioning
17. acceptance testing with respect to system spec. in 2.) above
18. trial operations
19. acceptance testing with respect to top-level requirement in 1.) above
A timetable of the completed system specification and design reviews was tabled. Those completed include:

- system specification
- facility specification and concept design
- structure specification
- tracker specification
- dome specification
- primary mirror analysis report
- payload specification
- spherical aberration corrector specification
- SALT operational requirements
- Telescope Control System specification
- Structure preliminary design

Gerhard also described some of the design, modeling and simulation work completed and in progress (e.g. tracker & payload, interfaces, control room layout) using the Pro Engineer package. A physical model for the entire telescope was also being developed. In addition, models for the following would be developed:

1. model for primary mirror edge sensors and actuators
2. optical elements and mechanical mountings (SAC and primary)
3. model of tracker control loops
4. Finite Element Analysis (FEA) of structure and tracker, including wind shake effects
5. modeling the airflow and temperature inside the telescope chamber to determine louver control algorithms

Some risks associated with the top-level specification were also being assessed, including:

- automated insertion of the Atmospheric Dispersion Compensator (ADC), which is potentially large and massive (see report by D O’D).
- error budget control: stipulated error budget is EE(50) < 0.6 arcsec. Present (incomplete) budget is already at EE(50) = 0.59 arcsec.
- The revised error budget now includes a more realistic treatment of the atmospheric profile, previously and erroneously assumed to be Gaussian. The median seeing values are now:
  - FWHM = 0.9 arcsec
  - EE(50) = 1.15 arcsec
  - EE(80) = 1.91 arcsec

(Gerhard’s PowerPoint presentation (”System Status overview”) is available for downloading at http://www.salt.ac.za/science/restricted/ using username SSWG and password 50Xmax.)

4. Developments of the SALT Payload (Leon Nel)
Leon presented the current concept for the SALT Prime Focus Payload (PFP) and discussed a number of outstanding issues (see PowerPoint presentation in Appendix). The major components of the PFP include the following:

- SAC structure (mirrors, cells, mountings, etc.)
• Moving exit pupil baffle
• Acquisition camera
• Guidance camera
• Off-axis guidance probes
• Autocollimator
• Calibration system
• ADC (atmospheric dispersion compensator)
• Science fibre routing
• Fold mirrors
• Four instrument focal stations/mounting points
• External baffle

All of the above needs to be incorporated in a stiff but light-weight structure with provision for rotation and cable handling (including science fibres), requiring cable wraps. The PFP is mounted onto the Tracker hexapod and three science instruments are mounted to it:

1. The Prime Focus Imaging Spectrograph (PFIS)
2. The acquisition/imaging camera (SALTICAM)
3. The Fibre Instrument Feed (FIF)

In addition there is an auxiliary focal station, designed to accommodate small, possibly non-facility (visitor), instrumentation.

The negative effects of a large external baffle acting as a wind “sail” were mentioned, as was the desire to have the payload be light-tight (e.g. to allow daytime calibrations, like flat fields, to be taken). A schematic of the PFP is shown below:
Related issues discussed included the following:

**4.1 Alignment of Payload with Primary Mirror**

The payload axis needs to be kept aligned in angles $\theta$ and $\phi$ to <1.5 arcsec of the nominal optical axis of the primary. This translates to an Image Quality degradation of 0.054 arcsec. Similarly, the paraxial distance from the primary mirror has to be controlled, and a misplacement of 10 microns leads to an IQ degradation of 0.1 arcsecs.

Methods being investigated to control the PFP orientation include measurements using the primary mirror array as a reference, possibly with an additional measurement of a star in the guidance field:

- Two laser autocollimators, aligned to the centre of curvature, and reflecting off the central obstruction.
- Absolute distance indicator plus a single laser autocollimator.
- Single autocollimator for angle control, image processing of a guidance star for best focus (distance from primary) control.

Issues under investigation still include the resolutions achievable using any of the above schemes.

Conclusions to date are that autocollimator will be able to control tip/tilts of the PFP, but not the distance from the primary, which will probably be best addressed using an active focusing system.

Larry mentioned that this idea was originally thought about for the HET, but eventually abandoned due to the problems associated with “hunting” for focus in varying seeing and the associated scale changes this implies.

Darragh raised the possibility of having a slit viewing system (using SALTICAM with a rear facing mirror), which would be very desirable both from the point of view of positioning objects and controlling focus.

**4.2 Guidance**

Leon presented a schematic of the guidance system concept for the three focal stations: PFIS, SALTICAM and the FIF. These will involve guide probes accessing guide stars in an annular field surrounding the 8 arcmin diameter science FoV, and possibly also in the science FoV (e.g. for the FIF). Coherent image fibre bundles, mounted on translation stages, and feeding a common CCD camera is the current guide concept. In addition pellicle guiding using SALTICAM will be implemented for bright star work.

**4.3 Interfaces**

Interfaces for the PFP include the following:

- Payload-tracker
- PFIS-payload structure
- Science fibre cable-payload structure

**4.4 SAC**

Outstanding issues regarding the Spherical Aberration Corrector include:

- Mirror coatings (with possible implications on maximum size of SAC mirror M3)
- Pupil size (impacting choice of mirror sizes)
• Over-pressurizing the SAC structure (to avoid dust contamination)
• Whether SAC will rotate with the PFP or not
• Interface of SAC structure with PFP/ tracker hexapod

It was considered desirable for the optical specification for the SAC coatings to include instrumental polarization to be better than bare Al. It was also considered important to have a scattered light specification for the SAC.

4.5 Status
Leon concluded with the current status and plans for various contracts. The tracker contract will be issued on 30 May 2001, RFP’s for the SAC are due 18 May and a contract is expected to be awarded by 30 June. The PFP is not likely to be awarded as a single contract, due to its rather unique multi-purpose role involving many subsystems.

(Leon’s PowerPoint presentation (“Payload_SSWG_0401”) is available for downloading at http://www.salt.ac.za/science/restricted/ using username SSWG and password 50Xmax.)

5. Operational Requirements
Gerhard Swart (SALT Systems Engineer) summarized the present status of the SALT Operations Plan, particularly the MMI (Man-Machine Interface) work that had been undertaken for the tasks to be carried out by the SALT Operator (SO) and SALT Astronomer (SA). The plan for the SALT Control Room was shown and the layout of the various terminals and VDUs discussed.

It was also mentioned by David that some preliminary work was beginning on the nature of the interface of the PI with SALT, taking the HET as a starting point. Larry mentioned that with several TACs operating it was possible for duplication of observing programs. For the HET, a Conflict Resolution Committee was set up to arbitrate on issue of conflicting observing programs.

The desirability of using web-based proposal tool (e.g. XML), at both Phase I and II stages, was also discussed. These issues will get increasing attention in the near future, particularly when SALT partners start getting access to the HET.

6. Requirements for SALT Acquisition and Commissioning Instruments
David Buckley tabled the requirements for both the Acquisition System and Commissioning Instrument. The former is required for the efficient identification of science targets, guide stars etc, while the latter is designed to prove that SALT meets its specifications in terms of:

• pointing accuracy
• tracking accuracy (open and closed loop)
• throughput (as a function of wavelength)
• image quality (as a function of wavelength)
The various demands placed on an instrument designed to undertake all of these tasks, plus normal acquisition of faint science targets, implies that a good quality (science grade) large format CCD is required.

**It was proposed by Ken Nordsieck, seconded by Ted Williams, that these requirements be adopted and this motion was passed unanimously.**

The dual roles (i.e. commissioning instrument and acquisition camera) required of the SALT Project will be satisfied using the proposed imaging instrument, SALTICAM. This instrument was previously proposed by Darragh O’Donoghue as a science imager and it was accepted by the SSWG to continue its development. In its initial configuration, at the straight-through focus of the SAC, it will sample the entire science and guidance FoV using the detector mounted on an X-Y translation stage. In its role as an acquisition camera it will be mounted with fore-optics giving sufficient focal ratio reduction and fed by a 45° mirror. This will also be the configuration when SALTICAM is used in its science role. SALTICAM will cover a ~10 arcmin diameter FoV, covering the entire 8 arcmin diameter science field as well as the 8-10 arcmin annulus for guiding.

It was agreed by the SALT Project that ~25% of the cost of SALTICAM (a figure of $105K) would be covered by the PFP (Prime Focus Payload) budget because of its non-science roles.

*(The final version of the requirements document (a Word file called “SALT acquisition commissioning – final”) is available for downloading at http://www.salt.ac.za/science/restricted/ using username SSWG and password 50Xmax.)*

7. **SALTICAM report**

Darragh discussed current status of SALTICAM. He reported that the results of the SALTICAM questionnaires indicated ample requirements for both high-speed and UV-capable imaging. While PFIS had imaging capability (narrow band), its lateral colour implies no broadband imaging can be done. One interesting and novel mode could be simultaneous imaging (SALTICAM) and spectroscopy (PFIS) using a dichroic beamsplitter. SALTICAM will therefore fulfill its role as a good quality scientific imager on SALT. Its scientific attributes, particularly sensitivity and field coverage, will mean that in its acquisition role, it will be particularly efficient. Another important aspect is that it will produce images of good P-R value at first-light.

To fulfill the roles as commissioning instrument, the CCDs will initially be mounted on an X-Y translation stage. The two butted 2K x 4K chips will give a square FoV of ~55-63 mm on a side, thus covering only ~ of the 107 mm diameter science FoV (8 arcmin diameter). In order to verify both throughput and image quality (as a function of wavelength and field angle), requires that the chips can be translated to ‘tile’ the focal plane (~5 such positions will cover the focal surface, inclusive of the guidance annulus).

Current cost breakdown estimate for SALTICAM is as follows:

- **Hardware:** $294K
- **Labour:** $105K
- **TOTAL:** $399K
The approval for SALTICAM to proceed to Preliminary Design was deferred until the afternoon, following the remaining instrument reports. *It was then proposed by Larry Ramsey, and seconded by Ken Nordsieck, that SALTICAM proceed to a PDR. The motion was carried unanimously.*

(Darragh’s presentation on SALTICAM (a PostScript file called “dod-sswg1”) is available for downloading at [http://www.salt.ac.za/science/restricted/](http://www.salt.ac.za/science/restricted/) using username SSWG and password 50Xmax.)

8. **SAC status report**


Current choice of pupil size is still between 10.5 and 11.0 m in diameter, and this will eventually be determined by vendor feedback on issues of cost, risk and implications to other subsystems.

As far as the system error budget is concerned, it will be the mounting errors of the individual elements that dominate the terms in the SAC error budget, rather than the manufacturing errors of the individual mirrors. Some thought needs to be given to how the mirrors are manufactured, which is likely to be mostly a serial process rather than parallel, since some manufacturing errors can be corrected for ‘down-stream’.

An important issue to be investigated is the nature of non-axisymmetric distortions. Since it has been decided at the SAC design review that the SAC optics should not rotate with the payload, any non-axisymmetric image distortions will rotate with the field during an exposure. This could have some bearing on the multi-slit spectroscopic mode of PFIS, depending upon the degree of distortion. This issue will be looked at by Arek Swat (SALT Optical Engineer).

9. **The Atmospheric Dispersion Corrector**

Darragh presented the results of his investigation into the issue of the correcting atmospheric dispersion in SALT. These results are summarized in the paper *An Atmospheric Dispersion Corrector for the SALT*, available as a PostScript file (dod-sswg3.ps) on the website [www.salt.ac.za/science/restricted](http://www.salt.ac.za/science/restricted). Any ADC is constrained to be in the space between the last SAC mirror (M4) and the exit pupil.

Initial investigation involved traditional ADC design involving counter-rotating Amici prisms, placed near the exit pupil. Lateral colour effects compromised the image quality in these designs, unless triplet prisms (containing NaCl) were used. These designs, involving immersion oil interfaces and careful control of the wedge angle, were considered too complex and difficult to warrant further investigation.

An alternative approach, based on the SOAR telescope’s ADC, involving a “linear ADC” (LADC), was subsequently investigated. This has two oppositely disposed prisms with varying axial separation. One prism is located just behind M4 and the second varies in
distance from 170mm to 103mm from this first prism, the separation being a function of the zenith distance. These large diameter prisms (300 and 255 mm respectively) are made of fused silica, so are good UV transmitters.

The issue of the specification on secondary dispersion in the Science Requirements document was raised. The specification for \( \leq 0.15" \) secondary dispersion at the shortest capable wavelength (320 nm) may have to be relaxed as indications are that this will be difficult to achieve over the whole wavelength range. This issue will be investigated further.

10. **Status of the Prime Focus Imaging Spectrograph**

Ken Nordsieck presented a status report on the recent work carried out on the design for PFIS, which is also available as a PowerPoint presentation (pfis_status_010419) on the website [www.salt.ac.za/science/restricted/](http://www.salt.ac.za/science/restricted/).

Current ideas of schedule are as follows:

- Integration: end 2003
- Systems level integration: early 2004
- Commissioning: end 2004

PFIS has been given the provisional name of “IMPALAS” (Imaging Prime focus ArticuLAting Spectrograph), although a final name would be decided upon following suggestions from the SALT community.

The instrument is conceived as sharing a common collimator for both the visible and near-IR beams, with multi-object slit-masks for MOS of > 100 objects over an 8 arcmin field. The first-light configuration will just have a visible beam (310 - 900 nm). A simultaneous NIR beam 850 - 1700 nm is conceived as a growth path. Science niches of PFIS include:

- UV Spectroscopy (310 - 400 nm).
- Very high throughput, medium resolution spectroscopy
- Fabry-Perot imaging spectroscopy
- Spectropolarimetry. Rare on large telescopes

Mechanical engineering constraints include:

- **In the structure:**
  - Flexure induced image motion during one observation < 0.1 resolution element = 3 \( \mu \)m [ ] differential motion of optical elements < 10 \( \mu \)m.
  - One observation: articulation fixed/ clamped; gravity vector variation through \( \pm 6\degree \).

- **For the mechanisms:**
  - Time constraints due to relatively short (~1 hour) observations.
  - Reliability due to poor access.
  - Filters, slitmasks, grating magazines accessible for changing.

The definition study, assisted by Swales Aerospace, has resulted in a preliminary structure design compatible with simultaneous dual-beam operation. It comprises an external truss with a collimator and camera mini-truss (under review) and featuring commercial curved rail articulation for camera alignment to the selected grating angle.
The optical design has evolved, leading to a reduction in the total number of elements. Reduced number of elements: camera from 15 to 11, collimator from 11 to 9

The various mechanisms (e.g. slit mask exchanger, waveplate rotator, grating inserter/rotator, etalon inserter, etc) were itemized, together with the likely methods employed for motion control. The baseline for the software will be LabView/ Linux, with overall integrated mechanism and CCD control. I/O will be "distributed", using commercial back-plane control modules multiplexed to single Ethernet or serial cable. The CCD detectors currently being considered for PFIS are Marconi-EEV CCD44-82 2048 x 4096 x 15 micron pixels. Issues to be explored further are:

- frame transfer operation
- QE variants, coatings, etc
- Deep depletion devices
- Anti-fringing options

Typical DQE curves were shown and are included here:

![Typical DQE curves](image)

The likely formats for the various observing modes were also demonstrated:
Spectral range for the visible beam of PFIS (delivered at first-light) will be 320-900nm, with optimization for performance at short wavelengths. Maximum likely spectral resolutions using 'standard' VPH gratings (i.e. not 'echelettes') will be 6500 (0.9 arcsec slits) to 12000 (0.45 arcsec slits). PFIS is likely to have a maximum of 35% efficiency on the sky, comparing favourably with similar instruments on other 8-10 m telescopes as seen in the following diagrams:
**PFIS Questionnaire Responses**

Preliminary results from the instrument questionnaire were tabled and discussed. The deadline for response was set for 25 May. Initial responses were required to define the highest priority modes of operation as well as suitable commissioning observations. Twelve responses were received before the meeting. Spectroscopic resolution requirements were fairly uniform across the range R = 500-12,000, though lower resolutions were more acceptable at shorter wavelengths (<350 nm). Multi-slit spectroscopy was in high demand, as was long slit spectroscopy. Likewise there was a strong desire a high time resolution (1-10 Hz) spectroscopic capability.

In order of priority, the average requirements for spectroscopy were as follows:

1. transmission
2. highest resolution
3. wavelength stability
4. largest field of view

Similar questions applied to Fabry-Perot spectroscopy and spectropolarimetry have solicited less replies at this time, and the results for the F-P mode indicate no obvious priorities. For spectropolarimetry, the highest priority was for polarimetric precision followed by transmission.

Ken pointed out some of the unique polarimetric modes (for an 8-10 m class telescope) being considered for PFIS. These include:

- VPH Grating Spectropolarimetry
- Spectropolarimetric imaging (unique on SALT), without a disperser, but utilizing the unique chromatic splitting dependence of the beamsplitter/analyzer to give R ~20 spectra. This would be useful for surveys and crowded fields, achieving ~0.3% precision to V = 22.
- Fabry-Perot Spectropolarimetry (unique on SALT). This could be used in diffuse emission line programs.

The final results of the PFIS questionnaires can be downloaded as PDF files (quest responses.pdf & quest comments.pdf) on [www.salt.ac.za/science/restricted/PFIS](http://www.salt.ac.za/science/restricted/PFIS). Also present is a PDF file showing the Wavelength-Resolution requirements (lambda-res plot.pdf).

**Draft Commissioning Plan**

Acting PFIS Instrument Scientist, Chip Kobulnicky, tabled a draft Commissioning Science document for PFIS/IMPALAS. This comprises sections covering the following:

1. Instrument capabilities
2. Imaging
3. High Time Resolution Spectroscopy
4. Fabry-Perot Imaging
5. Multi-slit Spectroscopy
6. Imaging spectropolarimetry
7. Single/Multi-object Spectral-Polarimetry
8. Fabry-Perot Polarimetry
9. Single/Multi-Object Spectral-Polarimetry
The aim is to provide size cutting-edge science programs that will drive the commissioning of PFIS/IMPALAS.

The most recent version of the PFIS commissioning plan (a zipped PostScript file called 'comm science.zip) is available on the SALT “Science & Instrumentation website (www.salt.ac.za/science/restricted/PFIS).

**Operational Scenarios**

Ken completed the report on PFIS with a description of the likely operational scenario for multi-slit mask operations. This includes procedures to ensure the correct alignment of the slits with the star field. These procedures would be:

During slew:
– Go to observation articulation angle (fixed for pass)
– Insert slitmask, do wavelength cal (calibrates slit positions on detector)
Acquire, start guiding.
Peak-up (using 3 fiducial objects in 5 arcsec holes)
– Short (1 sec) exposures grossly binned in dispersion direction
– Cross Dispersion correction: centroid
– Along dispersion correction: 10 exposures spaced 0.5 arcsec, peak-up
Request guider x, y, roll offset, observe

11. **The Fabry-Perot mode of PFIS**

Ted Williams presented a short primer on the Fabry-Perot mode for PFIS, which will provide the only imaging spectroscopic capability of first-light instruments. Current plans involve using dual etalons, with a choice of three etalons:

- Low resolution \( R \sim 800 \) (tunable to \( R \sim 1100 \))
- Medium resolution \( R \sim 2500 \)
- High resolution \( R \sim 12,500 \)

These will be used with a combination of order block interference filters totaling \(~20\). Issue discussed included the field angle dependent wavelength gradient, which greatest for the higher resolving powers. Other parameters to note are the free spectral range, resolution and finesse, all of which impact on the throughput, which is expected to be as follows:

- Low resolution 65-85%
- Medium resolution 48-63%
- High resolution 40-52%

Outstanding issues and tradeoffs still to be considered include:

- Wavelength range
- Resolutions/number of etalons at first light (defer highest resolution mode?)
- Finesse, throughput and filter set (possibly restrict wavelength coverage for first light)
- Dual or single etalon mode
Finally, Ted described Rutger’s contribution to PFIS/IMPALAS as consisting of the following:

1. Fabry-Perot etalons, controllers and mechanisms
2. Filters
3. Grating mechanisms (e.g. for VPH angle selection).

An amount of $810K has been tentatively estimated, and committed, for the above three items, and this would be counted as part of an in-kind contribution. Rutger’s will be subcontracted by Ken/Wisconsin for this aspect of the instrument.

Ted’s PowerPoint presentation (PFIS F-P Apr01.ppt) is available on the website www.salt.ac.za/science/restricted.

12. Progress on the design for UCHRS

John Hearnshaw proceeded to give a review of the current design work being carried out for the University of Canterbury-built High Resolution Spectrograph (HRS). The original concepts for the instrument, as based on the HERCULES spectrograph, have had to be significantly revised to better match it to a 10-m class telescope.

The major requirements for such a fibre-fed instrument are seen to be:

1. high efficiency
2. continuous wavelength coverage
3. precision

The efficiency issue implies that prism cross dispersers are the best choice (compared to gratings). For high precision radial velocity measurements (e.g. needed for the detection of extra-solar planets), measurements to m/sec accuracy are required. Since an air pressure change of just 1 millabar results in an 80 m/s shift, it is desirable to isolate the spectrograph inside a soft vacuum, just to remove the refractive index changes in air at different pressures. This was the philosophy behind the HERCULES instrument, which has recently begun to be commissioned.

The choice of echelle gratings has been investigated, with R2 being ruled out due to the costs associated with a large beam size (40 cm). An R4 in Littrow configuration would require a 20 cm beam and a refractive camera. R3 options (mosaic or manually aligned) are currently being investigated. One issue to deal with is the field angle variation across the field, which is 4.7° (2.35° from center-to-edge).

The basic formula for the current concept is:

\[ n \ell = 60027 \text{ nm}. \]

A total of ~95 orders would need to be recorded for full wavelength coverage. Resolutions of 30,000 – 100,000 are possible, depending on the fibre size. Highest resolution options will likely require some special consideration to avoid being extremely inefficient.
The instrument as currently conceived is suited to single ‘bright’ \((V < 18)\) point source targets, and will have limited capability for multi-fibres. It is expected that there will be single source and sky fibre pairs (of a variety of sizes to suite the seeing or resolution choice).

The scope of the HRS was discussed in depth, with a number of SSWG representatives expressing the desire that that HRS should be tackling other types of science as well (e.g. QSO absorption lines), and should have more fibre capability for extended/multiple objects. It was pointed out that, while desirable, this was not affordable in the terms of the current budget for HRS, which was originally estimated to be in the region \$750K\) to \$1M, excluding detectors and fibre feed. It had previously been agreed (at the August 2000 SSWG meeting) that the Concept Proposal for a High Resolution Spectrograph to be built by John Hearnshaw (PI) at the University of Canterbury be accepted and that the design should continue to be developed following feedback on the science required from the SALT community. The results of the instrument questionnaires supported both stellar and extra-galactic science, although the pre-eminent interests of the PI and PI institution are in the former realm. Given the limited budget and the still useful science role of the HRS as currently conceived, it was considered acceptable for the PI to target that aspect of the science requirements which could be met and potentially delivered within, or close to, the existing budget.

\textit{It was proposed by the Larry Ramsey, seconded by Ken Nordsieck, that the current concept of a single object, high resolution, spectrograph, with some limited sky subtraction capability, proceed to a PDR in March/April 2002. This motion was put to the vote and carried, with 6 in favour and 3 abstentions.}

13. Reports from SALT partners

\textit{CMU (Richard Griffiths)}

Richard reported that a new theorist had been appointed with an interest in QSO absorption lines.

\textit{New Zealand (John Hearnshaw)}

John mentioned there were now 5 tenured astronomy positions at the University of Canterbury. Stuart Barnes (finishing PhD) was involved in the HRS design phase. The UC group is predominantly stellar. They have recently explored possible involvement with Monash University (Melbourne, Australia).

\textit{Göttingen}

Klaus reported that instrument builder, Harald Nicklas, will be busy with the development of \textit{OmegaCam} (for the VST) until at least the end of 2002. Thereafter there is some possibility that he might have some time to be involved in SALT instrumentation.

\textit{Nagoya University}

Tetsuya Nagata summarized the interest his university has in joining the SALT collaboration. Science interests at Nagoya are mainly star formation and mm-wave astronomy. They have found the \$50K deposit required to join SALT and expect of order a few \$M to be raised at some point in future.
Nagoya, in collaboration with the SAAO, have recently commissioned the “IR Survey Facility” at Sutherland: a 1.4-m alt-az telescope with a 3-beam IR array camera featuring 1K x K HgCdTe detectors. The cost of this, ~$2M, was funded from a Monbusho (Ministry of Education, Science, Sports, and Culture) Grant-in-Aid for Priority Area: “Thorough Study of Magellanic Clouds” from 1998 to 2001 (PI: Prof Hasegawa of National Astronomical Observatory of Japan). The proposal for this grant was first submitted in 1995 February, but was only successful at the third attempt, in 1997 February-June. The project started in 1998 April (a Japanese fiscal year begins in April). "Thorough Study of MC" is a US$6M project, involving observations from x-ray to radio wavelengths and theoretical work, and the slightly over US$2M spent for the IRSF came out of this grant.

There is now a plan to apply for a priority area grant or “centre of excellence” (COE) project, which could help fund involvement in SALT. The $50K will be paid from the "Thorough Study of MC" grant. Prof Hasegawa and Prof Fukui (Nagoya) are core members of the ALMA project in Japan, and they are particularly keen for collaboration with large optical telescopes in the southern hemisphere. The commitment decision was made by people including Profs Sato (Nagoya; PI of the IRSF project), Hasegawa, and Fukui.

Future plans include:

- An application for a “Priority Area Grant”. We will apply for the next Priority Area grant in coming February. Priority Area grants are in the range of $0.2 – 6M per several years. The core for the next application is joining SALT.

- Application for "Centre of Excellence" (COE). Monbusho follows the competition line, and have been making several "COE"s in national universities and institutes. COEs consist of several famous researchers, and a large budget (~$ several M over years) is given to COEs. The Astrophysics Group of Nagoya University have been applying for the COE status, and will continue to do so. From this year one of the key projects of the COE should be SALT.

Nagoya will also seek for other grants, however, just paying to join SALT is probably very difficult, and constructing an instrument (easiest) or paying for part of the instrumentation would be easier.

David Buckley thanked Tetsuya for his presentation and commented that instrument involvement by Nagoya would be a good way to develop SALT 2nd generation instruments. The IR expertise was also of interest, since there are no first-light IR capabilities on SALT.

**UNC (Gerald Cecil)**

Gerald mentioned UNC’s involvement in the SOAR project and interest in Fabry-Perot observing modes, which will also be implemented on SOAR. UNC’s contribution to SALT could increase with involvement in 2nd generation instruments.

UNC are part of a consortium to obtain excellent quality large format CCDs from MIT/Lincoln Labs. These deep depletion devices undergo molecular beam epitaxy, which boosts their UV response to remarkable levels (80% in the blue). It was suggested
that SALT might investigate this option for detectors for PFIS. More details concerning this possibility would be known by October.

**Rutgers (Ted Williams)**
Ted repeated that Rutger’s involvement in PFIS would amount to ~$800K in-kind contribution. Rutger’s involvement in a CMB anisotropy telescope would provide excellent opportunities for follow-up with SALT.

**UK (Anne Sansom)**
There are now a total of six institutions in the UK SALT Consortium:
- University of Central Lancashire
- Keele University
- University of Nottingham
- Southampton University
- The Open University
- Armagh Observatory (Northern Ireland)

Anne mentioned that there was strong interest in high time resolved spectroscopic studies (at all resolutions), down to 0.1 sec integrations.

**14. End of Meeting/Other items**
The partner reports concluded the business of the SSWG. Several items originally on the agenda had to be deferred because of lack of time. These were:

1. Plans for the SALT Fibre Feed (David)
2. CCDs for SALT instruments (Darragh)
3. SALT budget and PDR procedures (David. This was presented in full the following day at the Board meeting anyway).
4. Status report on the HET (Larry. An update was given during the Board meeting).
5. Status report on SALT (Kobus Meiring. Given during Board and Review meetings).