

PrepSKA WP2 Kick-Off Meeting Summary

Nov 10-14, 2008
Manchester University
P. Dewdney

Summary:

The purpose of the meeting was to provide a forum for face-to-face discussions on WP2 between the SPDO staff and representatives of institutions who will contribute to WP2, and to review the setup of Work Package 2. Members of the Science Working Group (SWG) and the Engineering Working Group (who were not already attending as institutional representatives) were also invited. Forty-seven people attended the meeting.

A summary of presentations, discussion points, and other information:

- Present and review the Reference Science Mission and discuss its implications for informing the SKA design – see SWG report below. Developing the RSM is still an on-going activity. A solid draft is expected in March 2009.
- Present, review and discuss how the 40 tasks in WP2 description of work could be carried out to achieve the main goal of producing a “Costed System Design” for the SKA by the end of PrepSKA. The SPDO presented plans that amalgamate many of these tasks into larger “Verification Programs” that can more easily be related to an overall telescope system.
- Present and discuss a top-down timeline implied by the combination of the goals of WP2 and the time available for PrepSKA. This timeline provoked quite a lot of discussion and some concern over the speed with which decisions on technology selection must be made. This timeline must be consistent with the goal of obtaining a well defined system whose cost can be estimated.
- Present and discuss the project management setup (documentation, reviews, etc.) that are planned for WP2 and hopefully will be used later. (At the time of the meeting we had not yet filled the position of Project Management Officer. This has now been filled by Mr William (Billy) Adams.)
- Present and discuss a model for delivery of the PrepSKA program via Memoranda of Agreement (MoA) with participating institutions. The purpose of these agreements is to fix deliverables from these institutions so that the SPDO has a clear idea of what to expect from the various work packages. Since the WP2 meeting a few of these have been drafted and sent to the appropriate parties for comment. The draft MoA contain quite detailed breakdowns of work, review points, etc.
- Present and discuss concurrent work in WP3 – site issues that impact the SKA design.
- Parallel discussion sessions were held in most of the key technology areas, led by the SPDO Domain Specialists – antennas feeds and receivers; data transport; software and computing; (digital signal processing was not covered because that position has not yet been filled). Notes from these meetings are contained in Appendix II.
- Representatives of the contributing institutions were asked to make brief, informal presentations on what they were planning to do as a result of the meeting, and how they were going to proceed at their home institutions. Neil Roddis compiled a short document, **WP2 kick-off meeting: brief outlines from contributing institutions**, containing notes on these presentations. After the meeting, the notes were circulated to the original contributors for editing. The edited version is in Appendix I.
- Some important input documents, containing much of the SPDO and other material presented at the meeting, were released in advance, and are available on the SKA website.
- The agenda, presentations, list of attendees, and the outlines from contributing institutions can be found on the SKA website at http://www.skatelescope.org/pages/presentations_WP2-Nov2008.htm.

- The SPDO plans to hold a similar WP2 meeting, October 29-31, 2009 (Thur-Sat), in conjunction with the SSEC3 meeting. Please note these dates.
- Much of the above summary also appears in the SKA Newsletter 15.

Appendix I

WP2 kick-off meeting: brief outlines from contributing institutions 13th November 2008

Notes taken by Neil Roddis
Version 2 with modifications from participants 28th Nov 2008

UK (AF)

UK PrepSKA will run from July 2009 to March 2012. A good level of funding is anticipated, and this is well-matched to what they intend to do. There are two distinct themes; the AA work is in Theme B which relates to the European AAVP, of which the UK is 'firmly a part'. Involvement in AAVP formally starts in July 2009, but in the meantime SKADS outputs will contribute information. UK PrepSKA also includes generic work on signal transport and system design.

ASTRON (JGbdV)

ASTRON 'will do WP2', although the man months committed are too small to cover all of the work currently in WP2. They will bring in APERTIF and LOFAR. AAVP will be a 'strong part' of their activities, but is not yet funded. Whatever happens ASTRON can contribute to various work packages, but they need the extra funding to 'really contribute' to AAVP. They could spend a little time considering tuning APERTIF for out-of-focus operation.

DRAO (GH)

DRAO have already sent us a proposal for what they intend to do, but they will now send a broader-based one. They will require 'horizontal inputs' from other groups. Currently most of their digital people are tied up on EVLA and other things, but there should be an increasing number of people available, building up to a full team at the end of 2009. DRAO have a good measuring machine for reflectors. They also have some expertise in beam forming, and they will continue to develop this, and they will also continue their system design activity. They are looking for collaboration on optics and WBSPPs. In general they hope for more collaboration with the TDP.

TDP (LB)

The TDP is 'an integrated part of PrepSKA'. Its role is providing deliverables to the PrepSKA program. They have detailed WBSs and statements of work from the AWG. Detailed plans for 2009 have been agreed with the NSF. LB says that the TDP plans are pretty well integrated with the SPDO plan. There is some concern about the time lines, but they are closer that was originally thought. They would prefer to have more input from the calibration group before making design decisions, but recognize that in practice things need to proceed in parallel. TDP intends to build a complete antenna system, but they need to consider the cost and time to produce a verification model. They are happy about the concept of 'horizontal' collaboration.

MPIfR (RK)

MPIfR will no longer be involved in receiver work, but will concentrate their efforts on STaN, as requested by Roshene. Consequently they will be able to contribute little to cryo design. They have expertise in WBSPP design (presumably not funded either). The STaN involvement is well-defined; they have an

engineer, currently working on SKADS, who can begin the PrepSKA work in January 2009, for 8 months in total. In the DSP area MPIfR promised a lot of manpower and they still want to contribute, especially in non-imaging processing, ADCs and FPGA programming. Funding is available (36 months from March 2009), but recruitment is uncertain. MPIfR are also part of the AAVP.

CSIRO (DDB)

ASKAP 'looks a lot like' the verification system they are set to design. They wish to be part of community-wide groups in PAF design etc, and would like to receive a requirements and functional specifications document for the optics work. They had an optics expert, but he has gone to work in industry. However, they will take ownership of the tasks, re-draw the Gantt charts, hire and re-deploy as necessary. CSIRO have talented mechanical engineers who can look at the mount and feed support designs.

NRAO (SD)

The Dish Verification Program is 'intriguing'. Jim Ulvestad is already talking to management about this and presented two slides on the previous day outlining the top-level requirements for antenna verification at the VLA. EVLA should be considered as a pathfinder; the complete memo series is available on the web. Characterization of the EVLA dishes will proceed with some urgency.

NRF (JH)

Further discussions are to be held between SPDO and NRF over the coming weeks to clarify NRF's involvement in WP2. They are producing composite dishes for KAT7 and are looking at dish optimization for MeerKAT, including discussions with DRAO and TDP. They have good EM software and modelling using Feko as well as people working in imaging, which will enable them to study dynamic range issues. There is a big DSP group, currently focused on the ROACH architecture and tools development. They want their PrepSKA work to align with their work on MeerKAT, e.g. in M&C, and STaN and Calibration and Processing.

[GH asked if the EVLA radio quiet M & C design is being adopted for KAT and ASKAP.]

IT (DB)

A Portuguese consortium has recently joined SKADS; it has an R & D back-bone. There are 300 people in the IT facility. IT aims to produce R&D in ICT's with a focus on industry (in general), that is "well, fast and cheap". There has been some measurement work on pHEMTs, also on data transport. At the moment they are using their own funds, but they will put in a proposal for PrepSKA funding, where they hope to provide a site emulator for the AAVP. They have also looked at renewable energy, and warn that storage is very expensive. There is a large PV array in Portugal that may yield some useful information about the deployment of a large array of dishes.

OBSPAR (RW)

The Observatoire de Paris will work on 2 main parts :

1) Signal processing for RFI mitigation. OBSPARIS will lead this sub-package, which is part of the signal processing package. The RFI mitigation work will be in collaboration with ASTRON and other interested groups. OBSPAR and UORL have committed 12 man-months each to this task. If national funding can be obtained, a PhD student will also work on RFI mitigation for PrepSKA.

2) RF design: OBSPARIS will be mainly involved in PrepSKA and/or AAVP, working on integrated RF designs such as beam former chips, LNAs and integrated receivers. OBSPARIS has committed 28 man months to this.

Curtin U (PH)

Curtin has 15 people working on SKA science and engineering R & D; this will rise to 30 by the end of Q2 2009. Collaboration with UWA in a new international research centre could bring the total to more than 40 in the Curtin radio astronomy program. The technology park at Bentley (Perth) will be the base for Curtin RA and will facilitate SKA interaction with industry. Curtin is already doing performance/cost modelling for the SPDO. More resource is available than was originally planned for, including a share of new resources from the WA government. The Power Engineering and Sustainable Engineering groups at Curtin are also working on SKA related projects, as are an industrial provider of solar power. Other disciplines at Curtin also want to contribute to the SKA. PH's team are helping CSIRO in capturing information on PAFs. They are also looking at the design and costing of non-imaging systems, and investigating sparse arrays for the frequency range 70 – 500 MHz, the design and test of which will be integrated within the AAVP via a Curtin partnership with Europe. Steve Tingay is project manager on the MWA project, and MWA insight will also be captured for SKA pathfinder purposes.

Appendix II



WP2 – Antennas, LNAs, Feeds, Receivers

Breakout session summary

Neil Roddis

Rob Millenaar



Dish Verification Program

- The rationale in aiming to do DV by means of a well known reference antenna system, such as the EVLA.
 - The aim is to end up with the best dish possible; a new standard of excellence. Drastic beam DR specs impose drastic methods*.
 - Better do the best you can in testing before spending a lot of money in building all these dishes.
- EVLA can do snapshot measurements with high sensitivity. Use boresight on the reference and scan the antenna under test on strong point source. Look at sidelobes, stability of patterns to a deep level. Need sensitivity to make it work.
- The WSRT is an alternative -> high DR, but needs longer measurements.
- Using non-interferometric methods (for example using a strong satellite signal) was deemed not to yield the characterisation quality that we aim for.
- **The principle of adopting the interferometric method emerged, and the EVLA is thought to be the reference telescope.**



Dish Verification Program

- No commitments yet, but when done at the EVLA we now have a checklist of items to take care of (courtesy of Jim Ulvestad):
 - ALMA test facility (ATF); decommissioning to be postponed(!). There are 3 foundations with power, fibre and control trailer.
 - questions: what to be tested, who does it, who is responsible, how much time SD how much full system. Who pays the bills.
 - Issues: control, pointing, data interface to correlator, clock/lo, rfi tight DUT, compatible freqs. Needs to be compatible with EVLA configuration, how much total obs time, when to be removed?
 - Also: when will this be done: 2010 too early for EVLA; 2012 reasonable.
- Note: expect higher DR from EVLA than from VLA. But there are challenges on the way. The EVLA dishes will not be characterised by 2012.



Dish Verification Program

- Some other remarks:
 - (DDB) You can use the PAF to underilluminate the dish, to achieve better DR (provided the PAF is working as advertised)
 - Commercial companies that can do this job? Yes, maybe but that will be expensive.
 - Simultaneously, the AA Verification will be underway at the WSRT...



AA Verification

- What plans are there for AA verification at the WSRT?
 - (JGbdV) This has not been worked out yet, but there are challenges: how to deal with the problem of needing 12 hr synthesis for the WSRT, while the sky will not be constant for the AA.
 - (AF) Verification metrics and methods are part of the AAVS programme.
- What about EMBRACE verification?
 - (DK) Isn't completely determined yet. A/T will be done and T will be obtained separately. But still to be decided how to carry out beam characterisation by interferometry with (a dish of) the WSRT.



Dishes

- Remarks heard on dish designs:
 - (PH) Guard against basing end implementations on early Patriot-like IP protected choices. Guard the investments done at the pathfinders.
 - (NR) Dish designs aiming for wbspf and paf may have to be optimised for one of those on the basis of science requirements.
 - (LB) We need to develop criteria to evaluate the 4 designs. Figures of merit. DR, passband stability. The criteria for down selection will come out of calibration (and other) studies that are taking place simultaneously.
 - (GC) There are 5 disciplines to select from. Don't exclude anything/anyone until all the results are in. The planning should reflect that.
 - It is not optimal to fix optical design too soon: **We have agreed to extend the optical design timeline.**
 - Sanity check: we do not consider dishes with paf's only.



LNAs and Feeds

- Items discussed:
 - (DaK) The Ina part just concerns the first stage. Specs: low noise, reasonable gain. SPDO will produce the spec.
 - (DaK) Ina's being researched: are they all differential? Almost: LB's is single ended. Make sure there is a single ended design in the programme. We need to cover the bases.
 - (GH) For PAF Ina development the design iterations can be long because of the long device production run times.
 - (DaK) a design cycle for an Ina takes longer than now allocated for, 6 months may not be enough.
 - (LB) raises the issue of designing Ina's for a given antenna impedance. Needs close cooperation between feed and Ina people.
 - (DK/LB) differential Ina: designing for high impedance is tricky.
 - GH will send DRAO's view on their involvement.
 - (LyB) Cryogenics needs to be upgraded in status. On the same level as other capabilities.



The process

- Remarks:
 - (DDB) Gave his view of the ‘horizontal’ linkages between tasks.
 - (JGbdV) Paradigm shift: we signed up to do something and now we need to deliver something.
 - Considering the amount of work that groups want to do: nobody wants to do less; **everyone will do what they signed up for.**



Timeline

- The timeline for optical design is spread out over the time until the review.
- Timeline: it doesn't mean that development stops after the decision point (review). (At this time that date, May 2010, is not negotiable)
- (DK) Can that date be considered as a date for a fallback design? We should expect to approach SKA-like performance for sub-systems at that time.
- The timeline is tight, however **the timeline is agreed upon.**



Conclusions

- Dish verification to take place, preferably using the best reference antenna system available, provisionally the EVLA.
- There is broad agreement on what needs to be done and by whom.
- There are concerns on the tight timelines, but there are no objections.



Signal and Transport Networks

WP 2.7

Summary of Discussions conducted on
12 November 2008



Attendees

SPDO

- Meeting was attended by representatives from:
 - CSIRO
 - IT
 - MPIfR
 - SPDO
 - TDP
 - UMAN



Summary of Outcomes

SPDO

- Summary of outcomes
 - Reached broad agreement on technical deliverables and work responsibilities for WBS items:
 - STaN for WBSPF + PAF Dish Systems
 - STaN for WBSPF Dishes
 - Digital Data Back Haul
 - Timelines remains a problem
 - WBS for LO and Timing to be expanded and finalised
 - WBS for Monitor and Control to be re-evaluated within SPDO (more of a system issue)

- Level of effort commitment by institutions:
 - CSIRO No additional manpower over and above ASKAP
 - IT 17 man months
 - MPIfR 8 man months
 - TDP TBC
 - UMAN 55 man months over 3 years (TBC)
 - INAF TBC



- STaN for WBSPF and PAF Dish Systems
 - CSIRO and INAF
 - CSIRO to perform majority of work and take responsibility for deliverables
 - Documents during first phase to be combined in fewer documents
 - Duration of last phase to be reconsidered, to be shortened and time added to prototype design and development



STaN for WBSPF Dishes

SPDO

- STaN for WBSPF Dishes
 - MPIfR, TDP and UK
 - TDP to provide ATA and EVLA costed design information
 - UK to provide eMerlin information
 - MPIfR to perform majority of the work and take responsibility for deliverables
 - Work to start January 2009
 - Does not have expertise on mechanical issues, to be combined with first WBSPF and PAF WBS item
 - Involvement from INAF to be confirmed
 - UK funding decision expected by end of the month



Digital Data Back Haul

SPDO

- Digital Data Back Haul
 - IT, UK, ASTRON, (CSIRO, NRF)
 - First phase all contribute
 - IT to perform design of chosen optical solution
 - UK to perform design of external cable systems
 - CSIRO and NRF to provide site specific information as and when required



Timelines

SPDO

- Institutions will only be able to start work during January 2009
- UK grant proposal approval expected by end of November 2008
 - Will only be able to start work during June/July 2009
- CSIRO resource commitment to be confirmed
- INAF commitment and involvement to be confirmed



Outstanding WBS Items

SPDO

- LO and Timing
 - WBS shall be expanded but will follow same structure as other WBS items
 - Participants to be identified and timeline finalised
- Monitoring and Control
 - To confirm re-allocation of this item to system level.
However, some WBS will have to remain in support of the system level work.



General

SPDO

- Preliminary ICD's shall identify:
 - Parties involved in the interface
 - First pass primary information
 - Shall be refined throughout project
- Meetings shall be set up and conducted as and when necessary, to be coordinated by the SPDO
- Gantt charts to be updated on a regular basis by all institutions to reflect progress
- WBS Gantt chart items shall be updated to reflect responsible institution(s) for each activity



P9: Software and Computing PrepSKA Work Breakdown Structure 2008 November 12 Discussion

Duncan Hall
2008 November 13



Objective:

■ **Create WBS for PrepSKA for WP9:**

- Software
- Computing
- Calibration and Imaging

■ **Subject to constraints of:**

- Time
- Resources [documents already at hand]
- Additional information available
- Process
- People
- Usual non-negativities ☺



Discussion participants:

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- Duncan Hall, SPDO
 - Marco de Vos, Astron
 - Ronald Nijboer, Astron
 - Malte Marquarding, CSIRO
 - Jeroen Stil, University of Calgary
 - [Part] Arpad Szomoru, JIVE
 - Jasper Horrell, SKA South Africa
 - Paul Alexander, University of Cambridge
 - Athol Kembball, University of Illinois
 - [Part] Peter Dewdney, SPDO



**Original description of WP 2.9 is contained in
FP7-INFRASTRUCTURES-2007-1 [2May2007]**

- **WP 2.9.1 Computing and software specification:**
 - Deliver draft report on SKA computing and software specification, hardware and calibration strategy [SKA Phase 1 focus] (Del 2.9.1)
 - Deliver draft report on software system architecture, data products and science post-processing strategy [SKA Phase 1 focus] (Del 2.9.2)
- **WP 2.9.2 Computing hardware:**
 - Deliver prototype of Initial Verification System [IVS] computing hardware (Del 2.9.3)
- **WP 2.9.3 Software engineering:**
 - Deliver prototype of IVS software (Del 2.9.4)
- **WP 2.9.4 Data products and virtual observatory**
- **WP 2.9.5 Calibration**
- **WP 2.9.6 Science post-processing:**
 - Deliver report on final SKA computing and software specifications and strategies



Initial discussion areas:

- **Current state documentation to be shared among institutions:**
 - Links to be provided to public project workbooks
 - Relevant existing deliverables to be copied to SPDO as central repository, examples:
 - » Computing Working Group deliverables – offered by Jasper Horrell
 - » Virtual Telescope use cases – offered by Paul Alexander
- **Use-case driven software development:**
 - Proposed use to:
 - » Abstract to a “white box” view of system’s software requirements
 - » Decompose requirements to levels of detail sufficient for PrepSKA:
 - Sufficiently accurate estimation of required resources
 - Sufficiently accurate estimation of software development cost
 - Example available from public domain demonstrated
 - Applicability to SKA software development to be discussed



Summary of agreed suggestions for P9 WBS:

■ WP7.5 Monitoring and Control:

- Recommended to be removed from P7 [Signal Transport]
- Recommended to be included in P9
- Action Point: ASKAP to provide “inventory of existing frameworks for monitoring and control” to SPDO and Lead Institution [Lead Institution: UCam]

■ Proposal 1 of 2 from Athol Kemball affirmed:

- Reform T5 and T6 into three new Tasks – to better align with technologies:
 - » Aperture array calibration and processing [LI: Astron]
 - » Phased array calibration and processing [LI: CSIRO]
 - » Wideband single pixel feed calibration and processing [LI: TDP]
- Separate Task to be created for non-imaging analysis [LI: TBD]



Summary of agreed suggestions for P9 WBS:

■ Proposal 2 of 2 from Athol Kemball affirmed:

- Extreme scale computing combined with hardware investigation Task [includes power aspects] to be assigned to TDP as LI
- Extreme scale computing hardware costing aggregation Task to remain with SPDO

■ Action Point for all Lead Institutions:

- Share current state documentation
- Clarify and document to SPDO wording of Task descriptions
- For Tasks, clarify and document to SPDO expected:
 - » Resources required to execute
 - » Deliverables
 - » Timings of deliverables
 - » Risks that threaten above items