EUROPEAN ORGANISATION FOR ASTRONOMICAL RESEARCH IN THE SOUTHERN HEMISPHERE

COUNCIL

122nd Meeting
Garching, 7 and 8 June 2011

SCIENTIFIC TECHNICAL COMMITTEE

75th Meeting
Garching, 12-14 April 2011
Recommendations and Report from the 75th STC Meeting


Telecon: M. De Vos (on 14.4.), M. Prouza
Excused: J. Blommaert

Endorsement of the Long-Term Perspectives draft document
STC was presented with a Long-Term Perspectives draft document, outlining the planned evolution of ESO’s programmes over the construction period of the E-ELT. Assuming an E-ELT with a financial cost of 1000 Meuros, a funding scenario is outlined that allows its construction over an 11-year period. STC endorses the overall balance of the plan and was particularly pleased to see a continuing budget line for VLT upgrades and new instrumentation, consistent with science capabilities remaining as the highest priority.

E-ELT

a) Recommendation on construction
With the accession of Brazil, building the first giant telescope on a scientifically competitive timescale has become a real prospect. STC would like to congratulate ESO for having achieved this milestone and recommends seizing this unique opportunity, while ensuring continued excellence in the rest of the ESO Programme.

b) Comment on the Delta Phase B
Since the conclusions of the delta Phase B were not available at the time of the meeting, STC was not yet able to evaluate the impact on science, cost, risks and schedule. STC looks forward to receiving these results as early as possible in order to participate in the discussion of the trade-offs.

c) Recommendation on the Instrumentation Plan
Following up on its previous recommendation (STC-73) and on the discussions held during the E-ELT Instrumentation Day, STC recommends re-visiting the Instrumentation Plan in the near future. In particular, the process by which further selection beyond first light will proceed needs to be clarified. STC would like to discuss this issue at its next meeting.

La Silla-Paranal Observatory

a) Recommendation on New Generation Transit Survey Experiment
The STC discussed the proposal for the Next Generation Transit Survey Facility. This is a fully robotic observing facility designed to detect transiting Neptune-size planets orbiting K and M stars, proposed for installation at the Paranal site. The STC believes that this is an excellent scientific proposal, entirely based on external
funding and encourages ESO to proceed with the technical evaluation while ensuring that this facility will have no adverse impact on the activities at Paranal. The STC believes that the fully reduced light curves will represent an important scientific return for the ESO community. The STC stresses that this is not an endorsement of the use of the Paranal site as an experiment facility and that future opportunities should be separately evaluated.

(N.B. W. Benz and D. Queloz left the meeting during discussion of this agenda item, due to a declared conflict of interest; A. Marconi took the chair).

b) Recommendation on VLTI Implementation Plan

STC applauds the VLTI Implementation Plan as presented. It not only provides a clear picture of the way forward for this very complex infrastructure but also defines the priorities and resources needed. The Plan will allow tracking of future progress and will help to identify potential problems early on. The STC recommends that the Plan be implemented in full in order to maintain coherence in the VLTI programme. In addition STC supports soliciting science arguments from the community for inclusion in the Plan on on-axis faint object tracking for MIDI.

c) Comments on the proposals for a wide-field multi-object spectrograph

STC took note of the developments in the down-selection process for a wide-field spectrograph. STC appreciates the open process by which progress is being achieved and looks forward to receiving a more detailed presentation of the instruments under study, with supporting documentation, by its October meeting.

d) Comments on the Adaptive Optics Instrumentation Plan

STC reiterates the scientific importance of keeping NIR diffraction-limited imaging capabilities at the VLT despite the foreseen decommissioning of NACO in 2012. To achieve this, ESO outlined a three step plan: 1) a delay in the decommissioning of NACO until 2015, 2) inclusion of an auxiliary port with SPIFFI at the Cassegrain focus (the so-called double Cassegrain option) to cover the period 2015-2020+, and 3) a new MCAO instrument to take over in the longer-term. STC did not receive sufficient documentation to make an informed science and technical recommendation on the double Cassegrain option and/or on the new MCAO instrument. However, STC is of the opinion that ESO is on the right track and commends the efforts being made to ensure the presence of a NACO-like capability in the mid-term and to keep ESO competitive in high angular resolution astronomy in the long-term.

Delaying the decommissioning of NACO implies finding an alternative focus, since MUSE is scheduled to occupy its current focus. Since at the time of the foreseen decommissioning (2012) all foci of the 4 UTs will be occupied, this solution necessarily implies removing another instrument from one of the UTs. Obviously, this is not without consequences on the available instrument capabilities and requires careful planning in order to minimize overall science losses. In this respect, a number of possible options were mentioned such as the foci where UVES, FLAMES, VIMOS, or CRIRES are mounted.
In the CRIRES case, an interesting option would be to investigate coordinating its upgrade with a move of NACO to UT1 during this time. This option, coupled with the possibility of MUSE commissioning being delayed somewhat due to a late arrival of AOF, would bridge the gap until 2015. However, STC stresses that the full implications of this scenario have not been investigated in sufficient detail at the present time. In particular, the impact on science of taking CRIRES down for a longer upgrade must be assessed and short-term losses must be compared with longer-term gains. Furthermore, discussions with the MUSE team must take place in order to optimize the overall scientific return of the instrument for the Consortium (optimum use of GTO) and for the community.

STC expects ESO to look further into the question of an alternate focus for NACO and the consequences of taking any given instrument down while firming up its Adaptive Optics Plan. STC is looking forward to have the results presented at its next meeting.

ALMA

STC congratulates the ALMA team for the progress being achieved in the construction of ALMA. In particular, the very near acceptance of the first European antenna and the delivery of the Observing Tool (OT) are seen as major milestones being achieved.

(N.B. At the time of the writing of these recommendations the first AEM antenna was conditionally accepted. STC wants to congratulate the ALMA team for achieving this major milestone.)

a) Recommendation on the Archive

STC is concerned by the fact that the Archive represents a potential single-point failure item. STC recommends ensuring that adequate resources are being allocated over the short term to ensure that a reliable and robust system is in place for the June 1 opening of the Archive for Early Science proposal submission.

Closure of ESO/ST-ECF

Following decisions by ESA and ESO, ST-ECF has closed and ceased operations as of 1.1.2011. In close collaboration with the STScI in Baltimore, ST-ECF had brought the Hubble Space Telescope to the European astronomy community and made significant contributions to the operations of the observatory and its instruments. STC would like to congratulate all those who have been involved with the facility over the years for a job well done!

Annexes

1. STC 75th Meeting Agenda
2. Report from the 3 STC sub-committees
   a. LSP sub-committee meeting, 7-8 April, 2011
   b. ESAC sub-committee meeting, 11 April, 2011
   c. ESE sub-committee meeting, 22-23 March, 2011
Annex 1 - STC 75th Meeting Agenda

12 April

09:00  Closed session STC only
09:30  Closed session with DG
10:00  Welcome
10:05  1. Adoption of the Agenda
2. Approval of the Minutes of the 74th STC Meeting

10:45  *Coffee break*

4. ESO Long-Term Perspectives
11:00  4a. ESO Long-Term Perspectives (DG)
11:30  4b. Discussion

12:30  *Lunch*

5. Directorate of Programmes
13:30  5a. *Directorate of Programmes Overview* (A. Russell)
13:50  5b. Discussion of Directorate of Programmes Fact Sheets

14:00  5c. *Report of delta Phase B* (A. McPherson)
14:30  5d. *Report from the E-ELT Science Office* (M. Kissler-Patig)
14:45  5e. *Report from the ESE Subpanel* (T. Herbst)
15:05  5f. Discussion of E-ELT delta Phase B

16:00  *Coffee break*
16:15  Closed session

13 April

6. Directorate of Operations
08:30  6a. *Directorate of Operations Overview* (A. Kaufer)
09:00  6b. Discussion of Directorate of Operations Fact Sheets
09:15  6c. *Report from the La Silla Paranal Subpanel* (Y. Mellier)
09:25  6d. Discussion
09:45  6e. Proposal for Next Generation Transit Survey Facility (A. Kaufer)  
10:00  6f. Discussion

10:20  Coffee break

7. VLT Instrumentation
10:35  7a. Wide-field Spectrograph - Phase A Study Proposal (M. Casali)
10:50  7b. Discussion
11:20  7c. GTO Overview (M. Casali)
11:30  7d. Adaptive Optics Instrumentation Plan (M. Casali)
11:50  7e. Report from the La Silla Paranal Subpanel (Y. Mellier)
12:00  7f. Discussion

12:30  Lunch

VLTI
13:30  7g. VLTI Status and Implementation Plan (R. Gilmozzi/ F. Delplancke)  STC-481
13:50  7h. Report from the La Silla Paranal Subpanel (Y. Mellier)
14:00  7i. Discussion

8. ALMA
14:20  8a. Project Status Report (W. Wild)
14:45  8b. Discussion of ALMA Fact Sheets STC-479D-ALMA
15:00  8c. ALMA Early Science (L. Testi)
15:15  8d. Report from ESAC (L. Tacconi)
15:35  8e. Discussion

15:50  Coffee break

9. Directorate for Science
16:10  9a. Directorate for Science Overview (B. Leibundgut)
16:30  9b. Discussion of Directorate for Science Fact Sheets  STC-479C-DSC

16:45  Closed session
14 April

08:30  Closed session

12:00  Meeting with DG and Directors

12:30  *End of Meeting*
Report of the La Silla-Paranal (LSP) sub-panel

April 7-8 2011 sub-committee

Present:

LSP sub-panel: B. Cotton, J. Fynbo, A. Marconi, Y. Mellier (Chair), G. Perrin, M, D. Queloz, R. Ragazzoni;


I. General comments

This LSP meeting focused on only few items in order to spend sufficient time on the VLTI and the AO development plans. The VISTA and VST were also discussed, as the VISTA telescope is facing technical problems, while the VST had its first light. The outcome of the call for spectroscopic surveys was also presented to the LSP committee.

II. VLTI Infrastructure and PRIMA status report

The LSP committee had long presentations on the status of the VLTI infrastructure and on PRIMA.

Regarding the VLTI infrastructure, the continuing efforts done over the last two years on the actions recommended in 2009 are now close to completion. On going top priority actions primarily focus on the upgrade of ATs, the Delay Lines and the commissioning of PRIMA (see below) but also on a long list of actions already reported in the previous LSP reports over the last 2 years. As in its previous meeting, the LSP committee was impressed again by the amount of work, the level of achievement on all fronts, and the professionalism of the team. The LSP was also happy to see that the commissioning of PIONIER went smoothly and that the instrument is now in operation, is working perfectly and is already producing remarkable scientific results. The LSP congratulates the VLTI and the PIONIER teams for this achievement.

On the "vibration-war" side, the four UTs show less and less scatter and are all close to the same level as UT2, about 150-170 nm (rms), with significant improvement made on UT3 and UT4 during the last semester. However, when combined together, the level of vibration is
significantly higher than each single telescope (350 nm per baseline) and may be hardly be lower than 250 nm (anticipated without major modifications of the current vibration control design). If the requests reported in the last LSP report are confirmed by GRAVITY (200 nm rms), and MATISSE (300 to 180 nm rms), the current lower limit may not be sufficient to comply with their requirements. However, it does not seem that far, so one can expect that solutions can be found (e.g. MAMUTT) without major changes.

Regarding PRIMA, the commissioning is on going and most problems listed one year ago (FSU, PRIMET, DDL, STS, ADRS, ISS, PACMAN. OPDC) are now fixed. Early results on PRIMA astrometry look reasonably good at this stage, but there are still systematic residuals that need to be investigated prior to make assessment on the performances. On the other hand, very encouraging results have been shown on the technical feasibility of PRIMA co-phasing to observe faint stars, and on the potential limiting sensitivity of PRIMA in this mode. There are definitely significant progress done during the commissioning of PRIMA, on both the astrometric and limiting sensitivity sides, as recommended by the LSP in its previous meetings. The LSP committee is now waiting for the upcoming commissioning periods that are scheduled in 2011 Q3 and Q4 in order to have a clear view on the status on the performances of PRIMA.

The STC-LSP was impressed by the achievement of the VLTI and the recent successes of the PRIMA commissioning. It is also pleased to see that VLTI keeps improving both in performances and robustness. The Team active to support and develop the VLTI has built a strong expertise and the STC-LSP wishes that the relevant support will be given to make sure that the capabilities of the team will not decrease at a time where important steps have still to be completed.

III. VLTI mid-term implementation plan

On the request of the STC made in 2010, the VLTI team presented a VLTI mid-term implementation plan. The STC-LSP was pleased by the outcome of this effort that matched its expectation. It congratulates the VLTI teams for the quality and clarity of the document. LST is ready to endorse it. The LSP wishes to comment on some aspects:

1. The improvement of the performances of the telescopes feeding the VLTI must be seen as of the highest priority. For the UT decreasing the vibration using the MAMUTT system is essential for the successful deployment of GRAVITY and pushing the faint limit on some program of high scientific impact. For the AT the installation of the OBAMA and NAOMI (active and adaptive system) will increase the reliability and the performances of all instruments and will bring more flexibility in the operation. This is particularly important for imaging programs that will form the core of a significant fraction of the future VLTI programs.

2. The implementation of the PRIMA *phase tracking* on MIDI and AMBER will be of great
potential for MIDI and AMBER science, allowing fainter targets to be observed. However the STC-LSP believes that the implementation of the *phase referencing* mode for these two instruments must be of low priority. In the case of MIDI the combination of two different wavelength is likely to be a serious limitation and for AMBER the STC-LSP is not convinced by the scientific case by comparison with a 4 telescope configuration as proposed by PIONIER.

3. The suggested descoping of NAOMI by removing its J band capability must be considered in view of the whole instrument plan. In this context MATISSE, GRAVITY, PIONNER and PRIMA, does not need this facility and the J band is not seen as relevant. However we encourage ESO to forward the question of the scientific potential to improve the J-band performances of AT telescope injection to the AMBER community and to provide more information on the saving achieved by removing the J-band capability of NAOMI to the STC.

The STC-LSP took note of a new type of IR low noise detector and wishes to emphasis the potential of improvement that they could lead to the VLTI and AO performances. It encourages ESO to pursue the development effort in view of its future use at Paranal.

The STC-LSP took note of the need to develop a long range vision for the VLTI and support the idea to organize a workshop on it. He expects to be solicited on that matter in a near future.

The LSP asks ESO to contact the GRAVITY and MATISSE Science Team in order to clarify the science requirements on the vibration values and check they are compliant with the expectations provided by the VLTI teams assuming the anticipated MAMUTT performances.

**IV. AO development plan**

Following the recommendation of the last STC meeting, ESO pursued the Studies presented in October (see LSP presentation at the last STC), namely the "Double-Cassegrain", the "GALACSI-CAM", the "HP-IRLOS" and the "Hybrid-MCAO" (replacing HAWK-I). Among the first three, the Double-Cassegrain seems the technically simplest. Option four would require decommissioning HAWK-I and would not provide options to upgrade SINFONI, as strongly recommended by the LSP and the STC. ESO then is focusing on the Double-Cassegrain option (previously SPIFFICA0). The Phase A study started this month with a target date for the PAE in 2015. ESO will lead the project but will need some extra-resources for the IR camera and the mechanical structure. In parralel, ESO set up a Project Science Team, as requested at the last LSP. The Project Science Team will focus on the top level science requirements and on the discussions of trade-offs, whenever necessary.
The LSP is very happy by the continuous and good progress made by ESO on the definition of the new high-streh instrument in replacement of NACO. It will closely follow the outcome of further technical and scientific studies of the Double-Cassegrain option. The LSP would like to have a more detail presentation of this option at the next LSP, including details on the outsources options.

Regarding NACO, ESO presented several options to transfer the instrument on another UT. ESO stressed that, as NACO is a fragile instrument, any option that demands to move NACO more than once is risky and should not be considered. Therefore, if NACO is installed on another UT, it must be for a rather long period, and at the expense of another instruments of UT1 (CRIRES), UT2 (FLAMES) or UT3 (VIMOS2). Another option would be to postpone the installation of MUSE until the LGSF is operational and preserve NACO on UT4 in the meantime.

Although all these option secure the AO imaging capability on UTs, their impact on other instruments and on the scientific community behind cannot be overlooked. In order to discuss this at the STC, there are urgent needs for information on science cases (MUSE), on the instrument upgrade plans (CRIRES), on the anticipated spectroscopic surveys plans with FLAMES and VIMOS2, and on possible optimised/balanced schedule between these instruments and NACO.

Nevertheless, the LSP reiterates its view that NACO should be operational on UTs until a new AO imaging facility, at least as efficient as NACO (FOV, Strehl, NIR and L bands at least), be commissioned. We therefore encourage ESO to continue to explore further the options to install NACO on UTs that Marc Casali has presented. These options should minimise the NACO-less time and should also take into account the scientific impact on the other ESO communities if NACO must be switched with another VLT instrument.

V. Public Spectroscopic Surveys

The outcome of the call for public surveys has been presented to the LSP committee. Two out of 36 proposals have been pre-selected. One concerns a galactic spectroscopic survey with FLAMES, in preparation of GAIA; the other one, on the NTT, concern observations of transients. The final selection will be done during the next OPC meeting (May), after the PSSP meeting organised next week.

The LSP notes the PSSP recommendation not to select any VIMOS proposals at this stage and to postpone the selection by 1.5 year, until on going surveys are completed. This issue was not anticipated and this is the reason why the over-subscribed regions were not advertised in the call. This is unfortunate but it is not clear whether the outcome would have been different, as the over-subscribed fields are the most interesting from both a scientific and legacy value point of views.
VI. Status of VISTA and VST Surveys

The panel got good and bad news about VST and VISTA. We were informed that the continuous degradation of VISTA throughput results from the M1 coating that degrades much faster than expected. The magnitude Zero Points dropped by 0.2 to 0.6 mag. in about one year. All bands are degraded. ESO is now proceeding to recovery re-coating action and will move back to Aluminum coating which proved to have a longer and more reliable durability than the current NiCr-Ag coating. Unfortunately, during the M1 mirror disassembly, ESO discovered that the M1 axial support was broken and must also urgently be repaired. This accumulation of problems will delay all on going VISTA public surveys by several weeks.

The LSP panel deplores the situation and supports the on going recovery actions initiated by ESO. However, the panel is aware that several PIs continuously expressed their concerns about the performance degradations but were informed about the coating problem only very recently. The recent decision of interruption of operation of VISTA went as a bad surprise and raised a wind of unhappiness among the users. To avoid this, the LSP asks ESO to promptly improve the communications between the ESO teams responsible for VISTA/VST operation, the public surveys and the VISTA/VST user community. Transparent information about technical problems could easily be made public on a very short time scale in order to help users to better understand problems in their data and to anticipate re-organisation of their OBs.

On the VST side, the LSP is very happy to learn that the first light of VST in March was a success and that the telescope image quality seems as good as expected. The first real VST PSF shown to the panel is an illustration of an achievement that opens the route to VST Public Surveys this fall. It is important to notice that the first light of the DES telescope are now planned for the beginning of 2012, and if we take into account the one-year DES commissioning period, the VST still preserves a short window where it will be competitive.

VII. Status of VISTA Public Surveys

The LSP was satisfied again by the remarkable works done by the ESO Public Survey team in order to monitor the progress and the quality of the public surveys, to support the PIs in the organization and the distribution of public data releases and to prepare the forthcoming public spectroscopic surveys. Tasks seem to follow the early plans presented one year ago without major delays or technical difficulties.

The panel was however a bit lost after the presentation of the public survey efficiency with VISTA. Although several well motivated efficiency definitions were presented, the outcome of the analysis was unclear or inconclusive. The LSP suggests that the survey efficiency be revisited next time. The panel would like to follow the absolute efficiency based on simple well-defined definitions, the relative efficiency as function of time, based on one reference observing period, and have an estimate of the maximum efficiency one can reach for each
surveys based on a survey model. With these data in hands ESO and the LSP will be in position to assess how efficient ESO is in handling surveys and to monitor the evolution of efficiency as function of time.

### STC - La Silla Paranal Committee

#### STC-LSP Meeting Garching, 8 April 2011

Draft Agenda (Version 1.0, 29.03.11)

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<td>09:00</td>
<td>Welcome and adoption of the Agenda (Y. Mellier)</td>
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<td>09:10</td>
<td>VLTI Infrastructure Status Report (P. Hagenauer)</td>
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<td>09:40</td>
<td>Prima Status Report (F. Deplancke/G. van Belle)</td>
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<td>10:10</td>
<td>VLTI Mid-Term Implementation Plan (R. Gilmozzi/F. Deplancke)</td>
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10:40  **Coffee break**

| 11:00   | AO Development Plan (M. Casali) |
| 11:30   | Discussion |
| 12:00   | Public Spectroscopic Surveys (B. Leibundgut) |

12:30  **Lunch**

| 13:15   | Status of VISTA Surveys (M. Amaboldi) |
| 13:35   | Status of VISTA and VST (Th. Szeifert - VC from Chile) |
| 14:05   | Commissioning of OmegaCAM (O. Baade) |

14:25  Closed session
16:30  Meeting with ESO staff

17:00  End of meeting

LIST OF DOCUMENTS

Terms of Reference and Rules of Procedure for the STC
Rules for Dealing with Conflicts of Interest on ESO Committees
STC-479A-DOP  Fact Sheets - Directorate of Operations
STC-479B-DOP  Fact Sheets - Directorate for Programmes
STC-479C-DSC  Fact Sheets - Directorate for Science
STC-481       VLTI Status and Implementation Plan
**Report from ESAC**

**ESAC Activities since last STC:**
Long telecon before ASAC, 25 February
ASAC Meeting 28 February - 1 March in Santiago
ESAC face-to-face meeting, 11 April

ESAC Membership: Jose Afonso, Frederic Gueth, Lauri Haikala, Michiel Hogerheijde, Rob Ivison, Jes Jorgensen, Jesus Martin-Pintado, Raphael Moreno, Elaine Sadler, Linda Tacconi

European ASAC Membership: Frederic Gueth (ASAC Chair), Rob Ivison, Michiel Hogerheijde, Jesus Martin-Pintado, Linda Tacconi

ESAC welcomes Jes Jorgensen as new member
April 11 ESAC Meeting Agenda

Morning:
- Welcome and introduction of new member
- ASAC charges
- **Project update** (W. Wild)
- **Science update (CSV, ES and future capabilities, etc.)** (L. Testi)
- **Eu ARC Readiness for user support and Report on ES preparations** (P. Andreani)
- **The European ALMA Regional Centre Nodes** (M. Zwaan)
- Discussion
- **Eu Antenna testing update** (R. Laing)
- **ALMA Development Plan Studies status report** (L. Testi)

Afternoon:
- Discussion of ASAC report
- **Computing status report** (E. Schmid)
- **Archive status and plans** (A. Manning)
- **Observing Tool ES version and plans** (A. Biggs)
- **CASA data reduction and imaging group report** (D. Petry)
- **CSV and SV data reduction with CASA** (M. Zwaan) 16:15
- Discussion
- **Updates on: European Commission Programmes, workshops, etc.** (L. Testi)
ALMA is Here!

• ESAC congratulates ALMA on the achievement of the first ever Call for Proposals, which was issued on March 31.

• ESAC applauds the efforts of the ARC in their support of the Call, and recognizes that the workload will continue to increase with the approaching proposal deadline, proposal review process and the scheduling blocks for ES.

• Extremely pleased that 1\textsuperscript{st} AEM antenna close to handover. ESAC appreciates the huge effort of many people that have lead to this near-milestone.
ASAC Charges focussed the discussion:

- Charge 1 – Preparation for Early Science
- Charge 2 – Proposal Review Process
- Charge 3 – Path Toward Full Science
- Informal Charge 1 – Community Expectations
- Informal Charge 2 – Power & Environmental Impact
Charge 1: The Committee is requested to review and comment on the progress on preparing for Early Science. This should include: the status of the Construction project and progress with Commissioning and Science Verification; the scientific capabilities that are to be offered for Cycle 0; the preparations being made by the Department of Science Operations and by the ALMA Regional Centers, including the results of the integrated tests and progress on planning the activities needed to operate the facility. (Early Science readiness)
• Many areas of progress, but CSV has been hindered by bad weather.

• ESAC pleased by the latest AEM antenna progress and timeline, and positively surprised by the optimistic report of the European Project Manager that there could be 2-3 AEM antennas as part of the ES array, but concerned with the stark contrast to what ASAC members heard from JAO in Feb-Mar.

• European FE’s (Bands 7 and 9) continue to be in good shape, and performing better than expected.

• ESAC pleased with the capabilities offered in Cycle 0 (4 bands, 16 antennas, baselines up to 400 m, small mosaics)

• ARC is spread thin - they are supporting operations as well as Early Science. ESAC recommends that requests for additional support to the ARC be prioritized together with the staffing needs of the other programs in the ESO suite.
Readiness for Early Science II.

- Archive making steady progress but continues to be a cause of concern. Still many problems to solve before start of Early Science.

- Some communication problems between CSV and Computing IPT. CSV teams frustrated by having to do things manually, and debug software while commissioning or taking data for SV. Timeline for Cycle 0 is tight, and there is no time contingency left. ESAC suggests keeping an CIPT person in Chile who has good overview of the science goals for commissioning and science verification.

- ALMA Observing tool (OT), science portal, and proposal preparation tools are in very good shape. ESAC suggests that an OT-like environment is something ESO should consider for its observing proposal submission process.

- Although SV data will be public, ESAC reiterate the recommendation that CSV and ARC teams lead the first “ALMA is Working” data paper.
Charge 2:  A final version of the document “Principles of ALMA Proposal Review Process” has been approved by the Board. A draft of the Implementation plan (for full Operations) and a plan specifically for Cycle 0 will be provided to the ASAC, together with a report on progress in setting up the ALMA Proposal Review committees. The Committee is requested to comment on the implementation plan and the plans for Cycle 0.

- Projected number of proposals for Cycle 0 (320) likely way too low.

- ESAC pleased that the review panels for Cycle 0 are now in place, but remains concerned that the workload on the panels is too large. ESAC supports triaging of the bottom ranked proposals and remote “shadow panel members” as means to lighten the load on individual members.
Charge 3: Path to Full Science

Charge 3: The ASAC will receive updates on matters related to the completion of the full construction program of ALMA, including schedule, budget and the build-up of operational capabilities. Progress on establishing the principles that will govern the ALMA Development process will also be reported. The ASAC is requested to comment on these topics and bring any concerns to the attention of the Board.

• ESAC reiterates our endorsement that top priority for project is the timely completion of the full ALMA array.

• The European deliverables to the project, in particular, the Archive and AEM antennas, need to be in place on time and be performing optimally for the full exploitation of ALMA science.

• ALMA Development studies – several now underway. ESAC looks forward to the results of these studies and to seeing the document outlining the ALMA Development Plan Governance.
Informal Charge: Community Awareness

Community sounding on expectations for early science, and ALMA information resources for the general community.

• Call for Proposals is very clear regarding terms of ES.

• Tutorials, schools, science workshops and ALMA community days have been a huge success and the ARC and ARC-nodes have done a terrific job in preparing the community.

• Science portal provides video tutorials and lots of documentation.

• Proposal writing tools, sensitivity estimator, data simulators all in place.

• ESAC (and the community!) appreciates the effort that has gone into making all the tools and information available well in advance of the proposal deadline.

• ESAC supports continuing regular tutorials (on CASA, OT, etc.) and workshops (e.g. on VLBI, ALMA first results, ALMA Development, etc.) as proposed by the European Program Scientist.
APEX Update – telecon Feb 25

- ESAC is extremely pleased with the signing of the 3-year extension of the APEX agreement.

- Continued upgrades and maintenance on facility instruments and increased capabilities with PI instruments.

- Some problems with mixers in APEX-T2 1.3 THz receiver of SHFI. Sent back to Sweden for repair and could be ready for installation in June. ESAC recommends waiting for the installation of the receiver until the next shutdown period. This minimizes the downtime and risk to other SHFI bands with extra intervention, and will not negatively impact the scientific output of the T2 receiver.
European ELT Science and Engineering (ESE) Committee Report
March 2011

ESE Participants
Joris Blommaert, Colin Cunningham, Raffaele Gratton, Roland Gredel, Tom Herbst (chair), Isabel Hook (via telephone), Josef Hron, Gerard Lemaitre, Göran Olofsson, José Miguel Rodriguez-Espinosa, Gerard Rousset, Florian Kerber (secretary)

David Crampton, Marijn Franx, and Didier Queloz could not attend.

ESO Participants
Mark Casali, Philippe Dierickx, Roberto Gilmozzi, Bruno Leibundgut, Markus Kissler-Patig, Alistair McPherson, Suzanne Ramsay, Roberto Tamai

The meeting took place at ESO on 22-23 March 2011 and followed the attached agenda.

Unlike previous get-togethers, the March 2011 ESE meeting focused almost exclusively on a single topic: options for reducing the cost of the EELT program. The ESE report follows, beginning with some general remarks and recommendations, followed by a summary of the cost saving exercise and more specific comments on the individual options explored.

General Remarks
The focus of the meeting was the ongoing “Delta Phase B” effort, which has followed the completion of the formal Phase B period in the fall of 2010. The primary thrust of the EELT team during Delta Phase B has been to examine options for and the consequences of reducing the telescope cost by approximately 20%. In addition, there are a number of yet to be completed Front End Engineering Design (FEED) studies that require attention. This phase should end in approximately six months with the submission of the construction proposal to the STC-FC-Council process in late 2011.

ESE would like to highlight an important aspect of the Delta Phase B and decision-making process: STC, FC, and Council will receive the original construction proposal, completed in 2010, along with a number of additional documents addressing the cost reduction options examined in 2011. In other words, the 42m design is still the baseline, but there will be a “menu” of de-scope options, including their respective impact on science, cost, risk, and schedule.

Since our last meeting, ESO has successfully concluded the negotiations for the accession of Brazil. This represents a significant achievement, which goes a long way toward making EELT a reality. A successful outcome on such a short timescale was in no way guaranteed, given the economic environment and political changes in Brazil, and ESO deserves hearty congratulations.

ESE Comments and Recommendations
1. The EELT project should continue to examine options for producing a reduced-cost telescope proposal with minimum impact on science, schedule and risk. Some of the changes presented satisfy these criteria, while others apparently do not. Further details appear in the next section of this report.
2. The exercise of evaluating science impact of telescope changes is essential. ESE encourages refinement and expansion of these assessments.

3. ESE supports the EELT schedule priority regarding competitiveness across the Atlantic. This argues for going to Council with a construction proposal in 2011.

4. A substantial alteration of the baseline design would necessitate some formal review. This could take the form of a “delta” review with the same panellists as for the baseline design. ESE believes that the proposed reduction in M1 diameter is such a substantial alteration. Other items, such as eliminating the gravity invariant focus, are not. While holding a formal review would have manpower and schedule implications, the risk of not doing so is significant.

5. ESE is sensitive to the remarks from the instrument community regarding certainty in schedule and planning. Establishing a firmer roadmap, particularly for instruments 3 and 4, should be a priority, but this depends on information to be gleaned from experience with SPHERE, KMOS, AOF, and other experiments. ESE therefore suggests that the science office, working with the SWG/SAWG, establish rankings of science capabilities on a one-year timescale, with the goal of issuing a call for proposals in fall of 2012. ESE recognizes that there will be a compromise regarding direct negotiation with current teams versus an open competitive call, which may affect this schedule. ESE also notes that the uncertainty of exact timing and content of the SPHERE, KMOS, etc. information may force additional flexibility.

6. ESE requests an optical report on the modified telescope and its performance. The report should include clarification of the changes to the central obscuration, location of the pupil, the diameters of M4/M5, conjugation altitudes, modified actuator count and pitch if planned, etc. ESE recognizes that various options are under current active study and can wait for completion of these investigations before receiving this report.

7. Communication of EELT planning and progress to the wider community should be improved. ESO should consider producing a monthly electronic newsletter.

8. The evolution of the SWG into the SAWG (Science Advisory Working Group) seems logical. ESE struggled somewhat with the best option for including instrumentation representation on the panel, and this is clearly an issue for STC to address. The proposed terms of reference include representation from accepted instrument teams only. Many ESE members believe that conflict of interest, when openly declared, can be managed, and thus wider representation from potential instruments should be considered. As a working group, the SAWG would be effectively a component of the ESO program, and hence cannot replace the oversight function of STC and its sub-committees. ESE is sensitive to the workload imposed on the project by the existence of multiple committees, but does not see an acceptable alternative.

9. There was some confusion at the meeting regarding the number of usable nights at Armazones and the consequent importance of an instrument for marginal conditions. ESE understands that this material has been presented in the past, but a short document summarizing the situation would help both with our internal deliberations and in illuminating the decision-making process for the wider community.

10. The impact of various developments on the delivered PSF requires further study. Greater variation in image quality across the field of view of a 39m design will impact multi-object spectroscopy, while the better than expected quality of the prototype segments may mitigate the loss of exoplanet science due to reduced diameter.
11. The EELT team should continue to study the Nasmyth platform geometry and the cost and science impact of potential redesign of the focal stations, taking into account the instrument plan.

12. ESE believes that pursuing a faster primary, and hence a smaller M2, should be considered as a sensible course of action, independent of other decisions.

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**Summary of Cost Saving Exercise**

The EELT team presented a scaled-back version of the telescope which would have to meet the conflicting demands of reducing cost while not impacting the science case nor requiring significant engineering changes. Substantially reduced science would be unacceptable to the community, while major changes to the design may force a costly and time consuming cycle of re-design and external review.

In terms of science, the project faces the immutable fact that the cost of the telescope appears to be on a D^{1.2} curve, while the science is on a D^4 curve. Without additional constraints, the conclusion is clear: downsizing is a bad idea. ESE recognizes that such additional constraints may exist, but they are in domains such as member state finance and politics, which exceed ESE’s terms of reference. This report therefore concentrates exclusively on the science and engineering aspects of this exercise.

On the engineering side, the EELT project office has invested significant resources in evaluating the baseline 42m design, and it is impossible to gauge the true cost and risk of a significant modification without introducing schedule delay. Given the mandate to complete the European ELT on a competitive timescale, a less than exhaustive assessment of scientific impact and actual cost reduction of the proposed de-scope options inevitably introduces additional risk, which must be taken into account in any evaluation of how best to execute the overall program.

ESE notes that some of the proposed changes, such as the reduced M1 focal ratio, elimination of the lifting platform, etc., represent cost savings with minimal wider impact, independent of telescope diameter.

Finally, it was not clear to ESE that the proposed changes satisfy the requirement of lowering the project cost by 25%. Reducing the size and focal ratio of the telescope saves about 6%, while miscellaneous changes may bring an additional 6%. Both figures are uncertain due to the factors mentioned in the previous paragraphs. The funding profile presented by the Director of Science showed substantial positive cash growth in the years immediately following first light (the so-called “green wedge”). ESE cannot help noting that uncertainties in estimates, potential additional member states, and schedule adjustment could more than make up for the budget shortfall.

**De-scope Options – Detailed Remarks.**

ESO presented a number of options for reducing the cost and risk of the EELT:

1. remove 2 rings of M1 segments, reducing the diameter to 39m
2. reduce the M1 focal ratio from f/1 to f/0.93
3. eliminate the gravity-invariant focus and reduce the Nasmyth platforms
4. miscellaneous (eliminate lifting platform, identify alternate M4 petal suppliers, procure an M5 prototype in silicon carbide, etc.)
The following paragraphs present ESE’s view of the science, cost, risk and schedule implications of each of these options

1. Reducing M1 Diameter to 39m

Note that the 39m value represents not only a reduction in diameter, but also a crucial change in the definition of primary mirror size. The earlier, 42m figure corresponded to the maximum diameter fully filled with glass and did not count the “points” of the segment hexagons that protrude beyond that size. The 39m value is the “point-to-point” diameter and relates directly to the maximum spatial frequency delivered by the telescope. It also matches the definition adopted by the TMT project. While this change inevitably introduces some confusion, ESE supports the more scientifically motivated figure of 39m. For reference, the following table clarifies the definitions:

<table>
<thead>
<tr>
<th></th>
<th>Point-to-Point</th>
<th>Fully Enclosed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline “42m”</td>
<td>43.2m</td>
<td>41.3m</td>
</tr>
<tr>
<td>Descope “39m”</td>
<td>39.3m</td>
<td>37.0m</td>
</tr>
</tbody>
</table>

Science: The science goals of EELT would undoubtedly be significantly affected by a decision to reduce the diameter of M1. The Project presented an assessment of this impact based on scaling laws, arguing that EELT science – specifically, the time required to complete the core science cases – scales as the diameter raised to an exponent between two and four.

While the evaluation of this impact is still ongoing, ESE disagrees with this assessment. EELT is an adaptive telescope, and much of its high impact science involves faint point sources, for which a D^4 scaling law applies. In addition, one of the premier science cases, characterizing rocky exoplanets, scales even more rapidly: as fast as D^6. This is based on detailed simulations, but can be understood as a factor D^4 for a point source, coupled with the D^2 dependence of the inner working angle. These simulations also show that this flagship science case is already operating in the domain of small number statistics. Reducing the diameter as proposed would cut the number of expected target systems by 40-50% and would likely leave a sample in single figures. The reduced spatial resolution and sensitivity also has a significant impact on the extragalactic stellar populations case.

In terms of overall importance, then, ESE feels that the telescope is for the most part operating on a D^4 curve. The proposed size reduction then corresponds to a loss of roughly 32% of core science.

ESE notes that a smaller primary mirror may bring reductions in cost and risk for the adaptive optics system. Either the number of actuators could be reduced, or the overall system performance improved by having a greater actuator density on the pupil.

Cost: The cost will be reduced due to a physically smaller telescope main structure and dome. In addition, the smaller number of segments will mean less glass, a saving that may be offset by the additional cost of polishing a faster and more aspheric surface (see point 2 below.)

Risk: Beyond the obvious issue of funding, the reduced diameter does not appear to reduce risk substantially. The option of using a conventional steel crown on the main structure, as opposed to carbon-fiber composite, does reduce risk.

Schedule: The ESE perceives no qualitative schedule impact of this option. While reduced size may speed up and simplify the assembly of the main structure and dome, this advantage may be lost due to the more complex polishing requirements on M1 and M2 (see point 2 below.)
2. Shortening M1 Focal Ratio

Science: Shortening the M1 focal ratio does not appear to have a significant science impact.

Cost: A faster M1 primary will lead to cost savings in both the main structure and dome, since the telescope will be physically shorter. These savings in material appear to be modest, however. The deeper, more aspheric figure of the segments will be more difficult and expensive to polish, as will be the asphere on M2.

Risk: The faster primary, coupled with the smaller M1 diameter, leads directly to a smaller secondary mirror. The proposed M2 is 4m in diameter, considerably smaller than the 6m M2 in the baseline design. Wind induced motion of the secondary was the most significant component of the wavefront error budget in the baseline design, and polishing a convex 6m asphere is unquestionably a challenge. While the smaller secondary has a more significant asphere, the reduced M2 diameter unquestionably represents significantly lower risk. Earthquake induced accelerations at the top of the telescope will presumably also become less of an issue. ESE believes that pursuing a faster primary, and hence a smaller M2, should be considered as a sensible course of action, independent of other decisions.

Schedule: Reduction of the M1 focal ratio does not appear to have a significant schedule impact. Industrialization of segment fabrication will require output of roughly one element per day, and the polishing demands of the stronger asphere may nullify any gains in schedule from the lower segment count. An external review, if deemed necessary for this option, would lengthen the schedule.

3. Eliminating Gravity-Invariant Focus and Reducing the Size of the Nasmyth Platforms

Science: Despite its potential impact on an EAGLE-type instrument, the elimination of the gravity invariant focus (GIF) does not appear to affect science in a substantial way. Alternative configurations for EAGLE at a vertical focus on the top of the Nasmyth platform seem doable, and ESE was comforted to hear that the EAGLE team itself was willing to work with the change.

Cost: Reducing and simplifying the Nasmyth platforms should save substantial cost in steel and it eliminates the somewhat cumbersome crane arrangement for servicing the GIF. The smaller physical area of the platforms allows a smaller overall dome, again reducing cost.

Risk: This option may involve a slight risk of overcrowding on the Nasmyth platforms.

Schedule: This option does not appear to have a substantial schedule impact.

4. Miscellaneous (Lifting Platform, Alternate M4 Petal Suppliers, SiC M5 Prototype)

Science: None of the miscellaneous options has a noticeable science impact.

Cost: Elimination of the lifting platform will save money, both in terms of the hardware itself and the construction of the deep pit required for the hydraulic ram. Minor additional cost will arise from the need to increase crane capacity for lifting instruments. Identifying alternate M4
petal suppliers will cost money, but ESE believes that the substantial reduction in risk makes this a worthwhile investment. Similar comments apply to the silicon carbide initiative for M5.

Risk: Raising instruments with a crane rather than the lifting platform may involve slightly increased risk, but the instruments reside permanently at the Nasmyth focus. This will not be a regular operation. The M4 and M5 supplier options unquestionably reduce risk for these critical items.

Schedule: None of these items appears to have substantial schedule impact.

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**Agenda – ESE Meeting 22-23 March 2011**

**March 22, Afternoon**

14:00-14:15 - Welcome [R.Gilmozzi]
14:15-14:45 - Status and information on the E-ELT approval process [T.de Zeeuw TBC]
   (including Revised schedule; Specific options for Brazil's role; Update on financing situation)
14:45-15:00 - Discussion
   (including News management by ESO on the E-ELT programme – basically a concern about information flow to the community)
15:00-15:30 - E-ELT design status and near-term plans [A.McPherson]
   (including Cost reduction options under consideration; Update on site preparation activities)
15:30-16:00 - Discussion
16:00-16:30 - break
16:30-17:15 - Current instrument plan / Report phase A instrument PIs meeting [M.Casali]
   (including impact of smaller diameter on instrument selection and sequencing)
17:15-17:45 - Discussion
   (including Impact of proposed changes to the instrument focal stations and interfaces; Instruments/science for sub-optimal AO conditions)
17:45-18:30 - Closed Session
19:30 - Dinner

**March 23, Morning**

09:00-09:30 - Impact on science of a reduced telescope diameter [M.Kissler-Patig]
09:30-10:00 - Discussion
10:00-10:30 - Committee structure during construction / Science Advisory Working Group ToR [R.Gilmozzi]
10:30-11:00 - Discussion
11:00-11:30 - break
11:30-12:45 - Closed Session, drafting of report
12:45-13:00 - Feedback to ESO
13:00-14:00 - Lunch & adjourn