From the Desk of the Director-General

The last three months has been an intense period of activity across the SKA project. I will almost certainly miss an important activity in my list below, so I ask for forgiveness in advance if that is the case. The following significant events took place:

• Colleagues in Shanghai hosted an interesting workshop on SDP, High Performance Computing and SKA Regional Centres;
• Several SKA staff travelled to a well-attended (~70-80 people) Swiss SKA Day at EPFL Lausanne. Our Swiss colleagues are working with their government to seek funding to join the SKA;
• The SKA Management Review, excellently chaired by Michele Peron, Director of Engineering of ESO, met on 23-25 May. It provided a report to the Board for its meeting in July. A summary of the report and recommendations is being prepared for public release;
• In the middle of June there was a week-long meeting of StratCom and various IGO-related working groups, which served to push the policy work forwards;
• In late June and early July, we received a series of visitors from around the globe and from other projects (eg TMT) who were attending the SPIE in Edinburgh but took the opportunity to visit SKA HQ;
• There have been a range of consortium face-to-face meetings, too many to list, but demonstrating the busy time all aspects of the project face;
• On 4th July, following a request from Dave DeBoer, HERA, the Hydrogen Epoch of Reionization Array, became an SKA precursor (a precursor is a pathfinder telescope on an SKA site).
• As Colin Greenwood has indicated below, the SKA Board met at SKA HQ on 13-14 July. As you might imagine the 4 weeks leading up to the Board were an intense period as we prepared papers and presentations;
• Immediately after the Board meeting I attended the Spanish National Astronomical Society meeting in a very hot (42C on one day) Bilbao to give a plenary talk;
• On the weekend 22-24 July, the first of an annual event, the Bluedot science and music festival, was held at Jodrell Bank Observatory, our neighbour. SKA staff gave several talks and participated fully in the various events, including with an SKA tent and an outing for the inflatable antenna. Jean Michel Jarre was the headline act on the Saturday night.
• Bluedot was immediately followed by the major conference, ESOF16, the Euro Science Open Forum. ESOF is a major (3000 attendees) science and science policy meeting held every two years; in 2014 it was in Copenhagen, in 2018 it will be in Toulouse, 2016 happened to be Manchester. SKA featured heavily and impressively in the opening ceremony, with live link-ups to Jodrell Bank, Australia and South Africa (thank you colleagues) and the first presentation of our new SKA promotional video. We also organised 4 full sessions during the meeting.

However, for me, the highlight of the last 3 months was the announcement on 16th July of first light for MeerKAT. This is a tremendous achievement and I commend all of our South African colleagues for the hard work and dedication they showed in delivering it. It portends well for SKA!

Phil Diamond
Project
By Alistair McPherson, Head of Project

The past months have been filled with a great deal of work following the Systems Review, which included another review, the SKA Management Review which looked into the operation of the whole organisation from Board to the Office to the Consortia. I would like to thanks all of those who participated as I know it added to your agenda over the past months. From the report, we have several actions which will improve the operation of the project.

The work following the systems review is on-going. The initial review of the ICDs, both inter-element and those internal to elements has been completed and a detailed plan in place to improve them. The work towards the Functional Analysis and Budgets Reviews are continuing. The Functional Analysis are almost complete, although the work of the budgets has more development ahead. This will require input from the consortia.

The work of the Telescope Teams is progressing with several Resolution Teams concluding their work which has resulted in some instances with ECPs. In addition, there are several joint Resolution Teams dealing with timing and Sub-Arrays. This is important work to assist TM and Observatory Operations. I invited both TTs to carry out a review following the operation of over 6 months. Both came back with the response that the structure was working well, although the necessary resources to make the RTs effective was not always available. I would encourage all managers to make effort available to resolve these key issues.

One lighter time this period was the SPIE Conference in Edinburgh. SKA was well represented in Plenary talks as well as by individual presentations and posters. The stand was well visited and a great deal of interest and interaction took place. Thanks to all from both the office and the consortia who represented the project there. It is a key window for the wider community onto the SKA vision.
Project Management
by Andrea Casson, Head of Project Management

The past few months have seen several final element PDR closures as well as the June cost updates for both construction and operations from all consortia, which has represented a huge effort across the project. Further development of the Pre-Construction schedule to CDR has taken place, with all consortia estimating impacts on their milestones of the proposed L1 Requirements release dates and other factors. The status of the cost and schedule estimates are the subject of papers submitted for the Board of Directors meeting in July alongside the usual Engineering Report and Risk Report. Non-binding expressions of interest were received in June against the draft Cost Book and show a strong interest across the project, with over 80% of the work packages receiving interest from two or more Members, and some by up to five. Clarification meetings with Members are now being carried out. The Cost Book will also be updated with the June construction cost estimates and changes to the Work Breakdown Structure proposed by the project management team.

Mission Assurance
by Tim Stevenson, Head of Mission Assurance

The list of topics for Mission Assurance turns out to be ‘as long as your arm’. However, the theme is clear – we are presented with a set of unique technical difficulties and have to solve them in a unique environment.

A good example is Configuration Management. Everyone agrees that CM is critical to the success of design, construction and operations. Despite this broad agreement, CM has proved to be difficult to establish and maintain, and the reasons are a lot to do with the traditions of research infrastructures and of radio astronomy in particular. Mission Assurance has two jobs to do with regard to CM; to get a system up-and-running that is fit for purpose, and to get all relevant stakeholders, for many of whom it is an alien concept, to buy in and use it effectively. CM is a ‘holistic’ discipline inasmuch as it must touch all phases of a system’s lifecycle and all parts of a complex system, to be effective. To exempt or omit parts of the system or its lifecycle from CM is to create dark corners of uncertainty which inhibit decision making, particularly with regard to changes.

So, in this case, the unique technical challenge is the complexity and scale of the SKA and the unique environment is the need for flexibility for change and a steep learning curve for stakeholders. As a result of this recognition, considerable effort is currently being made in improving the change management system so that it is efficient and is seen to be ‘a good thing’ so that stakeholders will trust it.

It is the role of Mission Assurance to strive for such disciplines as CM to achieve their potential for protecting the SKA from costly errors.

Project Engineering
by Luca Stringhetti, SKA Project Engineer

During the last few months the Project Engineering Office was mainly focused on system work. The first achievement was the release of the new revision of System Requirement Specification revision 8, which includes Operational requirements and RAM requirements. Next step will be revision 9 which is expected for mid September. System Engineers and domain Specialists are working on the system budgets in collaboration with the Architect group and the Science group. Budgets have been selected for the next two versions of the System Requirement Specifications and a book-keeper for each budget has been allocated.

In June the System PDR process began and on the 23rd of June the first step, focused on the status of Interface
Control Documents, has been completed. The PDR process will last for a few months and it will be completed in November by a formal external review in the SKA office. The report, for this first but very important step, will be released shortly. The next internal review is on the design (functional and non functional) in late September. In the same period the first complete and thorough block diagram of the MID telescope has been completed. Currently, the block diagram, which describes the physical connections between products in the MID telescope, is under internal review (it can be found on the wall of the SKA office). The first release of it will happen in a few weeks. The plan now is to do the same exercise for the LOW telescope.

Architecture
by Peter Dewdney, SKA Architect

Among the myriad of technical issues being considered, this edition will focus on important system-level aspects of SKA1-low performance, especially imaging and calibration:

- The previous work to define a ‘baseline’ (in the sense of a system engineering baseline) for the Low array configuration, and to enable a sub-station capability is now under consideration as an ECP. Balancing cost, science capability and flexibility has required a great deal of discussion. This definition will enable negotiations for native title to continue and for infrastructure to be planned in detail. It will also provide a firmer basis for operational requirements, and solidify the functionality of station beam-formers and the correlator-beamformer system (CBF).
- The SKAO is reviewing/refining the requirements for band-pass shape, based on science requirements. It is also planning to undertake a review of band-pass calibration methods with a goal of developing a better definition of pre-calibration performance requirements. This is not a simple process and may take several ‘passes’.
- Tim Cornwell has pointed out in a recent memo that it may be very difficult to calibrate the ionosphere with SKA1-low. The SKAO is assembling a Resolution Team to look into this issue more deeply, in particular to utilise the expertise developed with the MWA and LOFAR telescopes.

It is recognised that this is not full coverage of imaging/calibration, and additional work will be needed to roll these aspects together with a more complete view of calibration.

Operations Planning
by Gary Davis, Director of Operations Planning

The primary focus of the Operations Planning group since its inception last year has been to define a set of additional design requirements from the perspective of observatory operations. These requirements are defined in the Operational Concept Document (OCD), revision 1 of which was issued in February following extensive consultation with the design consortia. Following the successful Operations Concept Review (OCR) during March/April, the ECP to have the new requirements ingested into the Level-1 System Requirements was approved by the Change Control Board on 20th June. Revision 8 of the Level-1 requirements was issued on 4th July. Incorporation of the operational requirements is a major milestone for the project.

One of the revised requirements specifies the operational availability: in simple terms it states that 95% of the collecting area of each SKA telescope must be available for observations for at least 95% of the time. This requirement has been allocated to the elements in the Reliability, Availability and Maintainability (RAM) Allocation document, issued last March. These requirements also appear in revision 8 of the Level-1 System Requirements.

All consortia provided operational cost estimates at the beginning of June. This is essential input for the budget estimates the Office is now required to present to the Board at each meeting. The next set of estimates will be required for the IGO negotiation meeting in September, and we have engaged with the consortia to define the

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information we need.

At its April meeting, the Board approved the concept of a network of SKA Regional Centres (SRCs). The Office has initiated an SRC Coordination Group (SRCCG) to take this work forward. It will be chaired by Antonio Chrysostomou, Head of Science Operations Planning. A kick-off meeting is anticipated shortly.

**Science**

*by Robert Braun, SKA Science Director*

Registration has now opened for the Science Meeting in Goa, India. I encourage anyone interested to register and make their travel plans early as this is peak tourist season in Goa, and so many flights may be unavailable at your desired time.

There was also a very successful SKA Special Session at EWASS 2016 Athens in early July, with a good turnout of around 70 participants, with an SKA stand also featuring at the conference that gathered much interest.

We’ve started working on an SKA simulation script that allows sensitivity and beam quality simulations to be done, the intent is to make this more realistic over time to include detailed models of the telescope and station beams of the arrays, as well as including calibration errors and simulating their successful removal. Another application would be in the area of proposal preparation for respective users to plan their observing strategies.

We are also looking forward to welcoming Anna Bonaldi, who will be joining the science team here at the HQ early September. Anna brings expertise in the areas of Epoch of Reionisation experiments, as well as many areas of cosmology.

In June, Jeff and Evan met with members of the TMT science team to discuss future synergies between SKA and the TMT. There are many parallels that exist between the two communities and with the ongoing design work. During July, Jeff presented an update on SKA1-low at a workshop on 21cm cosmology and EoR science at Cambridge. Participants included members of the HERA, MWA and LOFAR communities. HERA is now an SKA precursor and as such, these meetings are vital for cross-pollination of ideas related to the techniques for analysing 21cm EoR data.

At the end of July, Jeff also attended the first ASTERICS Citizen Science Workshop at St. Catherine’s College, Oxford University. The objective of this workshop was to discuss mass participation experiments linked to some or all of the astronomy ESFRI facilities and their precursors / pathfinders, namely the SKA, the E-ELT, KM3NeT, and the CTA.

**Policy Development**

*by Simon Berry, SKA Director of Policy Development*

The focus for the Policy team remains supporting the development of the processes and documents needed to finalise the design of the SKA as an Inter-Governmental Organisation (IGO). As regular readers will know, there is a formidable structure of working groups and committees involved in the process involving a very large number of people. It can probably feel a rather remote process to those whose focus on the project is on the engineering or science sides, but in recent times, attention has been directed in particular on ensuring that the whole ‘coordinated’ timeline of activities leading from now into production of science around the world fits together. That means being convinced that we can deliver an IGO Organisation that can implement the project when it is needed, and that has the appropriate power and operating processes to function day to day.

An important part of getting these aspects right is trying to learn from others. SKA is arguably unique in the
research infrastructure world, but during May, our team spent time in a range of interviews and discussions with other large research projects; learning how they function from the policy and administration side, and how they established themselves. This has been valuable information that formed part of an extremely busy June with meetings of the Board’s Strategy Committee, and all of the range of working groups and other IGO negotiation bodies. We reported on progress to the Board meeting earlier in July and kicked off various activities in what we are now calling ‘planning for Transition’; how we evolve from the current SKA Organisation company structure, into the future IGO. Work won’t actually slow down very much through August with the next focal point being the fourth ‘Plenary’ negotiation meeting that will take place in Rome at the end of September. Full steam ahead for that next milestone!

SKA Board Matters and Administration
by Colin Greenwood, SKA Head of Administration and Legal

SKA Governance

On 1 June 2016, Mr YIN Jun stepped down as the China’s Voting Board Representative and was replaced in this role by Mr CAI Jianing (Ministry of Science and Technology). Mr YIN also stepped down as the Board’s Vice-Chair and from its Executive Committee. We would like to thank Mr YIN for his contributions to the SKA project and welcome Mr CAI, who returns for his second term on the Board. A replacement Vice-Chair will be elected at the next Board meeting.

The 21st meeting of the SKA Board of Directors was held at SKA HQ, Jodrell Bank, UK on 13-14 July 2016. In addition to standing items on the agenda, the SKA Board reviewed the SKA Organisation’s Report and Statement of Accounts for the period ended 31 December 2015, the latest version of the pre-construction schedule, revised top-level operational principles and management of the SKA sites during construction and operations. There were also updates on policy issues such as progress at the Inter-Governmental Organisation (IGO) negotiation meetings, IGO transition planning, HQ and site hosting agreements, the design of the permanent SKA HQ building and the SKA Offices communications implementation plan.

The Notes from the Chair are available here.

SKA HQ

A draft RIBA Stage 3 (Detailed Design) Report for the permanent SKA HQ at Jodrell Bank was submitted to the SKA Office on 1 July 2016. This has been reviewed by the SKA Office and submitted for formal sign-off of this Stage by The University of Manchester on 28 July 2016. This report includes design proposals including façade strategy, interior strategy, services and access and a cost plan. This £16.5M project remains on target for completion by 2018Q1.
Staff

We are pleased to welcome Kesseven (Jay) Mooneyeven on an IT Intern placement; Jay commenced work on 1 June 2016 and will be based at the SKA HQ for one year. Jay is replacing Dan Brown who has now ended his placement and will be returning to University.

We are currently advertising for two computing roles: High Performance Data Analysis Specialist and Control System Software Specialist, and are re-advertising for the role of Head of Procurement.

Communications and Outreach

by William Garnier, SKA Director of Communications, Outreach and Education

ESOF as a case study of the role and impact of communications

For the SKAO Comms team, July was the culmination of several months of intense work in preparation for the Euro Science Open Forum (ESOF) conference, that we’ll use here as a case study to highlight the central role of communications in all SKA activities and its impact at a number of levels.

The massive presence of the SKA allowed us to make significant progress towards some of the critical SKA Project objectives, in particular:

• Confirming the SKA is one of the major science adventures of our times;
• Raising the profile of the SKA amongst high-level stakeholders and positioning the project in very high spheres;
• Reinforcing the connection and relationship with key stakeholders, including the media, and decision-makers;
• Strengthening the relationship and highlighting the partnership between the SKA and Industry;
• Enhancing synergies with other major Research Infrastructures in astronomy and beyond (LIGO collaboration, LHC etc);
• Promoting all the progress in the project on a number of fronts and to a variety of audiences.
"We're a major partner in the international @SKA_telescope which has its headquarters here at @jodrellbank" @JoJohnsonMP at #ESOF16

ESOF is probably one of the most important conferences for the project, bringing together key stakeholders, decision- and policy-makers, government representatives, Chief Scientific Advisors, influencers, and media from around the world. Held every 2 years in a European city, Manchester was host city this year and as such, we wanted SKA to stand out from the crowd. Three thousand delegates attended this year’s edition, including 400 science journalists, with an impressive 83 countries represented. Overall, I think it is fair to say that the SKA was the main player in town, represented in a variety of ways throughout the conference and side-activities. Details are as follows:

- **ESOF opening ceremony.** This was the key moment of the conference, attended by a high number of delegates. We managed to secure a 24-minute slot in the ceremony, with the popular BBC presenter and physicist Brian Cox as master-of-ceremonies. We took the audience on a journey into space exploration and the role played over time by radio astronomy, highlighting the critical role played by Jodrell Bank Observatory in the early days of radio astronomy, the importance of reaching out across borders in Europe and beyond to address new science questions, and leading to the next big questions that remain unanswered and the instrument we need to address such questions, namely the SKA. We organised live links with Jodrell Bank and with Australia and South Africa, where the colleagues did a fantastic job both in their preparation, their narrative during the show, and in taking care of all technical aspects to ensure the live links would run smoothly (special thanks to all involved!). The result was astonishing, generating a wow moment for the audience, as demonstrated in a number of tweets (a short selection follows). We uploaded the entire sequence on Dropbox if you are interested in seeing it .
Selection of tweets from the CEO of Siemens UK, ESOF conference, and a science communication expert

- **Sessions in the programme.** In a very competitive landscape, we managed to secure 4 compelling sessions in the programme, covering the broad spectrum of SKA activities: science policy, science, big data/High Performance Computing and science in society. This represented:
  - 25 speakers and moderators;
  - 14 men and 11 women;
  - 12 nationalities;
  - Government representatives, a Nobel Prize winner, European Commission Officials, main astronomy facility representatives, big industry representatives (CISCO, AWS), experts in outreach/education, social media and citizen science.

All sessions were very well attended and generated great exposure and many interesting discussions both in the room, on social media and in press articles. A selection of tweets is as follows.

Starting now @ #ESOF16 in Chapter 4: our panel discussion From Turing to the #Bigdata deluge esof.eu/the-programme/ ..."With @SKA_telescope it's unthinkable that we won't discover new things that benefit society" @OfficialUoM @radastrat at #ESOF16 #bigdata

@SKA_telescope will generate raw data at a rate that exceeds that of the global internet and will archive 10x more than #cern - #ESOF16

When we push the boundaries of our knowledge new physics always emerges" Prof. Robert Braun, @SKA_telescope science director at #ESOF16

"The @SKA_telescope has always fascinated me. Because of the enormous potential for innovation..." @EU_Commission RJ Smits #ESOF16

The huge amounts of astronomical data from @skat_telescope will be valuable to many different industries - Alison Kennedy talking @esof2016

"When you have good instruments to explore big ideas, usually good things happen" @cosmicpinot @SKA_telescope #ESOF16
- **Shared Sky exhibition.** In addition to being a fantastic and unique art exhibition featuring ancestral stories and mythologies from indigenous artists at the telescope sites, Shared Sky is also a great science diplomacy instrument. After successful events in Perth, Australia at the end of 2014 and in Cape Town, South Africa in early 2015, we featured the exhibition in its full version for the first time in the UK, at the imposing Manchester Central Library. About 50 guests took part in the opening ceremony, including UK, South African and Australian Government representatives, Robert-Jan Smits from the EU Commission, Brian Schmidt (Nobel Prize) and a number of science journalists as well as 5 of the artists that we could invite thanks to a grant from Arts Council England. A series of workshops was also organized the week following ESOF, inviting members of the public to take part in collaborative artworks which will then be offered to SKA Organisation. We invited the artists to the HQ as well. They really enjoyed their visit which allowed them to have a better sense of our global collaboration and where the project is coordinated from.

- **Blue Dot festival.** Jodrell Bank organised a music/science festival during the weekend of the ESOF.
opening, and a number of ESOF delegates were brought to the festival in what was a great encounter between science, music and art. SKA was well represented there, with 4 talks in the programme, and a stand featuring our massive inflatable telescope and hands-on activities. Special thanks to all the volunteers from SKAO, from UoM and from Cambridge and Oxford Universities who interacted with thousands of visitors at the stand over 3 days.

The @SKA_telescope engineering challenge! #bluedot @bluedotfestival @jodrellbank

Yay! Our scale 1:2 inflatable #SKAdish is now up for @bluedotfestival at @jodrellbank. Ready to welcome visitors!
- **Extras.** Last but not least, Nobel Prize winner and Vice-Chancellor of Australian National University Brian Schmidt gave a wonderful keynote speech about the SKA and EU Commissioner for Science, Research and Innovation Carlos Moedas visited us at the HQ in what was a very productive meeting.

We are here at the keynote by Professor Brian Schmidt, @cosmicpinot, discussing the @SKA_telescope project #ESOF16

**SKA trailer**

For the past five months, the SKA comms team has been working hard with a professional production company to create a trailer befitting of the SKA project, highlighting the big questions we’re trying to answer, the scale and global nature of the project, the challenges faced and the impact. The trailer is now ready and was shown for the first time in the ESOF opening ceremony during the SKA slot, and made a great impression. It will be published in August on the SKA’s Youtube channel and social media so stay tuned!

**SKA Communications 2016-2017 Implementation Plan:**

At their July meeting, the SKA Board of Directors noted the Communications Implementation Plan, providing further details on how the approved Communications strategy will be delivered. The plan provides a list of activities, channels and key actions, with their respective owners and the audiences reached. Each action has an associated reportable allowing to monitor and measure the successful delivery of the strategy. Plan is available here and all people involved are encouraged to upload progress on their reportables on a regular basis.

**Selection of SKA in the News**

We’ve read the news for you and are happy to provide this selection of media articles relevant for the SKA. Note that the appearance of articles in this section is not synonymous of endorsement by SKA Organisation.

- [Great piece on the FAST telescope on BBC World News](http://www.bbc.co.uk/newsround/36371569)
- [CBBC series on radio astronomy and SKA](http://www.bbc.co.uk/newsround/36394361)
- [UK Minister’s speech during ESOF, including a mention about the SKA](http://www.bbc.co.uk/newsround/36416919)
- [First Light with MeerKat!](http://www.bbc.co.uk/newsround/36394361)
- [Statement from RCUK (the UK research councils collective) on EU and international cooperation, including a clear positive statement about us about halfway down (“The UK also remains committed to other major international projects, including the Square Kilometre Array (SKA)”)](http://www.bbc.co.uk/newsround/36416919)
- [CSIRO engineers design 19-beam receiver of world’s largest single dish telescope (FAST) being built by China](http://www.bbc.co.uk/newsround/36416919)


www.skatelescope.org
• CSIRO colleagues Jill Rathborne (astronomer) and Mary D’Souza (engineer) interviews about their work on the SKA and ASKAP are featured in the 2016 Ultimate Science Guide, published by RiAus (Royal Institution of Australia).

Connect with us

For any enquiries, requests or feedback please write to ska-outreach@skatelescope.org

You can also find the SKA Organisation on Facebook, Twitter, Google+ and YouTube.