



Minutes 4th SKADS Board meeting

28-29 June, 2007

NH Hotel – The Hague/Den Haag

Distribution list:

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28 June, 2007

Introduction by SKADS Coordinator

PC gives an explanation of the voting procedure for the new Chair and Vice-Chair by e-mail. Everyone voted in favour of the present Chair – Peter Wilkinson, elected as vice-chair was Wim van Driel.

PC encourages all to think about the venue of the next SKADS Board meeting in January 2008 at a place other than the Netherlands.

Unfortunately Steve Rawlings will not attend the meeting as he is stuck in the US due to stormy weather conditions.

1 Opening/welcome – Peter Wilkinson

Chair welcomes everybody to the meeting.

2 Minutes 3rd Board meeting 18-19 January, 2007 – Peter Wilkinson

The minutes were approved, the action items discussed.

Actions items:

- 1, 3, 4, 5, 6, 8, 12, 13 and 14. Done
2. It was decided to have public minutes available. Chair/PC to do.
7. Done, SM will add some comments on the situation in Italy later.
9. Part of the agenda.
10. Annual report to be sent to the ISPO. SKADS Coordinator makes an executive summary. Will be done.
11. Done by means of a presentation.

The decision of the withdrawal of the 3 Australian participants was approved, this decision should be added to the decisions.

Chair presents the desired principal meeting outcomes (attached).

3 Coordinator's report – Arnold van Ardenne

ESKAC discussion had to be moved to the 2nd day of the meeting unfortunately, AZ, Chair of ESKAC, not being able to attend the 1st day.

Presentation of Steve Rawlings will be done by PA and PS.

News since last meeting

Contract negotiations with Portugal and the withdrawal of 3 Australian partners and Kwa Zulu Natal required 4 versions of the DoW; The situation now that three Australian participants are out of the project may lead to a contract change with CSIRO. Portugal (IST-CENTRA) has joined involving €72k in total, of which €6k from EC: Mario Santos is welcomed by the PC as official representative from Portugal for the first time. We now have 26 participants in the project. All logo's are there now, these are necessary for outreach purposes.

- The first version of the Costing exercise was completed in March and discussed in ISSC San Juan
- The EMBRACE Industry involvement workshop at ASTRON in June 2007 was rather successful.
- The SKADS Virtual Telescope exercise is almost completed



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- o The visit to USA and Canada by Van Ardenne and Faulkner in May was to align SKADS and TDP goals;
 - * to look at the 11 feed array on the 140 foot telescope at Green Bank – the Kildal feed;
 - * to look at Canadian dish developments and other progress.

Other issues

There is a potential Swedish proposal for European wideband feed development . PD comments that the fact that Sweden is not actively involved in PrepSKA was deliberate because of the size of the community there.

We are working on a new brochure and a poster for the Manchester round of meetings

Personnel Changes

DS3-T2 is led now by John Romein,

DS3-T6 by Albert-Jan Boonstra.

DoW

The new Description of Work will be effective as from July 1, 2007. As soon as it has been approved by Brussels it will be distributed, though the scope of the activities has not been changed.

Astronet

PC is involved in Astronet Roadmap Panel B. Astronet has its own website www.astronet-eu.org where all details can be found. PC gives a small introduction of the activities: initiative to improve transparency and coordination in planning and management procedures in European Astronomy. Will produce Infrastructure Roadmap in (to be finalised after the Liverpool meeting in June 2008) - investments needed by European Astronomy to ~2020 based on the now-completed Science Vision (which was discussed at the Poitiers meeting in 2007)

TvdH gives some more background information about the complicated process that is underway

There is a lot of misconception with regard to projects within the community.e.g. that ELT is a project which is technically almost ready and can be rolled out quickly while SKA is not !

HJvL had a questionnaire on EVN and found that the questions that are there are not the questions one would like to answer.

This is also confirmed by MdV, who also had a questionnaire. Maturity level and sizes of projects should not be misunderstood. MdV urges that all questionnaires on radio facilities are coordinated and shared to strengthen our position.

TvdH emphasizes SKA is a phased project. One of the questions is if the new facility is replacing the existing facilities.

Astronet will be further discussed in the ESKAC discussion on the 2nd day.

PC attended the ECRI2007 in Hamburg which was interesting conference organized by the EC.

RTS adds the possibility of getting funding by the European Investment Bank.

4 SKADS management report and 2nd annual financial report – André van Es

- 4.1 Due to the withdrawal of four participants from the consortium (Melbourne; Sydney, Adelaide, Kwa Zulu Natal) and one participant entering the consortium the agreement needed to be amended. PM suggests to add a rider into the Consortium Agreement stating the withdrawal from the consortium of four participants and the entry of the Portuguese. This will be affected in collaboration with our legal advisor, Stephen Kahn. PM reports the progress in the project, resulting overall in a 4 month delay. This can be recovered over the next periods. The third advance payment from the EC will be based on the 18 months spending plan. Overall Status of Project





- DS1/DS7 on track
 - DS2 started late but will complete on time
 - DS3 requires more information
 - DS4 started late but will complete on time
 - DS5 few months delay
 - DS6 no delays
- Summary by PC overall we are at least 4 months late

5 Toward the Mid Term Review

The ELT passed their MTR recently. They had one external reviewer, however, there was no EC representative. In our case Elena Righi-Steele will be there.

The ELT project office also invited three technical reviewers. These reviewers were there for ESO internal review purposes.

During the review only the SKADS Management Team, the Chairman of the Board and one or two specialists will be present.

PM explains the process for the annual report.

On July 2nd the formal Request for Reports will be sent out by the Coordinator.

The Technical progress report has to be sent to Brussels in a final version Mid August. This means that the man-month table needs to be correct as this is connected to the financial report.

Each participating institute will get an individual email with last year's C form, signatories and manmonth table.

As soon as any deliverables are ready, evidence should be made available, e.g. pictures, documents etc. The costing document will be added to the annual report as an attachment.

Everybody is requested to send copies of their contribution to the annual report to the PM, so he can start reading.

Meanwhile preparations for the workshop started. PM requests everybody to submit all presentations at least two weeks prior to the workshop.

The 2nd workshop will take place in Paris, and like last year, it will be organized by WvD and PS. WvD states that according to the DoW DS7 is in charge of the reviews, however, in fact the MT is responsible.

The EU determined the date of the MTR on 12 October,

Venue of the 2nd Workshop will be the basement of IAP and the MTR is planned to be in the Salle du Conseil providing an impressive ambiance.

Workshop dinner will be at the 1st floor of the Eiffel tower.

RTS comments that the timing is inconvenient with respect to the Manchester meetings that take place immediately prior to the SKADS meetings. PC replies that dates took into account the change from October to September of SKA2007 and the reviewer's agenda.

6 2nd SKADS workshop, Preliminary Agenda

The main purpose of the workshop should be an exchange of view vis-à-vis SKADS achievements. The second day will end at 15:00 h and will be followed by a closed session of the Coordination Committee.

MdV suggests to confirm opportunities and risks in the agenda.

Chair suggests to have a pre-meeting to be more precise on the agenda.

PA comments that there may be some junior people who would like to present their work in SKADS instead of having the usual presenters.





Wvd comments that 45 min. for lunch is too short and the programme of the 2nd day means that some break-out rooms are needed. He will check the possibilities.

AK thinks that this 2nd SKADS workshop might be a good opportunity to emphasize young people's involvement in SKADS. PC asks if there could be a way of funding, by the Observatoire de Paris perhaps. Wvd thinks this will not be endorsed in Paris.

CJ agrees with the suggestion to have young people participate.

PC confirms that these suggestions are helpful and will be considered in the structure of the program.

Italy Update

The present situation in Italy is commented by SM. Luigina Feretti was appointed as new director. INAF is now in a transition phase, awaiting the appointment of a new minister. Paolo Vettolani will nominate as soon as possible a new representative for the ISSC.

PC suggests to have the next SKADS Board meeting in January 2008 in Italy. SM confirms that this might well be possible and a good idea.

7 Status SKADS Benchmark Scenario (SBS):

PE said that this is now an SKA memo #93 – along with the Costing memo #92

Current figures are: AA station cost: €3.1M; total cost of Benchmark scenario €1.9M in 2011

Lots of the money goes on relatively simple things – antenna elements; LNAs; infrastructure; copper cable adds up

Noise temperature is critical: at 40K we would save €200M by building less area yet maintaining sensitivity

Weaknesses: this is a fixed design → not optimized and there is no clear model for back end processing.

Areas of study for AA: frequency dependent aperture; upper frequency limit; back-end processing requirements; noise temperature; optimization of digital sample size

RTS asks if the SBS will be updated before the SKA2007 meetings in Manchester. This is confirmed.

8 Status Costing Exercise on SBS

Paul Alexander reported:

Costing process will continue for many more years → vital to align with the other costing efforts → all future costing must be done with the "SKA Costing Tool" being developed

- Revisiting the costing of the Benchmark Scenario: an update is needed for the MTR
 - Not addressed in the first go were : correlator; central processing hardware; impact of phased development; scalings throughout the design
 - Needs better models for dishes; accounting practices etc
- Can we reduce the data to be processed? Currently driven by Tim Cornwell's thinking - processing may dominate the cost or achievability of a concept and more work needs to be done to test Cornwell's model
- In the Benchmark Scenario the main impact is via the dishes rather than the AA's
 - Diagram from memo #92: driving the cost is the calibration of the large FoV (from small dish diameter) which goes as a large power of the FoV





- For the AA one can synthesise a large (e.g. 60-m) - tremendous advantage. The AA gets its FoV from a large number of independent beams – costs scale first as a 60-m antenna then scales as the # of beams linearly (e.g. 200 x)
- In bench-mark scenario the 6-m telescopes are a problem – just feasible but needs looking at.
- Ideal to have a single approach to costing within SKA as a whole – this is achievable and the SKADS; ISPO and South African teams are now working together to achieve this
- Large-scale agreement on the way forward strategically
 - New tool needs to have Design Blocks and component libraries
 - Basic idea is to incorporate the SKADS concept into the International Software
- Last message: back-end processing is a real issue

PA reflects that Round 1 had a very aggressive timeline and that it was completed in time. It is only the start of an ongoing process during the SKADS project and it will be improved for the MTR.

It is essential that we identify the areas that were not covered in Memo 93. A new tool with design blocks for reporting and design structure, with costing elements in it.

9 Marie Curie CT and SKADS / Program 1st year, School Italy

The 1st Marie Curie workshop is a combination of science and instrumentation techniques. It looks very well organized and is a good reference of how this should be done. It is impressive to note that the school was full, and had equal gender distribution. ASTRON will organize the next workshop, preferably in the last week of October, MPIfR in Bonn the 3rd one of this year, possibly in the 3rd week of November, following by Kapteyn Institute in collaboration with JIVE in January 2008.

10 Progress in Canada

SD gives a presentation of the work that is being performed in Canada in particular small dish design: exploring performance/price

- Composite approach – completed on-site manufacturing facility in Penticton
- Will work with US TDP to explore cost-performance break-points – currently being driven by Australian MIRANDA project requirements .
- Rms of current prototype currently=0.25mm rms with peak-to-peak=0.97mm; could be 0.15mm rms if could get rid of some high points
- Working on modelling of the composite infusion process

LNA design Reasonable goals $T_{sys} = 25K$ at ambient temperature: think they can get this with $T_{amp}=15K$ and with 10K from everything else (this might be the difficult bit). LNA designed in 90nm CMOS: frequency 800MHz-1400MHz; DC Power 43mW; Noise figure 0.2dB (14K) at 85 ohms source impedance; will investigate LNA non 50 ohm antenna impedance. Performance at lower frequencies will be hard to maintain.

Digital phased arrays are being simulated by Tony Willis perhaps showing up some basic problems for phased arrays: Are the beams independent?: correlated noise issues; optimal spacing of beams; all affect survey speeds. The Canadians are in contact with ASTRON and aware of the work that is being done at ASTRON. The audience is impressed by the progress made, e.g. with regard to the new technology telescope developments.



The EVLA Correlator is based on FPGA (Xylinx 5 series); this programme has showed up limitations of industry standard design tools – with impact on cost and reliability – overall the programme should inform the SKA cost estimation in this area

11 Status of Australian ASKAP project

CJ is very happy to announce that the Australian government funded CSIRO-ATNF for 58 M €. This amount should be spent by 2012.

The project they were working on is now called ASKAP.

The SKA site needs to be fibered, it is estimated that this will take approx. 20 M AU\$.

In the course of 2007 a decision on the antenna will have to be taken, that this includes a risk is accepted. Main areas for technical R&D

FPA: critical area so looking at much simpler arrays to model – linear connected “checkerboard” array – appears to perform as model.

Antenna: ideas for “Skymount” giving fixed parallactic angle & stable field; new equatorial mount design: November 2007 decision on antenna

Receiver on a chip

High performance computing platforms

New web site www.atnf.csiro.au/projects/mira

Science case: www.atnf.csiro.au/projects/mira/science.html

Technologies roadmap: www.atnf.csiro.au/projects/mira/technology.html

Project Roadmap covers a 5-year plan

US TDP program

PC shows a presentation on behalf of Ken Kellermann of what is going on in the US TDP program that was funded recently. Unfortunately KK could not make it to the Board meeting this time. Two main points

Funded for 4 years at \$3M Per year

Emphasis on high frequencies and identification on design break points

Conclusions day 1

The Chair summarises the conclusions of day 1 as follows: meeting started with the usual formalities and re-appointing the Chair and appointing a new vice-chair. Portugal is welcomed, Mario Santos is representing the new participant. The MT gives the impression that the project is well under control at this stage.

SKADS Workshop

- take care not to be too expansive to worry the EC reviewer: interesting comment that a boring meeting structure is good: certainly we must be focused by the 2nd Annual Report and hence vital to get this in on time.
- need to find a time to look at the issues prior to the meeting
- nice to find a way to encourage young people to attend these meetings





Benchmark Scenario and costing

- Trade off issues sketched in and cost-modelling strengths/weaknesses identified
- Identified areas of study e.g. frequency dependent aperture; top frequency; back end processing requirements; noise temperature; optimizing digital sample size
- Costing based on Tim Cornwell's ideas for back-end processing – needs confirming. PA pointed out that the costs for the AA is in fact cheaper because of the way a large FoV is synthesized cf. dishes. 6-m dishes for the Benchmark Scenario is potentially a cost problem
- Helps to identify areas to concentrate our efforts
- Excellent progress in bringing together all the international costing efforts and developing the next generation of costing concept and software tools
- Back-end processing is a real issue

Marie Curie:

- Is up and running with first full meeting in Italy in September thanks to the efforts of the PC and the local organising committee
- The number of applicants is impressive.

Canada:

- Impressive reaction to failure of LAR design to be adopted within Reference Design
- Performance vs. price for small telescope designs in collaboration with USA and Australia
- FPAs and Tsys: interesting developments in particular on CMOS LNA design
- Large Digital Correlator experience important input to costing

Australia:

- The umbrella nomenclature is now ASKAP and the site is now at BOOLARDY.
- New Federal hard cash: total €58M → 45 dishes of 12-m and cross-continental capacity to NSW; cooled FPAs; SKA-ready infrastructure i.e. broad-band fibre
- Rapid and impressive build-up of activity across a broad front

USA

- Now getting explicit SKA funding 4 years at \$3M per year
- Emphasis on high frequencies and identification on design break points

June 29, 2007

12 SKADS Technical progress – Introduction

PE comments on and gives an overview of progress since the 3rd Board meeting in January.

Overall progress in last 6 months

- o Taken on substantial # of researchers
- o Increased resources for EMBRACE
- o First SKADS Design and Costing exercise memo
- o Refined EMBRACE mechanical design
- o Installed the focal lines for BEST-2
- o Commissioned three industrial studies
- o Started detailed design on 2-PAD
- o Substantial progress on phase transfer
- o Strengthened relationships with other groups: ASKAP; MeerKAT; NRAO, US TDP



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Timeline Summary:

- EMBRACE 3-6 months behind schedule
- BEST-2 approx OK
- 2-PAD about on time
- DS3-T1: OK

Deliverables

- Started late - so not up to meeting all MTR targets at TO+24 but deliverable rate allows schedule to finish on time in June 2009, even if 400m^2 of EMBRACE is finished

Frequency/sensitivity considerations

- sub-300 MHz: whole community agrees AAs are required here
- 300MHz-2GHz: Need increasing Aeff to maintain constant sensitivity: science/cost trade-offs for survey speed.
 - AAs are the best solution for sensitivity below frequency "X" and survey speed below frequency "Y"
 - X and Y found by design and cost modelling
- Above 2 GHz: whole community agrees dish solutions are required here

ISPO Links

- Cost modeling teams combining—already discussed
- Tiger Team for specifications: 3 scenarios being considered
 - Dish + FPA
 - Dish + single pixel feed
 - AAs+ dishes (essentially SKADS Benchmark Scenario)

RTS: looks a well structured approach

13 SKADS Scientific progress - Introduction and SAG

SAG – has not yet been set up. There was some uncertainty about the position of Luigina Ferretti, though the situation in Italy is still not completely clear.

Luigina Ferretti, Mario Santos, Ben Stappers and Joe Khan are proposed as members of the SAG. The proposal is unanimously approved by the Board.

PS would like to see some more interaction between the technical and scientific aspects in the project. A contribution to this will be the SKADS Pushchino workshop from July 30-August 1. RTS encourages the organization of the workshop to make proceedings, so that the information out of the workshop does not stay within SKADS.

Henrik Olofsson from Chalmers will start at OPAR in November to gain experience in doing astronomy with Aperture Array Phased Arrays.

PS shows the ongoing list of meetings and events

Outreach:

- Webpage with many new items
- 2nd SKADS newsletter with the usual items, in September the next issue will appear. PS encourages everybody to send input by mid August. Especially an update from BEST would be very much appreciated. PS would like to have all the names and some information of new hires for SKADS.
- SAT and WvD had an article accepted for publication.
- RTS compliments PS with the outreach activities and the SKA newsletter contribution.

A presentation for public outreach given by PS in Goutelas had a very nice picture. It would be good to have this available for all of. PS will make it available.



Evaluation of EMBRACE

- pulsar timing
- HI mapping
- Continuum mapping
- Source tracking
- Observations with strong sources
- Correlation with long baselines
- 12-meetings held so far – mostly teleconferences - 23 participants mostly ASTRON/JIVE OPAR
- Information is on wiki: <http://webmail.jb.man.ac.uk/skadswiki/Ds5T3>
- Needs engineering test plan by next February
- New hire at OPAR: Henrik Olofsson (formerly Chalmers) – starting Fall

14 DS2-T1 and SKA Virtual Telescope / Year in the life of SKA – Paul Alexander on behalf of Steve Rawlings

As SR could not make it to the meeting due to stormy weather in Texas this item is presented by PA.

DS2-T1 has a very large and diverse team. On June 6 in the meeting in Manchester everybody was reminded of the deadlines of the deliverables, which may be difficult to keep due to late start up of some institutions involved. Main topics are

- Continuum simulation methodology as described in Manchester – source physics painted onto the Lambda-CDM N-body simulations
- HI simulations: again painted on
- Polarisation simulations
- Pulsar simulations

Deliverables

- range of source catalogues; pulsar catalogue
- Dissemination policy : good to put through DS2-T2 process;
- Meeting agreed that the main issue to have it checked and verified within SKADS first
- Publication rights should be recognized
- Matt Jarvis can report on this internationally

SKADS VT and 4 years in the Life

Various stages of the “virtual” rollout were described

Stage A: 1000 square degrees could produce a 100k source HI survey to $z=0.2$; RM grid with 20 arcmin separation; confusion limited in continuum and much larger area shallower surveys.

Stage B: 1000k HI galaxies; RM grid all sky; continuum to 100 microJy; piggyback slow transient work

RTS commends this initiative - helps focus people’s thoughts; but it reminds us that building a telescope that is doing science while building the rest of it will be a non-trivial exercise

AZ asks if people are aware that the exchange with the German team seems not to be adequate. These team members are not really happy with the present situation. Rainer Beck was not at the meeting in Manchester. AZ thinks that there should be more interaction.

RTS: Question is if the use of the catalogues will be limited within SKADS. PE says that it should not be open to others before it is fully verified through the DS2-T2 team.

RTS is unhappy about the continuing attention for the Peterson exercise. PS answers that this will not compete with the SKA as it is limited doing one project. This is not the case with the SKA.





HSHS efforts in France: Some engineers will be working on this subject and they will be doing tests. AZ thinks that it would be good to have the French follow these developments and monitor what is going on. PS thinks that these efforts take away time that was meant to be spent on Embrace. WvD will deal with this, PC is happy to act if necessary. PS and WvD keep the Board informed at the next meeting.

15 Design Studies

15.1 DS2

DS2-T1 presentation by SR, presented by Paul Alexander, has been dealt with under 14. DS2-T2 presented by Cormac Reynolds
 Conclusion is that MeqTree appears to be an important tool to get the simulations done – making available via the SourceForge route on the Web

15.2 DS3 – Paul Alexander

This DS will meet all deliverables and milestones for the MTR.

T1 phase transfer looking good

- o Detailed technology survey and costing completed
- o Key points: fibre runs over 80km need optical regeneration and over 400 km need complete regeneration of the signal – begins to get very expensive: the mitigation is to limit the FoV on long baselines.
- o Phase transfer: 1ps for 20 GHz operation: several options one of which is fibres. Simulation of a practical 120km link using lab-test hardware looking promising

T2: refocussed with new leadership (John Romein)

- o System level architecture of data processing
- o Technology road-mapping: some overlap with DS4: e.g. explored stripped down Cell processor and produced 138 Gflops cf. 153 theoretical (impressive) – although communications BW not sufficient for our application.
- o Software modeling and architectural design
- o IBM links developing – would like other options for the road-mapping exercise
- o Software architecture: DoW in this area was very ambitious!
- o Need to link all the overlapping work in SKADS
- o Need to work on this to make up time

T3: functional simulator

- o Starting to come together in parts – first version of the framework tool is written
- o Interface will be the same interface as for the costing tool

T4

- o EM simulations Manchester/ASTRON
- o Station level beam forming Cambridge/Manchester
- o Coming to Manchester

T5 SKA for the User

- o Planning for 4 meetings underway
- o PC: can't do too much; can make inventory; can apply for funds in FP7
- o RTS: invite Ken Kellermann to meetings as chair of the International Operations Group who have written a White Paper. Perhaps PA should join the Operations WG to make the link clearer.

T6 Scalable design and implementation

- o has a new task leader, Albert-Jan Boonstra - task should be reviewed.





RTS says it would be good to invite Ken Kellermann as chair of the SKA Operations Working Group to any DS4-T5 workshops. It would also be good to have a European join the SKA OWG, either PA or someone else.

15.3 DS4 – Andrew Faulkner

Still aiming to keep to schedule

T1: LNA

- Annual meeting in Paris in March
 - Manchester: first trial LNAs next month; first real samples by end of year; good noise resistance hence good performance over a wide bandwidth
 - ASTRON: link with OMMIC – testing differential LNA with low simulated noise – some design stability issues
 - France (XLIM): SiGE with Philips and PIC substrate; so far noisy (70K) but cheap
 - DRAO: CMOS 90nm technology: published result of 21K and potentially 10K (but higher frequency than current AA specification) – see notes above
 - Manchester: ADC developing the design blocks first 2-bit by 2Q2008
- Demonstrator 2-PAD to be built with commercial devices
- SKA mid-freq AA *could* be built entirely with Si devices?
 - If reduce sample speed requirements to 2.4 GS/s
 - May be able to integrate front-end with the processing device – hence reduced power and cost.

T2: Digitisation and Control

- More positive on digitization
- More like 6 bits rather than 14-bit (3-bits for RFI and 3-bits for signal)
- Hence substantiates the working hypothesis of 4-bits for a quiet RFI site

T3: RFI mitigation

- ASTRON: getting LOFAR feed across
- OPAR: on-line polyphase filters for Nancay
- U. Orleans: cyclostationary algorithms
- IRA: adaptive beamforming for BEST-2 detection of RFI direction of arrival

T4: integrated Antennas

- ASTRON: Vivaldi; likely need differential LNA – developing reference array for 2-PAD
- FG-IGN: 2 engineers have worked in ASTRON for 2 months
- Manchester: Array studies : fully-filled vs sparse trade-offs and work with industrial consultant Roke Manor (part of Siemens group)
 - Fully-filled square grid
 - Fully-filled triangular grid
 - Fully-filled interleaved
- Manchester: Element studies: (work with BAE systems)
 - Vivaldi; Munk; Bunny ears

T5 and T6 → 2-PAD (Manchester and Oxford)

- Demonstrate an all-digital dual polarization array and how to build it up into an SKA station
- Experimental test bed for evolving ideas: develop solutions to key issues
 - Self-included RFI
 - Cooling
 - Communications interface – looks likely to be a “hotter spot” than the processing
- Specification:





- 8x8 array
 - 4 quadrants feeding beam combiner
 - Data rate 500Ms/s → 200 MHz
 - Up to 8-bits per sample
 - Polyphase filter: 2¹⁰ points with 8 taps
 - Resolution etc etc – did not catch all this
 - o Processing:
 - looking at technologies: industrial contract with Cambridge Consultants – looking at ASICs expecting ready availability of 45 nm technology by 2011 - €5-10M design and tooling
 - Need to prove with FPGA first as a prototyping technology and then 2-year lead-time for an ASIC – plenty of FPGA experience within the radioastronomy community – but too much power and money and there are reliability issues
 - Multi-core processors: many small companies developing, also Intel, IBM, NVidia; readily programmable – currently looks the best option
 - Some examples: Cell-BE; Blue-Gene; Clearspeed – problems are I/O communications
 - IBM chip – less processing power than the CELL (80 Gflops cf. 150 Gflops) but much more communication bandwidth.
 - Produces a few % of SKA processing power with BW on-off the chip.
 - It is, however, a general purpose floating-point processor – we need an integer processor in the next few years
 - o System Design
 - Outdoors + mini-bunker
 - Idea is that the outdoor elements are plug-replaceable → evaluate different antenna & LNA designs
 - Bunker with signal conditioning, ADC (COTS) and FPGA (COTS) for the DSP
 - Looking at water cooling
 - Target install date Q1 2008
 - Planning for what to do with the data!
- 15.4 **DS5 – Parbhu Patel by Dion Kant**
- Summary points
- o 500-1500 MHz (optimized for 500 MHz but ½ lambda at 1500 MHz)
 - o Single polarization – but implemented in 2-poln
 - o Antenna concepts – started from THEA with Vivaldi – exploration of low-cost construction methods
 - o Critical part is connecting from elements to boards
 - o Simulated VSWR (<2:1) looks OK even when scanning – impedance higher than 50ohms
 - o Costing for elements being carefully done
 - o RF beamformer chip developments
 - ASTRON - v1 chip have oscillations (oscillations problem now solved via a test chip) ; 2nd generation in July
 - OPAR design v1: but needs a differential amplifier – and hence being redesigned
 - o MPIFR working on analogue signal processing/ transport
 - o Italy: working on the receiver unit
 - o Lots of progress on signal combination boards
 - o DSP to be done by OPAR: LOFAR hardware to be tailored for EMBRACE
 - o Radome Study and tile mounting study underway





- o Siting will be along the line of the WSRT rather than North as previously proposed.

Aluminium antenna elements is the present situation: Costing of these elements gives a rather high price for one element, however, produced in large quantities it may result in a price of approx. 150€/ m2, using a low budget board named HIPS.

Completed receiver units will be tested next week at ASTRON.

Half cylinder EPS cover is hoped to be ready by October.

Embrace siting in Westerbork is considered to be somewhere in between the WSRT telescopes.

PE compliments the Embrace team on the progress that has been made.

15.5 DS6 – Stelio Montebugnoli

BEST-2: 8-cylindrical antennas

- o Analogue optical link – already tested in BEST-1 – now under commercial replication
- o Front-end: 0.4 dB with 60db gain – need this gain to overcome loss/noise of optical fibre
- o IF stage as for EMBRACE also as first part of the BEST-2: but now add digital control – e.g. to control attenuators to equalize receivers
- o Data handling linked with DS3-T2 and DS4-T2
 - Uses Bee2 board (5 x Xilinx Virtex-2 Pro70 FPGA with Power PC on board)
 - Paid €35k for the FPGA cluster – INAF not part of the Xilinx university programme – which would have brought in the Xilinx FLGAs free with a saving of €20k
 - Cost of 7k ops/€ would decrease dramatically if had received the FPGAs free
- o Software beamforming and multibeaming (30% complete) linked with DS4-T3: C-code written for BEST-1
- o RFI mitigation: also with DS4-T3 (50% complete):
- o Conclusions:
 - Hardware for BEST-2 under construction
 - Expect to show results on some radio sources for MTR
 - In principle on schedule

15.6 DS7 – Wim van Driel

The production of quarterly reports was started early this year by making a quarterly report over the 4th quarter of 2006. Even though everyone is working on the 2nd Annual Report, AvE will also request everybody to submit a quarterly report over the 2nd quarter of 2007. This is just a summary and should include all important news, including problems and bottlenecks that are foreseen.

Next deliverable from DS7 will also be the executive summary of the 2nd annual report to the ISPO. This will be available once the summary has been written.

DS7 is also responsible for the logistics of the Mid Term Review, which is on 12 October.

10-11 October will be the Symposium. Dinner will be at the 1st floor of the Eiffel Tower.

Price for participants of the workshop will be 50€. Details will soon be available at the website.

AZ: Will the Board members be invited to the MTR. PC answers that it will be the Management Team of SKADS, with the Chair of the Board chairing the meeting and John Seiradakis as reviewer and probably Elena Righi-Steele for the EC.





The MT may invite 2 others who are considered important for specific details.

16 SKA developments - Richard Schilizzi

Earlier this year the International Steering Committee passed a resolution on the phased implementation of the SKA.

Funding Agencies Working Group meeting took place end of May. PD and TvdH were amongst the participants.

SSC MoU expires on 31 December 2007. ISPO would like to have a new agreement in Manchester at the next meeting in October. Proposed parties to new international collaboration agreement: ESKAC; USSKA; RoW institutes

The draft MoU foresees funding agencies that will be investing in the project and will want influence in the project by means of a Forum, the ISSC will get a new name, SSEC, and the ISPO itself will be SPDO. The office is foreseen to move to Manchester early 2008.

SKA Program Development Office (SPDO) – proposed new name for ISPO

- o Framework to internationalise SKA technology development and design → costed system design
- o SPDO supported by
 - Cash to a Common Fund
 - In-kind contributions, secondments etc
 - Contributed funds PrepSKA, TDP
- o MoA signatories: organisations contributing to the Common Fund
- o SPDO director will report to SSEC executive
- o Project office will move to Manchester next year

Phase 1 Science → preliminary science plan for first 10%

- o Two prime science areas
 - Building galaxies
 - Pulsars and transient sky
 - (First light EOR depends on decisions on low frequency component)
- o Phase 1 science not to be published separately but as part of Pathfinders → Phase 1 → full SKA

Initial SKA Specifications:

- o Tiger Team; Paul Alexander; Jim Cordes; Peter Dewdney; Ron Ekers; Andy Faulkner; Bryan Gaensler; Peter Hall; Justin Jonas; Ken Kellermann.; Richard Schilizzi (Chair)
- o Goal : strawman specs for 3 technology options and possible evolution from phase 1 to full SKA – keeping discovery potential in mind
- o Options:
 - Dishes/SPF Jonas + Cordes
 - AA+dishes/SPF Faulkner + Alexander
 - Dishes/FPA/SPF Ekers + Dewdney
- o Costing Tools
- o Cost Constraints
 - €250M phase 1
 - €1500M full SKA – includes *everything* and contingency
- o Document by October meetings

ISPO Activities

- o Coordinating RFI second phase at the short-listed sites
- o Support activities of international forum





- Support ISSC in development of new governance structure
- Register of in-kind contributions to the international project – required by funding agencies – might affect weights attached to votes
- Prepare Project Book (incl. project plan; reference design; options)
- Update Business Plan
- SKA Specifications
- Cost and performance estimation

Simulations WG:

- now chaired by Cormac Reynolds
- main task is to determine the optimum configuration of the SKA taking the requirements of the KSPs & image quality into account

Operations WG

- Needs a SKADS member:

PC will discuss this with RTS.

PD thinks we need to revise the OWG as it is dominated by Australian based people.

Colin Greenwood, executive officer, started working for ISPO 3 weeks ago. He will be travelling around the world to 'knock on peoples heads'.

Science case needs to be refreshed and in place well in advance of the Decadal Review.

AZ: Who will be on the SSEC?

PC mentions the operational cost taking 150M € a year, i.e. 10% of the expected capital investment for the SKA.

17 FP7-PrepSKA – Phil Diamond

Will address:

What is design of SKA?

Where will SKA be located?

What is the legal framework and governance structure?

What is the most cost-effective mechanism for procurement of various components of SKA?

How will SKA be funded?

WP1 management €877k

WP2 technical €4756k

WP3 sites €415k

WP4: governance etc (...not all captured here)

Organisations involved: unique mixture of agencies and institutions

Leadership spread around

Timeline:

- Next week informal letter of indication of result
- July EC decide in overall preparatory phase programme – formal letter; average is 4M we are asking for 7.6M
- Contract negotiations Sept-November
- Contract signed end of the year





Organisations involved in the proposal that went to Brussels on May 2 are 8 agencies as well as institutes.

The EU contract will be signed by all participants. STFC agreed to lead the project and delegated the coordinator's function to Manchester in the person of Phil Diamond.

Next week we may expect an informal letter from Brussels as well as a formal one by the end of July. Requested contribution is for 7,6M €. The contract will not be signed before all the matching funds are in place.

AZ asks what the role of SKADS is vs. PrepSKA. PD answers that it would have been better if PrepSKA would have been 1 year later, however, this was not decided by the institutions involved but by the EC. Nevertheless input from SKADS will be essential for PrepSKA.

PA thinks that it is essential that the cooperation is in such a way that the work in SKADS is supporting PrepSKA.

General Discussion: SKADS and PrepSKA

- o SKADS has 2 years to go
- o CDIT pulls together all the technical design work – but CDIT will not be doing much of its own integration
- o Competition for brains!
- o Before PrepSKA starts – how can SKADS start to support and have input to international project as this ramps up?
- o The connection between SKADS and the international project is really beginning to come together
- o SKADS needs to define its next phase post 2009.

18 Future of ESKAC and SKA developments – Anton Zensus

ESKAC has been active for 5 years now. Now that we are heading toward a new MoU for the International SKA Project Office we should decide if we still need ESKAC. IF so how should ESKAC be organized? Currently ESKAC is operating only on a draft MoU.

USSKAC has a far more formal structure. Its membership is based on institutional financial contributions but with NSF as the main financially supporter of the consortium.

We need to make sure that the European viewpoint is heard on all aspects being considered within PrepSKA Also lobbying for Phase 1 of SKA (lots of the funding for which will have to come from Europe) – but there is no clear European path to achieve our major contribution.

Consensus is clearly that ESKAC should be revised. The issues should be addressed at an ESKAC Day in Bonn to take place in August/September.

Chair comments that he was asked to talk about PrepSKA and ESKAC at the USSKAC meeting in May. US (Fred Lo) asked who represents Europe in PrepSKA.

PD thinks that the strength of Europe is the fact that it is diverse as well as cooperative. We need a structure that suits us not just a copy of the USSKAC. ESO might get involved in SKA.

They are waiting for the new DG to take over.

Does Europe feel sufficiently represented in the structure of governance? Decision process in the international forum that was suggested by TvdH may not be advantageous.

PA says that in the long term we need to keep the communities that we have now and to grow into a wider astronomical community and for the stakeholders to have a say in how the project is Developing

RTS: In the optical world they have not concept of the sort of global cooperation like the SKA distributed development of technology – we are forging a new path. We have a way to go to show that we can integrate the design knowledge around the world.





Link with ASTRONET:

ASTRONET will address other sciences, not just radio astronomy. We need a community that represents radio astronomy. Chair asks if there is time for ESKAC to influence the ASTRONET roadmap process. The science roadmap is finished, the process for the technical roadmap started. ASTRONET will have a final meeting in Liverpool in June 2008.

Questionnaires for large scale facilities were sent around and all people who are involved in the ASTRONET exercise are at the website now <http://www.astronet-eu.org>.

Chair asks what we should do in the coming year. PC finds it essential to have a European body representing the SKA. There might be an invitation by the panels to the projects to appear before the panels.

AZ says that it might be good to know which projects have had the questionnaire. PD will ask for this list.

RTS will distribute the draft. Chair would also like the DS leaders to comment and concludes that a face to face meeting would be a good idea. Scientific and political advocacy is not a natural part of SKADS, however, we may express our wishes.

RTS comments that what is needed is representatives who cover both science and engineering. The draft MoA has a table with 6 European countries in it. Europe should think of the representation. Radionet is both in FP6 and FP7, it could be considered to let this be the representation of SKA in Europe. In that case it may not be necessary to have an additional body. After a discussion the conclusion is that we need this day. Radionet is not the body for this purpose.

19 SKADS second phase – Arnold van Ardenne

PC notes that the present SKA Pathfinder projects are reflector based. Therefore it may be good to have an Embrace+ project running from 2009-2012 i.e. to the end of PrepSKA. Similarly need to continue proving the scientific potential of AA's after SKADS finishes mid 2009. We do not have to build a pathfinder and cost should be low so as not to affect (Prep)SKA.

PC thinks that it is necessary to prove the technology works before we start to roll out the SKA. ASKAP and MeerKAT are contributing to this. PD thinks that the correct process is to keep the teams together and continue to work on the AA's, but hesitates to call it a science instrument.

PA: Why so fast? Shouldn't any additional funding go into the core SKA project. We could wait and build this instrument in phase 1.

PC: we will not have proven the AA concept to work – people still think it's technically immature. Remember the LOFAR decision was taken in the face of scepticism.

PD: agree that we need to keep the teams together and push development of AA's but I worry that it's another science instrument. UK is putting in a "Statement of Interest" to STFC (formerly PPARC) linking into the pathfinder projects. Agencies will look at this new idea and ask "what do you want". But agree that we must ensure that AA's are turned into a production ready system for Phase 1.

RTS: "a science instrument" is the problem – we have five already – more important is to define "what is the capability that we need to demonstrate that AAs are feasible." Also worry about level of resources in terms of FTEs in Europe. Where is the additional capability/resource coming from? European FTE's in PrepSKA is approx. 80 man years. But we do need to define "the minimum capability demonstrator".





PE: the end goals are vital and AAs are vital for us – we need to show they work properly. Community does not yet know the step to demonstrate this – but LOFAR is a large aperture array with digital beam-forming which will come on stream which will add confidence and provide all important lessons. PC does not agree.

If we build EMBRACE-2 too early we will not get the instrument we want – in terms of performance and cost. Need to spend the full time to get it right – need to be worthy of spending much more than the proposed EMBRACE+ within Phase 1.

HJvL thinks it will boost the capabilities in VLBI.

PC says that as considerable R & D funds were spent on AA's in the recent decade one should consolidate on this after SKADS.

Everybody agrees that it is essential to continue the work that is going on in SKADS. This item should be further discussed in the next SKADS Board meeting.

20 AOB and wrap up – Peter Wilkinson

SKADS Workshop and Mid-term review:

- State of readiness across the DS's -- any red flags?
 - a. MTR meeting formalities: Location: Paris at the Institut d'Astrophysique (Salle de Conseil) : formulaic agenda set by EC. People at meeting will be External and EC reviewers + SKADS MT + Board Chair + others as required (but not all Board members.)
 - b. External and EC reviewers will also attend SKADS Workshop.
 - c. Importance of 2nd Annual Report – deadline 30 July and submission on August 15 – as focus for both meetings.
 - d. Format of Workshop under review – suggestion is to hang the agenda around the SKADS Benchmark Scenario but some feeling that it is important not to confuse the reviewers with too much “novelty” and to stick to the standard DS formula.
 - e. DS2/DS3 deliverables look good for T0+24.
 - f. DS4/5 technical deliverables looking good but formally a little late for T0+24 but rate of progress good and finishing schedule expected to be met.
 - g. DS6 technical deliverables on time.
 - h. Overall feeling is that there are no red-flags and that the MTR should go well.
- SKADS and the Manchester SKA Science meeting
 - a. SKADS brochures and poster required for the run of meetings starting in late September

SKADS Science and Virtual Telescope Exercise

- VT Status review
 - a. Agreed to be a very useful exercise and having the “4 years in the life of” document ready by the time of the SKA Autumn meetings and the SKADS MTR will ensure good international linkage
 - b. Producing Proceedings from the July Pushchino meeting is also important in the same context.
- SKADS and the international science context
 - a. SKADS simulations and VT science is somewhat less aligned with international WGs than the Costing exercise: one science link is via Matt Jarvis.
 - b. Major efforts in raising consciousness in France look good.





- c. Concern over Hubble Sphere impact on SKA. Our “knowledge conduit” via the work proceeding in France although there are worries about the impact on SKADS-related manpower resource.

SKADS Costing Exercise

- Status review and the international context.
 - a. Alignment of concepts with the ISPO-sponsored team has taken place and the combined team is working towards a single set of flexible software tools as the next-generation effort
 - b. Back-end processing remains a major strategic issue – dominated by requirements of FoV of small dishes, not the AA’s.

SKADS and the international strategic context

- International linkage
 - a. Funding Agencies have bought into the project with the UK agency (STFC) taking a lead role.
 - b. SKADS leading players increasingly strongly linked with international project development - less concern about parallel paths.
- SKADS second half & coordination with PrepSKA
 - a. The EC is facilitating the next, fully international, phase via FP7 PrepSKA.
 - b. van Ardenne proposed an AA Pathfinder with very rapid roll out in 2009-2012 period; estimated cost, if located at WSRT €9-12M. Concern expressed over dilution of focus and effort in the lead up to SKA Phase 1.
 - c. Complete agreement, however, that the SKA project needs to clarify/specify “the minimum capability demonstrator” for AAs so we know the height of the fence to be jumped.

Outcomes of ESKAC discussion

- a. Schilizzi’s ASTRONET questionnaire reply for SKA is important – he will seek advice from European ISSC representatives (agreed that Wilkinson will pass on to any SKADS DS leaders not receiving it).
- b. Hope/expect to get invitation by Michael Grewing to talk to the ASTRONET ground-based astronomy WG.
- c. Agreed that we should hold an explicit ESKAC meeting in September to discuss aims/objectives and a new structure; there will be telecon before this.

Next meeting (added October, 2007)

Next meeting will be on 17-18 January, 2008 in Rome, hosted by INAF.



21 Action items

Action item	Action	By	Term
1.	Make public version of approved minutes available at SKADS website	PC/ CHAIR	Ongoing
2.	Make an executive summary of annual report for ISPO	PC	After approval by EC
3.	Make new brochure and a SKADS poster prior to September	PC	September, 2007
4.	Distribute the new DoW as soon as approved by EC	PC	On receipt of approval by EC
5.	Add a page to the CA to be signed by the new consortium member, IST	PC	September, 2007
6.	Everybody involved is urged to share the radio facilities questionnaires from ASTRONET they are requested to fill in	All	According ,to schedule
7.	Check possibility of having the January Board meeting in Italy	PC	August, 2007
8.	Improve Costing Exercise on SBS before MTR	PA	September, 2007
9.	Make proceedings of SKADS Pushchino workshop	PS	September, 2007
10.	Check situation German team in DS2	SR	August, 2007
11.	Follow the HSHS efforts in France and inform Board in the next meeting	WvD	Ongoing
12.	Consider to invite KK to "SKA and the user workshop" and have European representation in SKA OWG	PA	
12.	To organize an ESKAC day in August/September	AZ	August, 2007
13.	EMBRACE+ at the agenda of the next SKADS Board meeting	Chair /PC	December, 2007

Decisions

Decisions	
1.	(Re)Appointment of Chair and Vice-Chair, resp. Peter Wilkinson/Wim van Driel
2.	Approval of withdrawal from SKADS, was approved in 3 rd Board meeting
3.	Emphasize on young researchers' involvement in SKADS in 2 nd SKADS workshop
4.	Approval of suggested members of the SAG



Acronyms

CA	Consortium Agreement
CC	Coordinating Committee
DoW	Description of Work
DS	Design Study
EC	European Commission
EWG	International SKA Engineering Working Group
ISPO	International SKA Project Office
ISSC	International SKA Steering Committee
MTR	Mid Term Review
NDA	Non Disclosure Agreement
PC	Project Coordinator
PE	Project Engineer
PM	Project Manager
PS	Project Scientist
RD	SKA Reference Design
SBS	SKADS Benchmark Scenario
SWG	International SKA Science Working Group
T	Task
WG	Working Group

