SALT BOARD MEETING #37

28-29 May 2015 at Stellenbosch, South Africa

SALT OPERATIONS REPORT

J Chris Coetzee - SALT Operations Manager
and Petri Vaisanen - Head of SALT Astronomy Operations

TABLE OF CONTENTS: PAGE

Executive Summary…….. 2
Chapter 1 – SALT Operations…… 3
Chapter 2 – Astronomical Operations…… 8
Chapter 3 – Technical Operations……..15

Fig. 1: Program Completion per Semester…… 2
Fig. 2: SALT Refereed Journal Papers per Year……2
Fig. 3: End-to-end Process for SALT Operations……4
Fig. 4: Operations Dashboard 2014-2 Semester……6
Fig. 5: Fault Tracker……7
Fig. 6: Time Breakdown..…… 8
Fig. 7: Program Completion per Definition…… 9
Fig. 8: Papers per Telescope……..10
Fig. 9: Technical Faults for 2014-2 Semester……...16
Fig.10: Overtime and TOIL for 2014-2 Semester….17

EXECUTIVE SUMMARY

This report focuses on the integrated SALT operations activities and Special Projects since Board meeting # 36. The integrated SALT operations started on February 2, 2015 when the previous Tech Ops and Astro Ops were combined under one manager. Chapter 1 will discuss the most important joint activities and results achieved during this period. Chapter 2 will discuss the astronomy operations in more detail and Chapter 3 the technical operations.

It will be seen that the integrated operations has improved throughput, productivity, effectiveness and efficiency. Highlights include:

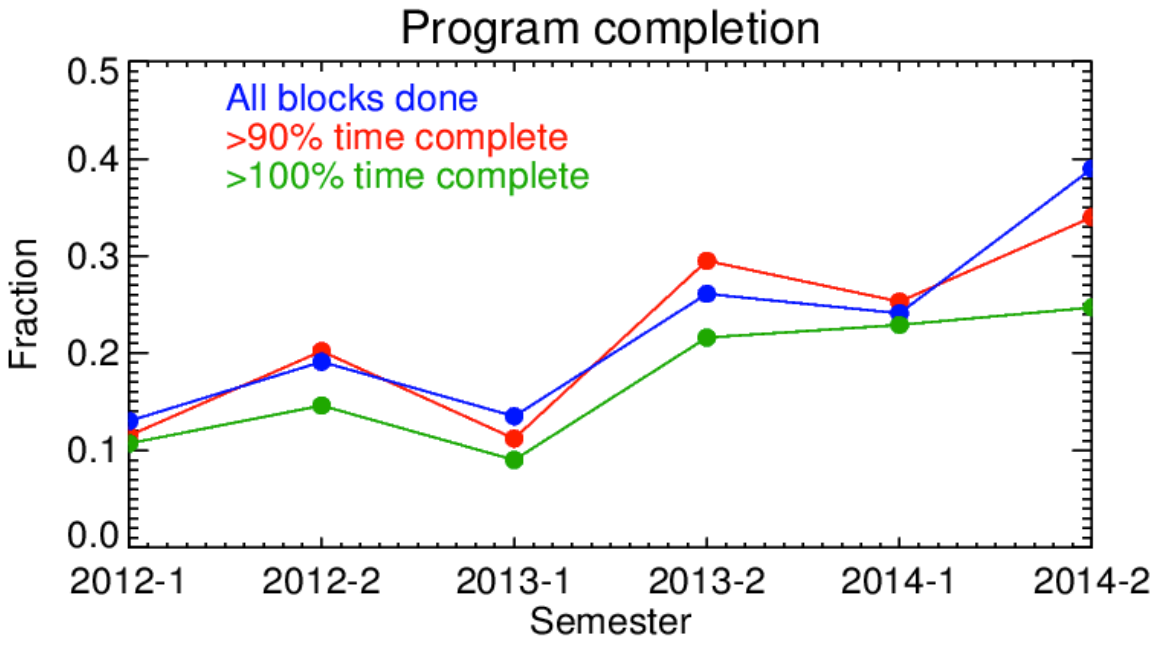


Fig 1: Program Completion per Semester

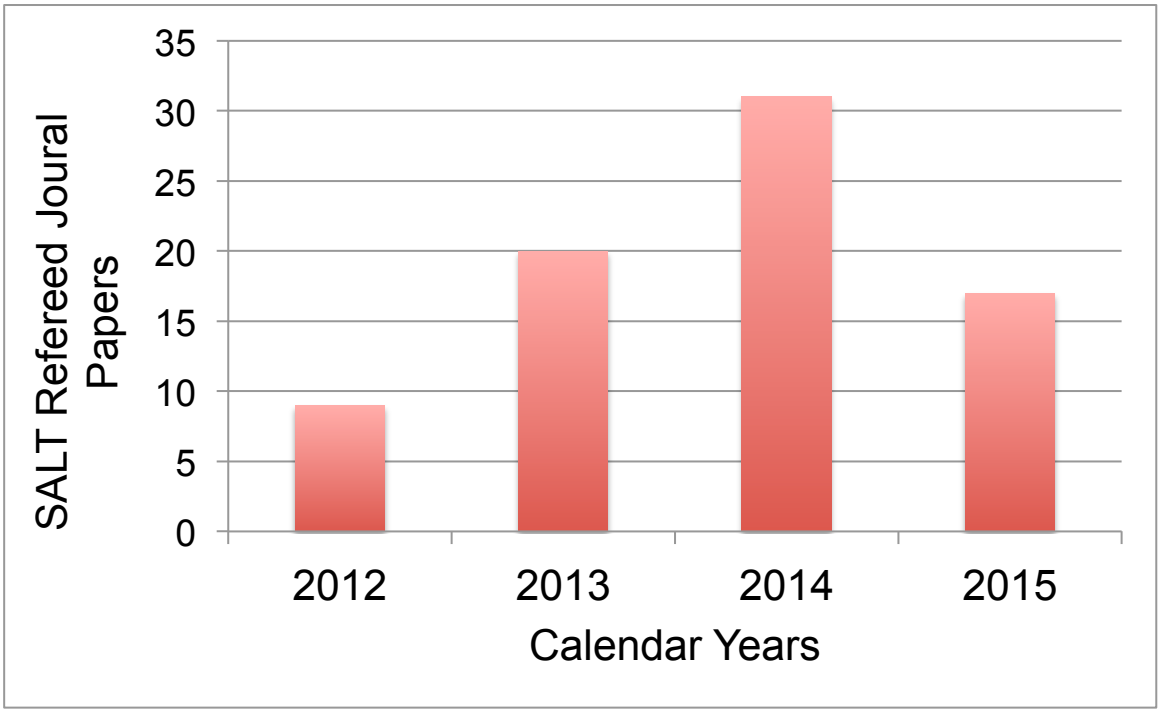


Fig 2: SALT Refereed Journal Papers per Year

Of course, SALT operations is responsible for the Program Completeness but only an indirect contributor (albeit a vital one) to publication production.

Astronomy Operations – Science time on the telescope for the past Semester was 41%, slightly less than other recent summer seasons. There was a concentrated effort to use this time efficiently, however, resulting in 39% of programs in the queue having all their submitted Blocks completed. This is the highest fraction to date. Significant resources were used to analyze and simulate Semesters in an attempt to further maximize SALT observing. These results and recommendations are presented to the Board. Apart from Fabry-Perot mode (back on-line now for 2015-1), all instruments operated nominally and plans were devised for re-commissioning of Polarimetry.

Technical Operations – the downtime of the telescope due to technical problems and operational mistakes during night operations (collectively defined as Technical Downtime) has dropped sharply from a high of 12,4% in January to 2,74% in April, with an average of ~8% for the semester. This is especially pleasing because November was still plagued by start-up issues after the cleaning of the RSS optics and the extensive maintenance work done on its many devices. The figure for the previous reporting period was ~10%.

CHAPTER 1

INTEGRATED SALT OPERATIONS:

Integrated operations was kicked-off on February 2, 2015 when Petri Vaisanen and Chris Coetzee took up their new positions respectively as Head of SALT Astronomy Operations and SALT Operations Manager.

It was very unclear in the beginning what we are striving to achieve with SALT! As we see it, our Mission is:

> *Mission - SALT must produce the maximum possible completed proposals per semester containing quality data so that partner PIs can produce quality science?*

In order to achieve the above mission, a 5 point plan was devised namely:

1. Recognizing that allocation of telescope time has a major impact (an issue outside of the control of SALT Operations), much discussion has gone into how to make more effective usage of the telescope. We urge the Board to consider how this might be improved. Certainly, strengthening interactions between SALT Operations, the TACS and users, and the Board will result in better utilization of the telescope's capabilities. We discuss this issue further below.
2. Scheduling short and long term - Improve the scheduling to support the completion of proposals as the top priority. Scheduling simulations to be done to develop optimized rules for achieving that goal. A scoring tool has already been implemented to help the SA make optimal decisions re blocks to observe during night operations in order to support the mission.
3. 10m Telescope performance – to improve the telescope to be more effective, efficient and reliable by implementing the Priorities program, addressing specifically the issues that constrain acquiring quality data appropriate for a 10-m class telescope. A systematic maintenance process has been developed and implemented that will also help to reduce down-time.
4. Performance Metric Tracking System – use the Dashboard and Fault Tracker systems to keep track of performance on a daily, weekly, monthly and 6 monthly basis. This will allow fast reaction to address issues as soon as they arise.
5. PIs – Discussing and implementing plans for how SALT Operations can support PIs and encourage them to publish papers once they have received completed proposals from SALT.

Astro Ops and Tech Ops teams are working well together and many synergies have been found.

- Better communication because of having only one Operations Meeting
- Better coordination between Tech and Astro Ops activities, including operational and project issues
- Better control since one person is in charge and held accountable for all operations and projects
- More accountability: performance metrics are presented at the weekly Operations Meeting, attended by the SAAO and SA SALT Directors. This monitoring of performance has certainly led to higher productivity. Minds are also focused on under-performing areas.
- Better communications has led to better teamwork, fostering common goals and better understanding of each others' challenges.

The entire operational process, end-to-end, was reviewed, starting with the request for Phase 1 proposals all the way through to the provision of data to the PIs, and even touching on the writing and publishing of science papers (see Fig. 3).

In addition, all the SALT operations staff participated in a review of the priorities of "what to fix first" (see separate report by Darragh). During this process, bottelenecks were identified and actions formulated to address the bottlenecks. A separate presentation in this regard is included in the Board papers.

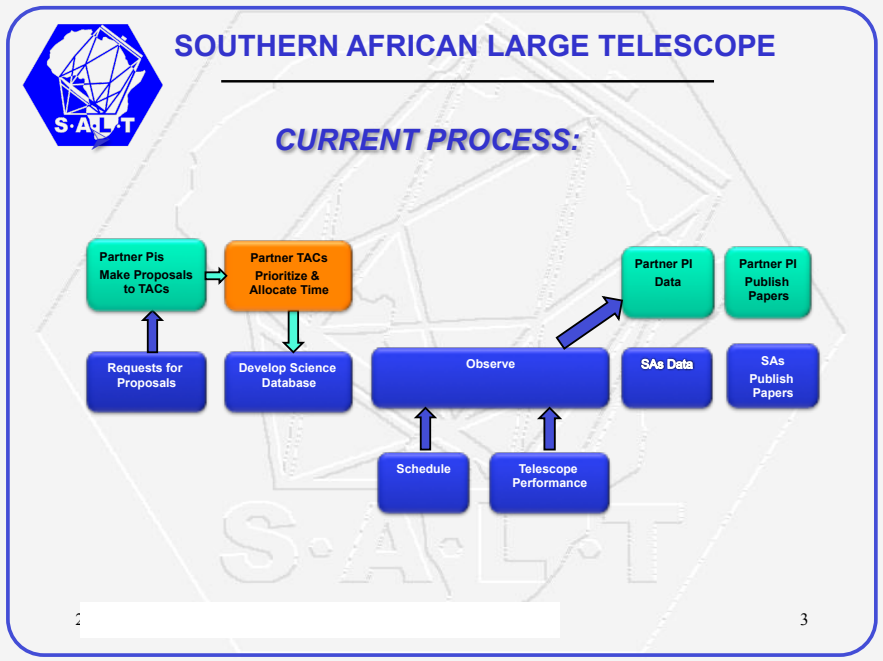


Fig. 3: End-to-end Process for SALT Operations

As mentioned above, we are concerned about how the telescope is being used, given that the rate of acceptable science data coming out of the telescope is FAR higher than the rate of proposal completion. It is clear that the telescope is being used more as a general purpose telescope but due to its design (e.g. not fully steerable), it is not really suitable for this role. Mike Shara then wrote a letter to the TACs, while they were considering Phase 1 proposals, explaining what they might like to keep in mind during their decision-making to better utilize the telescope's capabilities, which in the end would lead to better science productivity by their PIs. The SA TAC was mostly implementing most the advice already and this was strengthened by Darragh O'Donoghue's participation in their recent allocation of time.

We recognize that intruding in how partners use their telescope time is a very delicate matter: scientists at partner institutions have specific research interests and do not want to be told what they can or can't do with SALT. We recognize that the options for smaller partners are even more limited than for the larger partners. We are simply drawing attention to how effective usage of the telescope, given its limitations, is being constrained by characteristics of the observational programs being submitted.

Another issue which was recognized is the observation scheduling process. As this is under the SALT Operations Team's (SOPT) direct control, the team started a workgroup, with the SALT Operations Manager's in the Chair. The workgroup consists of Darragh O'Donogue, Petri Vaisanen and his team of people working on scheduling (Paul Kotze, Encarni Romero Colmenero and Brent Miszalski). It meets weekly. Two areas were analysed, one being simulation of a semester to determine the sensitivity of the process on various parameters. Resulting from that, better rules can be developed and proposed to the Board to improve completed proposals. The other was a scoring algorithm devised by Paul Kotze to help the observing SA make the most optimal decision during operations. These efforts have already born encouraging fruit. The results of their work are reported seperately by Petri Vaisanen.

An interesting fact that came to light is that the number of papers published versus completed proposals and the amount of science data do not correlate well. Astro Ops have written and spoken to PIs to offer help, if required, to speed up this process. The Board can also help in this regard by determining what the reasons are for not publishing papers and giving feedback in this regard.

As mentioned above, another initiative taken was to implement two new information systems. The one is called the "Dashboard" (as mentioned already) and the other the "Fault Tracker".

The operations Dashboard has now been implemented on the web and is being used on a daily basis during Tech Ops's morning meetings and on a weekly basis during the SALT Operations Meetings. It is also being displayed in the Control Room and soon in the SALT kitchen in Cape Town. The dashboard is depicted below (Fig. 2) and in a more legible form in Annexure A. Its content is fairly self-evident but more detail can be given at the Board meeting. Readers will see daily, weekly, monthly and six monthly figures and trends related to the production of observing blocks, science time, observing efficiency and down-time due to weather, engineering and technical issues.

An upgraded Fault Tracker System has also been implemented. It also tracks science and downtime but more importantly, faults occurring on telescope sub-systems. Fig 3. Below shows an example of a nightly interactive summary. The link to these reporting systems is at: http://ft.salt.saao.ac.za/.

In summary, the uniting of Astronomy and Technical Operations into one unit has given rise to more effective management control, far better communication, new initiatives in performance monitoring, and a united approach to prioritizing improvement projects. We believe that the fruits of this are already visible.

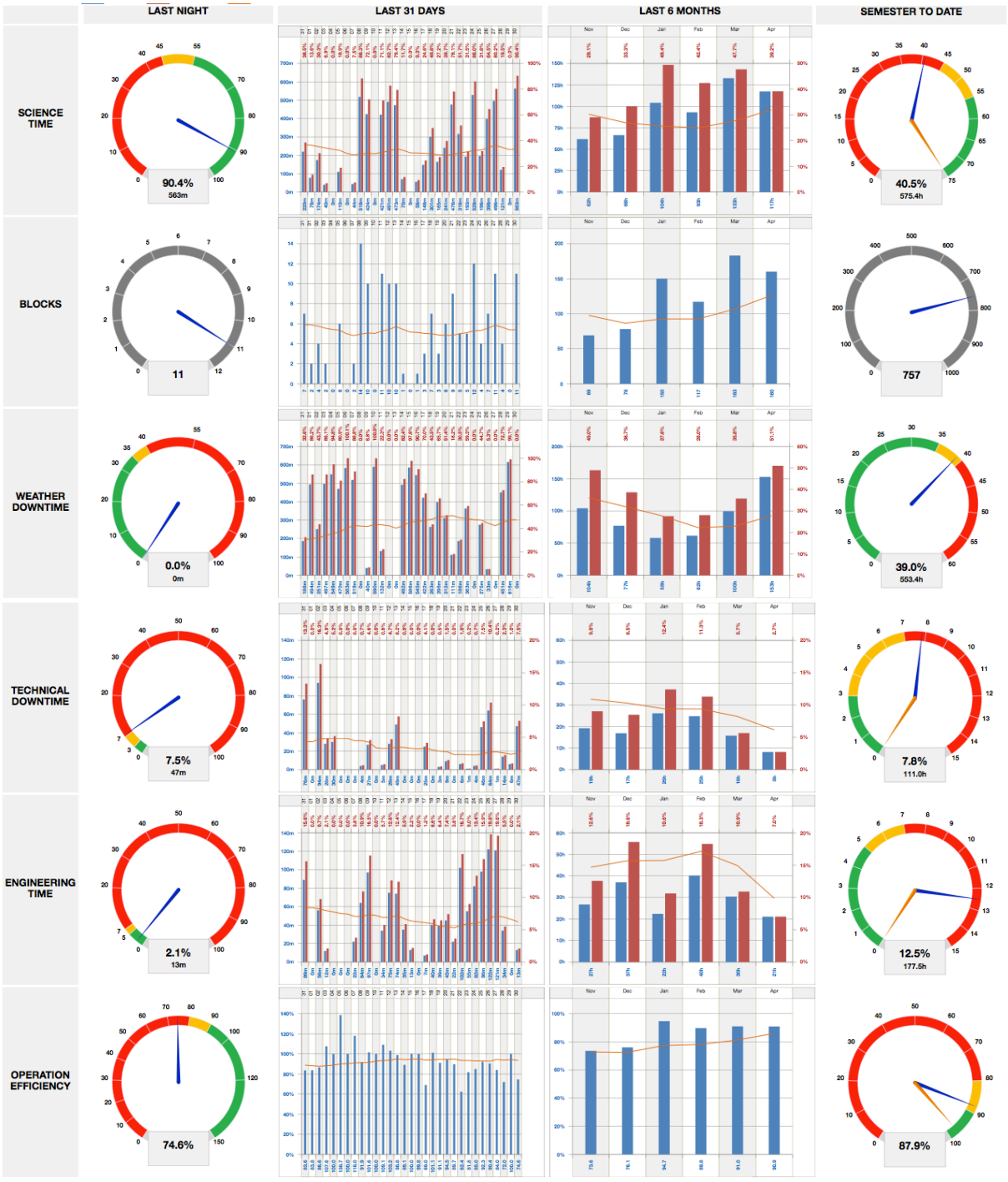


Fig. 4: Operations Dashboard from the last night of 2014-2 Semester showing the full semester statistics.

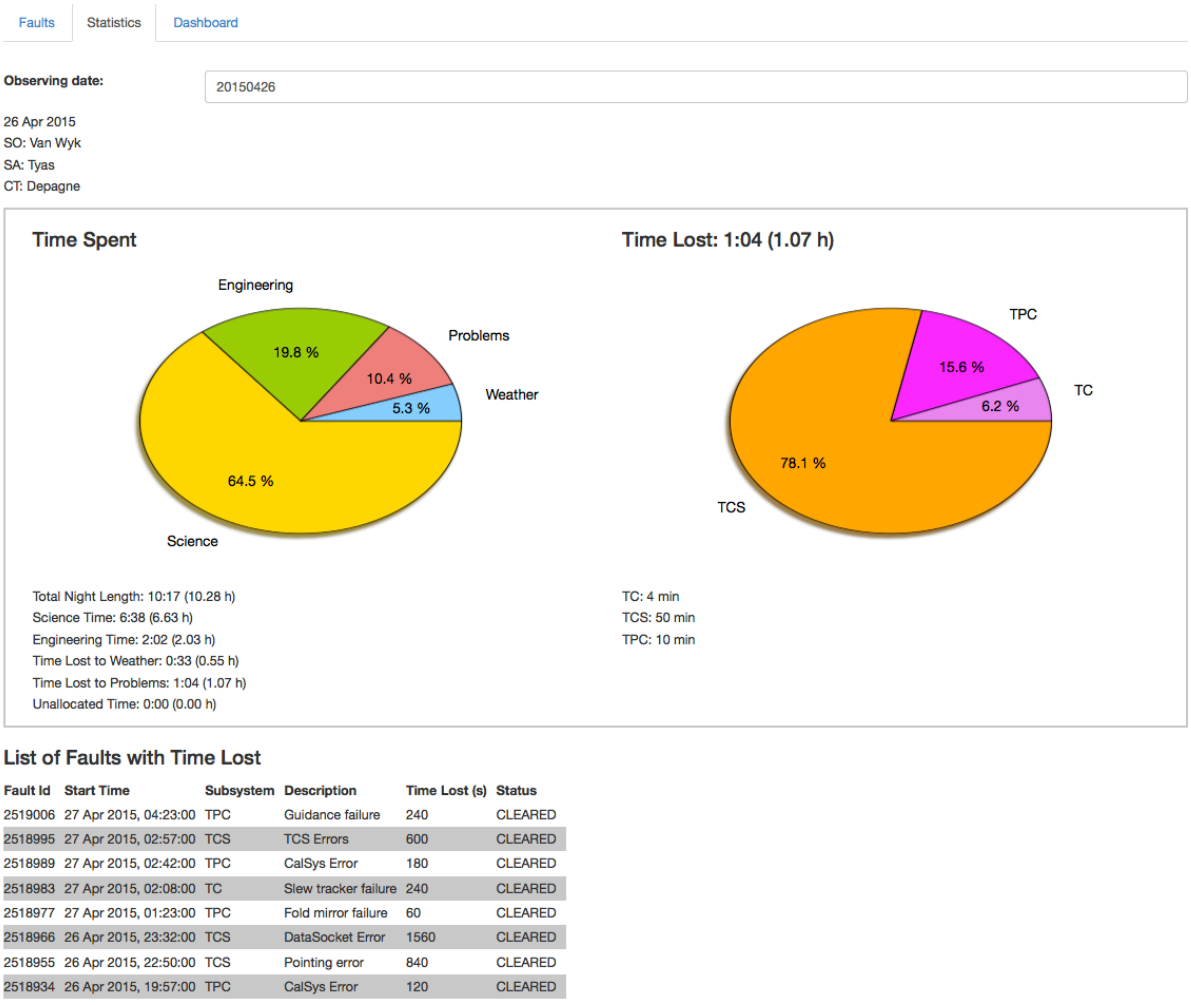


Fig 5. Fault Tracker.

A night with more than normal technical and engineering time was selected to highlight the information tracked. FT is updated automatically daily and the faults are entered as they happen during the night using the “Faults” tab.

CHAPTER 2

ASTRONOMY OPERATIONS

The astronomers in the SALT Operations team do not merely operate SALT. They understand intimately how the complex visibility patterns of a fixed altitude telescope work, how observations are carried out and data reduced, and hence the team is in a crucial position to help make SALT efficient and productive.

With this mission in mind, in the past 6 month period extra effort has been put into simulating and analysing the queue and its scheduling, into providing analysis of technical faults, and giving input on priorities. Work on data reduction pipelines has stepped up, while PI support and normal software development has continued as before. Astronomy Operations has also started providing weekly reports and stats highlighting issues and results, and plans for the week ahead, for the whole SALT Ops team.

SALT SCIENCE

A. Semester 2014-2 :

The visual below shows the nightly time breakdown of the semester which has just concluded. Full statistics with tables and figures are submitted in a document about Scheduling and 2014-2 statistics, and only most relevant numbers with brief comments are given here.

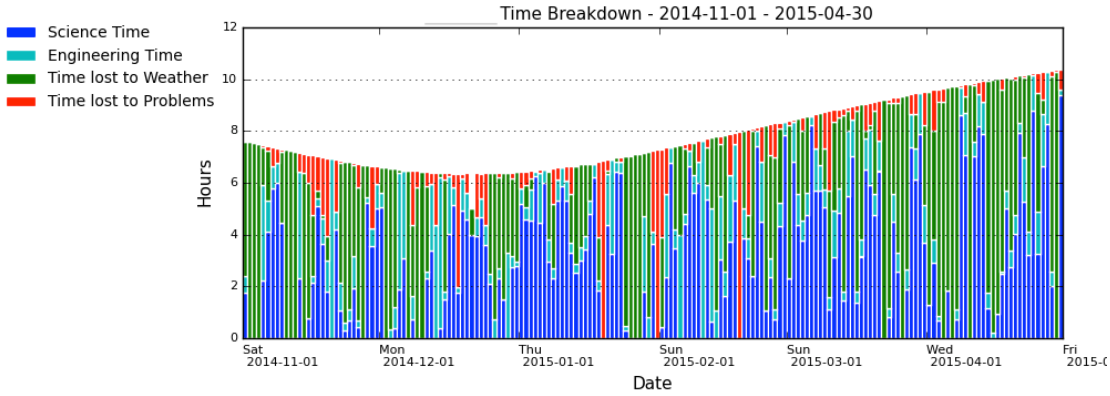


Fig. 6: Time Breakdown

Time breakdown: Measured purely by the eventual available 41% science time (defined as time between the end and beginning of twilight minus weather, engineering, and technical downtime), the past SALT semester turned out to be slightly worse than typical summer semesters. Weather downtime was 39%, higher than a typical 35% for the summer semesters. Technical downtime at 8% is similar to the long-term average, but better than 2014-1. Because of the necessary SAMS testing, engineering time at 12% was higher than specification. The previous 2 semesters were at a similar level mostly due to HRS commissioning and RSS re-work.

Program completeness: However, the 41% of available science time was used efficiently. A total of 30 programs, or 39% of programs in the queue, had all their submitted blocks completed. This is the highest figure to-date.

Another “completeness” measure across semesters could be what fraction of programs got 90% or over of their time allocation completed. For 2014-2 this is 34%, again higher than previously. (This measure is lower than completed blocks since the latter includes programs that did not submit blocks for their full allocation, such as ToOs.)

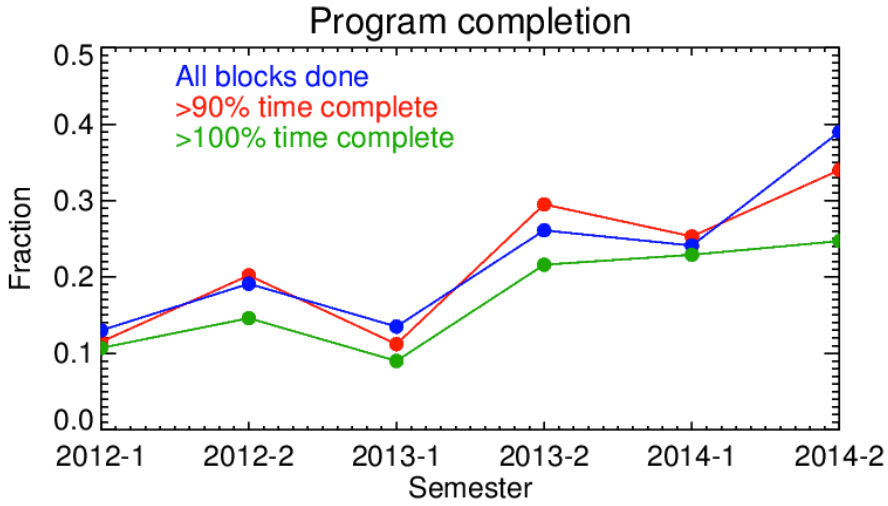


Fig. 7 Program completion using various defintions. The up and down trend is due to the summer/winter difference.

All in all, as seen above in Figure 5, there is a very positive trend of completing programs, suggesting the maturing of the observational process, and also the effect of Astro Ops giving attention to completing programs, e.g. by using Block Scoring. However, as will be argued below and in the separately submitted Scheduling document, we are now close to the maximum level possible unless something changes in the way time is allocated.

B. Director's Discretionary Time programs :

After the re-organization of SALT Operations, DDTs were approved by Petri Vaisanen and Ted Williams. Four DDTs were approved in 2014-2. Three ATels have been published so far. During the reporting period, two refereed papers were published on a DDT proposal from Semester 2013-2.

C. Semester 2015-1 :

77 Proposals were received for the new Semester. After technical reviews by Astro Ops, the TACs allocated time to Proposals, and after interactions with SAs, these are now in the queue.

D. Publications :

Refereed papers is a crucial metric by which the success of SALT is measured. As reported in the SPIE paper S. Crawford et al. 2014, 914909-01, if measured from the official start of science operations in 2011, SALT paper production is on par with other 8-to-10-m class observatories at the same development stage when normalized by the number of telescopes. In 2014, 31 papers were published. For the trend to continue following large international facilities, 2015 should produce 40 to 50 papers, as shown in the Figure 6 below. Gratifyingly, we are exactly on track in the year with 17 papers from 2015 thus far.

The list of SALT papers is available at http://astronomers.salt.ac.za/data/publications/ (there may be small errors or inconsistencies). Recently, Anja Schroeder at SAAO has studied the publication record in much more detail than before. A report is under construction. There is perhaps too little time baseline to make very significant analysis of SALT paper production yet, but some interesting results so far do include:

- There are currently around 110 "SALT papers" in the literature, about 100 of them directly using SALT data.
- Of the data papers 75% have resulted from RSS, and 23% from Salticam.
- Of the 60+ data papers since 2012, 90% are based on RSS data, whereas Salticam papers dominated slightly during 2006-2011 with 53% share.

- 48% of all SALT data papers have come from RSA programs, followed by 16% resulting from Polish programs
- Extremely simplistically, 30 completed programs per semester could result in 60 papers per year with a 1-2 year time delay. Pushing completed programs to 40 per semester with smarter time allocations, we could produce 80 papers per year in 2-3 years time. This could perhaps be set as goal to reach by 2017/2018.

As mentioned in Chapter 1 SALT Operations plans to facilitate paper production by concentrating on the *quality of SALT data* and helping, where resources allow, PIs to reduce and analyse their data.

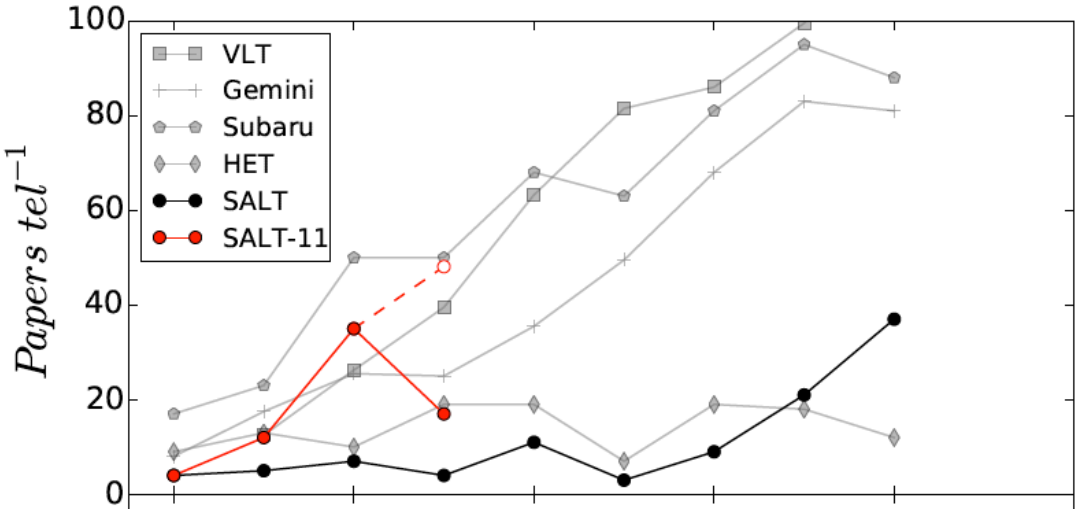


Fig. 8. Papers per telescope. The red curve shows SALT as counting from 2011, and the situation currently with 17 papers in early May. The dashed line is an extrapolation to the end of the year. (S. Crawford)

ASTRONOMY OPERATIONS ACTIVITIES

A. Software :

Software development to handle science programs from planning and submissions through scheduling of observations and observing itself, to pipeline reductions and data delivery, has continued as before.

The major new developments during this reporting period have been the introduction of the Dashboard, the implementation of the Fault Tracker system, designed already in the latter part of 2014, and implementation of Block Scoring and studies of semester scheduling. The first two were discussed in Chapter 1 already, Christian Hettlage has done most of the work, with support from Steve Crawford and others. Blocks Scoring and semester simulations have been worked on by Paul Kotze, and are discussed more below.

B. Block Scoring

Efforts to achieve optimal scheduling have been discussed and presented to the Board before. The problem has turned out to be a very difficult and complex one. A Beta version of the *nightly* optimal scheduler developed by Brent Miszalski was implemented at the telescope in December 2014. However, the team felt a more strategic approach was needed to optimize a full *semester*. Paul Kotze took this on, with support from many others. In the initial stage blocks in the queue are now scored based on (but not limited to):

- TAC allocated priority

- Remaining visibility
- Completeness of the block
- Completeness of the program

The total block score of each observation is displayed at the telescope, aiding the SA to make decisions affecting outcomes beyond just the night in question. At this stage parameters in the algorithm were chosen based on the philosophy that it is better to finish things once started, regarding both target visits and whole programs. The parameters are easily adjustable and are waiting for Board decisions on what exactly the goal of a semester should be.

C. Semester Scheduling :

The second phase of the strategic semester scheduling was coding a Monte Carlo simulation based on a real queue and real weather information, closely mimicing the way SAs conduct observations. The mode of observations can be changed in the simulation to check the outcomes regarding e.g. Block and Program completeness. Details of these simulations, developed and run by Paul Kotze, are presented in a separate document. The most important *conclusions of these simulations as compared to the past semester 2014-2* are highlighted below.

1. Target visibility constraints are the biggest driver of what can and cannot be done with SALT time currently. Programs cannot be finished even if 100% of a Semester was available, not even all the highest priority Blocks. This is mainly because of conflicts between targets at the same position in the sky, time-restricted targets competing for the same time slots etc.

2. There are not enough targets in the queue. There will be significant idle time of the telescope regardless of which observing strategy is employed with the current queues.

3. SALT observing has been running reasonably close to the theoretical maximum over the past semesters if the purpose is to maximize the number of blocks observed. The completeness percentages appear low; they have improved significantly recently since the attention of Astronomy Ops turned to completing proposals, but they cannot be significantly higher with the current strategic decisions concerning the kind of proposals in the queue.

4. Completion of Blocks of Priority P0-P2, or Partner share fairness, can be driven somewhat higher by employing various Block Scoring algorithms. However, the overall Program completeness rates will likely not improve materially without some changes in top-level strategy addressing issues 1 and 2.

5. Analysis of 2014-2 also shows that all TACs do not allocate all their available time, and PIs do not always submit all their time in phase-2. Both these facts make the issues above even worse. Astronomy operations wonders why TACs and PIs are not using their time.

D. Science papers by the Astronomy Operations team :

The SAs and other team members have continued producing their own science. There have been 11 refereed papers published by team members so far in 2015 (including one in Nature). Six of these papers are based on SALT data. There are half a dozen MSc and PhD students supervised by the team members, with one PhD submission and one graduation during the reporting period. Two SALT related Press Releases were issued by team members in early 2015, they are available on the SALT Web-pages.

E. Staffing issues :

After the re-organization of SALT Operations the team essentially has one less astronomer. We have been helped very significantly by Luke Tyas in both HRS support and SALT observing. His contract ends at the end of May 2015. Marissa Kotze, a SAAO post-doc has also taken significant responsibility in SALT observations, and we hope to retain her services. Paul Kotze (no relation)

previously a SALT post-doc was hired as an official SALT Astronomer from the beginning of April 2015 becoming the first South African SA.

INSTRUMENTS

A. RSS :

The instrument is performing well after the maintenance last year. In particular, its *throughput* increased significantly, by approximately a factor of 1.5, and better in the blue, as described in a separate document in BEC #57 “RSS Throughput Report”. After the re-installation it was discovered that the RSS internal focus was not optimal, the investigation and aligment procedure is described in BEC #57 “RSS Focus Report”. After the corrections, the focus is, in fact, better than before the optics maintenance.

RSS baffling was redone carefully in a thorough straylight investigation. The encouraging result is that unwanted light on the detector decreased by factors of many inside a lit up dome, and that “sky” background counts on spectroscopic RSS frames decreased by 50% on a dark night. A description of the tests and result is in BEC #58 “RSS Straylight Report”. This has significant impact on faint object science, though the straylight may still be above the readout noise level (TBD).

Night-time used for arcs and flats decreased after the introduction of the new CALSYS, reported in more detail by Darragh O’Donoghue. The light distribution was found to not be optimal, and a new design was installed on May 12 delivering evenly distributed light.

Detailed plans have been made for Polarimetric recommissioning. The beam-splitter should be arriving with Steve Potter later in May.

The most significant failure in RSS operations during the reporting period was the unavailibility of Fabry-Perot mode. New cabling was required after the LR and MR etalons were re-installed after the optics fix in November, and when they arrived the MR controllers was unstable. By the time wavelength ranges had been re-calibrated repeatedly and the situation finally diagnosed, and the controller swapped with a spare, 2014-2 had already come to an end. This resulted in the unfortunate situation where nearly all FP programs remained un-observed, affecting severely the RU and UNC partners.

B. HRS

HRS is in normal stable operations, with no major hardware interventions done over the last 6 months. It is regularly used by all observers, and around 30% of SALT observations are done with it. The acquisition procedure is very smooth with the instrument and after quantifying the numbers, we may decide to reduce slightly the time charged for an HRS acquisition.

The priorities now are getting the final documents from Durham for the official handover to happen, to quantify more clearly the final science performance to aid HRS PIs regarding velocity stability and sensitivity, and, especially, to launch a HRS pipeline to enable users to analyse and publish HRS data gathered over the past year and a half.

The Ion Pumps have been running smoothly since their installation in October 2014. Having a proper vacuum inside the dewars greatly improved the thermal stability of the CCDs. The Red CCD temperature now stays at -119.95 ±0.01 Degrees Celsius over periods longer than 24h. The Blue CCD has also been stable. We will top up the cooling gas only when it becomes necessary, but it will likely happen in the coming months. A BEC #58 report detailed HRS wavelenght stability over many months (better than 1 km/s). The more important short term stability over one hour was already shown to be 4 m/s in the commissioning report presented to the last Board meeting.

A software upgrade was done in late January to improve the CCD thermal management. It's main effect was to reduce the temperature swing when doing multiple exposures in a row. A set of three calibrated Iodine Cells arrived from Göttingen in April, with R=300000 spectra available for them, and one was installed at the telescope in early May for use by High Stability mode observations.

HRS pipeline work was stepped up during the reporting period, though we are sill not routinely reducing HRS data mainly due to lack of resources. A local working group was set up, supervised by Éric Depagne and Darragh O'Donoghue, a new and more detailed specification plan for the pipeline was written, while Steve Crawford has worked on a prototype version of the pipeline which can now extract velocities from LR and MR spectra with little interaction to some 0.5 km/s accuracy. Astronomy Operations will likely continue developing a full science grade pipeline for the LR/MR/HR modes, and while final decisions are still to be made, there are discussions in getting outside help for the HS mode. In particular, Darragh O'Donoghue has been in contact with Paul Butler from the Lick Observatory, though it is too early to report on any details yet.

The HRS Software ATP was successfully performed in January. The conclusion drawn by Janus Brink is that the software should be accepted, provided Durham provides four outstanding documents. However, there are a number of technical drawings missing as well, the HRS ATP process is still on-going and hence the ATP Committee cannot meet. The situation is frustrating, as we officially cannot take control of the instrument and all the software to integrate it into the SALT Operation systems. It is the feeling of Astronomy Operations that a higher level discussion is needed to take the process forward.

C: SALTICAM and BVIT. Operating nominally. An internal Astronomy Operations decision was made that since BVIT is so seldomly used, it is more efficient to operate remotely from Cape Town by the most experienced local user, Marissa Kotze. This has been done successfully once already.

RECOMMENDATIONS and REQUESTS based on discussion above and supporting documents

The most important topic we wish to bring to the Board's attention is that of deciding on a clear vision of observational and scientific priorities. Does the SALT Board want to maximize the number of papers (in peer-reviewed journals) coming out of the telescope? Is its highest priority to ensure every partner gets their fair share of observing time? Does it wish to see the highest quality science get preferential priority? Does the partnership wish to make suggestions on the allocation of time by their respective TACs? If so, is there a consensus on what suggestions to make to the TACs?

The SALT astronomers have now built up a large amount of experience from observing at the telescope. As we are also users of the telescope, we offer these recommendations in support of more effective usage of the telescope:

1. It is strongly recommended that, when allocating telescope time, TACs consider visibility distributions, repeat visits to a given target over a short time scale, restrictions on seeing and weather and so on. This will win back significant science time on-sky. If a decision is made, Astro Ops can investigate methods how to do this in practice, including possibilities of obtaining more information about targets and tracks in phase-1 already.

2. It is strongly recommended that TACs allow only a single Priority per Program if program completeness is a goal. This is the only way to increase program completeness significantly.

3. Increase over-subscription of Blocks in queue. The best way would be to heavily use optional targets and pools within proposals and TACs should encourage this. Another option is to increase the time given to allocate per semester – this would help on-sky efficiency, but would hurt overall program completion. The separately submitted Scheduling document includes a specific suggestion for a new P1/P2/P3 time breakdown.

4. It is recommend the Board consider whether carry-over of some small carefully determined number of unfinished P1 blocks should be allowed in the interest of striving for highest priority program completion. If the Board thinks this is useful, they should commission a study from

Astronomy Operations of the pros and cons of the effect on the queue, what work would be needed, and to come up with any practical ways of doing it, by the next Board meeting.

5. Statistics show that the winter semester has consistently around 45% weather loss, whereas the summer semester is closer to the 35% specification. We recommend changing the time allocation assumption for the winter semester to 45% weather loss.

6. We request clear requirements and goals on what SALT observations actually aim at. The separately submitted Scheduling document has more details and quantitative suggestions for standards meeting expectations and for longer term goals regarding priority time and program completions.

7. It is recommended that time allocations move away from the traditional strict Dark, Gray, Bright bins. Experience has shown that a simple Dark and Any split would be more flexible at all levels, in constructing phase-2 blocks the PIs can specify their maximum Moon phase levels.

8. Many of the details of the above issues are complex. How much discretion does the Board wish to give to SALT Operations to make decisions on its behalf?

Finally, two comments and requests not related to scheduling and time allocation:

1. SAAO and SALT have established VODAS, the data archive for SALT data. However, its use is severely hampered by the uncertainty of proprietary times for SALT data, we do not know which data sets should be made available there. When should data be made available and what level of data pipeline products should be included?

2. We wish to again draw attention to the fact that we are repeatedly asked to provide reduced data products for the PIs to analyze their data. The most dire bottleneck is HRS, with zero papers to date, after the instrument being 1.5 years on the telescope. SALT Operations is severely under-staffed in the area of data pipeline development, the sole responsible person being funded by SAAO and laden with many other responsibilities.

CHAPTER 3
TECHNICAL OPERATIONS:

Primary Mirror : 63 segments have been coated since the last Board Meeting, well above the target of 46 per semester. All segments now have coatings of less than a year old. The cherry picker was out of commission for a month during this semester, which prevented swapping segments, so the coating performance is better than expected.

RSS : The RSS-VIS is performing adequately after the service and maintenance done during October and part of November 2014. . The LR and MR etalons were put back into operation after experiencing *inter alia* problems with the MR controller and mechanical mountings. Initial results of the extra baffling material installed are encouraging but does not meet stray light requirements yet. Detailed figures were reported to BEC#58.

Tracker: has now settled down after the replacement of its rails. Unfortunately some setbacks were suffered when the Y-drive clutch suffered breakdowns during January and February, which resulted in the loss of 2 nights. One of the breakdowns was caused by a bona-fide mistake by the maintenance team. The anti-gravity drive cable had to be replaced since it was starting to fray beyond its safe operating specification. A design fault was made during the project phase w.r.t. the choice of cable and drum size. That led to the onset of fatigue of the cable and its condition started to deteriorate rapidly. One night was lost during this repair.

A new technology and a more powerful motor, with integrated harmonic gearbox, selected for the Rho-drive upgrade, has replaced the current motor/gearbox combination since they do not meet the following error specification. Analysis has shown that some parts are mechanically overstressed as well.

Glycol leak Detection System: This system is now fully installed and its ATP has started.

Weather mast: the 30m-weather mast had to be replaced.

TCS: A pointing model issue was resolved that caused defocus during large dither motions. This fix will improve telescope acquisition efficiency.

Software solutions: Research into alterative control system solutions for telescope subsystems (especially Payload and RSS PXI) to improve maintainability is ongoing with assistance from National Instruments, SA. As part of this initiative the control software of a number of subsystems has been ported to Linux and is undergoing testing. A number of “black-box” hardware interface systems have been fully internalized in the process.

Fraction of Time Lost Due to Technical Issues: as reported in Chapter 1, it averaged 8,3% for the semester with the high in January peaking at 12,4% in January and a low of 2,74% in April. The high figure of January was mainly due to the lost time suffered due to the Y-drive clutch failures and the unscheduled anti-gravity cable replacement.

Figure 9 below shows the Technical issues (including SO and SA induced technical fauts) during the 2014-2 semester. The largest single contributor was the tracker (TC, 30h downtime), followed by the Payload (TPC, 18h), and RSS (14h). The tracker failures happened in January/February when we had 2 Y-drive failures and a Y-anti gravity drive cable replacement after it started to fatigue, the RSS downtime was mostly in November after reinstallation, while the Payload downtime is evenly spread.

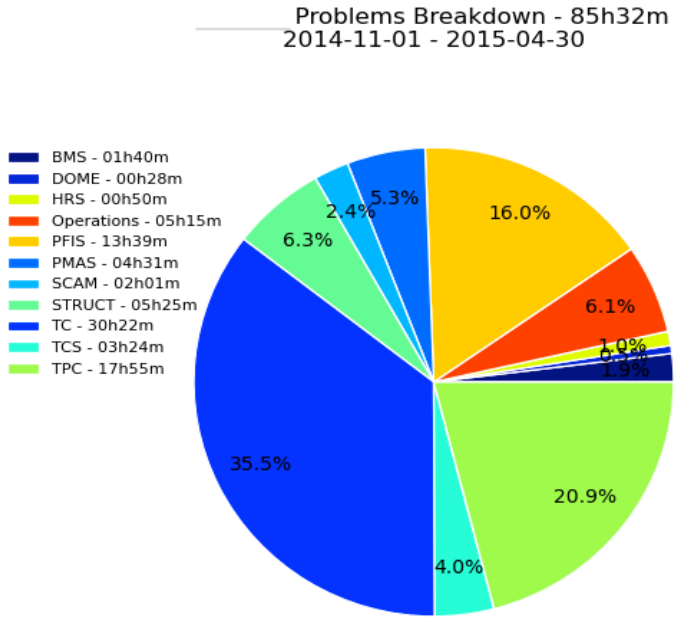


Figure 9: Technical Faults (including SO and SA induced technical faults) for the 2014-2 Semester

Maintenance: Tech Ops have set ourselves a target to improve the maintenance aspects of our operations in order to improve reliability and uptime**.** The good news is that Martin Wilkinson, SALT System Engineer, has completed and implemented the systemized maintenance system (see BEC#58 Tech Ops report) via Aurora. Routine maintenance "tickets" are now being issued by the system and has to be closed off by the responsible person's supervisor. A full list of all maintenance work done during the financial year is attached as Addendum ……

Electricity Saving: no new initiatives were taken in this field during the reporting period. SAAO is upgrading its electrical capacity and distribution on the plateau. It includes a powerful enough generator that will be able to run *inter alia* all SALT systems and instruments, This includes the chiller which will give us the opportunity to mitigate some of the effects that the PM suffers during prolonged power outages.

The Failure Mode Effect and Criticality Analysis (FMECA)
The implementation of the leak detection system mitigated 2 red items from the last report, leaving 15 red items, 4 of which cannot be mitigated further by Tech Ops. The remaining 11 will be mitigated in time.

TOIL: A graph has been included from the date of the previous Board Meeting until end of April 2015. The TOIL figure now stands at 1788 hours. Some key individuals that contribute to both operations and projects have accumulated many hour of TOIL. It is difficult to find time to grant them TOIL. The key individual figures are: Ockert Strydom – 450; Keith Browne – 392; Hitesh Gajjar– 174: Janus Brink – 133; Jonathan Love - 125

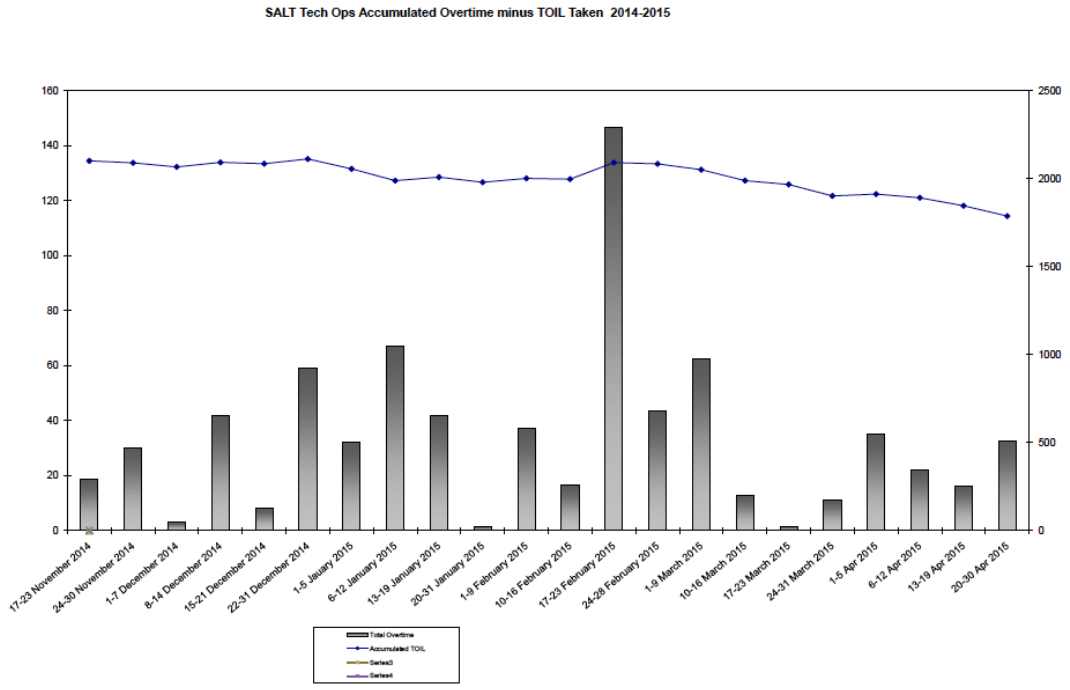


Fig. 10: Overtime and TOIL for 2014-2 Semester

Discounts: negotiated during the year totaled a healthy R210,000.00

PROJECTS:

Separate reports have been filed for the SAMS and Tracker Upgrade projects. The RSS Throughput project was put on hold in order to determine various options going forward, including funding sources. Ockert has been working on the specification of the new RSS guider after receiving the requirement from the astronomers. He has also been allocated the role as SAMS System Engineer to ensure that the Primary Mirror Alignment System, of which the SAMS form a part, is being adequately tested.

CALSYS

During this reporting period a modification to its CALSYS system was devised and it is now ready to be put back onto the telescope. Darragh has reported on this project.

NIR

Darragh has taken on the leadership of the NIR from SALT's point of view. Regular videocons are being held and interfaces between SALT and the NIR are being addressed. The biggest concern is the shortage of funding to commission the instrument on site. The option of installing the instrument in the spectrograph room instead of on the telescope is being investigated.

HEALTH AND SAFETY:

Two people went for the first part of Safety Representative training. The second and final part will be done in June. Thabelo Makananise, the new electronics technician, went for his working at heights training.

MANPOWER ISSUES:

Thabelo Makananise joined us on 2 February as the new Electronics Technician and is making good progress. He has shown eagerness to learn as well as application of his new found knowledge.

Both Johan Hendricks and Nicolaas Jacobs have completed their final machining modules for their fitter and turner artisanship and only have to undergo their trade tests to qualify as artisans. They are

already doing higher level technical work that free up both Eben Wiid and Jonathan Love to do more specialized engineering work.

The System Engineer, Martin Wilkinson, has to retire by the end of June this year. This will leave a gap in our system engineering, opto-mechanical and mechanical engineering capabilities. The System Engineer's salary is budgeted for the 2015/2016 year and options are being investigated to mitigate the effects of his retirement.

The future application of senior personnel after the completion of current projects needs urgent attention. The situation is as follows:
The major projects such as SAMS and Tracker Upgrade come to an end by March 2016. The essential RSS guider and RSS optics Repair projects are not fully funded at the moment. So, the implications on senior and key manpower are as follows:

- Hitesh Gajjar will have to be redeployed by April 2016 since the SAMS project will be completed by March 2016 . One alternative is that the technical operations budget will have to carry his salary cost, but, at this point in time, unfortunately does not provide for it. Should he leave, SALT and the SAAO will loose a very knowledgible electronic engineer that knows the critical SAMS and PMAS systems, as well as the telescope systems in general, very well. The other option is for him to be deployed to the SAAO, but I believe their budget may not be able to carry his costs either.
- Ockert Strydom works on both the RSS Guider and RSS Collimator Repair projects. He is also the System Engineer for SAMS and a specialist FEA consultant for the Tracker Upgrade Project. Although his salary is covered by the 2015/16 budget the projects that he primarily works on can not make meaningful progress without sufficient funds to buy required material and parts. There are funding available from SAAO projects to give him a slightly longer time horizon (currently his contract terminates in March 2016). Should he work say the planned 75% of his time on SAAO projects and only 25% on SALT projects and operations, we will be left without a strong mechanical engineering capability dedicated to SALT when Martin Wilkinson retires end of June 2015.
- Raoul van den Berg, our best performing and experienced Project Manager of the Tracker Upgrade Project, will have to be let go at the end of March 2016. So will Grant Nelson as his full time mechanical engineer. Although they knew from the outset that it will be the case, it will still be a severe loss to SALT and SAAO. Both organisations suffer from a lack of professional project management skills and experience.
- To complete the SAMS project successfully during this financial year, we need to retain both Deon Bester and John Menzies. Motivations were included in the Tech Ops report to BEC#58, as well as the CFOs report on funding requirements for the Priority Projects. The motivations boils down to the following:
    - Deon Bester is responsible for the coding and debugging of the SAMS II (MARS) software, which is the new version of the original SAMS software. He also plays a crucial part in the testing, debugging and acceptance of the Primary Mirror Alignment System, of which SAMS forms only one part. His 9 months contract extension will cost R300k.
    - Dr John Menzies is the mathematician of SAMS and is required for modelling of SAMS and data reduction to compare the actual behavior of the system with the model. From those comparisons new actions and tests have to be defined to debug MARS and PMAS. His 9 months contract extension will cost R430k
- To execute the RSS guider Project we will need Stephen Hulme as a key resource to work with the team. Janus is over extended, as we know, and he needs help. Stephen is a qualified Mechatronics Engineer with previous experience in a variety of SALT electro-mechanical devices and software such as SAMS. He also worked on the successful upgrade of WebSAMMI. His 9 months contract extension will cost R200k

RECOMMENDATIONS:

1. The Board finance the contract extensions of Deon Bester, John Menzies and Stephen Hulme for 9 months to the combined value of R930k.