

Report of the CASCA Radio Astronomy Committee, Dec. 2007

A telecon was held on Nov. 15, 2007, with the full committee in attendance:

Sean Dougherty, DRAO
James Difrancesco, DAO
Ken Tapping, DRAO
Martin Houde, Western Ontario
Gil Holder, McGill
Ingrid Stairs, UBC (Chair)

1) Successor for Ken Tapping on spectrum management. One year ago, Ken informed Greg Fahlman and the then Head of DRAO that he would continue as spectrum manager no more than another two years. He has recently reminded Greg that a year has passed, but apparently no action has yet been taken to find a successor for him. We note the increasing urgency of this question, especially given that at least 6 months overlap will be necessary in order to train the new person, preferably someone from within DRAO. We ask the Board to encourage HIA to act on this matter as soon as possible.

2) Proposed merger with OIRAC. We understand that Paul Hickson and Gilles Joncas are evaluating the mandates of all CASCA committees, partly due to repeated requests from OIRAC to merge the OIRAC and RAC into one ground-based astronomy committee. We reiterate our arguments that the RAC serves a very useful reporting and advocacy role in its current form. The technologies involved in radio astronomy are considerably different from those in optical/IR, and it is difficult to imagine a committee dealing with both that did not either lack expertise or require considerably more work on the part of each of its members. While we recognize that ultimately this is the Board's decision, we would argue that a separate RAC serves a useful purpose in the Canadian community.

3) Reports

a) Spectrum Management: Ken Tapping

i. DRAO Protection Zone Project. This involves DRAO and the Industry Canada Offices in Kelowna, Vancouver and Ottawa. The objective is to better define the protection zone for DRAO and to provide better management tools for IC-Kelowna to use in issuing licences, and also to form the basis of a proposal to take to Geneva as a contribution to an international agreement on the definition and operation of Radio Quiet Zones for next generation radio observatories. This work involves making propagation path loss measurements and comparing them with theory, and researching discrepancies and the margins needed to reduce interference risks to

manageable levels. We made a report to the last URSI Meeting.

ii. Noise Floor Level. This one also involves DRAO and the Industry Canada Offices in Kelowna, Vancouver and Ottawa. The interference issues arising with single transmitters and services have been researched and legislated, and re-legislated for decades. However, with the numbers of transmitters ballooning, with many of these being either mobile or unlicensed devices, we need to consider what is happening to the noise floor. How are all these legal instruments contributing their whispers of unwanted emissions to produce unacceptable increases in the base noise level radio astronomers have to observe through. Moreover, what approaches can be made to dealing with it? The first stage of a pilot project has started. It consists of measuring the base noise level at DRAO in the 406-410 MHz band, which is shared with other services, and will be extended to another band, probably 1400-1427 MHz band, which is not shared.

iii. Infrared Astronomy Protection. The objective is a contribution to the next ITU Working Party 7D Meeting, to be held in Geneva in April, 2008, building on the Canadian document we got accepted during the last meeting. This one will include a list of observatories, bands of interest and the sort of observations being made.

b) JCMT: Martin Houde

SCUBA-2 is currently expected to arrive at the JCMT before the end of 2007. Acceptance tests are to soon take place in the UK (Dec. 2007). SCUBA-2 will first be delivered equipped with engineering grade arrays. Science grade arrays should arrive in time for commissioning later in 2008.

HARP/ACSIS is working fine for the most part, although HARP has one dead and two noisy pixels. There are no plans to fix these for the moment. All the observing modes are available, except for frequency switching and "two-beam" chopping.

ROVER, the line polarimeter, is still waiting to be commissioned. It is hoped that this will take place in 08B.

Rx W (345 GHz and 690 GHz dual-polarization receiver) is still experiencing a lot of problems both at 345 GHz and 690 GHz. It is hoped that it will soon be repaired and become available in March 2008.

Rx A (230 GHz) is working fine.

e-SMA testing at 345 GHz has recently produced interesting results, as fringes have recently been observed for the first time. A call

for proposals (science pilot programs) could be issued in the summer.

Secondary mirror. There was a recent two-week shutdown to fix a vibration problem. It has been back on-line since early November, and although its functioning has improved, it was still not perfect at the time of the meeting.

c) CCAT: All

Apparently little change was made in organization or financing at the meeting in July. The Canadian contingent has some CFI money available, but this will not be enough to contribute toward construction. The RAC would like to find a way to gauge community interest in this project; it will be necessary to have broad support if this telescope is to be part of the next LRP. For now, our understanding is that the Canadian contributors are continuing to seek private funding.

d) ALMA: James DiFrancesco

i) ALMA Personnel News

a) ALMA Director

Last week, the ALMA Board announced it was agreeing not to extend the appointment of Massimo Tarengi as ALMA Director beyond March 31, 2008. A search for a new Director will begin shortly.

b) ALMA Assembly, Integration and Verification Team

Joe McMullin, formerly the Head of Interferometry Data Analysis in Socorro, NM, (in charge of CASA development at NRAO) has become the lead of the ALMA AIV team in Chile. In addition, Lewis Knee, formerly the Group Leader of the Millimetre Astronomy Group at HIA, has taken a 3-year leave-of-absence to join the AIV team in Chile. Other members of the AIV team include Dick Sramek of NRAO and Masao Ishiguro of NAOJ.

c) Hiring

NRAO and ESO have begun the process for many hirings at ALMA. At present, ALMA-related announcements are out for an ALMA EPO Program Officer, two ALMA Technical Specialists for Front-End Integration, an ALMA Front-End Software Engineer, a CASA Assistant Scientist, a Lead Engineer for the AIV team, a Head of Technical Services at the ALMA Operations Support Facility, an ALMA Commissioning Scientist, an ALMA Assistant Scientist, and an ALMA Software Development Manager. See the NRAO website, under

Employment, or ESO website, under Recruitment, for more details.

ii) News of Interest

a) Science

NAASC held a workshop in Charlottesville, VA on "Transformational Science with ALMA: Through Disks to Stars and Planets" in late June, including 100+ attendees. Another NAASC workshop on Massive Star Formation is planned for late summer 2008. The proceedings for the first NAASC workshop, "From Z- Machines to ALMA: (Sub)Millimeter Spectroscopy of Galaxies) was published in late August.

b) Receiver Band / Front End Construction

In June, the ALMA Board approved contracts for the Band 9 receivers with NOVA, the European Front End Integration Center at RAL and the Water Vapor Radiometers. In addition, the Technical Evaluation for the design of the Santiago Central Office was approved by the Board.

acceptances of the 3rd, 5th, 6th, and 8th B7 cartridges and the 4th, 6th and 8th B9 cartridges were made during this period

Band 6 CDR was held in Charlottesville in early October

First complete ALMA Front End will be delivered to the OSF and not the ATF; assembly of the second FE was completed in July.

c) Antenna Test Facility (ATF)

Two antenna test correlator was shipped to ATF in late July with integration and testing in early August. ATF tests have been approved until June 2008. After that, the antennas will be shipped to Chile, and test work will resume there. In early October, stable fringes were achieved on Mercury at the ATF for 2 hours, using many key ALMA devices such as the test correlator, etc.

A call for volunteers has been made for help with ATF tests both in NM and Chile. Contact Deputy Project Scientist Alison Peck if interested in helping out. (HIA will be sending three persons from the MAG to contribute to this effort.)

d) ALMA Software

CASA, the ALMA (and EVLA) offline software reduction package, is having its beta release (version 0.5) on November 15. The

release is very limited with only a few members of various advisory committees having early access to the package. This limited release is being done intentionally to minimize the impact on the nascent CASA helpdesk system, which is just being started at the various ALMA Regional Centers.

e) Chile

Up-to-date images of ALMA construction happenings in Chile can be found at:

<http://www.alma.nrao.edu/almanews/almagallery/index.html>

About 475-500 people have been working at the ALMA site throughout this period

In April, first VertexRSI antenna pedestal assembly was delivered. The assembly of this antenna was completed by late-September, and the second VertexRSI antenna pedestal was delivered around the same time. In July, the first three Mitsubishi antennas were delivered to the OSF. After assembly was completed in September, some pointing tests were done. Work on these antennas and the various antenna "laydown areas" continues as of November. The first holography transmitter was installed in early September with testing of antennas is expected by the end of the year.

Design and engineering for the AOS antenna station layout, among other things was completed in June. Work on the Technical Facility Building also continued during this period. A contract to build the AOS Transporter Hanger was awarded in August

The first 130-ton, 28-wheel ALMA antenna transporter ("Otto") was completed in Germany and shipped to Chile. It is expected to arrive in late 2007.

The ALMA Annual External Review was held in mid-September in Santiago.

iv) Canadian ALMA News

a) Band 3

At least four Band 3 cartridges were delivered to NRAO by the Band 3 team at HIA over this period.

The Band 3 Critical Design Review was held in Victoria on September 27-28. The Review was passed with flying colours. Congratulations to Stephane Claude, Keith Yeung and the rest of the Band 3 team.

Some concern was raised by NRAO over shifts observed in Band 3 beam pointing in the cryostat. The problem was traced subsequently to loose screws in the beam measuring equipment and not to Band 3 construction.

b) Band 1

The ATRG-V is exploring the possibility of collaboration with the groups in Chile and Taiwan to build Band 1 receivers for ALMA, as part of its nascent Development programme. Early discussions with Chile have begun and a student from Taiwan spent some time at HIA last year. A summit in February 2008 at HIA is proposed to compare approaches for Band 1 development.

c) Observing with ALMA Workshop

Rene Plume of the University of Calgary has been planning an two-day "Observing with ALMA Workshop" that will focus on science exploitation of ALMA, by describing its capabilities, and providing hands-on practical demonstrations on planning, executing and reducing ALMA data. The plan was to hold this in Calgary, AB the week after CASCA 2008 (May 26 & 27). Given delays in the roll-out of user support for the ALMA offline software system and the likely delay of early science until late 2010/early 2011, Rene has been looking into delaying the Workshop by one year to position it better for Canadians. News about the delay should be available in the winter solstice issue of Cassiopeia. Work on the flyer explaining the general concepts of interferometry and the abilities of ALMA is continuing.

d) Canadian ALMA Operations

A new version of a Memorandum of Understanding between NRC-HIA and NRAO about the principles of collaboration in North American ALMA Operations was submitted to NRAO in early November. The 7.25% share of operations of which Canada is responsible will be in cash for Chilean operations and development and in kind for North American operations. The MOU included a proposal to have 1.5 PY for ALMA scientist support (with an emphasis on helpdesk activities), 0.5 PY for software support (for CASA software) and 1.0 PY for hardware support (Band 3 maintenance and repair) based at HIA. Negotiations between NRC and NRAO are expected to continue through the beginning of next year.

e) Canadian ALMA Project Manager

James Di Francesco of HIA has taken over the role of Canadian

ALMA Project Manager in the interim from Lewis Knee, effective November 1. In this role, James will oversee Canadian ALMA budgets for the software and hardware construction activities, work with NRAO to define Canadian operations support for ALMA, and assist Jim Hesser in ALMA Board activities.

f) ASAC/ANASAC

Canadian participation in these committees has changed over the last few months. Chris Wilson (McMaster) rotated off the ASAC and has been replaced by Doug Johnstone of HIA. Chris also rotated off the ANASAC and since Doug was already on ANASAC, Douglas Scott from UBC has been asked to join that committee as the second Canadian participant

g) CFI ALMA funding

The CFI grant to University of Calgary is ending in June 2008. Given delays in the overall project, the completion of software development funded by CFI has also been delayed. Russ Taylor and Rene Plume are exploring an extension of the current CFI grant for 14-months to use unspent funds to complete software development

e) EVLA: Sean Dougherty

The EVLA correlator project is anticipating the delivery of the prototype correlator (PTC) to the VLA in the Q3 2008. This prototype will be capable of handling 1.5 GHz of bandwidth from each polarization of 10 EVLA antennas, and will be emplaced for both on-the-sky testing of the hardware and for NRAO to initiate integration in to the EVLA system. The current plan is to then commission basic operating modes of this correlator, before shared-risk science. The capabilities of this 10-station system will be impressive in continuum observations, with at least a 1.43x performance gain over the full 27-station VLA system, and at some frequencies over 4x better e.g. 15 GHz (Ku band). When mapping the whole of the primary beam at L-band the speed gain over the VLA is as high as a factor of 6 for full polarization imaging. With such impressive relative performance, the science promise and potential impact of the EVLA-PTC system is immense. Furthermore, as the number of EVLA antennas, available bands and the correlator capability all increase, the EVLA performance will continue improve accordingly.

f) SKA/ASKAP: Sean Dougherty

Technology development in Canada aimed at the SKA continues. The

Composite Antenna Radio Telescope (CART) project at DRAO recently passed a major milestone, completing its first 10-m diameter composite reflector. The reflector was mounted on an ex-geodetic telescope mount salvaged from Yellowknife for both laser ranging measurement and holography tests conducted at Ku band. These tests determined a surface rms of 1 mm, capable of good performance at 2cm (15 GHz). It also demonstrated excellent RF performance. A group at Concordia University are exploring currently the characteristics of the resin cure process to enable more precise modelling of the reflector cure. A Mk2 version of the reflector is planned with a design optimized to improve reflector manufacturing process.

The PHased-Array Development (PHAD) project has now completed a 200-element array, complete with RF receiver chains for all elements, and a digital data acquisition system. Tests are now underway in an anechoic chamber, and it is planned to mount the array on the CART telescope for on-the-sky tests. In parallel, the astronomical response and performance of phased array feed systems is being studied through software simulations. This is aiming to address a number of fundamental issues, such as correlated noise, effective field-of-view, beam weight precision, pointing stability to name a few, that are all vital to understanding the capability of these feeds.

Further improvements on the room temperature Low-Noise Amplifiers (LNAs) developed at the University of Calgary are underway. In addition, very low power, broad band analog-to-digital converters are being developed at U of C. The promise of orders of magnitude lower power consumption make this an exciting new development. A U of C group is also developing novel beam-forming algorithms based on 3D filter design.

In the meantime, the ASKAP (Australia SKA Pathfinder) is forging ahead. A number of the engineers from HIA were in Sydney to discuss system design issues, related to phased-arrays, beam-formers and correlators. These were very constructive, leading to a broader discussion of a number of ASKAP design options. The ASKAP plan is to have six complete antenna systems in place in the West Australia desert by mid-2009 to enable testing of the various systems required for this SKA demonstrator array.

g) Education/Public Outreach: Gil Holder to take over this portfolio, with the first task being to find a more permanent home for the RAC web pages.