

## **RAC report to the CASCA board, November 2006**

1) A RAC telecon was held Nov. 8, 2006. Present were: James di Francesco, Sean Dougherty, Martin Houde, Judith Irwin, Ingrid Stairs (Chair), Ken Tapping.

2) Old business: We appreciate the Board's support of our earlier request for HIA to begin planning for an assistant and eventual replacement for Ken Tapping on spectrum management. While it appears that HIA considers this not to be an urgent matter, we believe that it is. Ken's other NRC duties are putting time pressure on his ability to deal with spectrum management. We emphasize that this topic needs to remain a formal, budgeted project within NRC, especially in the context of SKA efforts. We feel that this issue should be re-opened with HIA, and we ask the Board for continued support.

3) Telescope and subcommittee reports:

a) Spectrum Management:

Band-by-band allocation studies have recently been completed, and there is a good working relationship with Industry Canada in Ottawa and Kelowna. The next World Radio Conference is in 2007. A major issue not on the agenda for this meeting is the planned extension of the allocated spectrum up to 3 THz (100 microns), but various groups are already trying to stake claims. The RAC will be consulting with OIRAC to draw up lists of spectral regions of interest to astronomers for communication to Industry Canada.

b) ELVA:

EVLA is going well in general, and is part of the "base program" in the NSF Senior Review (SR) document. The major Canadian contribution is of course the correlator. Some issues have led to small, but tolerable delays (about 6 months total). Recently, Breconridge assembled successfully the prototype baseline boards that were designed at HIA. This is the most complex PCB board ever made or designed in Canada. A mechanical board is being tested for strain from reasonably massive heat exchangers (boards will need to survive 10 kW per cabin) and for a novel correlator chip mount. An electrical version of this board is now under test at HIA. The overall picture for the correlator project is "rosy."

c) SKA:

The SKA is increasingly viewed as a legitimate worldwide project by the relevant funding agencies, eg NSF and the EU. The Europeans are gearing up to write a "preparatory phase" proposal for "Framework 7" funding. The SKA is part of the official roadmap of ESFRI (European Strategy Forum on Research Infrastructures) and FP7 funding could amount to ~1.7-2B euros.

A short-list of two sites (Western Australia and South Africa) has been drawn up. Demonstrator telescopes are planned for both sites (xNTD in Australia, KAT in South Africa). There are still many technical issues to be solved in both cases. Regardless of where the SKA is ultimately located, it is likely to be a staged project, first operating at ~ 0.3--3 GHz, with higher frequencies coming later and possibly with different technology. There is now an SKA reference design, consisting of small dishes with focal plane arrays to give large field of view. In light of this development, Canadian efforts on the LAR have been shelved to focus work on projects related to the reference design, such as low cost reflectors and beam-forming arrays.

In February, the HIA Advisory Committee reaffirmed the plan to develop a substantial Canadian role in the SKA via collaborations with the US, Europe and/or Australia. Brief synopses of the options follow:

US: NSF is interested in the long term (eg SR report) but has deferred a technical development proposal (TDP) from the US SKA consortium, asking them to resubmit a smaller proposal (less than \$20M over 5 years). Canada has been asked to participate in the TDP, and we certainly want to keep ties to the US consortium, especially given existing involvement in NRAO collaborations. We aim to reuse our current SKA activities towards this participation. A potential LAR-type high-frequency southern hemisphere telescope in collaboration with NAIC was deemed at the Canadian SKA board meeting in June not to be a high priority in terms of a realistic SKA demonstrator and this is not being pursued.

Europe: they currently have ~40M Euros that includes matching funds from national agencies for the SKA Design Study (SKADS). This is looking primarily at aperture arrays. There is also good prospect for obtaining large sums of money via Framework 7 (~1B euros). There was recently a meeting in Manchester (with Canadian, Australian and NSF participation) on a preliminary phase FP7 proposal which (ideally, from a European perspective) would define the SKA: developing governance, management, financial engineering, address political issues and provide a detailed design.

Australia: The focus is on the Extended New Technology Demonstrator (xNTD), currently planned to be 30 12-m reflectors with beam-forming arrays allowing 30 square degrees FOV. It will be located in Western

Australia and could well become a component of the SKA itself. There is broad Australian support for this, to high levels of government. The ATNF is investing a large fraction of its resources in this project. The Canadian SKA board decided this represented the best immediate opportunity for Canadian collaboration, and we are now pursuing an memorandum of understanding with the Australians for a collaboration that aims to extend the xNTD into MIRA (Mileura International Radio Array). While the collaboration details still need to be worked out, it is hoped the MOU between CSIRO and NRC will be signed in the near future to commit ~\$20M LRP money to the project (Note that Australia is aiming to spend ~\$100M over the same time period). The first face-to-face meeting with the Australians was held in Penticton in October, concurrent with the PDR of the composite molded dishes being developed at DRAO. The current xNTD timetable is aggressive, with a plan for 6 antennas in the WA desert in 2008. There will be an antenna meeting at ATNF in Dec. 2006; Canadian representatives are invited along with Australian industry representatives. Meanwhile the Canadian SKA Science Steering Committee is working on the MIRA science case, in consultation with the Australians. There will be a MIRA science meeting at ATNF in March, which a number of Canadian astronomers will be attending.

Canada is still in arrears on its SKA consortium dues; HIA is trying to arrange an MOU with the University of Calgary to resolve this issue.

d) Education/Outreach: The RAC presented a poster at the undergraduate session at the CASCA meeting in Calgary in June. The (sub)millimetre summer school at HIA in August was a big success, with participants from Canada, the US and Europe, and there were calls to make it a regular event. We need to start raising awareness within Canada about the upcoming EVLA capabilities, and will inquire about a possible EVLA session at the upcoming CASCA meeting.

e) JCMT:

The JCMT is out of its 6-month refurbishing, with the modifications necessary to accommodate SCUBA-2. ACSIS commissioning with receivers A and B occurred in Sept. and the telescope was available for normal use as of Oct. 1. Most observations happened with ACSIS/receiver A (B is not in good shape). ACSIS is mostly working well, but some modes (eg frequency switching) need work. Now is the (last) month of HARP-B commissioning. Receiver W has been modified to consist of B- and D-bands, with the B-band receiver designed to work with the SMA B-band receivers. SCUBA-2 should arrive in April 2007; the delay is due to a large competing order at the industrial contractor. There is a new associate director (Antonio Chrysostomou) at JCMT, who will deliver

the science program and interact with the legacy teams. There is a Nov. 24 proposal deadline for semester 07A, with HARP-B available. SCUBA-2 proposals are expected for 07B at the earliest. There was no significant damage to the telescope from the recent earthquake.

f) ALMA:

East Asia has now formally joined ALMA. Construction is ongoing. The first HIA band-3 receiver was shipped to Charlottesville Nov. 6 after testing. Band-6 receivers are also starting to be delivered. A plan is being developed for North American science planning, with Chris Carilli (NRAO) in charge. Canadian involvement in the science centre is being defined; there will be a meeting in Victoria after the Seattle AAS meeting to continue this discussion. Doug Johnstone has been nominated for the ALMA Science Advisory Committee; Chris Wilson will be an ex officio member and remains the Canadian project scientist. An ALMA board meeting in Spain in early November was likely to discuss the operations plan for the whole project. There will be wording in the operations plan to reflect Canadian participation, but there are no specifics yet. A science meeting would follow in Madrid. There is movement in both Europe and North America for a single Time Allocation Committee.

4) New telescope issues

a) Arecibo: The NSF Senior Review report has been released; among other things it recommends the closure of the Arecibo observatory past 2011 if Arecibo cannot find other sources of funding for about half (\$4M USD) of its \$8M astronomy (non-ionosphere, arguably non-radar) operations funding. Similar recommendations were given for the VLBA. While there are few Canadian users of the VLBA, Canada does have a sizable Arecibo user base. It is therefore reasonable to ask whether Canada could and should contribute to Arecibo operating costs in the post-2011 era; NAIC welcomes any such initiatives at this point in time. We would like to call the Board's attention to this possibility, and encourage its discussion and potential planning in the context of the next LRP. The RAC will be investigating funding opportunities.

b) CCAT (post-telecon email discussion): This is a proposed ~\$100M USD facility/proposal 25-m submillimetre telescope to be situated near ALMA and with the possibility to do lots of 200-micron observations. Cornell and Caltech are the leaders, and Canada (Fich, Halpern, Borys) is among several groups that have indicated interest. A goal is for Canada to buy in at 20%. The US universities are raising private funds for this, aiming for first light in 2012. The Canadian involvement would not be through NRC but through the consortium of

interested universities, and some of the fundraising may also target private donations. Given the uncertain nature of the funding and the short timescale, this program seems to be going ahead outside the current LRP. If it does proceed, it probably needs mention in the next LRP to demonstrate completeness/complementarity. It would be a good idea to discuss how/if the LRP could accommodate such new opportunities without the equivalent of a full mid-term review process.

5) Proposed merger with OIRAC: OIRAC had proposed that it merge with the RAC to form one committee addressing all ground-based astronomy issues. While the RAC heartily supports the multiwavelength sentiments that prompted this proposal, we are concerned that a combined committee would either be too large to be practicable or else have fewer people from each discipline and lack the expertise to cover both the scientific and technical issues of all ground-based telescopes in a timely and practical fashion. We find we already have plenty of work for the RAC to do in supporting and promoting Canadian radio astronomy and feel that a full committee is really needed to keep up that work. That said, there are certainly many areas in which our two committees have common interests, and we should make efforts to communicate about these, as necessary. For example, issues related to spectral pollution are now threatening IR astronomy (3a above). As a first step, then, Ken Tapping will be contacting OIRAC shortly about this common problem.