Report of the CASCA Ground-Based Astronomy Committee (GAC): May 2015

Membership and Activities

- Pauline Barmby, Western University (chair, 2012–15)
- John Hutchings, National Research Council (2009–15)
- Laura Parker, McMaster University (2012–15)
- Craig Heinke, University of Alberta (2013–16)
- Erik Rosolowsky, University of Alberta (2013–16)
- Gilles Joncas, Universite Laval (2014–17)
- Jon Willis, University of Victoria (2014–17)
- Kenneth Tapping, National Research Council (continuing member, spectrum management)

The GAC contributed a white paper[1] to the 2015 Long-Range Plan Mid-Term Review in which both present and future ground-based facilities were discussed. We monitored the use of ground-based telescopes by Canadian astronomers in collaboration with D. Crabtree (HIA). GAC members serve on related international committees, including the the Gemini Science and Technology Advisory Committee (Parker), Users Committee for Gemini (Barmby, Heinke) and the CFHT Scientific Advisory Council (Barmby).

Use of telescopes by Canadian astronomers

Monitoring the health of Canadian observational astronomy requires knowing what telescopes Canadian astronomers use and the scientific impact of those telescopes. Figure 1 shows that CFHT, Keck, and the VLT each contributed to about 250 Canadian (meaning, at least one author Canadian) papers from 2008–2012, with Gemini about 160 and JCMT about 120. All other ground-based telescopes were below 100 papers.[2] CFHT also scored in the top quartile in the total number of papers per telescope (Figure 2); Gemini was in the top half. Impact per paper (number of citations compared to average; Figure 3) is a more complicated measure, due to citation differences between fields, but CFHT and Gemini also score well on this measure compared to other optical telescopes.

[1] `http://casca.ca/wp-content/uploads/2014/09/GAC_WP_MTR.pdf`

[2] Data for NRAO facilities including the VLA and VLBA are still being compiled and are not included here.

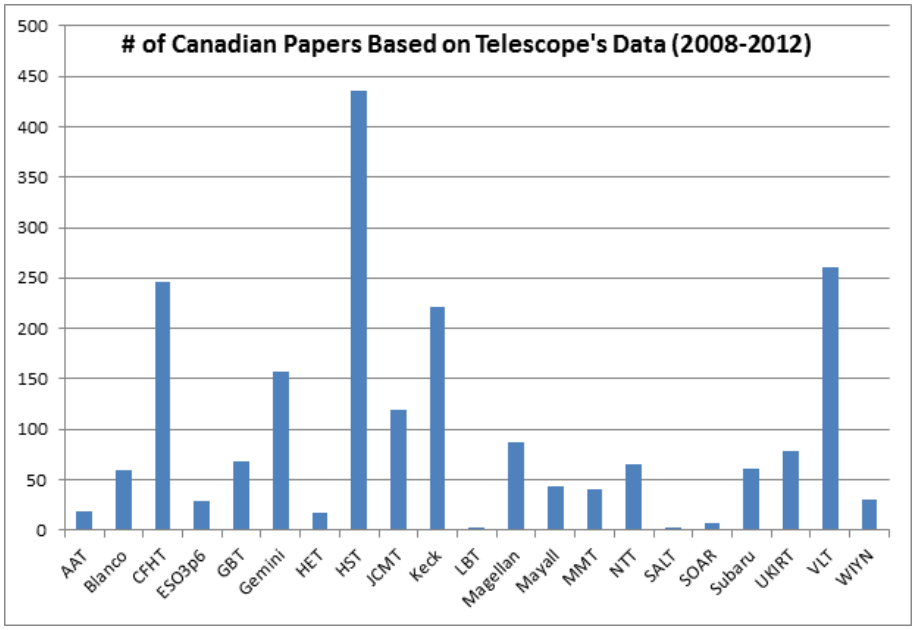

Figure 1: Number of papers that use data from a telescope and include at least one Canadian co-author. Courtesy D. Crabtree.

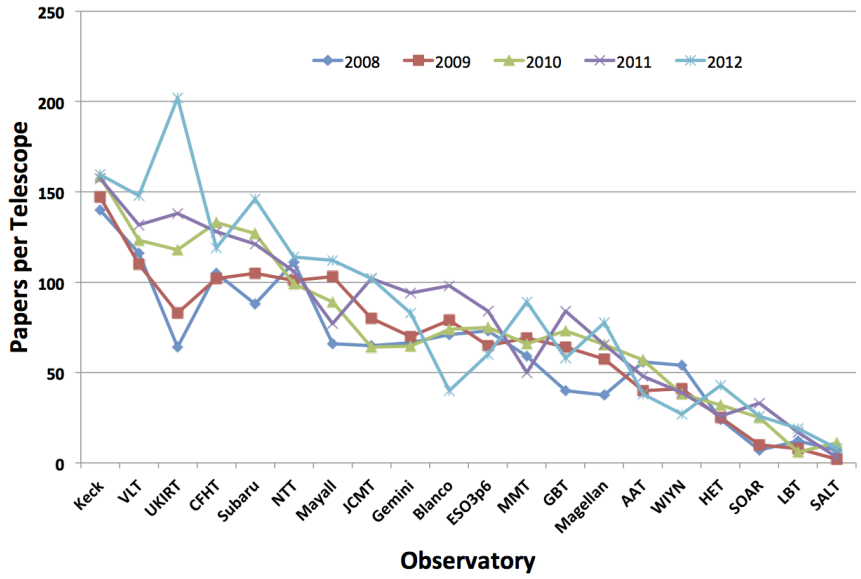

Figure 2: Papers per telescope (i.e., Keck numbers divided by 2 and VLT by 4) for worldwide observatories. Courtesy D. Crabtree.

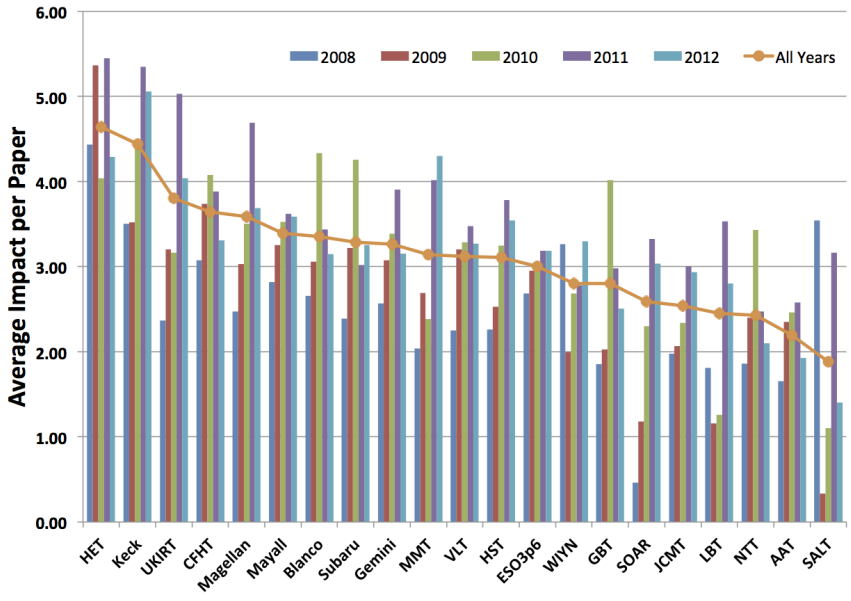

Figure 3: Impact per paper from different telescopes; impact is defined as the number of citations to a paper divided by the citations to the median AJ paper of the same year. Courtesy D. Crabtree.

CanTAC

Canadian proposals for CFHT, Gemini, and, until recently, JCMT, are evaluated by CanTAC. It is planned that CanTAC will review Canadian AstroSAT proposals after that satellite launches. A recent change is that JCMT proposals will now be evaluated by a single international TAC. Both Gemini and CFHT have separate TACs for large programs; CanTAC is not involved in evaluating these. GAC members feel that overall, CanTAC has served the community well; compared to other TACs, it is highly functional. But as Canada's role in international observatories changes, CanTAC's role may need to change as well; a review of CanTACs role and how it is carried out may be appropriate in the next few years.

Facility reports

Future projects (J. Hutchings)

TMT. Our future took a giant step forward with the announcement that we are funded for TMT. Among the details are the fact that the amount is less than the full request. The missing amount is the final dome construction that takes place in Hawaii. NRC is funded to do the NFARIOS instrument. This means that the TIO need to revise their construction plan accordingly, and also that our share will be some 15% instead of the $\sim$ 19% planned. Many details remain to be confirmed but the news gives us all encouragement to pursue our other plans now. We acknowledge the efforts

by many that led to the funding approval for our share of TMT.

At the time of this report, there are some very public protests happening, triggered by TMT construction, but with implications for the entire suite of Mauna Kea telescopes and thus for Canadian astronomers. The GAC urges the Board to continue to monitor the situation.

SKA. Moving forward with SKA is now a significant challenge. ACURA has set up an advisory committee, led by Bryan Gaensler, to steer their course and interact with the community. Current issues include the effects of the re-baselining, Canada's potential contributions, Canadian scientific interests, and the timeline of funding for SKA1. Reports have been generated that illustrate the expected interest in SKA by the Canadian community. The project itself has some ongoing issues, including the nature of the organization.

MSE. The MSE project office at CFHT is coordinating an international effort to formulate a detailed design over the next few years. The international science team is also working actively, and will convene in Hawaii in June. The funding and schedule remain to be defined, but potentially still have an impact on CFHT long term observing commitments. The future of UKIRT remains a possible way to address some of this planning.

DAO (D. Bohlender)

The DAO telescopes are scheduled on a quarterly basis and were oversubscribed in calendar year 2014. The 1.2-m and McKellar spectrograph received 37 proposals (20 from Canadian PIs) requesting 447 nights for a subscription rate of 125% over the year. Robotic operation was scheduled on 64% of the available nights. The 1.8-m Plaskett telescope received 35 proposals (30 from Canadian PIs) for 398 nights or an oversubscription rate of 112%. Spectroscopy continues to be the most popular mode for the 1.8-m facility with 48% of the available nights used for spectroscopic programs, 31% for direct imaging and the remaining 21% for spectropolarimetry. More than 9200 imaging, 6100 spectroscopic, and 2200 spectropolarimetric science observations were obtained with the 1.8-m telescope in 2014 and more than 3600 new science spectra were acquired with the 1.2-m telescope.

The telescopes contributed to 12 refereed publications, 8 conference papers, and 9 circulars published in 2014 (ADS/Google Scholar). The refereed and conference papers were equally distributed between the two telescopes. 2015 shows promise for another productive year with 6 refereed papers appearing in the first 3 months of the year.

In July 2014 a new thin, backside-illuminated, 2048 x 512 pixel E2V detector was commissioned for dedicated use on the 1.8-m Cassegrain spectrograph. Progress continues to be made on automation of the 1.8-m telescope and we expect to start replacing cracked wheels of the 1.8-m dome before the end of 2015.

There are now almost 250,000 DAO CCD spectra and images in the DAO archive available at the CADC; almost 90,000 of these are science observations. In a continuing effort to digitize the rich collection of archival DAO photographic spectra, almost 3,300 high-quality plates have now been carefully scanned and transformed to FITS format and are also available through CADC services.

DRAO (A. Gray)

The Dominion Radio Astrophysical Observatory (DRAO) operates several observing facilities: the Synthesis Telescope (ST), a 7-element aperture synthesis array; the single-antenna John A. Galt Telescope (formerly known as the 26-m Telescope); and the 10.7cm solar radio flux monitor. Operations of all telescopes were impacted in 2014 by NRC's response to the cyber-intrusion event, with both Synthesis and Galt telescopes being unavailable for approximately 4 months (late-July through November).

The ST is capable of simultaneous observations at 1420 MHz and 408 MHz. It offers wide-field continuum polarimetry and neutral hydrogen spectroscopy at 1420MHz ($1'$ resolution over a 2-degree field), and continuum total intensity only at 408 MHz ($3'$ resolution over a 6-degree field). Telescope time is allocated via a competitive, peer-reviewed process, with deadlines at both equinoxes each year. Both short-term and long-term proposals are undertaken, with past projects ranging from targets of opportunity to surveys aimed at wide sky coverage or deep integrations. Although best-known for its work on Galactic ISM, in particular the Canadian Galactic Plane Survey (CGPS), the ST is also used for targets from solar system to nearby galaxies.

During 2014 a dedication ceremony was held to rename the 26-m Telescope as the "John A. Galt Telescope", in honour of Dr. John Alexander Galt (1925–2012), the first employee of DRAO and its director from 1963 until 1980, who remained closely associated with the telescope until the mid-2000s. He was part of the group that received a Rumford Prize in 1971 for pioneering VLBI experiments in 1967 that used this telescope, for which it also received an IEEE Milestone Award in 2010. A mini-symposium was held at DRAO in conjunction with the dedication to highlight John's career and the science in which he was interested, from Zeeman splitting to spectral-line observing of comets.

Fittingly, the John A. Galt Telescope is currently being prepared for a survey to study Zeeman splitting in hydrogen. It is also used to support the CHIME pathfinder experiment being conducted at DRAO by a consortium led by UBC, and to provide short spacing information for ST HI observations. The telescope is open to external users via peer-reviewed proposals, but there are no proposal deadlines for this instrument, and the dominant use is long-term projects. The telescope has been used to observe from 408 MHz to 6 GHz, but the majority of experiments focus on neutral hydrogen spectroscopy at 1.4GHz.

Solar radio monitoring is also flourishing at DRAO, with the long-running Solar Radio Flux Monitor experiment— operated in partnership with NRCan—continuing to provide thrice-daily measurements of the 10.7 cm radio flux to the space environment community. A "next-generation" instrument is under construction to provide measurements at additional wavelengths as well as high time-resolution spectrometry. It is currently being commissioned, with tracking capability and basic data recording implemented at the time of writing. It is expected to be fully operational by the end of 2015. The solar monitors are not available for external use, as they are dedicated, single-purpose instruments.

CHIME (M. Dobbs)

The CHIME project is in full swing. The CHIME pathfinder telescope, consisting of 1/5 the collecting area of full CHIME and 256 electronics channels, is fully constructed and being used now to prototype calibration and analysis algorithms as well as hardware validation. Already the correlator for the pathfinder is one of the worlds largest operating radio correlators (only ALMA is larger). Ground was broken for the full CHIME telescope (2048 channels, four 20 m $\times$100 m cylinders) in early 2015. Fabrication of the custom analog and digital electronics for full CHIME will begin soon, with the target of having the instrument on the sky in early 2016. A Fast Radio Burst backend for full CHIME was proposed to CFI, with results not yet released. The FRB backend extends the science reach of CHIME and brings on a larger team.

CHIME has garnered recognition outside of academia as well: the Pathfinder telescope structure won the 2014 Annual Thompson Okanagan Kootenay Commercial Building Award (Oct 2014) and CHIME was also highlighted in the 2015 Canadian Federal Budget (page 103). The design, construction, commissioning and analysis of CHIME includes a large team of trainees: the first CHIME-trained graduate students have received their degrees and the first two CHIME-trained postdocs have gone on to faculty positions. The staff at DRAO has been enormously helpful in all aspects of realizing the CHIME project, and the project wishes to emphasize to CASCA the importance of the DRAO staff and site for radio astronomy.

NRAO (C. Heinke)

Access to the NRAO facilities JVLA, GBT and VLBA for Canadians through NRAOs open skies policy remains unchanged from the last GAC report. NSF continues to seek partnerships with universities to pay at least half of GBTs $8 million operating cost, in exchange for guaranteed time. So far, the NSF has obtained a two-year, $1 million investment from West Virginia Univ. for GBT time, but no permanent funding has been arranged. The USNO and China are each contributing to VLBA, in exchange for guaranteed time. The largest change from last year is the preparation of an NRAO VLA Sky Survey proposal, which has just concluded (March 2015) a community input phase. This is planned to take 20% of the PI time over seven years (in B and A configurations), including an All-Sky and a Deep component. The proposed survey science focuses on imaging galaxies (AGN and star-forming galaxies) through time and space, large-scale structure, radio transients, polarization studies of magnetic fields (of distant galaxies, and the local ISM), and obscured Galactic source populations.[3] NRAO is also actively exploring the science and technical cases for the Next Generation VLA (ngVLA), which could include expansions in baseline length, collecting area and frequency coverage by up to a factor of 10.

ALMA (E. Rosolowsky)

ALMA is in Cycle 2 of its Early Science operations and has just completed the Call for Proposals for Cycle 3. In the response to the Cycle 3 Call, the number of proposals received rose again to 1592

[3] https://safe.nrao.edu/wiki/pub/JVLA/VLASS/VLASS_final.pdf

from 1381. Seventy-nine Canadian astronomers participated as PIs or Co-Is in Cycle 3, roughly the same as for Cycle 2 (76). The operations of the array are settling into an annual cycle that includes fixed time for proposal calls, maintenance and upgrades. Data from Cycle 2 continue to be delivered and the observatory anticipates that there will not be a significant shortfall in the delivered data with respect to the time allocated in the review process. The past year also saw impressive new results coming from a successful long baseline campaign during science verification, showcasing ALMA's impressive resolution for the first time.

While the construction phase of the telescope has ended, the capabilities are still being built out to specification. The recent call for proposals only included 36 of the final 50 12-m antennas. The remainder are still undergoing commissioning and outfitting and will be integrated into the array over the next year. Additional capabilities still need to be fully deployed, like routine observations at large baselines, target of opportunity responses, and polarization measurements. It is anticipated that Cycle 4 will represent the first cycle of regular science operations. ALMA data have been used in 221 papers to-date from Early Science data. Canadian-affiliated astronomers were on 11 ALMA papers in 2014 and 7 papers to-date in 2015. No major issues face Canadian participation in ALMA in the short term, but the long-term productivity of the telescope relies upon improving access to the data; improvements to the archive are expected to facilitate this.

JCMT (P. Barmby)

Ownership of the JCMT has transferred from the UKs STFC to the University of Hawaii, and operations by the East Asian Observatory (EAO) began March 1, 2015. Many of the JCMT staff who were associated with the JAC have transferred to the new organization. Canada and the UK continue to participate in the JCMT via university consortia; the JCMT archive at CADC is also still open and ingesting new data. The Canadian participation is funded until January 2017. The semester 15B (1 August 2015 – 31 Jan 2016) proposal period is now open, with a deadline of May 15. PI eligibility for these proposals is limited to Canadians associated with university consortium members (McMaster, Alberta, Lethbridge, Western, Saint Marys, Waterloo). A call for survey proposals is planned to come out May 15 with deadline TBD but approximately July 31; any Canadian can participate in the surveys.

CCAT (P. Barmby)

The multi-institutional CFI proposal to fund the Canadian share of CCAT construction has been reviewed but the outcome has not been released at time this report was written. The CFI proposal is a cornerstone of Canadian CCAT participation; without it, a new approach will be needed. Disappointing developments since the last GAC report are the US NSFs decision not to fund the project and the withdrawal of Caltech as a partner. However, letters of interest have been received from the Max-Planck-Institut fuer Radioastronomie and the National Astronomical Observatory of Japan. ESO has also expressed a strong interest in joining CCAT and there is a new potential foreign partner with both donor and public support. The CCAT partners are currently deciding on a way forward.

CFHT (J. Willis)

CFHT operations continue to be very efficient and deliver high quality scientific data with the three facility instruments WIRCam, Megacam and ESPaDOnS. The most significant observatory development during the past year has been the successful completion of the dome venting project for which the results of an initial assessment indicate an improvement of 0.1 arcseconds in the median image quality - exactly as predicted. Official congratulations are richly deserved for an innovative project which has been implemented with considerable skill.

New instrument development at the CFHT is currently focussed on the GRACES, Sitelle and SPIRou facilities, which we discuss in turn. GRACES, the fibre-feed linking the Gemini-North observatory to CFHT/ESPaDOnS, has been completed and was offered to the community in the 2015B Gemini Call for Proposals. This marks a significant technical success, although the GAC awaits the results of the initial observing programs before judging the scientific impact of this new capability. Sitelle has not yet been delivered to CFHT. Although a press release of April 10th presents the project to be in its final stages, these continued delays are troubling. The project's status as a visitor instrument (as opposed to a facility instrument) limits any strategic impact on the observatory which these delays might have. However, they remain frustrating for an instrument which holds much scientific promise if delivered in a timely fashion. The SPIRou instrument is undergoing its mid-term review in April 2015, the results of which are not yet known. It therefore seems premature at this stage to comment in detail.

The four current large programs underway at the observatory comprise MaTYSSE and BinaMIcS (both using ESPaDOnS), plus MATLAS and OSSOS (both using Megacam). There are no significant concerns regarding the execution of these programs, which are due to terminate at the end of 2016B.

Questions concerning the medium- to long-term future of the CFHT presently centre upon the issue of future very large observing programs and on the future redevelopment of the observatory within the vision outlined by the Maunakea Spectroscopic Explorer (MSE) project. At its November 2014 meeting the CFHT SAC recommended expanding the current large programs (accounting for between 30-40%) of Canadian and French agency time to upwards of 60% of the time available to each agency, starting in 2017A (when the current LPs are complete). The GAC considers this a sensible response to the challenge of maintaining the scientific competitiveness of the CFHT. Looking further ahead, the past year has seen the establishment of a MSE project office with interim project manager, scientist and engineer. The office is funded for up 4 years and has been tasked with developing a fully costed construction and operation plan to support the scientific aims of the new observatory. The group of interested partners continues to grow, with both China and India signing collaborative agreements with MSE in 2014. Furthermore, a major science planning meeting will be held on the Big Island in July 2015 and promises to continue the scientific momentum gained thus far.

An associated issue concerns the future operation of the neighbouring UKIRT facility on Mauna Kea. UKIRT is currently operated under a short-term contract jointly awarded to the University of Arizona and Lockheed-Martin. At the expiry of this contract it is likely that a new operating organization will be sought. Should CFHT participate and succeed in any bid to run UKIRT, the GAC recognises that this may offer an important observing facility to Canadian astronomers

bridging any period of CFH telescope deconstruction and the building of a new facility. The GAC therefore supports endeavours by CFHT to plan for a bid to operate UKIRT.

Overall, the GAC continues to be very enthusiastic about the promise of MSE and repeats its recommendation given to the 2015 MTR panel that MSE construction should take precedence over other CFHT activities: if MSE is funded and ready-to-go, construction should not be delayed.

Gemini (L. Parker)

The Gemini Science and Technology Advisory Committee (STAC) meets May 7–8 and will publish a report soon thereafter.

The instruments on Gemini have generally been working well. GPI is now in regular operations and FLAMINGOS-2 is working reliably in imaging and long-slit modes, with MOS commissioning planned for 2016A. GMOS on Gemini North and South remain Canadas most requested instruments, and are being used extensively by the large and long programs.

In 2015B Canada's oversubscription rate (for regular PI time), particularly in the south, was lower than typical. This is most likely due to new proposal modes (large and long programs and fast turnaround programs) being available.

Plans for future instruments are progressing. GHOST (a high resolution optical spectrograph) started the critical design stage this year and is due to be commissioned in 2018. The development plan for the next Gemini instrument, Gen4#3, is also well underway. In late 2014 there was a request for proposals for feasibility studies for the next Gemini instrument. Four of these proposals were funded and the feasibility studies will be completed later this year. The feasibility studies will then inform the request for proposal process for the Gen4#3 instrument.