



## Minutes 5th SKADS Board meeting

January 17-18, 2008  
INAF - Rome

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	Organisatie / Organization	Datum / Date
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<b>Goedkeuring / Approval:</b> SKADS Board	ASTRON	

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Project supported by the  
European Commission  
Contract no. 011938

## Project

Doc.nr. SKADS-08011718-Minutes 5th  
:  
Board meeting\_SAT\_PNW  
Rev.: 1.0  
Date: February 1, 2008  
Class.: Limited

## 1 Opening

The Chair opens the meeting and welcomes everybody to Rome with a special thanks to INAF for their willingness to host the meeting.

Before going through the minutes the chair presents the desired principal meeting outcomes.

He also informs the participants of the ESKAC meeting that took place on January 16, some aspects of which will be presented by TvdH.

## 2 Minutes and action items of the 4th SKADS Board meeting

The minutes are extensive, therefore they are not gone through page by page.

There is a bit of confusion about the correct version of the minutes, which is the (final) 22 pages version. The minutes are approved unanimously.

As far as the executive summary of the 2<sup>nd</sup> Annual Report is concerned: The EC should first approve the 2<sup>nd</sup> Report before an executive summary can be made. It is expected that this can be done soon.

Action items:

No.	Action	By	Status
1.	Make public version of approved minutes available at SKADS website	PC/ Chair	Pending
2.	Make an executive summary of annual report for ISPO	PC	Pending
3.	Make new brochure and a SKADS poster prior to September	PC	Closed
4.	Distribute the new DoW as soon as approved by EC	PC	Pending
5.	Add a page to the CA to be signed by the new consortium member, IST	PC	Pending
6.	Everybody involved is urged to share the radio facilities questionnaires from ASTRONET they are requested to fill in	All	Closed
7.	Check possibility of having the January Board meeting in Italy	PC	Closed
8.	Improve Costing Exercise on SBS before MTR	PA	Closed
9.	Make proceedings of SKADS Pushchino workshop	PS	Closed
10.	Check situation German team in DS2	SR	Closed
11.	Follow the HSHS efforts in France and inform Board in the next meeting	WvD	Comments below
12.1	Consider to invite KK to "SKA and the user workshop" and have European representation in SKA OWG	PA	Comments below
12.2	To organize an ESKAC day in August/September	AZ	Closed
13.	EMBRACE+ at the agenda of the next SKADS Board meeting	Chair /PC	Closed

**Action item 11:** SAT and WvD have been involved in this effort. WvD keeps an eye on it. The HSHS project is involved in the next 4 year plan. It is being advertised as SKA preparation, WvD considers it under control. RTS asks if it could be helpful if the SPDO would be involved.

SR says that a detailed paper commenting on the proposed HSHS analysis will soon be submitted. It shows that the 1sigma analysis proposed by Peterson (Chang et al) is not valid to do the BAO experiment. This paper is the result of the PhD thesis of Abdalla.

AvA thinks that the activity is dealt with in a correct way. The French SKADS partners will continue to monitor the activities. The item will be an agenda item for the next Board meeting again.

**Action item 12.1):** PA is on the OWG. KK will be requested to help to organize it.



### 3 Report Project Coördinator – Arnold van Ardenne

There are now 26 participants in the project and the number of EU countries involved was extended to nine.

Mid Term Review presentations made clear that SKADS is on track. We have good contacts with the US, unfortunately contacts with China are still weak.

Change of task leaders:

Thijs van der Hulst is the DS2 leader. Albert Jan Boonstra is task leader for DS3-T6. Leader for DS2T2 will change since Cormac Reynolds will leave JIVE. We will have to seek a successor.

The character of the SKADS workshops is more that of a symposium.

The 1<sup>st</sup> one was in September 2006 at the Paris Observatory.

The 2<sup>nd</sup> one took place in October 2007 at the Paris Observatory in Meudon.

The 3<sup>rd</sup> one may be in Bologna in October 2008. This one was scheduled to be in Australia, however, there will be a half day focused workshop on 10<sup>th</sup> April in Perth following the SKA meetings there.

A new SKADS poster was developed as well as a new SKADS brochure, Distribution should be wide. Everybody is encouraged to contact the SKADS project office for this purpose.

Key SKADS achievements include development of the Benchmark Scenario, leading the development of Aperture Arrays and electronic beamforming, the Design & Costing exercise and the Simulation activities. The number of young people involved has clearly increased judged from the number of participants in the SKADS workshops.

DRAO, ASTRON and CSIRO are collaborating on Focal Plane Arrays, though this is not explicitly connected to SKADS. There is another collaboration with OSO and South-Africa concerning the feeds of the MeerKAT.

A formal letter from Brussels approving the new Description of Work is awaited for.

Contingency funds: there was some money spent for contract extensions within DS2 and the Pushchino workshop was funded. Suggestion is to keep the contingency funds at this level.

Chair comments that it is impressive to see what is going on. RTS agrees with the impressive activities resulting from SKADS. RTS comments that the word Scenario has been replaced by Representative Implementation. RTS also requests to have access to presentations and pictures.

We will think of way of distribution of press releases and other information in such a way that ISPO/SPDO is informed as best as we can.

### 4 Report Project Manager – André van Es

AvE gives an overview of the

- contract status
- 2<sup>nd</sup> Annual Report
- Financial Status

Contract status:

After consultancy with the EC clause 39 was invoked relieving most participants from the necessity to submit an audit certificate.

There are a couple of actions to be taken to get the financial part of the 2<sup>nd</sup> Annual Report approved. It should be possible to tackle these things in just a couple of weeks.

At Mid Term Review the total project cost amounted to € 13.250.261.

Eligible cost are the costs that are recognized by Brussels as eligible and may include matching for AC partners.

DS4 and DS5 are the big spenders, though still a lot has to be spent. About half of the EC money has been spent now. More than half of the matching has to be realized in the second half of the project and there is no guarantee yet that all matching will be realized at the end of the project.

At the end of the project the number of manmonths should be spent. Not meeting the deliverables and not enough matching may result in less EC funding at the end.



6k € was assigned to the cosmology book. Oxford should include this in the C-form. The book is finished, it should appear any moment.

The 2<sup>nd</sup> year we spent the scheduled number of manmonths.

To get the Quarterly Reports in time is unfortunately troublesome. This is really inconvenient, as this year in particular we should catch up the delays in some DS's and deliverables. The PM urges this to be done by the DS leaders in time. Good choice of priorities should now be made and monitoring will be increased in the current year to catch up with the delays.

Integration of DS8 in the D & C exercise is an action for this year.

PA and AF prepared a lot of input for the OWG, this has now been turned into a SKADS Memo.

(Major) risks identified now:

- Delay of deliverables (planned vs. actual)
  - Risk of commitment to international SKA influence on SKADS, collaboration is fine, but may result in compressed timescales
  - Test-time of demonstrators may become too short
  - Changes of key staff personnel may impact the project

AZ would like to have PDF versions of the presentations available at the wiki immediately, so that everybody can access these in the afternoon. Appropriate action will be taken.

## 5 Report Project Engineer – Andrew Faulkner

PE gives an overview of the milestones achieved so far.

Concerns are:

- Embrace time slip
- Reducing Tsys within SKADS
- Delays in building 2-PAD
- Power consumption requirements
- Late start of computing requirements
- Rate of reaching deliverable dates

This spring there will be a technical meeting/workshop focused on DS3 and DS4 at either side of the Perth conference.

Status of SKADS Benchmark Scenario:

PE gives an update of the SBS (Representative implementation), as well as an update on how the SKA could be built given the details that we know by now. Aperture arrays are a great opportunity for the SKA, however, we have to deliver in time.

PC asks why the aperture array specification does not go up to 1400 Mhz. PA answers that the cost would go up by a factor of 4 if we go up to 1400 Mhz. We have to demonstrate that the correlator for the SKA is achievable based on the Phase 1 SKA position of aperture arrays. There are still great uncertainties in cost. PA is dealing with the computing requirements in the new round of the costing exercise.

## 6 Report of Project Scientist – Steve Torchinsky

Within the D&C exercise PS is leading the science block. Simulations are done within the technology constraints.

The cosmology book from Oxford has appeared and is available at the SKADS website. So are the proceedings of the Pushchino workshop. All presentations are available at the website.

Cormac Reynolds is leaving JIVE, which constitutes a potential problem, DS2-T2 is then lacking coordination although people are in place. HJVl thinks departure of Cormac is merely a JIVE management problem, however, the SKADS Board Chair feels that DS-T leaderships constitutes a Board responsibility.

Apart from the SKADS wiki there also is a MeqTree wiki,



Question is there is still a Cradle of Life Key project for the SKA as the frequency is limited to 10GHz? WvD remarks that he thinks that this remark should not be made in a SKADS quarterly report, so therefore he decided to leave this out. This is an international SKA issue. SKADS never addressed this KSP. TvdH adds that within the timescale of SKADS there is not the time and no money to do this at an appropriate scale.

The Path2SKA project was introduced by SR yesterday in the ESKAC meeting. There is a funding timescale in France to do Science Simulations in FP7, proposals for which to be submitted before February 28 while the Path2SKA proposal will be submitted much later, so this is unfortunately unsynchronized.

All SKADS memos can be found at the SKADS website, both scientific and technical.

The testing and siting effort of EMBRACE at ASTRON has increased and is led by Richard Strom. In Paris Henrik Olofsson and Laurent Chemin have been added to the team. Test plan, both engineering and science is coming along and it will be available for everyone. The current (early) version can be found at the SKADS wiki. PS thinks it is not yet ready to be sent to Ken Kellermann, chairman of the OWG, as RTS suggests, PC approves the idea of having the plan checked by KK. PP also thinks it is good to have it checked by KK but the version should be more mature.

PS added some further comments to the HSHS effort and the Peterson proposal. There is more detailed information available now. There is a team in France which will require some Nancy technical support.

As far as outreach is concerned PS would like to receive a mini cv from the new hires for the SKADS newsletter; as well as other interesting news for the next version of the SKADS newsletter. Input for the next SKA newsletter is also very much appreciated.

It is considered to have a SKADS science conference in July 2008.

It is emphasized that there is an urgent need for the new leader of DS2-T2 on behalf of the D&C exercise.

## 7 Costing the SKA, 2nd round – Paul Alexander

Size of the dishes has now changed to 15m, as a result of which there will be fewer dishes. This has large impact on communications and correlator. We need a proper design cost for the low-frequency AA.

So far the total cost is some 1.5B € with approx. 20% uncertainty and communication being the biggest part of the cost and this cost being very dependent on the exact layout of the collectors – the link with the International Simulations WG (new Chair L. Gurvits) needs to be strengthened.

When the number of stations on the long baselines are limited it results in a dramatic drop in cost. Computational cost is considerable but AAs do not dominate since AAs are beam formed at station, Hence SKA based on AAs looks like 200 large antennas (hence not many baselines) equipped with focal plane arrays

RTS asks if there is interaction with the SKA team that is working on this effort. PE answers that there is very much interaction between the 2 groups.

Conclusions:

- Design and costing II will be completed end of January 2008
- Same basis as SKAcost – used, cross-checked etc. in many places although calculations overall still using spreadsheets.
- Costs are in-line with the TT specification
- Communication costs are very high
- Some outstanding items are still being worked on
- For 200M € physical infrastructure cost is 1.7B €, uncertainty 0.35B €
- Observing modes significantly alter cost



## 8 SKADS – the 2<sup>nd</sup> half of the project – Arnold van Ardenne

Some remarks:

- The date of the MCCT meeting in Spain should be rearranged.
- Next Board meeting will be in Liverpool 19-20 June, 2008. We also received offers from Pushchino and Portugal. PC thanks for the offers from these locations.
- 3rd SKADS Annual Workshop is suggested to take place in Bologna/Italy. Question is if this is a reasonable suggestion. LF answers that they are already organizing the EVN meeting from 23-26 September, 2008.  
The last workshop in Paris had 80 participants. It is suggested to have the meeting in Lisbon, Portugal. Suggested dates 18/19 September, 2008. If they cannot make it, the workshop will be in Manchester. (Note: meeting now confirmed for Lisbon on these dates)

No change of course in the DoW but we have to do a sanity check with industry. Costing activity should be started emphasizing that the network is a major aspect. We could consider to have a workshop lead by IBM. The timescale could be 2<sup>nd</sup>/3<sup>rd</sup> quarter of this year. To work this out is an MT issue. Action item for the next board to develop a plan.

We should place a higher emphasis on deliverables and progress at simulating technology, component and (sub)system level, to be worked out before next board meeting.

Extensions beyond SKADS are “SKA for the user”; a Readiness Demonstrator and a new simulations programme (PATH2SKA)

## 9 3<sup>rd</sup> SKADS workshop – Andrew Faulkner

The approach of having multiple short presentations at the 2<sup>nd</sup> workshop in Paris worked well. Therefore the aim should again be to having as many as possible presentations from the people who are doing the work, but there should also be time for discussions.

It is suggested to emphasise the remaining deliverables now we are facing the end of SKADS and also include lessons learned and consequences, as well as to look forward to SKA. PC adds that the emphasis should be more on system design.

## 10 LOFAR & European Developments – Marco de Vos

LOFAR core stations have been used for a year now. One of the aspects that have our attention now is what is the reaction of the system to lightning.

The calibration review took place, system CDR and we had a configuration workshop. BSIK MTR was very good except for the concerns about user-software, steps have been taken to improve this.

At the end of 2007 the LOFAR control room was opened in Dwingeloo, which is now the WSRT control room too. As we managed to deliver some land back to nature we got some additional funding and LOFAR got additional funding for exploitation from the Dutch government.

The target is to have 25 stations at the end of 2008. Meanwhile experience with international stations, like the one in Effelsberg can be reported. EU-LOFAR is developing with definite/potential funding in collaboration with Germany, United Kingdom and France. The Effelsberg station is completed, Garching and Tautenburg are in the procurement phase. Some consortia have been founded, the organizational structure for EU-LOFAR has to be developed, just like plans for optimal science and station layout. LOFAR is changing rapidly.

From Mauritius an interest in a LOFAR station is shown, the Mileura activity has a certain but limited scope. It is a niche instrument.

**Expres:** HJvL adds that he would like to say something about Expres, which is a project to connect the European VLBI network with fibres. Various milestones have been passed and observations have already been done. Streaming VLBI data from across the globe at 500 Mbs/sec. HJvL would like to give a more extensive presentation on “e-VLBI” at the next SKADS Board meeting with the title Progress report on Expres. The Yebes telescope in Spain has just been connected.



## 11 Developments

### 11.1 in Canada – Sean Dougherty

Most efforts in Canada are complementary to the other efforts in the world like SKADS, PrepSKA and TDP. Working collaborations need to be established, which takes a lot of effort. Efforts are focused on the price/deliverable relation. Many efforts are related to ASKAP in view of the cooperation with CSIRO, the Mark2 effort being aimed at better production methods.

#### Composite (carbon fibre) reflectors

- 10m built Mk1 – weight 1 tonne i.e. much lighter than SA one; surface rms of ~1mm (OK to 15 GHz)
- Built 12 GHz holography system in one month with help from Mike Kesteven (2-PAD team should contact them!)
- Mk2 reflector to be built in June 2008 (e.g. keep surface and mounting beams separate till final bonding); goal for weight = 700kg; goal for rms is to maintain ~1mm
- Tsys for FPAs
  - 90nm CMOS LNA for RT operation and 85-Ohm antenna impedance – reporting  $T < 14K$  across a band 0.8-1.5 GHz
  - Differential amplifier with reported performance of ~0.3db (~21K)
  - Designs being made for 60nm CMOS and integration with antenna elements (RF matching across the wide band)
  - Designs using silicon-on-insulator technology being explored
- PHAD (Canadian phased focal plane array)– is alive
- New areas of R&D development are reported from the University of Calgary. This is a relatively small but very strong group.
  - There is the Antem/URSI 2008 in Banff from 27-30 July, this will be organized by the University of Calgary where a new group is set up by Russ Taylor.
  - Started work on ADCs in Calgary with low power first go: 5-bit 1 G/Sample/sec 2 milliwatt dissipation measured.
  - Next step being planned is 3-bit 20-Gsample ADC in 90-nm silicon with simulated 25mW dissipation

### 11.2 Brief summary of other pathfinder activities – Arnold van Ardenne

#### 11.2.1 in US/TDP

KK could not make it to this meeting. KK sent a link to a website with interesting information on their work: <http://wiki.gb.nrao.edu/bin/view/Electronics/ResultPresentations>

#### 11.2.2 in Australia

Carole Jackson (in absentia) sent a presentation on the impressive work going on in Australia with various links for further information at the websites, focal plane array developments and the collaboration with Canada. This presentation is available at the website.

#### 11.2.3 In South Africa

South Africa is making some interesting progress. There is a dish at Hartebeeshoek. They have political pressure to have a working system in 2009. MeerKAT delivery is scheduled in 2012 for the entire system.



## Day 2: January 20, 2008

Chairman announces that Portugal has confirmed the 3<sup>rd</sup> SKADS workshop 18-19 September in Lisbon.

## 12 Report of Design Studies

### 12.1 DS2 Science Simulations & Astronomical Data Simulation – Thijs van der Hulst

T1 led from Oxford

- o Sky simulations: far advanced → catalogues with >250 million sources
- o Pulsars: how many expecting to detect and computing power needed
- o EoR: simulated via 100 Mpc cubed, with foregrounds taken into account
- o Polarisation maps – magnetic fields
- o SKADS Virtual Telescope project – nearly finished, was really successful.

T2: led from JIVE

- o meqTrees using simple source catalogue and simple station AA model
- o including errors in pointing etc.
- o Set up of JONES repository [www.astron.nl/meqwiki/JonesMatrices](http://www.astron.nl/meqwiki/JonesMatrices)
- o Leader (C. Reynolds) leaving 1 March 2008 – looking for solution via vdH and JIVE

Comments

- o SR: Results on astro catalogues are already very useful - but the timescales are very compressed for linking them with DS2-T2!
- o RTS: Need to look at how this work can feed into WP2 in PrepSKA – this is a vital continuation
- o AF: Configurations for the D&C are a vital thing
- o PNW agrees – with this we can declare overall success from DS2
- o AvA: also would like to know what are the consequences of different sidelobes

PC remarks that it is good to punctuate in the quarterly report what the priorities should be in view of the timescale of the program.

### 12.2 DS3 - Paul Alexander

Within T1 there is good progress on phase transfer and knowledge of cost breakpoints.

T2 had a late start and there is still some concern. The correlator is what should be focused on. Overall T2 is considered to be too ambitious and has to be descope.

T3, the functional simulator, is progressing well with elements well defined.

T4, the siting task can be declared “complete”.

T5: SKA for user has two meetings planned, in August in conjunction with the MCCT workshop and another one in January, 2009 in conjunction with the Oxford MCCT workshop. SR comments that this has a large overlap with the proposed PATH2SKA Marie Curie Programme

Within T6 are some issues, less manpower and hence will have to be descope. This is depending on a decision within ASTRON – detailed milestones needed.

A new person now joined the Design & Costing team in Cambridge.



### 12.3 DS4 - Andrew Faulkner

AF emphasizes that as far as the demonstrator is concerned 2-PAD is an evolving system. Within T1 for the LNA: Manchester is fabricating InP MMICs with long gate lengths to reduce noise resistance; the first LNA fabrication is expected February 2008. ASTRON using differential device sources from OMMIC - currently has design and stability issues; DRAO reported yesterday. For the ADC: Manchester is developing low power design in InP The first 2 bit ADC is expected later this year. Industrial study contract with IBM for multiple ADCs fabricated onto the processing devices will be reported in April 2008.

T2: (digitisation and control): BEST implementing Berkeley BEE2 FPGA processing – only 8 bits needed in Medicina → further confirmation that 4 bits should be adequate in radio quiet zone.

T3 (RFI mitigation techniques) in ASTRON/OPAR/UORL/IRA is working on adaptive beamforming as part of BEST

T4: (Integrated Antennas): ASTRON's differential Vivaldi using low cost foil structure – manufacturing techniques can be used for other designs. FG-IGN's Bunny Ear arrays should be linked more closely with Manchester.

T4 (Array configuration studies) – if could construct a triangular array could save 16% elements

T5/T6 (2-PAD demonstrator for all-digital AA) can illustrate all technology from DS4. This is a small system which evolves. Main issue is protection from self-induced RFI. 1<sup>st</sup> element array will be from ASTRON (Vivaldi) followed by BECA (and evolution of Vivaldi).

Description of 2-PAD etc. using DSP via Cyclops chip from IBM - prospect of integer multi-core processor later on.

DS4 will have a coordinating workshop in late April 2008.

### 12.4 DS5 - Parbhu Patel

For the centreboard a new design is now being done. 300-tile case architecture explained, four tiles will be combined to reduce the number of receivers.

The antenna concept – Vivaldi using a Rogers board and microstrip feed. The definite tile is being manufactured.

There has been good progress in larger-scale manufacture and assembly

ASTRON beam former chips are under test, some debugging is required, hence moving to OPAR v2 beamformer chip – with a view to using in EMBRACE. Completion of first “hex board” in June-July 2008, this is the major milestone → first big set of tiles by 3 months later.

CDC board, down-converter etc. is designed by Italy and DSP and control interface is done by France.

The Radome is being constructed.

The location of EMBRACE will be between telescopes 4 and 5 in WSRT, site preparation is underway and the testing procedure is being set up by testing team.

It is difficult to give another time plan; however, once the first tiles are installed it is a matter of rolling out the rest to complete the system.

### 12.5 DS6 Stelio Montebugnoli

BEST-2 counts 32 Receivers and 8 cylinders, total area 1440 m<sup>2</sup>.

Front-ends and analogue optical link designed and implemented, IF stages are digitally controlled Report on data handling for large telescopes - using wide band (1 GS/sec) 8 bit ADC and Berkeley FPGA hardware (BEE-2).

First light on Cas A was October 2007.

Now connecting all 32 RX to correlator in collaboration with Berkeley and South-Africa. Calibration is in progress in the protected band.

BEST-3, more than 7000 m<sup>2</sup>, should be ready by early 2009.

Thoughts from BEST-2

- Correlator: FX correlator (with initial narrow banding) allows RFI mitigation – and is the only way to reduce demanding time delay requirements - but if delays not compensated the direct pixeling of the FOV is not possible.



- Calibration is hard in presence of RFI - and if no calibration there is no possibility for adaptive beam forming.

DS6-T4 can be useful for testing some of the DS4 tasks. SR would like to do some scientific testing with BEST-2. SR asks what are the astronomy plans for BEST-3. These should be planned in 2009

PNW is glad to note that the results are what we expected them to be, however, has the impression that we need to talk more to each other and work harder on the linkages between the demonstrator programmes. PC confirms that the SKADS MT is organizing meetings to be fully aware of what the demonstrators are doing.

PS thinks that we are very much in contact and there is much interaction. Demonstrators are coming together but PNW has the feeling that the demonstrator teams should travel around more and get together and exchange information.

## 12.6 DS7 – Wim van Driel

DS7 was responsible for the organization of the workshop. Another responsibility is the delivery of quarterly reports, that supply very useful information for the Management Team. It is more and more difficult to get the information together. DS leaders should take their responsibility!

AvE confirms the procedure that was agreed. DS manager to send the information to the PM and he gives the info to the DS7 leader for assessment.

### SKADS Chairmanship

PC requests PNW and WvD to leave the meeting. Formally, this is the last meeting that we have Peter Wilkinson as chair. It is up to the board to take the decision whether or not to continue the present situation or to appoint WvD as chair for the remaining 3 Board meetings. WvD is happy not to be appointed for the next 3 Board meetings. The issue is that we have to consider if it is wise to change chairs now. TvdH would be disappointed if PNW would not be prepared to serve for the rest of the project now we have only 1 ½ years to go. It is decided unanimously to continue in the way it is now. PNW and WvD reenter the room and confirm their willingness to continue the present situation.

## 13 PrepSKA

### 13.1 PrepSKA developments

#### 13.1.1 Phil Diamond (status)

The contract and DoW were agreed by all parties.

Final comments received from EC which were only cosmetic to have a final version as there are no changes to the work. A very positive development is that SKADS arranged Portugal to join the radio astronomy community.

Everybody is urged to check the final details of the A forms. INAF, NWO and STFC supply officers for the policy work-package.

As soon as the final approval is received from the EC a letter from the EC will follow, then UMAN can start to advertise for the senior posts for the CDIT. It will formally start on April 1, 2008. Reporting changed slightly. EC now requires 18-month reports instead of annual reports.

1<sup>st</sup> Board meeting will take place in Perth on April 11, preceded on April 10 pm by the first WP meeting. The SKA forum and SSEC are meeting on 7, 8 and 9 April.

#### 13.1.2 Richard Schilizzi (WP 2 and 3)

WP2 is system design. The activity this year is driven by Project Engineer to make a design for the EWG. The Central Design Integration Team will be talking to SKADS, South Africa and Australia. This integration aspect is very important for the global effort.

WP3 is about site characterization. The Site Engineer will lead the WP. There has to be thorough integration between SKADS and the Site Engineer.

SPDO will wait for people to come available from other projects as the policy is to try to get experienced people. PrepSKA wants to have the best people who are experienced. Just a modest number of senior engineers, 6 people, will be appointed first. Second year more junior engineers and technicians will be



appointed. MdV is worried that senior people we need for SKADS and LOFAR will be recruited for PrepSKA.

PNW emphasizes the importance to make the distinction between the roles of SSEC and the PrepSKA Board. RTS: SSEC is responsible for the Scientific and Technical WP2 and WP3. SSEC (via SPDO-CDIT) has to oversee the work program. PrepSKA has direct control over WPs 4,5,6 The project will lead to a closer level of communication between agencies and engineers. Implementation of the plan to take place in the last year of the project.

### 13.2 SKA and specification document – Richard Schilizzi

Tiger Team process took most of last year, results will be discussed by the SSEC. There will be a (four) phased implementation and there is a fixed cost for construction.

After SKA2007 in Manchester some aspects have changed. For example the phased implementation came back in after comments from funding agencies.

Phase 1 will have dishes and wide-band single pixel feeds and receivers and AA, either dense or sparse to be discussed. Phase 1 is 10% of the full SKA.

There are 3 representative implementations that will be studied during the program.

We can say that we thank the 30M € proposed for AAs in Phase 1 to the efforts in SKADS, PNW thanks PA and SKADS PE for their efforts in getting the Design & Costing done as well as for their efforts in the Tiger Team.

PC asks about the SKA high after the 2020 timeline, who are the people that are working on that. RTS replies that it is the US in particular in the next decade. We are waiting for a number of results from other projects that will take a few years.

### 14 Status ESKAC – Thijs van der Hulst

October last year at the Manchester meeting on behalf of all European SKA parties the revitalisation process of ESKAC started.

A revised MoA was made, a subcommittee will make a final iteration. A new chair, Thijs van der Hulst, has been appointed since January 1, 2008, vice-chairs Wim van Driel and Steve Rawlings were chosen and members were confirmed in the meeting on Wednesday, 16 January. JIVE will act as banker and for administrative and secretarial support, including the website the coming years. Membership fee will be 25k€ per partner. ESKAC briefly discussed issues related to the post SKADS era.

HJvL brought across that JIVE will not pay 25 k€

PNW is happy that TvdH is elected chair and that ESKAC is getting a more professional body.

SSEC 2 will have new representatives from ESKAC, former ISSC members will be on the first meeting of the SSEC.

### 15 SKADS next step program outline

PNW introduces the situation. AA's are not only dense arrays.

RTS confirms the first 3 bullets of the document are roughly correct.

In order to prove the technical readiness within the demonstrator program, we felt that a European project bringing together new opportunities should emerge. The SKADS team is doing very well and a program to add to the PrepSKA program could be very productive.

There is a list of generic requirements included in the document.

PNW asks when RTS foresees the first installation of phase 1, this is end of 2011. PNW visited Fraunhofer in Freiburg with Mo Missous, and Solon Power in Berlin could be another party to provide solar power installations. Fraunhofer is very interested in the project and excited by the idea of a collaboration and illustrated this by sending an enormous amount of information.

PC had in the previous board a more ambitious proposal.

Discussions points:

The aperture array demonstrator should have a science case behind it. There is pressure for the engineering team to have a science team behind it. We need to convince the community.

RTS asks how much of a science case is needed to get the funding. Main doubts within the community are dynamic range and stability.



PD supports the idea of an aperture array demonstrator. There is an intermediate step necessary. From the UK agencies point of view a science instrument in addition to LOFAR would not be supported. Should go for an instrument that can demonstrate scientific capabilities with limited goals, full suite of software and user interfaces.

SR real science papers should result from this instrument. Both things should be possible.

PA: Their should be tests that we really have to deliver, this will increase the chance to raise the funds. What do we want to demonstrate.

Tsys demonstrator involves interactions and coupling from antennas.

RTS: Criteria for the outside world, set out what the tests are we want to do. Unless this readiness demonstrator validated by the SSEC and SPDO. Sub-committees and commissions and/or a workshop. We should not go into details in the Board meeting.

AF says we should convince ourselves first and secondly the community and funding agencies.

A couple of aspects should be realized as AF described in a document.

PC a specifying workshop should be organized instigated by ESKAC. We should not divert from that. The workshop should be set up under the ESKAC flag.

PNW: Other partners may join in, not only European.

European participation in ASKAP is very limited. The project should not just be an Embrace2. It should also show the manufacturability. PP says we have to describe what we need to do. If that list is there we can consider we need to build another instrument.

PNW that needs to be part of the overall thinking. What can be tested with the existing demonstrators and what should be tested on it.

There is a long tradition of developing technologies in different countries. It is not about sensitivity. By design at this point of time it is necessary to have tensions. The leading body is ESKAC. It is good to have some good competition.

PA there are advantages to build a larger AA, we should be clear what we want. If we do not raise the funds to continue through the PrepSKA, the SKADS team can fall apart.

AF: There is more than the demonstrator itself. There is a whole range of tests that can be done rather cheaply.

MdV: The project should be a natural next step to SKADS. One aspect is to show that we can build together as Europe an integrated system. Another is that we want to end up with the SKA and connect dishes and aperture arrays, this is critical.

PNW thinks we need to have a number of meetings.

Prime goal system technical readiness, this is more or less an extension of SKADS. It looks a bit extravagant.

RB: Combined program with scientific simulations introduced yesterday. How does the EC think about this. SKADS PC asked this. SKADS has made a significant step in AA technology, but not fully integrated. This should be emphasized in SKADS more strongly. SKADS has been the first necessary step. The next natural step is 4000 m2 collecting area. A workshop should be the next step to define the Scientific demonstrator.

Proof of a concept of a large scale aperture array. We are building prototypes. This may be considered as the prototype of phase one.

Beyond station level. SD it is like SKADS, technical readiness, two level sub-system or system level.

We need to make a next step, a natural step.

RB asks if we have an idea of the requirements of the site? Many aspects have to do with environmental robustness, supplying the energy, e.g. solar power business. Test site perhaps in southern Europe. It should demonstrate it can operate when the day temperature gets very high.

PD: Dish verification system. The system should be tested as a whole, with the aperture arrays and dishes. It should be tested in the desert.

PC says that it is important to set out a timeline. Proposal ready to be criticized before June. Approach the funding agencies second half of this year, also bearing in mind looking at the 2012 timeline from the global project.

PA perhaps we have to move faster and have the application by the end of February.

Not a whole final picture, but a rough description. This can be connected to a European activity.

PNW 1 day work 1<sup>st</sup> week of February. Schiphol? PA, PNW and AvA think about this.



PD we envisage a request for funding for a clarification system. To maintain the overall funding over the PrepSKA.

PNW thinks of the involvement of solar power, additional funding from different sources.

1. Verification system for dishes, US / Canadian system. What is our best guess for the IVS for dishes?
2. SR it should be called verification system; RTS says there is an initial verification system in PrepSKA. Should be linked with the PrepSKA workpackages.

Agreed on point 1, UK funding with timing end of February.

## 16 End of meeting

The meeting was closed at 13:45.

## 17 Chairman's summary of meeting

### Generic

- MT is doing an excellent job in keeping the programme under control: the MTR was a great success.
- MCCT is up and running with a highly successful first meeting in Italy and plans for the next ones well in place.
- Overall the programme is in full spate – with the spend rate and current deliverables OK – but coming to a critical year when we have to start producing real hardware deliverables.
- Teams should be prepared for emails from AvE triggered by DoW milestones as we confront the need to deliver: it's the MT's job to keep the pressure on!

### Science

- Oxford conference available on line and will very soon be available as a book
- Pushchino proceedings produced – SKADS memo
- Lots of science and technology and outreach information on the SKADS wiki and web page
- Papers being published – going onto astro-ph
- PATH2SKA initiative within MCCT by Rawlings et al will be major programme (€4.5M ceiling) – wish it all success
- Start of science evaluation/test of EMBRACE: agreed to be an excellent idea (when plan is ready) to ask for international comment through the SPDO.

### Design & Costing

- AAs are now in the provisional SKA Specification – major progress and option for 10,000 m<sup>2</sup> in Phase 1.
- Some evolutionary changes cf. the original SBS (e.g 15m dishes with no station beam forming)
- No longer a “scenario” but a “representative implementation”
- Thinking is underway on a range of architectural issues; station configurations; processing boxes etc.
- Issue of correlator needs to be considered for AAs – can't just say that the one appropriate for AAs will be shared with the dishes → 2 correlators needed
- Communication costs are a major driver intimately linked with configuration: there is not yet a full understanding of the communication costs within the combined international programme.
- Overview: process gives impression of developing real credibility even though there is a long way to go
  - o €1.5 B is the current headline figure – but excludes infrastructure of perhaps €200M
  - o Needs to include issues on power consumption/supply in cost document
- Sanity check with industry with regard to network and processing vs cost/availability? (cf. communication costs): ACTION item for next board meeting is to organize a workshop

### Canada:

- Exciting progress on light, accurate, composite antenna design and manufacture.
- Remarkable results reported on devices using 90nm CMOS: i) LNAs sub 20K – but remain issues of performance on impedance non-matched antenna and over very wide bands and for a



centre frequency of 600 MHz appropriate for current specification for AA-hi: ii) ADC's with exceptionally low dissipation. – all shows the need for international agreed testing procedures to have all these international efforts on a standard playing field.

- 3 different EE departments involved in SKA R&D focused by Calgary.

**Australia:**

- RX in a chip – great achievement but is it the right way to go?
- LNA and receiver integrated electronics for FPA

**South Africa:**

No presentation – AJF comments that they need to have a system in 2009 → KAT7 12m symmetrical dish with horn feeds in Karoo. Buy time for designing MeerKAT 2012 for final system.

**Dates:**

- 6<sup>th</sup> SKADS Board – Liverpool 19/20 June (after ASTRONET)
- 3<sup>rd</sup> SKADS Workshop Preferred option for Lisbon Portugal 18/19 September – reserve is Manchester

**Day 2**

**DS2:**

- o excellent progress on simulated skies and meqTrees-based technical simulations
- o now need to integrate T1 and T2 to provide feedback to design – agreed that configurations for the D&C are the vital first thing - with this we can declare success.

**DS3:**

- o good progress on phase transfer based on MERLIN system
- o identified need for 2 correlators – since i/p and o/p data flows are different (high data i/p for AA , less data o/p; vice versa for dishes)
- o functional simulator is building up a head of steam – overlap with DS2-T2 should become clearer
- o D&C programme going well – comms costs and link with configuration is a “hot spot”

**DS4:**

- o Lots of sub-system progress
- o Generic validation of limited # of bits needed from the BEST programme
- o 2-PAD is now building up a head of steam to deliver first light in mid-2008. Issue - as for EMBRACE - is time for testing.

**DS5:**

- o European collaboration (France, Germany, Italy) led by ASTRON.
- o Good progress in overall architecture and larger scale manufacture. Decision pending on use of OPAR beamformer.
- o Overall the project is coming together – replication by local industry.
- o Major issue is the finishing time and the time needed to make tests

**DS6:**

- o As anticipated from start the BEST programme is furthest ahead of the demonstrators since based on an existing collector system. First light in October 2007. Lots of RFI hence a good test bench for mitigation algorithms

Chair : there needs to be greater linkages between the demonstrator teams

**DS7:**

- o the quarterly reports are not being produced reliably – Board urges DS leaders and the MT to make this happen.

**PrepSKA**

- o due to start in April 2008
- o division of roles between PrepSKA board and SSEC (via SPDO) clarified. Latter deals with WP2 and 3; former does the rest. Some concern over competition for the experienced manpower



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**Specifications review:**

- Fixed cost philosophy
- €300M phase 1 to include AA (but could be sparse or dense TBD)
- €1500M for complete SKA lo+mid only.
- SKA-hi plans to follow results from EVLA and emERLIN etc

**AA readiness Demonstrator**

- Agreed that a plan needs to be developed under auspices of ESKAC



Project supported by the  
European Commission  
Contract no. 011938

## Project

**Doc.nr.:** SKADS-08011718-Minutes 5th  
Board meeting\_SAT\_PNW  
**Rev.:** 1.0  
**Date:** February 1, 2008  
**Class.:** Limited

## Action items

Action item	Action	By	Term/status
4.1.	Make public version of approved minutes available at SKADS website	PC/ Chair	Pending
4.2.	Make an executive summary of annual report for ISPO	PC	Pending
4.4.	Distribute the new DoW as soon as approved by EC	PC	Pending
4.5.	Add a page to the CA to be signed by the new consortium member, IST	PC	Pending
5.1.	Everybody is encouraged to distribute the new SKADS brochure as much as possible	All	Ongoing
5.2.	Have presentations as early as possible available at SKADS website	All	Ongoing
5.3.	Have a mature version of the Embrace test plan checked by KK	PS	
5.4.	Keep PS informed about new hires in SKADS and other information for the SKADS Newsletter	All	March 2008
5.5.	Emphasize on system design in 3 <sup>rd</sup> SKADS workshop in Lisbon	PE/PS	
5.6.	Have Express as agenda item at next SKADS Board agenda	PO	
5.7.	Sanity check with industry with regard to network and processing vs. cost/availability – organize a workshop	MT	
5.8.	Punctuate the priorities of DS2 in the quarterly report	TvdH	Asap
5.9.	DS leaders should take their responsibility with regard to reporting for the quarterly report	DS leaders	ASAP!
5.10.	To organize a “SKADS next step” meeting 1 <sup>st</sup> week of February	PA/Av A/PNW	Asap

## Decisions

Decision	
1.	3 <sup>rd</sup> SKADS workshop in Lisbon on 18-19 September, 2008
2.	6 <sup>th</sup> SKADS Board meeting in Liverpool on 19-20 June, 2008 immediately after ASTRONET symposium
3.	Peter Wilkinson will continue to be Chair for the rest of the project
4.	Have a “SKADS next step” meeting at Schiphol 1 <sup>st</sup> week of February



## Acronyms

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

