SKA Organisation Bi-Monthly Bulletin

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From the Desk of the Director-General

Welcome to the first SKAO Bulletin of 2016. The articles below, written by my senior SKAO colleagues, provide a sense of the significant level of work already done this year within the SKA Office, across the consortia and within the Science Working Groups. In addition to that, significant progress has been made on developing the text of the convention (or treaty) and its related protocols, which will form the basis for the future governance structure of the project.

As readers of this bulletin will know, the governments negotiating the convention plan a series of three meetings. The second was held in the very pleasant surrounds of the Accademia dei Lincei in Rome in January of this year, with the third to follow on April 19-21 at the same location. All concerned continue to be pleased with the overall progress of the negotiations. That is not to say that there is not considerable work to be done but I do remain hopeful that an agreement can be reached as planned.

The photograph below is of the negotiating parties at the conclusion of the January meeting. For of those of you who recognise me, the gentleman to my left (as I face the camera) is Enrico Vicente, a Minister from the Italian Ministry of Foreign Affairs and the Chair of the Negotiating Group.

The SKA Organisation has a very busy time over the first half of this year. A brief glimpse of the major forthcoming meetings in the calendar shows:

- March 9-10: StratCom, Beijing
- March 15: SKA Finance Committee, SKA HQ
- March 16-17: Science and Engineering Advisory Committee, SKA HQ
- March 22-23: SKA1 System Review, SKA HQ

www.skatelescope.org
• April 4-6: 20th SKA Board Meeting, Pune, India
• April 19-21: 3rd IGO Meeting, Rome
• May 11-13: HPC/SDP Meeting, Shanghai
• May 23-25: SKA Management Review, SKA HQ

Philip Diamond
SKAO Director-General

Project

By Alistair McPherson, Head of Project

You will see from the comments below that there has been a great focus on the preparation of the Systems Review, along with the work to agree the array configuration for SKA-Low. The work towards the Systems Review has gone well, but has shown the work we have all still to do, particularly in the area of Systems Budgets.

The work on the array configuration for SKA-Low is progressing well and two workshops which have progressed the planning. The key issue here is that to get to an end result we will need to compromise between the requirements for calibration and the requirements for science, along with cost and risk. Thankfully, attitudes are helping to find a solution.

We hosted a Consortium Leaders’ Meeting last month and we spent some time discussing the Roll-Out Plan and agreeing the interactions between the consortia. This was extremely useful and there is now general acceptance of the plan proposed by AIV. This has assisted with the coordination of the work and the expectations and assumptions of each of pre-construction consortia.

The development of the Construction Work Breakdown Structure is progressing and an initial version has been reviewed by the Consortia Project Managers. This is being used as a basis of the Cost Book for the IGO discussions. Naturally it is not yet fixed and will be developed further.

Finally, the cost estimates for the consortia have been received and will be reported to the Board. I would have been amazed if the total had come within budget, and so I was not disappointed with the results. There is work to be done by all in reducing costs whilst trying to maintain performance. This will take application and some relevant lateral thinking by many of us. We must all try and either think of how we can deliver for a lower price or, if we cannot do that, where we will need to cut. The latter is clearly not the desired solution.

System Engineering

by Tim Stevenson, Head of Mission Assurance

The focus for SE remains on System Review. Significant progress has been made on establishing key (technical) budgets which is important to ensure that allocated requirements, if met, result in a system that meets performance requirements. As a Project, we are still some way away from proving that we have a design that delivers the performance the science requires, and this is normal for a Preliminary Design. Shortly after System Review we expect to have created the evidence we need to focus on critical aspects in detailed design.

Considerable progress has been made in defining the Integration Test Facilities and their various roles in the development and construction of SKA1. In short, these centres will reduce the need for expensive and risky on-site
test campaigns where design and manufacturing shortcomings are brought to light, perhaps too late. Three centres will be established: one in Italy, and one in each of the telescope host countries. The benefit of these centres, if used correctly, is reduced cost and risk during construction activities on site.

Architecture
by Peter Dewdney, SKA Architect

There have been a number of architect activities in the early part of 2016. The most important are described in the following:

- Finalising the SKA1-low configuration: A ‘calibration consultation workshop’ was held in early Dec 2015 to take the first step. The purpose of this workshop was to establish the requirements for the locations of the outer stations for SKA1-low. The previous configuration of randomly distributed stations over all of Boolardy Station was found to be very expensive. A 3-arm spiral, somewhat similar to the original Baseline Design configuration, but modified to introduce better u-v coverage was found to be sufficient to carry out ionospheric calibration, providing sufficient collecting area was located at these stations. A set of locations was established, but the outcome did not include the configuration of the individual stations.

A follow-on workshop was held on Feb 25-26 to complete or at least make another significant step on fully defining the configuration. The intended outcome was a sufficiently detailed description of the configurations of the antennas in outer stations and stations within the core to complete the design of the balance of the SKA1-low system. Although the result was not quite reached immediately, the workshop was successful in outlining the science needs, which were expressed very specifically. It should now be possible to constrain the options to a small number and should go a long way towards achieving the goal.

It is critical to reach a conclusion in this area because aspects of the ‘downstream’ design cannot be completed without a final configuration.

- SKA1-mid Antenna Pointing: Pointing is a fundamental performance aspect of any dish antenna for astronomy. More complete and detailed requirements for pointing, based on science needs, are now being fleshed out as a result of discussions with the Dish Consortium, especially the Structures group. These discussions are proceeding very well.

- Framework for Error Analysis: The SKA telescopes are designed to be ‘next-generation’ instruments with goals to make significant steps in overall performance. This requires assurance that errors do not propagate to the point that they become systematic limitations on performance. A particularly important example is the requirement is to be able to integrate for ~1000 hours, while expecting ‘natural noise’ to decrease in a well-understood fashion. As a result, for example, at some frequencies imaging dynamic range of 10⁷ is needed to meet this requirement. Although aperture synthesis telescopes are quite robust, there is significant potential for systematic errors to limit performance, and they must be formally analysed, allocated and controlled. While there has already been analysis work done, a unified framework is being developed to associate the sources of error, methods of calibration, and residual errors with a much smaller set performance measures. Ultimately the intention is to show that the science capability of the two telescopes can be met and they are unlikely to be limited by systematic errors. Several people in the SKAO are contributing to this work.
Telescope Teams: The telescope teams are tasked with resolving specific technical issues at the system level that arise during the design process. Each Resolution Team (RT) will deliver a result that can be incorporated into the design, result in new/modified requirements, or contribute to the error analysis. Typically a list of issues are running in parallel:

- SKA1-mid: Without going into detail the current list is: RT1 Construction Phasing; RT2 RFI Characterisation; RT3 Clock Offset; RT4 Telescope Calibration; RT5 Subarrays; RT6 Noise Injection.
- SKA1-low: The list here involves a few wider issues: Calibration and Configuration; CSP Relocation; Synchronised Telescope Network Time; Station Layout; Sub-arraying; SKA1-low Construction Phasing; Performance Budgets; Network Architecture; Collecting Data for RAMS on AAVS1. Some of these overlap with the wider-scope design activities being carried out by the SKAO as a whole.

Operations Planning

_by Gary Davis, Director of Operations Planning_

The Operational Concept Document (OCD) was issued to the Consortia for consultation during December/January. A total of 356 comments was received. Many of these were thoughtful and constructive; some prompted revisions to the document, whilst others need more detailed consideration and were either deferred to the next version or referred to the relevant IET. If you read the latest version and you observe that one of your comments was apparently not taken into account, it may be that we are still thinking about it.

Revision 1 was issued on 11th February and it has gone forward to the Operations Concept Review, which is taking place by correspondence and should be complete by the end of March. An ECP will then be raised to ingest the new requirements from the OCD into the Level 1 requirements. It is quite possible, for a variety of reasons, that some of the proposed requirements in the OCD might not survive this process: the Level 1 requirements will remain, at all times, the definitive specification of what is to be delivered by the design project.

One of the proposed requirements in the OCD is a re-statement of the availability requirement, with the terms more precisely defined than in the past. In simple terms, the requirement states that 95% of each telescope (LOW and MID) shall be available for science observations for at least 95% of the time. The recently-issued RAM (Reliability, Availability, Maintainability) Allocation document allocates this requirement amongst the elements. Design choices and maintenance strategies should be developed to meet this allocation. We have previously asked all Consortia to submit draft RAM reports and FMECA (Failure Modes Effect and Criticality) reports 12 months before CDR (Critical Design Review); we are available to assist and advise with this on request.

An Operations Plan (OP) will be presented to the Board for formal approval at the same time as the Construction Proposal (January 2018 on current planning). The OP will contain a description of the operational model, the structure of the organisation (see previous bulletins), the staffing requirements, and the operations budget. In order to keep the Board fully informed, I will be presenting them with an estimate of the operations budget at every meeting beginning in April. Accordingly, I asked all Consortia to provide operational budget estimates by the end of January. This will be a recurring exercise prior to every Board meeting.

The 2016 work plan for the Operations Planning team in the Office includes, in addition to the topics discussed above, the following items: supporting the IGO negotiation process; developing selection processes for operational functions which are to be outsourced; researching and adopting best practice from other observatories; submitting the final...
Science
by Robert Braun, SKA Science Director

In February we’ve had another Low consultation meeting to discuss station layouts. The summary of this should be available in next couple of weeks for product distribution.

There are two major documents that the science team have drafted and distributed amongst the Science Working Group chairs for their comments and inputs.
- The first of these documents explores possible “generic surveys” that might form a portion of a key science project package. This allows the suggestion made at the Stockholm KSP workshop that concepts be explored of early definition of several surveys that could cover the broadest range of scientific applications.
- The other major document was a scientifically based error budget analysis of SKA1-low and SKA1-mid that attempts to quantify the combination of instrumental and calibration requirements needed to enable the very demanding scientific objectives of the SKA to be met.

The organisation of the SKA Science Meeting 2016 is progressing smoothly, with the set dates of 7-11th November in Goa, India, and so looking forward to a combined science meeting and KSP workshop. The first announcement has been sent to the Science Working Groups but please, don’t hesitate to spread the word to any people you think might be interested in attending. The website of the conference will be available shortly.

I would also like to take this opportunity to say farewell to a member of the science team, Jimi Green, who has taken up a post at the Parkes Observatory in Australia. It was a pleasure to work with Jimi and I and the team wish him all the success in the future.

For the rest of the science team:

Tyler Bourke attended the AAS in Florida in January, attending the ngVLA workshop and also assisting at the SKA booth, as well as also giving a colloquium on the SKA at University College London, also in January.

Evan Keane published an excellent paper on Fast Radio Bursts titled “The host galaxy of a fast radio burst” through Nature. The paper reports the discovery, with the Parkes radio telescope, of a fast radio burst, FRB 150418. It achieved international interest from most major news outlets.

Policy Development
by Simon Berry, SKA Director of Policy Development

In addition to us supporting a successful industry briefing day in Madrid, well attended by several dozen industry representatives of various scales, the last couple of months for our policy team has been dominated by work towards the second IGO negotiation meeting in Rome in late January. As is often the case in the project, advantage was taken of many people being in the same place to co-locate a number of meetings. In addition to the set-piece of the negotiation meeting itself, held in the beautiful surroundings of the Accademia dei Lincei, all of the supporting
working groups met, as well as meetings to discuss the arrangements for the project Hosting Agreements. The good progress of the first round of discussions continued, although all involved recognise that challenges remain in reaching agreement on all the key issues. Perhaps the most important (and challenging) of these are the requirements that will enable the various countries to sign the Convention document itself and the accompanying financial arrangements. The working group activities between sessions was intense leading into the January meetings, and is already ramping up again ready for the next round of negotiations in April. The next stop, by the time this bulletin is issued, will see the procurement and IPR working meeting in Beijing, and then a meeting of the StratCom, preparing a range of material for the forthcoming Board meeting.

SKA Board Matters and Administration

*by Colin Greenwood, SKA Head of Administration and Legal*

**SKA Governance**

On 18 February 2016, Dr Giampaolo Vettolani stepped down as Italy’s Nominated Representative (Member) and Voting Representative (Board); he was replaced in these posts by Prof. Nicolò D’Amico, President of Italy’s National Institute for Astrophysics (INAF). In addition, Dr Grazia Umana stepped down as Italy’s Second Representative (Member) and Science Representative (Board); she was replaced in these posts by Prof. Steven Tingay, who is seconded from Curtin University as director of ORA (INAF).

The 20th meeting of the SKA Board of Directors will be held in Pune on 4-6 April 2016. The main topics of discussion will be science, engineering, operations, policy and an update on the status on negotiations in Rome to establish the SKA as an Inter-Governmental Organisation. A science workshop will be held on the third day of the Board meeting.

**SKA HQ**

On 21 January 2016, SKA Office endorsed the Stage 1 (Preparation and Brief) Report which incorporated the SKA’s detailed building requirements into a preliminary design brief. In order to meet the SKA’s detailed requirements, the UK committed an additional £2.8M for construction of the SKA HQ building at Jodrell Bank Observatory; the total budget for the SKA HQ is now £16.5M. Work is progressing on Stage 2 (Concept Design) with a target of completing this stage by the end of March.

**Staff**

We are delighted to welcome the following new staff to the SKA Office:

- Theunis Kotze, who took up post as In House Legal Counsel on 11 January 2016;
- Luca Stringhetti, who took up post as Project Engineer on 1 February 2016; and
- Nick Rees, who took up post as Head of Computing & Software on 29 February 2016.

In addition, we are pleased to welcome Kevin Barriere, who joined the SKA Office on an internship on 1 February 2016. Kevin is supporting our work in power generation until July.

On 12 February, Jimi Green left his post as SKA Project Scientist to take up a position with CSIRO in Sydney, Australia. We wish to thank Jimi for his contributions to the SKA and wish him all the best for the future.

We will shortly be advertising the post of Head of Procurement on the SKA website.
Communications and Outreach
by William Garnier, SKA Communications and Outreach Manager

Communications Steering Committee
In these first two months of the year, a main focus was the preparatory work for the annual SKA Communications and Outreach Steering Committee (Comms SC) face-to-face meeting, which was held at SKA HQ on 23-25 February. Colleagues from Australia, Italy, the Netherlands, South Africa, Sweden and the UK attended what was considered by all a very productive and successful meeting. Meeting in person at least once a year is critical to reinforce links and build trust (key to the success of our endeavour, as we frequently have to deal with sensitive situations and issues that need to be resolved collectively), to discuss and share best practices, to ensure SKA-related national communications strategies are aligned with the global project’s (and similarly to ensure the global communications strategy supports national endeavours), and to discuss and elaborate long-term strategic directions for the global communication. The main objective of that particular meeting was to collectively revisit the project’s communications strategy, based on a thorough assessment of the current strategy, a better understanding of the national strategies, priorities and available resources communications-wise, an analysis of best practices, and an exploration of ways to improve the collaboration across the partnership to increase efficiency. The updated communications strategy will be presented for approval to the Board at the April meeting.

Releases
We coordinated and issued three important releases during the covered period.

H2020 grant: In a joint effort with several stakeholders (EU, SKA Australia/CSIRO, SKA South Africa), we issued on 22nd February a press release on the €5M H2020 grant received for funding Infrastructure Consortia activities in both telescope host countries. As expected, the media attention was quite low on this release, but surprisingly,
it became one of our most popular stories on social media, in particular Twitter, reaching an audience slightly different to the one that usually follows us, including EU and EC stakeholders. This is obviously very positive, and strongly participates in keeping the profile of the project very high amongst political spheres.

**Feb 2016 • 29 days**

**Top Tweet** earned 14.6K impressions

#SKAnews: the SKA has been awarded €5M from the European Union via @EU-H2020 funding! skatel.org/news_TbXYx plc.twitter.com/7QneaHr1g

The European Union's Research and Innovation programme Horizon 2020 to further advance some of its pre-construction activities.

7,385 people reached

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**SKA awarded €5M funding from the European Union**

The Square Kilometre Array (SKA) project has been awarded €5M from the European Union's Research and Innovation programme Horizon 2020 to further advance some of its pre-construction activities.

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**LIGO:** You probably all heard about the extraordinary announcement made by the LIGO team on 11\textsuperscript{th} February who made the first direct detection of gravitational waves. We wanted to congratulate the LIGO team for this great achievement and also took the opportunity to provide further details on where does SKA fit into the gravitational wave landscape and the synergies and complementarities between SKA, LIGO and other facilities in this domain.

**Fast Radio Burst (FRB):** As reported by Robert Braun, Evan Keane was lead author on a paper published in Nature on 24\textsuperscript{th} February, determining for the first time the origin of a FRB. We led an international press release on this exciting result, involving 12 institutes around the globe (Swinburne, CAASTRO, and CSIRO in Australia, University of Tokyo and NAOJ in Japan, Max Planck in Germany, University of Manchester in the UK, INAF in Italy, NRAO in the USA, etc.) and linked the discovery to the future capabilities of the SKA. The media coverage was absolutely spectacular. Overall some 300 articles mentioning the SKA were written within 3 days, with a total readership of millions. Examples of publications include Nature of course, the popular Bad astronomer blog, IFLS, New Scientist, the Guardian, Scientific American, Cosmos Magazine, BBC, Discovery news, Washington Post, Forbes and Fox news, as well as a very good CNN video (seen by over 100,000 people in 3h alone).
Our FRB result announcement was seen by over 9,000 people on Twitter and over 10,000 on Facebook.

LIGO Follow Up: Last week there was research published that described the follow up programme that commenced after the initial LIGO announcement. Researchers from the SKA community played an exciting part in the follow-up observations using a number of SKA pathfinder and precursor facilities and so you can read up more about this in our announcement on the website.

Other news
In February we were invited to give one of the keynote talks at the Archaeology & Astronomy workshop in Leiden, the Netherlands on the topic of Shared Sky, our indigenous astronomy art exhibition, given by Mathieu Isidro. This was an opportunity to promote the exhibition but more importantly to discuss further European engagement in the SKA with our contacts there, in support of the Organisation’s strategic objectives as set out by the Board.

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.