Minutes of the 8th SALT Science Working Group meeting

10th October 2002

Adelphi Building Conference Room, University of Central Lancashire, Preston, UK

D. A. H. Buckley
Project Scientist

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The eighth meeting of the SSWG took place on Wednesday 10th October 2002, in the Adelphi Building Conference Room of the University of Central Lancashire, Preston, UK.

1 Participants

Members:
Anne Sansom (UK Consortium)
Frank Bash (proxy; HET)
David Buckley (Project Scientist, Chair)
Gerald Cecil (North Carolina)
Patrick Cote (Rutgers)
Peter Cottrell (Canterbury)
Brian Chaboyer (Dartmouth College)
Richard Griffiths (CMU)
Wolfram Kollatchny (Goettingen)
Janucz Kaluzny (CAMK, Poland)
Ken Nordsieck (Wisconsin-Madison)
Darragh O'Donoghue (South Africa)

Ex-officio attendees:
Michael Albrow (U. Canterbury, NZ)
Mark Bailey (Armagh Observatory, UK)
Brendan Byrne (Armagh, UK)
Gordon Bromage (UCLAN, UK)
Malcolm Coe (Southampton, UK)
Patricia Whitelock (SAAO, South Africa)
Matt Bershady (Wisconsin)
Kobus Meiring (SALT Project Manager)
Andy Norton (OU, UK SALT Consortium)
Marek Sarna (CAMK, Poland)
Gerhard Swart (SALT Systems Eng.)
Lisa van Zyl (Keele, UK)

2 Agenda

2.1 Science with SALT Workshop

- discussion following the proposal presented at the last meeting
- we should decide on a suitable date(s) for this meeting, so please would representatives canvas their respective communities

2.2 SALT Engineering issues (Gerhard Swart)

- summary of developments (edge sensors, mirror alignment, status report)
- overview of Telescope Control System (TCS) developments
- technical requirements for operations & maintenance
- issues relating to the error budget
- payload update (baffle, ADC, guidance, focusing, etc.

2.3 SALT instrumentation reports and updates

- CCD status report (Darragh)
- SALTICAM VI Final Design review report (David)
- SALTICAM status report (Darragh)
- PFIS status report (Ken)
- HRS discussion group report (David)
- HRS status report (Michael)
- Presentation on Dispersed Interferometry (David)
- Discussion of HRS plans, schedule, etc.

2.4 Instrument costs, contingency, etc. (David)

- completion of instruments, commissioning, operations, etc.
- guidelines on allowable in-kind costs
- contingency principles and procedures

2.5 Reports from SALT partners

2.6 Other business

Participants were welcomed by the Project Scientist, particularly those ex officio attendees from the UK SALT Consortium.

The minutes for the 7th SSWG meeting (10 April 2002) were presented and accepted unanimously to be a true record of the proceedings (Proposed: Chaboyer, Seconded: Cecil). No immediate matters were arising from these minutes that were not dealt with in the main agenda.

3 Science with SALT Workshop

Discussion was held on the optimal venue and timing for the Workshop. For the former it was agreed that Cape Town should be the venue. There was no single date in the period September-December which satisfied all parties in terms of teaching commitments, etc. It was felt that the Workshop should coincide with the SALT Board and Science Working Group meetings, in order to minimize travel cost and time away. Following the decision of the Board, it was recommended that a date be chosen commensurate with the SALT meetings to be held in the latter part of 2004, probably October 2004.

Gerald Cecil suggested that the possibility of having the meeting as a webcast be investigated, in order for participation by those unable to travel to Cape Town.

Internet II (Abilene) could make this viable. He also suggested that the proceeding be distributed on CD-ROM.

4 SALT Technical Status Report (Gerhard Swart)

Gerhard Swart (SALT Systems Engineer) gave a technical status report of SALT, which covered five main areas:

- Operations and maintenance plans
- Telescope Control System
- Mirror alignment
- Tracker payload
- Error budget

His presentation can be accessed from the SALT SSWG website:
http://www.salt.ac.za/images/science/restrict/Sys_Eng_Oct02.ppt

The following is a summary:

4.1 Operations and Maintenance

Gerhard began with an overview of the status of the various SALT subsystems in terms of design reviews completed and acceptance testing done.

The specified SALT failure "downtime" is < 2% (similar to Keck and the VLT), but not always achieved on large telescopes (e.g. Subaru and HET). It is, however, vital if we want to get good return on invested money.

How can SALT achieve this?

- Reliable equipment. All designs have been reviewed with this in mind. Equipment warranties contracted where possible.
- Appropriate maintenance and operational "systems" (preventative maintenance, quick repair/replacement of broken equipment, stable procedures in place

"Systems" include:

- SALT Operators (SO's) , SALT Astronomer (SA's), management and technical staff
- Configuration control and error tracking software systems.
- Spare parts and procedures for failed equipment)
    - Nordic Optical Telescope (NOT) has a spare of just about everything
- Preventative maintenance plans and procedures
- Construction project will give manuals and SALT-specific training
- Error tracking software, spares and staff salaries not part of construction project

Conclusion: now would be the right time to start !

4.2 Telescope Control System

The PDR was held May '02, with external reviewer, Hilton Lewis, from Keck. His reported stated that progress and the Concept Design were acceptable. He recommended a phased implementation and an increase in staff for this work. increase suggested

A SALT Operator interface worksession has been held, where the SOMMI prototype was evaluated. This process included feedback from night assistants at Sutherland, And involved discussions and co-operation with HET SW staff, RA's and TO's.

Other developments:

- An additional Software Engineer starting 4 November
- CDR for Phase 1 (SO functions) planned for November 2002
- Network and TCS Interlock Panel installed
- Time server procured, distribution system to be developed
- Interface Simulator available to suppliers and used for testing

4.3 Primary Mirror Alignment System (PMAS)

The PMAS comprises the following subsytems:

- Centre of Curvature Alignment System (CCAS),
- edge sensors, or Segment Alignment and Maintenance System (SAMS),
- mirror actuators, or Segment Positioning System (SPS), and
- the Mirror Alignment Control System (MACS) resident on the MACS computer

The purpose of PMAS is to:

1. Provide initial alignment of segments in tip/tilt and piston in less than 2 hrs
2. Keep alignment for at least 5 days (our target being 14 days)

HET is not yet successful in achieving or maintaining alignment, although heir CCAS is not designed for the more stringent SALT spec. Heat in the HET dome seems to be preventing good alignment. The HET *Wavescope* suffers from defocus and centroiding errors, due to heat plumes from the tracker. In addition, the HET edge sensors (inductive rather than capacitive) are not sensing Global Radius of Curvature (GroC) changes. The above problems means that alignment is only maintained so long as the temperature does not drift by more than ~1 degree C after alignment.

CCAS

SALT is implementing a solution based on a modified *Wavescope*, involving:

- A high resolution CCD for improved sensing accuracy
- Shack-Hartmann lenslet array with 7 lenslets per segment for piston and better accuracy
- A complete error budget for coarse/fine alignment and piston
- SALT-specific software, programmed in *Labview*, to integrate with MACS.
- Improved optical design and components.

SPS

Two different actuators have been tested: one locally sourced and another from Germany. The latter (from *PI (Physik Instruments)* has been chosen, due to its excellent performance over operational temperature extremes, and lack of hysteresis. These are off-the-shelf components, but cost more than originally budgeted.

The SPS comprises of:

- SPS PC Software. *Labview* code, written in-house, which runs on the MACS computer (located in the Computer Room).
- 273 Actuator Controllers. These provide closed-loop control of each actuator. They are located in a cooled igloo behind the Primary Mirror and each is serially linked (by fibre) to the MACS PC
- 273 Actuators, comprising a DC-servo motor with encoder. Each unit has ~20m of cables to the igloo (to be negotiated with PI).

SAMS
These are provided by *Fogale Nanotech* (France), a company with significant capacitive sensor experience. The CDR and a prototype test will be held on 14 October 2002.

The sensors are capacitive (compared to HET's inductive) comprising of 6 sensor pairs per segment which measure vertical displacement and gap variation. The fixed truss geometry means GRoC can thus be determined. SAMS comprises of:

- SAMS PC running *Labview* software
- Sensor amplifiers and A/D's in igloos behind Primary Mirror
- 480 "receiver" and "transmitter" plates (of a capacitor)
- One "stuffing box" per set of sensors.

4.4 Prime Focus Instrument Payload (PFIP)

Gerhard gave an update on the tracker payload developments. Both mass and space are heavily constrained. A recent change is that both the moving baffle and ADC are now one assembly.

4.5 Error Budget

In reference to previously voiced concerns regarding certain aspects of the error budget (e.g. April 2002 SSWG meeting), Gerhard made the following points :

The concern at the previous SSWG meeting was about the reported EE(80) = 1.022", compared to specification of <0.9". The latter is the "as-contracted" value and the former represents the current, best-estimate, of what could be achieved.

Steps are being made to try and recover from this, namely:

- Get the best CTE values for Primary Mirror segments as possible. The first few batches had CTE < 50 ppb, while the last batch was 120 ppb. The contracted value is 150 ppb. We cannot guarantee better CTE glass without us paying more money.
- Minimise thermal variance in Telescope Chamber. The HET ventilation and electronics are very different, not comparable. Analysis of nightly thermal variation shows error budget value realistic, worst case (low wind, large day.night temperature variation).
- Optimise other designs (e.g. CCAS sensor, edge sensors). "As-tested" values will be entered into Error Budget when available.

Gerhard provided the following answers to specific questions following his presentation:

1. When is the initial (<2 hour) CCAS alignment done ? (Matt Bersahdy)
Beginning in twilight.
2. what is the current payload (PFIP) mass ? (Ken Nordsieck)
~1000 kg
3. how are the edge sensors protected ? (Gerald Cecil)
They are covered during re-aluminizing.

5 Atmospheric Dispersion Corrector (ADC)

Following Gerhard's presentation on the mechanical design of the ADC, a number of issues regarding the optical design were discussed. The ADC spec allows for an IQ degradation by ~10% at 550nm. In addition, the system spec calls for the ADC to perform over the wavelength interval 320-850 nm, with secondary dispersion of <0.15” (5% degradation).

Gerhard was asked to provide a figure for the image degradation at the wavelength extremes.

During testing, it will be possible to test the ADC on its own, and SALT, without the ADC inserted.

Darragh recommended that an interferometric test be conducted. If the ADC passes such a test, then performance will be as-designed.

The M4 issue was also mentioned, i.e. the revised merit function for trading off the clear aperture size against IQ or vignetting. This will be assessed after manufacture.

6 SALTICAM VI Final Design Review

David Buckley reported on the FDR for the SALTICAM Verification Instrument and ACSI optics, held on 12 Aug 2002. The FDR documents were reviewed by himself, Gerhard Swart (SALT Systems Engineer), the SSWG, several SAAO astronomers and one external reviewer, Dr Eli Atad-Ettegui (ATC, Edinburgh). Most of these people (excluding SSWG representatives) attended the review meeting.

The review of the ACSI optics was required before the ACSI FDR (planned for Jan 2003), due to the lead time in ordering optical blanks and starting the optical fabrication.

The detailed FDR report, including the external reviewer comments and replies from the PI, was tabled. In terms of the budget, a $14.6K cost increase has been incurred, mainly due to the new addition (requested by the SALT Project) of X-Y slide automation, and optics cost increase. Other cost escalations due to both Rand and Pound appreciation against the Dollar not ‘real’. The latter are covered by forward cover in purchase of £’s.

7 SALTICAM status

Darragh O’Donoghue presented an update on the SALTICAM status. This presentation can be downloaded from:
www.salt.ac.za/images/science/restrict/SALTICAM_Oct02.ppt

Topics covered included:

- Specification and Requirements
- Final Design overview
- Final Design and risk by subsystem
    - ACSI Optics
    - Cryostat & FT Mask
    - VI Structure & Filter Wheels
    - Motion Control
    - CCD Control
    - Software
- Budget and risk
- Open discussion

Specifications
These are sourced from the following documents:

- *SALTICAM Specification Issue 2*
- *Functional Performance Requirements Doc*
- *SALT Commissioning and Acquisition Instrument Requirements*

These can be distilled to requirements for:

- Field of View
- Image quality
- Wavelength range
- CCD cosmetics, pixel size and number of pixels
- Sensitivity (as a function of wavelength)
- Readout time and noise
- Software (including integration with SALT system)
- Ancillary: safety, envelope, mass, temperature control, environmental, operational & maintenance

Satisfying the Requirements

- Field of View (8 arcmin, 10 arcmin preferred)
  ✓ACSI mode: almost 10 arcmin; VI mode: 10 arcmin on X-Y stage
- Image quality (ACSI: EE50 0.3", EE80 0.5"; VI: No SALT IQ degrade)
  ✓ACSI mode: optical plan will supply this; VI mode: YES
- Wavelength range (320-950 nm)
  ✓VI and ACSI mode: YES
- CCD cosmetics, pixel size and number of pixels
  ✓VI and ACSI mode: YES
- Sensitivity (as a function of wavelength)
  ✓VI and ACSI mode: YES
- Readout time and noise (3.3 e$^-$ at 10 μsec/pix; 5.0 e$^-$ at 3 μsec/pix)
  ✓VI and ACSI mode: To be confirmed when real CCDs are tested
- Software (including integration with SALT system)
  □VI and ACSI mode: NO (not at FDR stage of development, trying to catch up)
- Ancillary: safety, envelope, mass, temperature control, environmental, operational & maintenance issues
  ✓VI mode: YES so far (addressed in Safety and ICD documents)

Design
Darragh reminded everyone of the basic design elements of the two configuration of the instrument, namely Verification Instrument (VI) mode and Acquisition Camera and Science Imager (ACSI). The two configuration share the following subsystems:

- Cryostat and CCD
- Frame transfer mask
- Cryotiger compressor
- CCD controller
- Host PC

Items unique to each configuration are optics (ACSI only), filter mechanisms, structure.

Work completed to date
This includes the following:

- VI mode:
    - Image quality, ghost & stray light
- ACSI mode:
    - Refractive index checks
    - Optical design & analysis
    - Ghost analysis
    - Preliminary stray light analysis
    - Focus & thermal analysis
    - Lens coupling & coatings
    - Tolerance analysis & partial error budget
    - Optical testing (incomplete)
    - Opto-mechanics (~complete)
    - Fabrication plan
    - Element drawings

Immediate work to be done
Includes the following for ACSI mode:
- Final stray light analysis
- Coating choice & procurement
- Finish error budget (after ACSI mechanical design complete)
- Optical testing tolerance analysis
- Opto-mechanics: cell/barrel interface
  ✓Test plate matching
  ✓Element drawing revision
  ✓Fabrication plan implementation: optical blank material procurement

Concerns and Risks
There has been some escalation in costs since the PDR, and a number of risks, listed below:
1. $10,000 increase in the costs of anti-reflection coating the optics
2. ~$6,000 for a spare BaF_2 element
3. CCD delivery is ~6 weeks behind schedule from *Marconi (E2V)*
4. Final mosaicing solution still to be determined/contracted
5. Schedule risk (mitigate with overtime)

Discussion
Gerald asked if the SALTICAM project was the SAAO's first experience with Leach (SDSU) controllers, which it is. He also mentioned the potential desire for Strömgren filter (e.g. Bruce Carney at UNC). Janusz also mentioned the possibility of other filters (e.g. SLOAN). The budget situation means that there is only one set being provided by the SALTICAM construction budget, namely a UBVRI set. Anne reiterated an earlier suggestion that a dichroic could prove useful for simultaneous imaging (with SALTICAM) and spectroscopy (e.g. PFIS, or eventually HRS). These would have to be funded out of new initiatives.

8 PFIS status report

Ken Nordsieck presented a status report on the Prime Focus Imaging Spectrograph/IMPALALS. His presentation can be downloaded from the SALT SSWG website:
www.salt.ac.za/images/science/restrict/PFIS_Oct02.pdf

His presentation covered the engineering status (optics, mechanical, control systems) and management (budget and schedule).

8.1 Optics

The optical designs have been updated for both camera and collimator using the final indices of refraction (as with SALTICAM, there were errors in the tabulated values). The result has been a ~20% image quality degradation, which can be addressed by either decreasing manufacturing margin or relieving the spec.

The thermal design has been completed, with refocus now in the camera. The pupil placement and fold mirror positions have been updated for maximum NIR collimated beam. Fused quartz has been used instead of fused silica in the common collimator beam to avoid a NIR absorption line. The camera configuration has also been updated.

Spectral Resolution

At PDR the maximum resolution of 6250 was overstated, due to using median (zenithal) seeing of 0.9 arcsec, not telescope image of 1.25 arcsec. The revised model now uses seeing degraded to 37 degree Zenith Distance, the actual SAC and PFIS models. In median seeing, a 1.25 arcsec slit will give 70% throughput. The effective resolution at a given grating angle is also reduced to 70% of the previous value. By increasing the maximum articulation of camera to 100 deg, this increases max resolution by 20%, or R = 5500 at 50 deg tilt, 1.25 arcsec slit.

VPH Gratings

The PDR budget has priovision fpr 5 VPH gratings and one grism (for low R work). VPH procurement will occur in next 6 months. Some tradeoff study is still required, namely UV efficiency vs high resolution efficiency. It is suggested that efficiency in UV be maximized for the highest and lowest density gratings, while efficiency at high resolution be maximized for the other three. It should be noted that SALT can easily add further VPH gratings, since the grating magazine is designed for swapout.

Current designs for the VPH gratings, and the parameter space they operate in (wavelength coverage, resolution, efficiency) were presented. Some discussion ensued on possible changes. Following the SSWG, the Project Scientist was asked to canvas the SSWG community to provide feedback to the PI on the preferences for the VPH grating designs to be pursued.

Ken reported that his discussion with a new potential VPHG vendor from Liege indicated that they were uncomfortable with too high index modulations (of order ~0.1), required for some PFIS VPHGs.

Optomechanical

One of the largest PDR risks are the optics, especially optomechanical mountings, which was under-budgeted at PDR. A subcontract for optomechanical was awarded to J. Alan Schier of the Pilot Group. He has done the optomechanics for Keck ESI and DEIMOS and is comfortable working with fluid coupling, salt elements and solgel. Tasks to be completed include determining the mounting tolerances, design and fabrication of lens holders and assembling the lens groups.

Current Concerns

This includes the anti-reflection coating strategy, where the baseline design has solgel on interior surfaces and ‘hard’ conventional multi-layer coatings elsewhere. At present the costs are poorly defined.

Stress birefringence in the collimator potentially degrades the polarimetric efficiency. The blanks would need to be tested, or selected for low birefringence, and in the case of NaCl, there is a potential problem due to the lack of such data. Selecting the four CaF_2 blank costs on this basis may incur increased costs. In addition, the investigations need to be made of the VPH and etalon effects.

<u>Planned Procurements</u>
Before CDR:

- third etalon (before year's end to get good price)
  - it was subsequently agreed by the SSWG (Proposed: Chaboyer; Seconded: Kaluzny?) that the purchase of the third etalon go ahead.
- fold flat/ coating
- camera/ collimator blanks
- grating blanks

Just after CDR:

- camera/ collimator figuring
- waveplates, beamsplitter
- VPH gratings

8.2 Structure and Mechanisms

For the structure, the guide mount interface has been designed as well as the collimator assembly. Some of the mechanisms designed include the waveplate, slitmask, grating mechanism and camera articulation.

PFIS is now able to do a full articulation (up to 100º) in < 20 sec, enabling efficient PFIS imaging mode setup to support MOS slitmask observations.

8.3 Control Systems

Control hardware for a generic mechanism test bed has been purchased, and is now operational. This has been useful for the LabView 'learning curve', and in answering operational questions for mechanism designs. In addition, work has proceeded on wiring architecture, electronics control box placement and cable harnesses.

Software development has therefore used actual operating hardware. A prototype client / server scripting system has been developed which is consistent with the telescope architecture.

8.4 Management

<u>Budget</u>
The following table shows the current cost to completion estimate for PFIS (in baseline Mar99 $), where both the University of Wisonsin (UW) and total costs are shown. The delta costs are per quarter, whereas the "% Cont" is the *accumulated* amount of contingency/budget reserve allowed as a fraction of the total available (20% of the baseline total PDR value).

	PDR	**'02 Q1**	**'02 Q2**	**'02 Q3**
UW	$2,426,501	$2,616,194	$2,675,390	$2,814,391
Total	$3,645,947	$3,835,640	$3,929,229	$4,068,574
Delta		$189,693	$93,589	$139,345
%Cont		26%	39%	58%

The main reasons for the deltas are described below for each quarter, where the amounts are in current (nominal) $:

Q1:
- Salary accounting error $96K (one-time error)
- Swales contract $32K
- Drafting subcontract $50K
- Opto-Mechanical subcontract $50K
- Management assistant $45K
- Indirect cost saving −$30K
- Waveplate saving −$40K

Q2:
- SAAO Cryotiger, etc $25K (not in original budget)
- US$ slowed inflation $50K
- electrical engineering underestimate $15K

Q3:
- Drafting subcontract underestimate: $97K - $50K - $20K = $27K. Control mech design schedule risk.
- Optomechanical subcontract: $220K - $50K - $20K = $150K. Control optics technical/ schedule risk; biggest PDR budget deficiency

Prognosis
To date the use of available contingency (58%) somewhat above that expected at this point (50%), but is still on track. Remaining deltas will be much better known at the time of CDR:

For capital purchases, preliminary RFQ's have been issued on the largest budget items. Predictions are for likely cost increases for the CaF_2 blanks and anti-reflection coatings. This is likely to be somewhat countered by savings in mechanisms/controls, lens fabrication and slitmask mill.

For schedule, the remaining contingency (~40% of total) would cover an ~8 months slip.

9 HRS Subcommittee report

Following a motion at the 7^{th} SSWG meeting (April 2002), the Project Scientist constituted a SSWG subcommittee to investigate some contentious issues regarding background subtraction, order spacing, etc.

The following people participated in the email discussion:

Michael Albrow (Canterbury, HRS Project Scientist)
Matt Bershady (Wisconsin)
David Buckley (SALT Project Scientist, Chair)
Janusz Kaluzny (Poland)
Chris Clemens (UNC)

Pat Cote (Rutgers)
Darragh O'Donoghue (SAAO)
Phillip MacQueen (U. Texas)
Larry Ramsey (Penn State)

Consensus was achieved and the following three motions were carried:

1. *This committee accepts that as accurate a measurement of background as possible is essential for SALT HRS science, consistent with available resources. In regard to the number of fibres, this requirement can be satisfied with 1 star and 1 sky fibre.*

2. *This committee believes that there is sufficient motivation for increasing the inter-order spacing to warrant requesting that the instrument designers investigate this possibility, either with prism or grating cross dispersion.*

3. *This committee believes that it is imperative for the instrument designers to investigate the effects of a changing pupil on stability of HRS radial velocity measurements, and weigh the relative merits of an encapsulating tank against other alternatives, e.g. iodine cell, interferometric comb, etc.*

10 SALT High Resolution Spectrograph (HRS) Concept Design

Michael Albrow presented details of work done on the redefinition of the HRS Concept Design, following the recommendations put forward by the SSWG HRS subcommittee (see above).

The material is included in the document *Revised SALT HRS Concept Proposal, by Stuart Barnes and Michael Albrow,* and can be downloaded from:
www.salt.ac.za/images/science/restrict/HRS_Oct02.pdf

The current work concentrates on the optical redesign following the decisions conveyed by the SSWG subcommittee on 23 July 2003. Because of the relatively short amount of time available (~10 weeks), the discussion is preliminary, but indicates the way ahead.

The main change in design has been to use bundles of 4, 7, 9 or 14 fibres to increase throughput at higher resolution. Single, large fibres (e.g. 500µm) will be used for the lowest resolution modes.

The revised design has two 308 mm $\times$ 408 mm R2 (θ_B = 63.4°) échelle gratings, with ruling density of 87 grooves/mm, in a mosaic. High resolving powers can be obtained (R = 75,000) using 100µm fibre bundles. Cross dispersion is achieved using two 46.4º prisms, in double-pass mode. The inter-order spacing is then sufficient for up to 3 independent spectra, e.g. one 'object' and two 'sky' either side, or 'nod & shuffle' an object between two fibres. There is even some possibility for MOS spectroscopy. Although details of the camera optics are still to be worked out, it is likely to be a catadioptric system.

A R = 14,000, the spectrograph efficiency will peak at ~14% (including fibre, telescope and CCD), comparable to efficiencies on similar instrument on large telescopes (e.g. VLT UVES, Keck HiRES).

The SSWG were encouraged by the direction which the design has moved and the work completed leading up to this meeting. Following discussions regarding the way forward for the HRS, the following motion was proposed by Darragh and seconded by Ken:

> *"The SSWG encourages the HRS team to formulate a Concept Design Proposal following the guidelines of the instrument Statement Of Work (SOW) and, provided it is accepted by the SSWG, recommends that HRS proceed to PDR"*

This motion was carried, with two abstentions.

11 Externally Dispersive Interferometry

David Buckley summarized the basic principles of Externally Dispersive Interferometry (EDI), a promising technique developed by Dr David Erskine at LLNL. EDI is capable of both boosting the resolving power of a given spectrograph some 2-3 times above its nominal value, and also providing unprecedented radial velocity precision.

The technique is based on a Michelson white-light interferometer, in which light is fed from an optical fibre before it passes into a spectrograph. The EDI imposes a regular set of fringes, which act as regularly spaced fiducials, with shapes exactly mimicking the PSF. These fiducials allow very accurate determination of spectral shifts (e.g. caused by radial velocity motion).

Because the EDI process involves a heterodyning effect, which effectively moves the normal grating frequency response function to higher frequencies, the resulting spectral information has a higher effective resolution. The peak of the response function now lies out at higher frequencies, where the information content of the many sharp absorption lines, needed for good radial velocity determination, is greatest.

Advantages of the EDI is that it can be simply retrofitted to an existing spectrograph, or better still designed to be incorporated in the fibre-fed echelle spectrograph, like SALT HRS. Other attributes include compactness, low cost, high transmission and ability to counteract PSF changes (e.g. due to moving pupil).

David mentioned that Erskine, together with a group at UC Berkeley Space Science Lab, were interested in building an EDI which could be used with SALT HRS. They also expressed general interest in being involved in SALT, with the result that the SALT Board Chairperson would be visiting California next month to discuss this possibility.

The PowerPoint presentation can be downloaded from:
www.salt.ac.za/images/science/restrict/EDI_Oct02.ppt

12 Instrument Project Protocols

David tabled two documents, prepared for discussion by the SALT Board:

1. *"Allowable Costs in the Valuation of Instruments"* , and
2. *"Instrument Contingency Expenditure, Acceptance and Valuation"*

These were written in order to provide guidelines and protocols in dealing with these issues as they apply to SALT instruments (first, and subsequent, generation instruments). The aim to clarify the procedures used in assessing legitimate instrument costs, particularly when it pertains to expenditures above their budgeted amounts. These documents aim at removing an apparent contradiction, namely that the SALT Board has approved useage of PFIS contingency funds, which are not currently budgeted for.

Ken described how the PFIS “contingency” is different from the usual “risk” associated with normal commercial contracts, and based on the NASA paradigm of a “budget reserve” which covers both cost uncertainties, schedule delays and true risk associated with unexpected events, like breakages and unforeseen tasks. Instrument cost estimates improve with time, as an instrument programme progresses, and the cost to completion should be reviewed at specific milestones (e.g. design reviews). It is usual practice to spend such budget reserve as soon as shortfalls are discovered, particularly in the case of schedule slippage, where a delay can have a knock-on effect.

To date ~60% of the PFIS budget reserve has been allocated, which is just over what would normally be expected at this phase of the project (i.e ~50%). The second document proposes an incentive not to use contingency/budget reserve, namely to value such expenditure differently (e.g. one-off allocation of time instead of shares in perpetuity). Agreed to contingency monies must be made available for valid expenditure, as determined by negotiation between the PI and Project Scientist. Some amount should be preserved as a true “safety factor”, for unforeseen events.

Following the inputs from the SSWG and SALT Board, the above two documents would be revised accordingly before becoming official policy.

13 Reports from SALT partners

The meeting concluded with brief summaries regarding recent activities from the partners.

Rutgers (Pat Cote)
Five new astronomy courses have been initiated.

UNC (Gerald Cecil)
An external review of the department has been conducted, which has endorsed the hiring of more theorists. A new hire was recently appointed, who is an expert on GRBs and ToO observations.

South Africa (Darragh O’Donoghue)
Darragh reported that the new National Astrophysics and Space Science Program (NASSP) will begin in 2003. This is aimed at Honours and Masters level postgraduates who will be exposed to the many branches of astronomy and astrophysics. The course is to be hosted by the University of Cape Town.

SAAO is heavily involved in SALT instruments (SALTICAM and detector package for PFIS).

The SALT Collateral Benefits programme has got a boost following the appointment of Dr Clifford Nxomani as its Manager.

Poland (Janucz Kaluzny)
Two SALT meetings are being planned, one in November 2002, and a future NATO sponsored meeting.

Göttingen (Wolfram Kollatchny)
There is potential interest in involvement of SALT 2nd Generation instruments. Göttingen are also involved in the MONET program: two 1.2-m robotic telescopes to be situated in Sutherland and McDonald Observatory.

Canterbury (Michael Albrow)
Michael reported that despite repeated attempts, Auckland University were not interested in joining with Canterbury in SALT.

Dartmouth College (Brian Chaboyer)
Brian mentioned the desire of Dartmouth to increase its shareholding by allocating further operations funds to allow the already paid-in operations funds to be used for capital expenditures.

UK Consortium (Anne Sansom)
Anne reiterated the UK interest in HRS. A meeting of the UK Consortium was held in September. Many different interests are represented within the Consortium.

Wisconsin (Ken Nordsieck)
A new staff member has been appointed to the Department, a magnetic theorist.

Hobby Eberly Telescope (Frank Bash)
Frank reported on the success of the LRS and HRS. The former having been involved in some excellent science, which has been very competitive with Keck. Likewise, for target of opportunity observations, HET with LRS has been very successful (e.g. Gamma ray burst follow-up).

MRS will soon begin commissioning, expected to take 12 months. The J-arm of LRS will also be commissioned soon.

CMU (Richard Griffiths)
Richard reported on an initiative to use a Superconducting Tunnel Junction (STJ) camera, developed at ESTEC, on SALT. He and David would be visiting tone Peacock at ESTEC during the following week to investigate this possibility.

14 Other business

Ken Nordsieck brought up the issue of PFIS commissioning. There would likely be period during commissioning where some science could be expected, but that this should be seen a period of "shared risk". A commissioning plan and further discussion of this would be held at the next SSWG meeting.

Regarding the operational software, specific planning tools for the use of SALT Principal Investigators will be produced by the SALT TCS team, including the design of the Science Database. More information and guidelines are needed, however, particularly in regard to the form of the data archive and SALT data release policies.