Period 40
AiC Report to the NOT Council and STC

53^{rd} STC meeting & 57^{th} Council meeting
April 27, 2010

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April 25, 2010

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1 Introduction

This report covers the operations of the Nordic Optical Telescope for period 40: 2009-10-01 to 2010-04-01.

2 Down Time

The down time statistics are based on individual fault reports. In Table 1 I give the general down time statistics for period 40. A total of 87 fault reports were submitted, with an average time lost of 6 min per fault, for a total down time of 0.5% (0.5% on scheduled observing nights). Of these, 58 reported no time lost, 29 reported < 2 hrs lost, and none reported 2 or more hrs lost.

This compares to a down time of 0.7% over all nights (0.8% on scheduled observing nights) in period 39, and 0.2% over all nights (0.2% on scheduled observing nights) in period 38. Of the 93 fault reports reported in period 39, 63 reported no time lost, 30 reported < 2 hrs lost, and none reported 2 or more hrs lost. Of the 88 fault report in period 37, 66 reported no time lost, 22 reported < 2 hrs lost, and none reported 2 or more hrs lost.

Table 1: Technical down time statistic period 40: 2009-10-01 to 2010-04-01

Night included	Time lost	Nights	Percentage[a]	Last semester	Last winter
All nights	555 min	182	0.5%	0.7%	0.2%
Scheduled observing nights[b]	455 min	132	0.5%	0.8%	0.2%
Technical nights	35 min	23	0.2%	1.1%	0.2%
Service nights[c]	120 min	39	0.5%	0.9%	0.2%
Visitor instruments	65 min	27	0.4%	0.2%	0.0%

[a] Taking the average length of time within nautical twilight. Exact numbers for each night are used when looking at "All nights"
[b] Excluding technical nights and visitor instruments
[c] Excluding service nights with SOFIN

Also with reference to Table 2, the general conclusion is that the level of downtime is rather stable with similar amounts of fault reports and no major failures during the past 3 semesters (at the time of writing the last fault report listing more than 2 hours down time is from more than 2 years ago).

2.1 Weather

For period 40 a total of 647hr 9min was lost due to bad weather which corresponds to 31.8% of all the dark time, as compared to 10.9% in period 39 and 38.2% in period 38. The total amount of clear dark time was 1390hr in period 40, as compared to 1447hr in period 39, and 1259hr in period 38.

2.2 General overview

In Table 2 the number of faults and total time lost as a function of the system and kind of fault is presented together with the overall numbers for the previous two period (38 and 39).

Table 2: Down-time statistics for period 40[a]

Syst/Type	Soft		Elec		Optics		Mech		Others		Total		P39/P38	
Telescope	2	00:00	5	00:35	0		9	01:40	0		16	02:15	30/20	05:00/01:50
Building	0		6	01:35	0		3	00:30	0		9	02:05	2/6	00:00/00:00
Computers	11	00:20	3	00:10	0		0		3	00:00	17	00:30	12/16	00:55/00:45
ALFOSC	11	00:50	3	00:00	1	00:00	0		0		15	00:50	14/16	01:00/00:50
MOSCA	1	00:05	0		0		0		0		1	00:05	4/1	00:05/00:00
NOTCam	7	00:20	0		0		0		0		7	00:20	9/5	00:00/00:05
StanCam	5	00:45	0		0		0		1	00:00	6	00:45	8/3	00:45/00:20
FIES	7	00:55	1	00:00	0		0		3	00:00	11	00:55	12/16	03:20/00:20
Others	0		3	00:00	0		0		2	01:30	5	01:30	2/5	01:05/00:00
Total	44	03:15	21	02:20	1	00:00	12	02:10	9	01:30	87	09:15	93/88	12:10/04:10
P39	49	05:50	30	04:40	2	00:00	8	01:35	4	00:05	93	12:10		
P38	52	02:25	18	00:50	2	00:30	8	00:20	8	00:05	88	04:10		

[a]For each system-type category the total number of faults and total time lost are given

2.3 Main problems

There were no faults causing more than 2 hours downtime during period 39, but there was one problem that caused small amounts of down time on various occasions. Although also in total it did not cause 2 hours downtime, it was the single problem that cause the most downtime in the semester so I will discuss it here.

- **2010-01-05 to 2010-02-09: Telescope crashes**: 1hr45m

  On several occasion there were reports of unexplained building 'jumps' and crashes, where the latter caused in several cases downtime of 10-30 min as the telescope system had to be restarted. Some investigation showed occasional increases in friction in the building drive system. It was suspected that one of the building brakes (which are activated when no voltage is applied) was failing, and after replacing one of the power supply units the fault has not recurred.

3 Instrument use

Table 3 lists the number of scheduled observing nights and technical nights for each instrument. This covers all nights, including CAT, CCI and guaranteed time. In this table I have also included the number of observing runs, and the number of nights per observing run for each instrument.

Table 3: Instrument use

Instrument	No. of nights		No. of runs	Nights/run
	Scheduled	Technical		
ALFOSC	58	10	17[a]	2.1
FIES	51	3	17[b]	2.4
NOTCam	15	7	3[c]	4.0
TurPol	15	–	3	5.0
SOFIN	9	1	2	4.5
MOSCA	5	2	1	5.0
OPTIMA	3	–	1	3.0
StanCam	3	–	–[d]	–

[a] Excluding 22 service nights [b] Excluding 11 service nights
[c] Excluding 3 service nights [d] Excluding 3 service nights
[e] Telescope stand-down for aluminisation of mirrors

4 Comments recorded in End-Of-Night & End-Of-Run reports

As before, most comments written in the reports during period 40 were very positive, both about the observing system and the support from the staff.

There were a few request for some improvements to the sequencer TCS display which includes graphs that show the guiding errors as a function of time. These graphs can now be scaled in both axis, while a separate graphs has been added which gives an indication of the brightness of the guide star which is useful in case of bad weather.

For StanCam it was requested to get an automatic image data display, which has been provided by implementing the common data display for this instrument as well. For its use in combination with FIES where it provides a movie of the fiber head during integrations it was requested to add an image scale to the display, and allow for an option to switch-off the signal (beep) that indicates the end of an exposure, which in case of the movie mode occurs very often. Both these features were added.

It was also noted that the data reduction computer provided to the observers in the control room is not very powerful and has outdated software. In fact, we are planning to replace the computer with a more powerful computer, with a more modern operating system and up-to-date software in the near future.

5 Operations

5.1 Additional services

5.1.1 Educational activities

We have been extensively involved with organizing the NOT/OSO Nordforsk summer school, see

`http://www.chalmers.se/nordic-baltic-school` ,

that will be held June 14-23 at Onsala Space Observatory in Sweden. During this school the NOT will be used in remote mode and preparations were made for the use of the remote observing system. The system will be largely the same as used during the NOT/OSO Nordforsk summer school at Tuorla observatory in Finland last year, but one thing we are looking at is to improve access for the remote observers to the observing system computers.

Beyond the NOT/OSO Nordforsk summer school we also will have the regular on-site observing courses for the Stockholm University (5 nights in May) and the master school in CUO/NBI guaranteed time (3 nights in August).

As part of International Year of Astronomy 2009 (IYA2009) an essay competition was organized in the different Nordic countries. The participants had to write an essay on an astronomical topic and the winners, elected by national expert-panels, were invited to visit the NOT in December 2009 where in collaboration with the staff astronomers they planned and carried out an observational programme.

As the result of initiatives taken in the operational sub-committee (OSC) of the CCI a specific committee (LPIYA) coordinating the activities from the different telescopes on La Palma as part of the IYA2009 was set-up. Through this committee we were involved in the organisation of an exhibition called "Mira qué Luna" in Santa Cruz de La Palma, see

`http://www.lpiya.org/miraqueluna/`

where we assisted in setting-up the exhibition, provided some hardware and we contributed with a poster of an IR image of the Moon taken with the NOT. The activities of the LPIYA has been very successful and it was agreed to continue coordinating outreach activities of the telescopes on La Palma through this committee. In name of the whole group and all telescopes at the ORM a poster (including logos from all telescopes) was presented about the work of the group by Emilio Molinari (TNG) at the CAP2010 meeting (March 2010, Cape Town) on communication in astronomy as an example of a multinational collaboration started during IYA2009.

A very specific outreach activity that was also started in the OSC is an initiative to create closer ties between the observatory and the people of La Palma by targeting secondary school kids and giving them some feeling of what is being done at the observatory. This project 'Nuestros Alumnos y el Roque de Los Muchachos' includes both an introduction to astronomy, but also the practical side of running the observatory (optics, mechanics, electronics of telescopes), and consist of giving talks on astronomy at the school and receiving groups of high-school kids at the observatory for workshops and guided telescope tours. We aim for one specific age age-group ($\sim$15 years), where the intention is to reach all the kids of this age over the whole of the island. Currently we are in the early stages of the project. This has included meetings with representatives of the teacher on La Palma to define what is being offered, and a schedule was defined for visits during the period March-May plus a couple of dates in September. Several presentations (including by NOT staff) have been given at a few schools and subsequent visits were made to the ORM. Things seem to be function properly and the project is well on its way. A general web-page with information about the project can be found at

`http://www.lpiya.org/nuestrosalumnos/` .

As part of the support and training of the NOT students on La Palma, regular meetings have been held with the Nordforsk post-doc and lectures by the staff where held about the basics of the IRAF astronomical data reduction package, and about the reduction of echelle spectroscopy in particular using FIEStool. Lectures about data reduction of NIR (NOTCam) data and long-slit spectroscopic (ALFOSC) data are planned for the near future.

5.1.2 Service observing

During period 40 a total of 39 nights of service observing were done, excluding the 9 SOFIN nights done in service mode by Dr. Ilya Ilyin (Potsdam). The Nordic service nights consisted of various more or less isolated observing nights spread throughout the semester. In addition, also in this semester there was a large number of observations that were done by the staff for the ToO and monitoring programs during technical and Nordic service nights.

5.1.3 "Fast-Track" Service Program

In period 37 there were 12 proposals accepted. Of these there were 6 'grade 1' proposals, 2 'grade 2' proposals, and 4 'grade 3' proposals. All the proposals for which we received instructions were executed. The 4 remaining proposals for which no observing instructions were received were closed as these proposals expired at the end of period 40.

In period 38 there were 28 proposals accepted. Of these there were 17 'grade 1' proposals, 10 'grade 2' proposals, and 1 'grade 3' proposal. Of the 'grade 1' proposals, 14 have been completed, and was nearly completed. Of the 'grade 2' proposals, 9 have been completed and 1 has been partially completed. The 'grade 3' proposal has been completed.

In period 39 there were 9 proposals accepted. Of these there were 7 'grade 1' proposals, 2 'grade 2' proposals, and no 'grade 3' proposal. Of the 'grade 1' proposals, 6 have been completed and 1 has been partially completed. Of the 'grade 2' proposals, 1 has been completed.

In period 40 there were 23 proposals accepted. Of these there were 15 'grade 1' proposals, 5 'grade 2' proposals, and 3 'grade 3' proposal. Of the 'grade 1' proposals, 7 have been completed and 1 has been partially completed. Of the 'grade 2' proposals, 3 have been completed. Of the 'grade 3' proposals, 1 has been completed.

Up till now 1 proposal has been received in period 41 which is still in the process of being graded.

5.2 General

5.2.1 Safety

Several safety activities have occurred in the past six months. To conform the Spanish regulations all staff and students were asked to signed their respective 'MAC Risk Assessment' documents acknowledging agreement with its contents.

Some electrical safety checks have been done at the telescope to verify that all the safety device function correctly and conform to current CE safety standards. It was recommended that a couple of earth leakage breakers, though functional, and some of the illuminated safety signs should be replaced. In addition the machines in the mechanical workshop that do not have the CE certification were inspected by an licensed company, and safety recommendation made (e.g. add emergency stops, include safety guards, obtain representative user manuals).

In the ORM safety committee which was (re-)created by the ORM operation sub-committee of the CCI, rules for using the access roads to the ORM when officially closed as a preventive measure where agreed, and for the NOT an agreement has been obtain with our vehicle insurance company for cover when using the road within these rules.

Efforts to organize a basic First Aid course in English for the students and staff that are not sufficiently fluent in Spanish have been rather frustrating with very slow response and reactions which were first positive and then negative. It the moment we have some specific offers which look more promising but this still needs to be finalized.

5.2.2 Service building

To reduce power consumption in the service building, work has been done on a new and more efficient heating system including new radiators and a central thermal control. Also, increased insulation is considered for the workshop.

5.2.3 Weather station

Various repair and maintenance work was needed on the weather station. The rain sensor was broken by failing ice. A new sensor was ordered and in the mean time we are using an older spare that is less sophisticated and more sensitive to false alarms. The mains power supply cable from the telescope was severely affected by a lightning storm in February and as a quick fix power is now supplied through a simple cable from the service building. Taking the opportunity, a cable duct will be made from the service building where a new cable will be installed with new lightning protection. During the storm also the communication was affected as a RS232 to fibre converter was damaged and had to be replaced. There were also some problems with the fuse of the weather station cause by the new building drive system (see below).

5.3 Telescope Building

5.3.1 Lightning storm

The lightning storm that affected the weather station also caused various problems in the telescope building. The lower hatch of the dome had some fuses blown, while the upper hatch had a function fault which might have been caused by the dome part just above the sensors on top being pressed down some mm as the dome was hit in that area by lightning. The GPS time server for the TCS was also damaged. Its antenna is sitting just inside of the dome at the top of the telescope and the suspicion is that it conducted some (part of the) lightning which damaged the GPS unit internally. The TCS is now using the general computer time server in the service building, while we still have the old stand-alone clock system as a back as well. Depending on the cost of repair, we might consider not replacing the GPS unit.

5.3.2 Drive System

A problem with the new building drive where it frequently tripped its own earth leakage breaker was solved by installing a different type, as recommended by Siemens. Unfortunately another problem has prevented the installation, where the weather station fuse constantly blew-up when powering on the drive. This is believed to be due to an earth leakage somewhere in the mains power line to the station. After the lightning storm in February this 'leak' seems to have turned in to a permanent short circuit and it was not possible to power the station at all from the line going to the telescope. A separate line from the service building now provides the power and as a consequence this has also solved the fuse problem with the building drive.

A full mechanical test of the new building drive was made by installing one of the motors in the telescope building. We now know how to do this in detail and how much time it takes. The only thing remaining is to specifically schedule and execute the replacement of the drive system. As on earlier occasions we have taken care in having the old and the new system existing alongside each other and allow for a switch between the systems as fast as possible (though this is on the mechanical side still a few hours). In this way it is possible to do functional tests whenever required, and by the time we will switch over completely it will be possible to go back to the old system on relatively short notice. In the end the idea is to have the new system running for some time before removing the old system completely.

5.3.3 Clean room

Constructing a mountable clean room in the dome is still pending. Due to the more extensive work and delays with the building motors no more progress has been made.

5.3.4 Communication

As the old lightning protections for the phones were no longer available on the market and we were running out of spares all were replaced by a different type. The lightning storm mentioned before did not cause any problem so they clearly work properly.

Some tested were made with radio walkie-talkies to check if it is possible to link the telescope to FIES building, service building and Residencia, but due to their limited power and the amount of metal in the telescope it did not work properly and a a different system is being tried.

5.4 Telescope

5.4.1 Telescope control system

If the building stops (e.g., because the safety system is triggered or if the drive system fails) the telescope will (after some time) drive in to a safety switch and its power will be cut. When this happens while moving at full speed this leads to the telescope 'crashing' in to building with potential risk for damage to equipment caused by the electromagnetic energy that is stored in the motors and drive electronics. If this happens at low (tracking) speed this will also in the end lead to the safety switch being tripped by the telescope, but normally there is plenty of time to check the building (typically the safety system at the bottom of the entrance stairs is tripped by accident) and the safety system can be reset before the power to the telescope is cut, the tracking is lost and the telescope system needs to be restarted. To prevent strong crashes, the TCS can ramp down the telescope azimuth speed when a loss of power to the building is detected. When this happens during tracking there will be (slightly) less time to reset the safety system in case of false alarm as the telescope would stop before reaching the safety switch, but the advantage would be that even if the telescope is stopped the powered is not switched-off and there is no need to restart the system. This system is currently being implemented and tested.

In the near future we plan to move the User Interface, which runs on a rather ancient computer screen to a big colour screen by using a regular PC to act as front end to the TCS.

5.4.2 Telescope drive

After some earlier reports of some unexplained 'knocking' noises coming from the telescope when slewing in azimuth, in March the noise had increased and the telescope was seen to move with respect to the building during slewing. After doing some tests it was found that the problem was associated with one of the tachometers of the azimuth drive. The faulty tachometer was replaced with a new one and this solved the problem. Since no obvious damage could be seen to the old tachometer all the coils of its rotor were measured and found to be OK, i.e. giving consistent resistances. It was decided to try the old rotor with only the stator with its magnets of the new tachometer. This combination worked well, identifying the original problem to be the stator of the old tachometer, the rotor being undamaged. A calculation found that the frequency of the knocking, and related jumps in the azimuth motor currents, corresponded exactly with the interval of the ten separate stator magnets. A complete new tachometer and a separate stator are being purchased as spares.

5.4.3 Safety

To avoid problems with the dome staying open after sunrise by accident we now have a system that starts warning 5 minutes before sunrise and performs an auto-closing if necessary. The (awake) observer may prolong the open time beyond sunrise if that is needed for flat field observations etc. Once telescope is closed at or after sunrise it can be opened at will during daytime as usual.

5.4.4 Pointing

Although the pointing is stable and well defined, there are some systematics that are unexplained. Specifically, there are systematic deviations in altitude which very in a well defined way as a function of altitude and azimuth. These effects are not very large (up to 10 arcsec in the most extreme case), but there seems to be a potential to reach an RMS pointing in the order of 1-2 arcsec which is of general interest, but in particular for spectroscopy as it could lead to significantly reduction in time to acquire a target on the slit of fiber. At the moment it is not certain that this is a specific behaviour of the telescope, but the deviations appear to be stable in which case any pointing model should in principle correct for this. It is possible that the pointing model is wrongly implemented, but that seems unlike. We believe the most likely alternative to be that the pointing model is wrongly calculated, or more accurately, does not provide an adequate description for the precise behaviour of the telescope. This is currently being investigated.

A separately point is that in general there does not seem to be any significant difference between a pointing model based on measurements made with an instrument as compared to one made with the guide probe at the optical axis.

We are planning to migrate the telescope pointing model routine from the TCS to the sequencer, allowing for fully automated pointing tests using more suitable stars from the GSC catalog.

5.4.5 Catalogues

A new catalogue of blanks fields used for making twilight flat fields for optical imaging is being made. Instead of using catalogued dark fields, we are using the Guide Star Catalogue and searched systematically for areas with no stars brighter than a certain magnitude limit. These fields still need to be tested before this catalogue is implemented.

5.4.6 Balance

Especially in the case that asymmetric instruments (like ALFOSC) are mounted on the adapter there is a risk of damage to the rotator drive if the telescope power is lost while pointing away from zenith. The rotator balance was checked for no-instrument, ALFOSC, NOTCam and MOSCA. In general, there is no space to move the around the things that are already permanently mounted on the rotator and or the instruments and a separate fixture was designed for weights to be added after mounting an instrument. Tests indicate that weights in the range 25-50kg are needed. The new fixture is being prepared and will need to be tested.

5.4.7 Guide star acquisition

A few improvements have been made to the guide star selection. To protect the guide camera very bright stars (<9 mag) are excluded from the search for guide stars, while for stars brighter than 11.7 mag a grey filter is put in the beam. It has been noted that for the faintest stars in this range the guide star can often only barely be seen and might not be detected by the system. Basically, the change from using the grey to not using it was to steep and a scheme was implemented where an intermediately attenuating filter (a 'yellow' filter) is used for the faintest 'bright' stars. Also, the selection system was changed such that no guide star is selected near to a star (closer that the size of the guide camera's field of view) that is excluded because of its brightness.

One of the most stringent limitations on areas available for guide stars is that defined for beam-switching observations with NOTCam which require offsets larger than the field-of-view of the camera (4×4 arcmin for the wide-field camera). To improve this, separate areas were defined for each direction where a bigger area can be used in each separate case. These options have now been verified.

5.5 Observing system

Various improvement were made to different aspects of the observing system. Zero point calculated online for data from the wide-field SuperWASP cameras are now provided on our weather page. The zeropoints are only from a first look reduction, but in general they give a very good impression of the transparency and stability of the atmosphere. The camera only observes specific areas on the sky, but the data do indicate if there likely are clouds, and how thick they are. As the zeropoints are not final reduction results we only presented on our weather page within the observatory network, and they can not been seen from elsewhere.

The feedback from observers on the functionality of our sequencer-based observing system has been very positive. Still, over the last few months, a substantial effort has gone into further improving the usability of the observing system and of the the toolkits we offer to our observers. Various of the recent improvements are described below. Upcoming improvements include a new observing block generator, which will take full advantage of the possibility to control all subsystems (TCS, Detector, Instrument) through the sequencer and thus allow for very advanced scripting. The fast-track service observing system will particularly benefit from this upgrade but this will benefit all modes of observing.

A special script was developed for the staff that provides a (wakeup) alarm when the weather improves. This is specifically intended for those cases where the weather is bad in the middle of the night but it is not clear if it might improve or not. The script checks all the weather parameters, and only when all are within the accepted limits will it warn the user so there is no need to constantly check this. After defining the requirements for the proper use of this script the plan is to provide this feature to the visiting astronomers.

A general review for consistency was made of the orientation in which data was displayed by the different post-processing system for different instrument.

5.5.1 Sequencer commands

A general issue in defining sequencer scripts is that the way it works might depend on the specific state of the instrument, the detector or the telescope. This is especially an issue for scripts (for ToO or monitoring observations) which might be executed at any time, or when using scripts from previous observing runs. Therefore, there is some need to provide/define some general default setting. The original idea was to provide 'setup-instrument' scripts which will set things to specific default values (e.g., for ALFOSC, all wheels to 'open', full-window read-out and no binning for the CCD, the calibration mirror unit and FAPOL out of the light beam, the internal instrument focus set to 1810 and the relevant keywords cleared). However, it was noted that for FIES there is no real default instrument setting, while for ALFOSC or NOTCam there are actually different defaults for imaging, spectroscopy or polarimetry making this somewhat ill defined. So, beyond some basic (re)set commands like fies.setup-ccddefaults or notcam.setup-ima and notcam.setup-spec it was decided to not make specific scripts but to consider more basic commands/scripts that (re)set some defaults for specific parts of each instrument.

5.5.2 Focussing

A sequencer command 'focus-auto' has been developed to analyse focus images for ALFOSC, MOSCA and StanCam taken with corresponding sequencer commands. The calculated best focus value is reported on screen together with various statistics.

All the default focus values are now entered in our data base system, while the web-pages have been changed to list the values from the data base instead of specific numbers. Also, where appropriate, sequencer scripts have been changed to use these data base values. In this way, if there is a change to any default focus value (e.g., after an aluminisation) this only needs to be changed in the data base.

5.5.3 Target acquisition

A 'target acquisition' web application is being developed. In the web form target coordinates and target acquisition information (primarily the required position angle) can be provided together with a finding chart. When the form is submitted a sequencer script is generated that will point the telescope, acquire the guide star and displays the finding chart before the prompt is given back so observations such as acquiring a target on a slit or simple imaging observations can be started immediately after the script. In principle this facility will be integrated in the new observing block generator and should be available for all instruments. As a first step a version for ALFOSC was made. Similar scripts for other instruments are planned.

5.5.4 Observing instructions

We are developing an observers' cookbook 'system' in which general and instrument specific information and instructions or made in a modular form and a cookbook can be provided on an instrument basis. In this way specific information only needs to be updated in a single place. Versions for FIES and MOSCA have been made, while the existing version for NOTCam needs to be integrated with the need system. Also a version for ALFOSC is bing prepared.

5.5.5 Exposure time calculator

An improved version of the exposure time calculator is being developed to include estimates of the peak counts for both photometry and spectroscopy and includes the option to select the specific binning used. A preliminary version exists, but this still needs to be checked properly before it can be released.

5.5.6 Observing descriptions & FITS header

There are many issues that concern FITS keywords in relation to observations and the resulting data. This is particularly relevant for things like automatic scripts as part of calibration plans, or data reduction and analysis through pipelines, but also for extended Virtual Observatory compatibility of our data and we had a specific working group meeting consisting of the astronomy staff and software group about this.

It was agreed that in addition to IMAGETYP and OBS_MODE to describe the type of observations a 3rd one will be created called IMAGECAT. To fill the 3 keywords with the correct settings we are looking at using the set defined by ESO, but some addition will be needed and need to be agreed. A next step will be to define the (combination of) values for the 3 'observing type' keywords for each and all of the different types of observations. The latter will also provide a basis to define how these keywords will be set. The general system will be such that at the end of an observation the 3 keywords will be set to default values. In all cases where the observing set-up fully defines any of the keywords, this will be set automatically during the observation, while for those that can not be defined the latest defined values will be used (which will be the default values if this is not specifically set). Beyond specifically setting the keywords, the idea would be to provide standard sequencer commands/scripts that as part of an observation set the keywords to the corresponding values (e.g., the command 'expose' will always set the keyword IMAGETYP to 'OBJECT', while the command 'stdexp' will set it to 'STD'; or more elaborate/sophisticated variations on such a scheme).

We also agreed to make a full review of the set of keywords that were are using for data from each instrument. This is basically a check of the relevant document that was made in 2004 by Saskia Prins, where the name and format should be defined of any keyword that is missing. Beyond the observing system related keywords it should be defined what 'phase 1' and 'phase 2' proposal information is required in the header, and if any additional keywords would need to be created for that purpose.

A point to consider for the observing block (OB) generator we are planning (see above) is related to the FITS keywords and their settings. As an OB describes a complete observation, it also should be able to define all the relevant keywords. I.e., the information to decide for each (set of) observation(s) in the OB to which values the keywords should be set (in particular the 'observing type' keywords mentioned) should be included for each observation.

A specific change to the existing FITS keywords has been an update to keywords that contains information about the timing of exposures to an precision 0.1 second for ALFOSC, StanCam, FIES and NOTCam to reflect the accuracy of our timing.

5.5.7 Data archiving

Some improvements and bug fixes were made to the observing data tracking and archiving system. One of the main advantages is that it can be started from anywhere, e.g., DVD production can be started from the Residencia before going to the telescope, and everything can be ready by the time you arrive at the telescope. Some more improvements of the archiving system are planned (reprinting of covers, burning more than one night to one DVD, dealing with shared nights, etc)

At the sea-level office a mass data storage system has been set-up to copy all the data from the archive (CDs and DVDs). As a first step this will be the more modern MEF format data, where the plan is to convert older data to a more modern format before saving it. Software is being written to make the process of copying the data from the disks as easy as possible. In the long run the storage system can act as online archive and be integrated with a Virtual Observing system.

5.6 Detectors

5.6.1 New detector controller and data acquisition system

As part of providing a detector test facility at the telescope a design for a calibrated light source has been made. In parallel with this some work has been done in looking at the use of commercial micro-controllers to replace small discrete circuit designs. One idea is to combine these two projects and make the calibrated light source digitally controlled which should make it more flexible, i.e. giving it a controllable level setting and make it remotely operable.

The following software developments were done in relation with the new data acquisition software (DAS) for the new detector controllers:

- **DAS FITS header information module**: This module will collect FITS header information for systems other than the detector controller itself
- **DAS remote data saving module**: This module is responsible for implementing the current remsave functionality in the new system
- **DAS sequencer commands (ongoing)**: A set of sequencer commands identical to the ones we currently have has been developed for the new CCD3/DAS. This will make any script we currently have compatible with the new system
- **DAS test documentation**: A set of test documents has been made. These documents describes tests to be made on the different software components and the result the tests should give for the test to be passed

The main remaining task for the software is testing it with the controller and preparing the documentation. A full integrated test of the software and the controller at the telescope will be planned after the software has been successfully tested with the controller.

5.6.2 CryoTigers

Both the StanCam and FIES Cryotigers detector cooling systems have caused further problems over the past six months. In early February 2010 the StanCam detector temperature rose to -58 C (unfortunately there is no dewar temperature sensor for StanCam). No obvious problem with the cooling system could be found but the dewar vacuum was low, but this could have been due to the instrument warming up. The dewar was pumped and a bit more PT13 gas was put in the cooling system since its pressure was slightly below the preferred level. A couple of days after the temperature rose again, and again the dewar was pumped. Since the second pumping no large rises of the detector temperature have occurred.

The filter/dryer of the FIES system was replaced with a new one last November. Though it did seem to have helped at the time, this does not appear to avoid the occasional problems as described below.

As a result of the lightning storm in February the FIES dewar warmed up. After pumping the dewar and restarting the CryoTiger the cold-head temperature only fell to -160C and at this level it was not possible to maintain the reference temperature of -120 C for the detector. As a temporary measure the detector reference temperature was increased from -120 to -110 C. To try and recover the correct operating temperature the dewar was allowed to warm-up to room temperature pumped for a day and cooled but it only returned to -160C. On 30 March for no obvious reason the cold-head temperature dropped on its own to -199C, then a couple of days later rose to -196C and has been stable since. The detector reference temperature was put back to -120C.

5.7 ALFOSC

5.7.1 Imaging

An upgrade is being made of the list of photometric standard fields for ALFOSC based on the updated version of the Landolt catalogue (AJ 137, 4186). The new catalogue has 27 Landolt fields with three or more 'well' observed standard star in the ALFOSC field-of-few compared with 14 in the current catalogue. In addition, the new web-page will include a link to tables with the magnitudes from Landolt for each field, and the required integration times when observing with the UBVRI under 1 arc sec seeing are indicated.

The automatic flat fielding script to take twilight flat fields have been made more verbose and provides the measure bias level and the 90%-percentile level of the incoming flats.

5.7.2 Spectroscopy

Various improvements were made to observing scripts and their documentation. A special section was made in the documentation with all the 'spectroscopy' sequencer scripts. The instrument align instructions for the staff were updated removing references to the old BIAS system and integrating the description of the different steps. The software for the alignment was updated to include more grisms.

The plan is to modify the holders for the low-resolution grisms #10, 11 and 12 (which are mostly use as cross-dispersers where there are mounted in the filter wheel)such that they can be mounted horizontally and vertically in both the grism and filter wheel without the need to change their position in the holder.

Work is continuing to make calibrations scripts for ALFOSC similar to the EasyThAr scripts for FIES which checks the illumination level and defines a proper exposure times.

5.7.3 Polarimetry

The ‘Wedged Double Wollaston’ (WeDoWo) prism for one-shot polarimetric observations with ALFOSC on loan from Asiago Observatory, Padova, Italy was received and has been installed. Some first checks were made but unfortunately the weather has not been good enough during technical nights to check it in detail, though the performance is not expected to be very different from that in AFOSC on the 1.82m Telescope at Asiago.

The WeDoWo is mounted in the grism wheel and together with the 10 arcsec horizontal slit which is used as mask, it is permanently available in Nordic observing time. The use and performance of the WeDoWo with ALFOSC will be documented and provide on the ALFOSC web-pages for use by observers and proposal applicants.

For circular polarimetry with FAPOL a quick look tool was developed. The script is interactive, where the user marks the target in one image and the script calculates the degree of circular polarisation. Also a more detailed analysis is being made of polarisation standard star observations made with FAPOL, including observations of candidate standard stars currently investigated with Turpol in order to define the relative calibration between these two instruments.

5.7.4 Detector

There is a problem CCD images windowed in the Y-direction when using the alfosc.readout command to readout the CCD before the exposure time has completed, where an image is returned with a wrong window. It was discovered that this was a problem in the CCD controller itself. Considering that the same person that is developing the new detector controller would have to correct this it was decided to wait for the new controller to correct this. The documentation and the relevant commands were updated to reflect this problem.

5.8 NOTCam

5.8.1 Observing system

The existing NOTCam instrument setup script for imaging mode was upgraded to include tcs.focus-delta offsets automatically - depending on the filter and camera combination used. The reference point is always the focus for the WF camera and Ks band, which it is assumed the user has estimated (or uses the default). In addition, a new instrument setup script for spectroscopy mode was made, see:

`http://www.not.iac.es/observing/seq/notcam-seq-scripts.html`

5.8.2 Filters

As suggested to the STC already in 2006, NOTCam would benefit from an upgrade to the full near-IR broad-band filter set corresponding to the UKIRT photometric system ZYJHK used for instance in UKIDSS. This means purchasing the two new standard filters Z (0.84-0.93 um) and Y (0.97-1.07 um). NOTCam has an array with a particularly good response at the 'blue' end, shown by comparing J-band zeropoints with INGRID, LIRIS on the WHT and NICS on the TNG. LIRIS has an untested 'Y' filter, NICS has a broad 'SW' filter (cut-off = 1.75mu) unsuitable for photometry, and INGRID has a so-called Z filter which is actually the same as our Yn-filter, i.e. not the new standard Z. Instruments that do or will have the new standard Z and Y filters are: WFCAM/UKIRT, UFTI/UKIRT (Y), VISTA, HAWK-I/VLT, NIRI/Gemini (Y), GMOS/Gemini, PANIC/CalarAlto, JACARA, etc.

After the STC meeting in May 2009 it was decided to upgrade NOTCam with low resolution grisms which will require custom made broad band filters. We have therefore made a joint inquiry about costs and time schedule for the following 4 new filters: the 'standard' Z and Y, as well as two custom made filters for spectroscopy, here called ZY and JH.

Offers were requested from several companies (NDC Infrared Engineering Ltd., UK; Asahi Spectra Co. Ltd., Japan), and; Omega Optical Inc., US) of which the first one provided us with practically all our current NOTCam filters through the GEMINI infrared filter consortium. UKIRT got their WFCAM Y filter from NDC and their Z filter from Research Electro-Optics. More detailed information about the offer will be send directly to the STC.

5.8.3 Imaging

The focus pyramid was re-calibrated with data taken on good seeing nights in September 2009. The re-calibrated pyramid was tested in February 2010 and we found a different offset between the WF and HR camera (+150 units vs +90 before). The reason for this may be the lower data quality used in the first calibration, but this needs confirmation.

To facilitate dome flat field and quality control observations a light regulator for the dome light from the control room was installed, but it did not worked well as the light level was very unstable. New electronics were installed, but this still needs to be tested.

Finally useful data was obtained in JHKs in June of a suitable field in very good seeing to define the optical distortion of the WF camera. The analysis of this data is pending.

5.8.4 Spectroscopy

The NOTCam calibration unit for spectroscopy is still only a temporary solution with arc and halogen lamps mounted on the inside of the telescope baffle lid, completely manually controlled. The lamps are not yet under computer control and no info goes to the fits headers. A list of suggested FITS header keywords, including those needed for the three calibration lamps, has been defined. Work is on-going on the technical side to integrated the calibration unit in the observing system.

The design of the new low-resolution grism is still in progress. With the help of Micheal Andersen a design was made which covers the range 'ZJ' (0.705–1.317$m\mu$), 'JH' (1.147–1.870$m\mu$), and 'HK' (1.370–2.554$m\mu$). We are currently looking for manufactures (see for the corresponding order-selection filters above). The plan is to both purchase the grism and filters and commission them as soon as possible.

5.8.5 Polarimetry

It has been very hard to obtain reasonable measurements of polarization standards using the 4 NOTCam Polaroids, and commissioning of these Polaroids has taken quite some time. Based on very few JHKs band measurements of two zero-polarisation standards and two high-polarisation objects (not standards) over two different nights we find that the 2 zero-polarisation standards give 1–1.5 % polarisation in JHKs. This accuracy is probably as good as it gets with the Polaroids (we believe this to be limited by distortions of the Polaroids with respect to their holder as they are cooled down to -200 C). We are currently working on quick-look reduction tools to reduce and analyse observations taken with the Polaroids. Also, a general observing script for polarimetry using the Polaroids is being developed.

We believe that to a dual-beam polarimeter would be the way to go for NOTCam polarimetry, and we will study this option in a bit more detail.

5.8.6 Detector

- **Reset level jumps & dark current**

  An upgrade to the NOTCam clock-board was made to shift the levels from 3.5V to their specified 5V level. The board was designed as a daughter board that interfaces directly to the existing clock-board. Two empty clock-boards were provided by CUO for this purpose.

  The results from testing the NOTCam new clock-boards is documented in

  `http://www.not.iac.es/instruments/notcam/staff/clockboards/newclockboards.html`

  and the main improvements were: 1) removal of shift-register glow, 2) removal of some horizontal stripes, 2) lower (8 e-) and more stable read-noise, especially notable for the reset-read-read mode. There was, however, no change in the behaviour of the number of counts in dark exposures as a function of integration time that was hoped for.

  The NOTCam calibration web page has been updated with new dark images.

- **Bad pixels**

  The improved determination of bad-pixel masks is an on-going project, but the evolution of the array in terms of the increased amount of cold pixels (from 0.2% to 0.4% of the array) over 2008 - 2009 is well documented on the NOTCam Calibration web page. See:

http://www.not.iac.es/instruments/notcam/calibration.html

and masks for ‘zero’, ‘hot’, and ‘cold’ pixels are available for downloading. The archive is continuously updated to account for changes.

The notcam.cl reduction package will be upgraded to improve handling of bad pixels.

5.8.7 Observing overheads

The cause of the varying and large readout overheads is believed to be mostly due to an aging ISA PC-board. Nevertheless, using a ‘spare’ ISA PC board for testing gave no difference. It was suggested to move the whole NOTCam data acquisition system to the old computer ‘elizabeth’ and try to run the software from this computer. It was also noted that a new computer recently installed for SOFIN by Dr. Ilya Ilyin (Potsdam) appears to work as well with ISA PC boards as the old (outdated) system computer. We have been trying to purchase one of these computers, but have not obtained a reaction from the (German) company yet.

In the end, we should get rid of the large readout overheads (unpredictable as well as expected ones) with the new controller. In the mean time, a special exposure command for NOTCam was suggested in which the dither overhead can be folded into the readout and file storage overhead. This could save up to 1.6 hours per night, depending on the type of NOTCam observations being made. Work is on-going and such a new expose command is currently being tested. For the notcam.expose command, which now has $\sim$13 seconds overhead, it is expected that this work-around would lower the overhead to around 6-7 seconds per exposure, quite an impact for short exposures. It is not clear whether a similar approach is worth-while for the frame command, since it is not clear exactly where during the exposure command the hanging/overheads are ‘happening’. The multi-exposure command notcam.mexp is also more complicated, but we will look at this as well.

5.8.8 Vacuum & Cooling

As concluded in the previous report we have now a reasonably well behaving cryostat since March 2008, giving better vacuum and holding time than ever before. NOTCam has remained cold since May 9th 2009 with no incidents, and we hope to beat the record of 360 days continuously cold this spring.

The alert system was improved after the accidental warm-up in April 2009 with a cronjob that will check that there are new readings twice per day, and if not, an alarm will be sent by email to staff. In November slight problems were reported with the readings (4 temperatures plus pressure) that go into the log used for monitoring and alerts. These readings are stored with a time resolution of once per minute when NOTCam is stored, and once per 10 minutes when NOTCam is used observing (this in order to avoid any extra overheads on the system). The logs were investigated, and it appeared that occasionally, and apparently only during storage, a reading could be corrupted or give just zero values, although quite seldom and irregularly with a frequency of about 1/700 measurements. It is believed that the internet plug during storage position could have a bad connection, and this is being looked at. Also, the problem only lasted until the next mounting of NOTCam, so it depends apparently on how well the plug is inserted.

The tubes of the PTR cooling system was believed to have a small Helium leak somewhere, since the PTR has to be refilled with high-quality Helium about once a month. However, it was discovered that the expansion secondary circuit tank was empty, and had to be refilled with glycol.

5.8.9 Quality control

There have been problems with unstable lamps as well as variable daylight leakage in through the hatches that make quality control tests such as linearity tests and shutter tests difficult. A new remote control unit installed in September was tested in December and January and found to be sufficiently stable (only stable to within 0.2% after an initial ramp-up). Also, it was found that the telescope needs to be lowered to an altitude of 45 degrees to avoid day-light leakage through the hatches. The location of the lamp (behind the telescope) is perfect in the sense that it gives a rather diffuse light distribution. A new light level adjustment knob with a fine-graded scale has recently been installed and needs to be tested.

The NOTCam quality control software has been ported to IDL and integrated into the post processing system. Final tests are being carried out before it is released.

5.8.10 Reduction software

An upgrade of quick-look reduction package notcam.cl will be released soon. It contains an improved flat-fielding routine, as well as an optional handling of bad pixels. The quick-look reduction script for standard ABBA spectroscopic observations is still pending.

5.9 FIES

5.9.1 Instrument

The 'new' bundle C (the refurbished original bundle 'A') was received at NOT and has been pulled from the hole under the telescope to the FIES spectrograph. All 4 fibers transmitted healthy amounts of light after the installation. The new bundle has been installed and tested, and is the default bundle as of January 2010. The 4th fiber allows for simultaneous sky background observations, but this option still needs to be tested in practise.

The new fiberhead was aligned with the telescope using a laser mounted in the adapter V-block. An XY-slide was prepared and mounted on the adapter plate to make alignment of the fibers easier. With the new bundle C the XY slide was repositioned to get maximum counts in all fibers. The alignment of the arm positions of the calibration fibers was determined for the different fibers.

The position of the calibration fibers at the adapter was realigned and we now require only short exposures times for calibration exposures for all science fibers.

The current FIES pickoff mirror has stains and is likely not optimally reflective and probably needs to be replaced. From measurements it was found that that the mirror of the first single-pass collimator of the instrument has a very poor reflectivity of only 82% while the mirror of the second double-pass collimator has a somewhat better reflectivity of 90%. We are investigating the possibility to recoat these mirrors.

It was checked if the edges of the cross-disperser causes the extended wings in the X-direction of the point-spread-function of the instrument by masking off the edges, but this did not give any difference.

5.9.2 FIES building

To avoid the few occasions that during the summer the temperature of FIES can not be kept stable because of excess heating by the sun it was decided to add small, light-coloured pebbles to the roof to increase its heat emitting capacity. First the large stones on the roof will be distributed more equally and smaller stones will be added to fill-up any large holes between the bigger stones before adding the smaller pebbles.

5.9.3 Observing system

The common DS9 based display system has now also been released for use with FIES/StanCam. The definition for the direction of movement was changed in connection with the move from the old to the new (sequencer based) post-processing system for FIES/StanCam.

New interactive sequencer scripts were made for the staff to self-calibrate the position of the fibers in StanCam images.

Some updates were made to the standard FIES calibration script fies-calibs, which now accepts command-line arguments. The user can now specify the number of flat fields and biases they want. The new script will always make the data available on the /data/service/calib directory accessible via anonymous ftp. If sufficient flat fields and biases are made the data will also be made available for use by the FIEStool online reduction.

The instrument scripts that set-up the instrument for calibration or target observations for the different fibers were improved such that they will be queued until an ongoing exposure is finished. Also the scripts to take target or calibration exposures were improved such that they will wait for the CCD camera to be idle before sending any CCD related commands (e.g., binning or starting an exposure). All this is intended to enable better scripting of these tasks in superscripts, and in order to lower overheads.

A new script (fies.setup-ccddefaults) was made to set the FIES CCD parameters to default (as at system startup), and a new script (fies.setup-fib23-star) was made to set-up the instrument for observations with simultaneous sky.

5.9.4 Exposure meter

A device to protect the new FIES exposure meter photon counting head from accidental over exposure was built and works as expected. It still needs to be packaged correctly (built into suitable instrument cases) and installed.

We still need to develop a system to use the measurements from the exposure meter to calculate an intensity-weighted time of mid-exposure and add this to the FITS header.

5.9.5 Target acquisition

The movie-mode in StanCam used to view the fiber head during exposures was upgraded to provide a better image and allow to rescale the image in size and intensity scale. Also an option was added to allow the beeps at end of each integration (many in the movie-mode) to be switched-off.

5.9.6 Quality control

An automated quality control data acquisition and analysis system will be developed that can make a more complete analysis of any exposure using a ThAr lamp (including exposures with simultaneous observations of a target and a ThAr lamps) to check for line position to be used for temperature-stability analysis, and check line-ratios to look for indications of any problem with a 'dying' lamp effecting the data.

5.9.7 Reduction software

A FIEStool master-frame database was made, see

`http://www.not.iac.es/instruments/fies/fiestool/masterframes.html`

which is automatically expanding whenever new calibration frames are made using the fies-calibs script.

Some information related to installing FIEStool on MacApple were added. See

`http://www.not.iac.es/instruments/fies/fiestool/faq.html` .

Prefabricated master wavelength reference and master order definition files will be added to the FIEStool distribution to help simplify the initial steps in data reduction. It should be investigated how best to reduce simultaneous sky spectra. Also some other improvements are considered.

5.9.8 Detector

Some indepth discussions have been going on about possible detector replacement to reduce the fringing in the red and expand the wavelength range covered. Beyond the cost, a main issue is the charge-diffusion of deep-depletion devices which degrades the resolution. Still no definite option has been chosen.

5.9.9 Atmospheric dispersion corrector

In principle all preparations have been made for the installation of the ADC for FIES. Still no specific plan has been made for the testing and subsequent commissioning at the telescope.

5.9.10 Documentation

Various updates were made to the observing instructions to account for minor changes. Also some minor updates were made to FIES staff pages related to astronomy support. The main FIES-page instrument description was updated with features of the new fiber bundle, and now mentions the exposure meter. See:

`http://www.not.iac.es/instruments/fies/`

5.10 MOSCA

5.10.1 Data acquisition

MOSCA still needs to be included in the sequencer system. Although the instrument is not used often, the fact that we will not get a new controller for MOSCA and no new system will replace the current BIAS program makes it more attractive to implement this if possible.

A new telescope setup script (tcs.setup-tel-mosca) was made which set up the telescope field-rotation, telescope focus, etc to the default values used with MOSCA.

A focus web page was set-up including best focus values for the broad band Bessel UBVRI and SDSS griz filter. As expected there is no significant focus offset between these same thickness filters.

5.10.2 Detector

We found that the fault on the video board in the detector controller used by the detector that showed the recurrent problem was indeed the cause of all the problems. The solution was a swap of the faulty video board with another board in the controller that uses the other half (channel) of its board. During the clean-room tests the detectors were operated warm and this gave bright columns from two chips but at the same relative positions. After spending sometime trying to identify the cause of these features the instrument was cooled and the bright columns disappeared, showing them to be 'normal' features of the detectors. Since the solution was implemented MOSCA has been cooled down for three runs and it has been used in eleven nights without any problems with the top right CCD.

The MOSCA quality routine has been integrated into the sequencer environment, to the extend possible, see:

`http://www.not.iac.es/instruments/qc/mosca_howto.html`

5.11 StanCam

Similar to the existing catalogue of standard fields for ALFOSC a list is being defined of Landolt fields with three or more 'well' observed standard stars and a similar web page will be made.

5.12 SOFIN

Given the problems with running the SOFIN programme on one of our spare computers, a new computer was brought by Dr. Ilya Ilyin (Potsdam). This new computer works well with the old style ISA PC-cards used by SOFIN to communicate with the detector controller. The SOFIN programme worked well on this computer, and a similar computer might be of interest in relation to the problems we encounter with NOTCam (see above).

5.13 TurPol

5.13.1 Instrument

It was noted that the dark slide is getting harder to pull out (i.e. close). The slide unit was checked and now moves very smoothly.

5.13.2 Data acquisition

In the last semester we had some problems with the data acquisition computer where we had to change the computer. To avoid any potential problem we need a similarly old computer to act as a spare in case of an emergency. We have found a computer that could potentially be used as a spare. It will be installed and tested before the next Turpol run.

5.13.3 Target acquisition

We are still planning to implement the existing 'handset' interface used to center a star on a fiber in FIES, and use it to center the targets for TurPol more quickly in the diaphragm.

5.14 Standby Camera and Spectrograph

A document was prepared describing the user requirements for a Standby Spectrograph and Camera (SCS) to be mounted permanently at a folded Cassegrain focus.

The general requirement is to provide an instrument with the same general capabilities as currently provided by ALFOSC. The new instrument should fit in the area current occupied by the adapter between the main telescope structure and the Cassegrain focus such that it is always available while an other instrument can be mounted at the Cassegrain focus. The general idea is to have a largely fixed instrument set-up with as little changes as possible. In principle the plan is to have the near-infrared camera and spectrograph NOTCam permanently mounted at the Cassegrain focus.

See for details:

`http://www.not.iac.es/instruments/development/SCS.pdf`

5.15 Computers and software

As part of general re-design of the computer system involved in data acquisition, data processing and data archiving all the all observing system related software has been migrated away from the observers data reduction computer ('florence') and the archive DVD production computer ('cassandra'). Both these computers will now be replaced with more powerful computer, with a more modern operating system and up-to-date software in the near future.

5.15.1 Computer cabinet

All the computer servers at ORM are now installed in the computer room in the back half of the visitor office in the service building. This room has improved the cooling and provides much easier access to the servers and the DVD units used for the data archiving.

5.15.2 General computer system

All the user account in the sea-level office were moved to a new and bigger computer, as the increased used by the staff and student put some extra pressure on the aging server.

To improve the reliability of the network connection from the sea-level office. This includes the purchase of networking hardware to automate switching between the main external links to the backup link (SLO-ORM) when there is a failure in any of the main links. However, this involves IAC because some of the setup needs to be done on their side of the system.