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ANZSCC RESPONSE TO SSAC REPORT

Dear John

I am writing to provide you with the Australia-New Zealand SKA Coordination Committee (ANZSCC) response to the SKA Site Advisory Committee (SSAC) Report, as discussed by the Board on 22 February 2012. This response is on behalf of both the Australian and New Zealand SKA Organisation members.

As previously indicated the ANZSCC has a number of significant concerns with the SSAC Report which are detailed in the attachment to this letter. In reviewing the SSAC Report, the ANZSCC sought the views of a number of senior radio astronomers, including those without any direct involvement in preparation of the ANZ bid. All have been asked to strictly observe the confidentiality of the Report.

As explained in more detail in the attached assessment, the ANZSCC considers there are critical shortcomings in the SSAC Report arising from several principal causes:

- Flawed processes leading to inadequate or incomplete information being presented to and considered by the SSAC;
- Poor quality inputs on measures like Figures of Merit (FoM) preventing the SSAC from being able to draw well-informed conclusions;
- The assessment compares two possible designs for the SKA rather than comparing the intrinsic site attributes;
- Inadequate consideration of differential risk factors between the two sites; and
- Lack of rigour and unsupported conclusions in connection with implementation and cost factors.

To summarise the concerns in the attached A-NZ response:

Radio-frequency interference (RFI) assessment (core site): It appears that neither the Expert Panel on RFI nor the SSAC had access to either the raw data or scientifically driven FoM analysis needed to discriminate between the two core sites on RFI. Based on an analysis of one available data set in common between the core sites from the SPDO RFI monitoring program, we demonstrate that differentiation is possible between the sites with, in this case, the Australian core site being more radio-quiet based on spectral occupancy and notably more radio-quiet based on RFI noise power levels.

RFI assessment (remote site): The conclusions drawn in the Report appear to be inconsistent with the evidence, and the advice of the Expert Panel. The Expert Panel indicated that the *measured* RFI showed that the monitored A-NZ remote sites were more radio-quiet than the monitored southern African sites. The Expert Panel further advised that an analysis based on transmitter databases (as was used in the Report) could not be used to robustly compare the expected RFI from the sites because the databases do not reflect emitted RFI, and the database content is not comparable between sites.

Given that radio quietness is arguably the most essential quality of the SKA site and the most heavily weighted selection criterion, it is disturbing that data sufficient to conduct a robust analysis was not considered.

Based on the date of the addendum to the Expert Panel's report, we understand that this data and advice may have been received by the SSAC after the site interviews and after the initial SSAC vote. This raises the possibility that the SSAC did not have the opportunity to adequately consider the Expert Panel advice. In any case the conclusions drawn by the Report based on analysis of the transmitter database are questionable. The result of the transmitter database analysis was the most significant driver of the relative ranking of the two sites in the RFI characteristic.

Array configuration: We are concerned that the process of collaborative configuration optimisation with SPDO never occurred and there was no opportunity provided for the A-NZ array configuration to be optimised for the FoM and weights used in the assessment, contrary to the agreed process and counter to the conditions necessary for a valid array performance comparison. It is particularly problematic that the A-NZ site bid team were unaware of the FoM and weights until the Report was released. This omission is compounded by the fact that the presumably also un-optimised southern African configuration is, for understandable reasons, naturally better aligned with the final FoM. In our view, there can only be a valid comparison if both configurations are specifically optimised for appropriate FoM.

We are also concerned that the process has not given any consideration to the potential for an array station to be located in New Zealand, as the A-NZ Motivated Alternative configuration was not considered. At the 8 December interview, the A-NZ team provided clarification on the proposed A-NZ configuration and offered to provide a configuration analysis of such a configuration. One of the strengths of A-NZ is the flexibility to place stations over the full 5100 km baseline from Murchison WA to the Southland in NZ, yet there appears to be no recognition of either the

flexibility of the possible array configuration or the value of the inclusion of NZ in the SSAC Report.

Further, we consider that there has been insufficient scientific input into the determination of configuration FoM, meaning that they do not reflect some fundamental scientific considerations relevant to assessing configurations. This includes both the EMI-risk at short baselines and the likely range of observing modes at long baselines. As such they do not provide a sound basis for site evaluation, as we explain in detail in the attachment.

Implementation and Cost Factors: We consider that the comparisons made in the Report are, to a significant extent, of design factors rather than of intrinsic site attributes. There were also deficiencies in process which meant that the Report was unable to make consistent comparisons.

Our analysis indicates that the differences between the bids on both capital and recurrent costs relating to power are largely explained by design factors and costing assumptions rather than site specific cost factors.

In relation to data transport, the Report appears to have based its analysis primarily on the assumption that a particular design choice (the co-location of the data processor and super computer) could be implemented in South Africa and not in Australia. The ANZSCC advises that this assumption is incorrect and is therefore not a valid criterion for ranking sites. We are also concerned that the Report has made questionable assumptions to justify the claim that connectivity to partner countries outside South Africa is a low level risk. We also note that while the SPDO-led determination of the initial A-NZ configuration was constrained to only include locations with predictable connectivity to existing data infrastructure of a suitable capacity, this was not offset by a reduction in the perceived risk in relation to communication costs.

An overarching concern is that the data and analysis used by the Report tend to understate or overlook a number of key technical risks for the project that we believe should be central to the Board's considerations. They include:

- Radio-frequency interference risk in the central area (and to a lesser extent remote sites) which has the potential to significantly erode the value of the investment by the partners over time. This includes the project risks posed by broadband electromagnetic interference (EMI) from farm activities, and the effectiveness of technical solutions to 'null' strong GSM signals;
- The costs and logistics in developing a broadband network for the SKA in the situation where one does not already exist; and
- Conclusions being reached on implementation and costs factors without a rigorous assessment of relevant factors, without a consideration of delivery and execution risks and relying on a number of assumptions without testing them. As currently written, the commentary in the Report does not support the conclusions in some cases.

In summary we believe that the issues we have raised above and in the attachment have a significant impact on the scoring and assessment contained in the SSAC Report and thus result in a Report that in its current form should not be the basis for any decision by the members. The Australian and New Zealand members of the Board thus consider the issues raised in the attached response require urgent and serious consideration by the Board.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Patricia Kelly', written in a cursive style.

Patricia Kelly
Chair
Australia-New Zealand SKA Co-ordination Committee
29 February 2012