

## **REPORT OF THE GAC (September 2011 – May 2012)**

### **MEMBERS**

Tim Davidge (CHAIR) (2009-13) HIA / NRC  
Jo-Anne Brown (2009-12) University of Calgary  
John Hutchings (2009-13) HIA / NRC  
Roland Kothes (2009-13) DRAO  
Kristine Spekkens (2011-14) Royal Military College  
Kenneth Tapping DRAO, continuing member, spectrum management  
Kim Venn (2009-12) University of Victoria  
Ludo van Waerbeke (2011-14) University of British Columbia  
Tracy Webb (2009-12) McGill University

### **DISCUSSIONS**

From September 2011 to May 2012 the GAC was canvassed on the following issues:

- 1) LSST data access (November 2011). Some members of the Canadian community received an email from Tony Tyson that discussed how Canadian astronomers might gain access to LSST data. A copy of this message was circulated to the GAC for comment.
- 2) Gemini and NOAO (December 2011). In late 2011 AURA floated the concept of the Gemini Observaory being operated as an NOAO facility. At the request of Greg Fahlman, the GAC was canvassed about this issue. Given that Tim Davidge's position at the Canadian Gemini Office placed him in a conflict of interest, this request was channeled through Brian McNamara. The Canadian Gemini Science Advisory Committee was also contacted for opinion. There was broad consensus that the operational model suggested by AURA would not be beneficial to Canada.
- 3) SKA and role of GAC (January 2012). Tim Davidge was contacted in early 2012 with a suggestion that the GAC could serve as the Canadian Science Advisory Committee for the SKA. The GAC was queried, and there was broad agreement that the GAC should not serve in this capacity - the GAC is intended to provide a broad perspective of all Canadian ground-based facilities, and it would not be feasible to serve as a SAC for all Canadian initiatives. One outcome of this discussion was the suggestion that a Canadian SKA SAC be formed.
- 4) JCMT. The Future of sub-mm Astronomy Workshop was held early in 2012, and one recommendation was that Canada stay in JCMT. The GAC was queried for comments on this issue, and there were no responses.
- 5) The nature of GHOS (May 2012). At the request of Alan McConnachie, the GAC was canvassed about potential Canadian interest in design options examined for a high resolution spectrograph on Gemini. There was only one response, with no clear opinion stated.

## REPORT ON FACILITIES

*\*\*\* Current National Facilities \*\*\**

ALMA (Contribution by Tim Davidge and James Di Francesco)

Alma operations with a limited number of telescopes started in September 2011, and work continues to add telescopes to the arrays. The keen interest of the Canadian community to use ALMA was demonstrated in the response to the Call for Proposals for Cycle 0. There were 24 Canadian-led proposals for ALMA Cycle 0, and 3 of these were allocated time. It should be emphasised that this tally does not include proposals with non-Canadian PIs and Canadian co-Is. The facility is currently obtaining data for Cycle 0 programs, and this is expected to continue until the end of 2012. A Call for Proposals for Cycle 1 is expected by end of May. Cycle 1 offers enhanced capabilities with respect to Cycle 0, most notably with 32 12 metre antennas in the main array.

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CFHT (Contribution by John Blakeslee)

CFHT's immediate challenges are (1) to understand the reason for the recent catastrophic failure of dome shutter gear box mechanisms, (2) to make the dome shutter operational as soon as possible, and (3) to ensure that the failure does not occur again. The telescope is expected to remain closed until mid-June. Other high-level priorities at CFHT include improvements to dome venting, TCS upgrades, OPERA reduction pipeline work, and the development of next generation instruments. SITELLE development has been proceeding steadily, and this instrument is on track for delivery to CFHT in late 2013. SPIROU faces more challenges, and last December it was decided to delay the preliminary design review from May to October 2012, to give time for several outstanding issues in the instrument design to be resolved. The Imaka project recently adopted a multi-phase development schedule, beginning with Phase A on-sky tests at the UH 88 inch, and - in a later phase - the construction of a demonstrator instrument with full GLAO correction over a 10' field of view. Finally, a workshop will be held in mid-2013 to discuss the long-term future of the CFHT.

Canadian interest in the CFHT remains consistent. During the past few years, CanTAC typically received 25 - 30 CFHT proposals per semester, with an oversubscription rate between 1.5 and 2.0.

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DRAO (contribution by Roland Kothes)

Synthesis Telescope: The ST continues to be fully utilized for scientific observing. The ST operates without deadlines and generally deals with longer-term projects. Telescope time is mainly allocated via an externally peer-reviewed process, with proposals assessed as they are received. A typical observing time is a little over a week per field, or around 50 fields per year. The oversubscription rate, based on the number of fields observed compared with the number of fields requested, was ~190% for 2011. The majority of targets are Galactic, although a modest number are extragalactic. The largest project currently being observed on the ST is a 59-field proposal studying the Galactic Anti-centre.

26-meter Telescope: For the past several years the 26MT was largely devoted to GMIMS observing, and this project is nearing completion. Work was done to recommission the HI spectrometer facility, which had lain idle since GMIMS began, but is needed for short-spacing observing in support

of ST projects, and for planned post-GMIMS work on the next large project - extragalactic Zeeman splitting. A new cryogenic focus box is being constructed for the Zeeman project, and is expected to be ready for use in August 2012. The Zeeman project is expected to dominate 26MT usage for at least 2 years.

In late February 2012 the telescope suffered an accident that caused damage to the reflector back structure, so the 26MT has been in maintenance status since then. An engineering assessment indicates that the damage is not serious. Before re-starting observations, upgrades to control systems are being implemented to ensure that this sort of accident is not repeated. A resumption of observing is not expected before July, with final repair work completed before September.

**Solar Radio Flux Monitor:** The SRFM continues to provide thrice daily calibrated flux measurements of the Sun at 10.7cm wavelength using two redundant systems ('FM1' and 'FM2') that ensure continuous coverage. These measurements are distributed freely via the spaceweather.ca website, in a collaborative effort between NRC, NRCan, and CSA.

In the past year the pointing algorithm controlling FM1 has been upgraded to address both diurnal (HA dependent) and annual (Dec dependent) variations between the fluxes measured using FM1 and FM2. New encoders were fitted to FM1, and a similar upgrade is planned for FM2 in the coming year.

Operations of the Next-Generation Solar Flux Monitor (NGSFM) are expected to start in 2013. This will record fluxes at multiple wavelengths, and feed a high-resolution spectrometer.

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DAO (contribution by Dmitry Monin and David Bohlender)

**General:** The DAOSA (DAO Science Archive) is now available on-line. It enables the electronic transfer, archiving and metadata ingestion of DAO CCD and digitized PDS FITS data, and provides an interface for users to retrieve data from the archive. The DAO Spectroscopic Plate Archive was also released in 2011. At present, this database contains more than 1000 datasets. Finally, more sensitive dome cameras and fish-eye lenses have been installed in both telescope domes to improve remote monitoring capabilities.

**1.2 meter:** A more sensitive photon counting head has been acquired and tested to replace the existing Exposure Meter. This will provide better guiding on faint targets. Improvements have also been made to facilitate remote observing. Cloud detection software has been developed for the sky camera that monitors sky conditions (cloud cover, sky brightness, etc.). This software will make it possible to determine automatically when sky conditions are suitable to open the dome on marginal nights, or re-open after having previously closed because of precipitation. The visual eye piece used for viewing the coudé slit has been replaced with a digital camera.

**1.8 meter:** A new 2K × 4K E2V CCD and controller have been purchased for the Newtonian imager. This will double the FOV of the camera. Non-sidereal tracking has also been implemented. This mode of operation allows objects moving at non-sidereal rates such as comets, asteroids or Earth satellites to be tracked.

The popularity of the remote observing capability of the 1.2 meter is reflected in the observing statistics. During 2011 there were 42 proposals to use this telescope, and the oversubscription rate was

1.5. In contrast, there were 28 proposals to use the 1.8 meter, with a subscription rate of 0.9. The subscription rate for the 1.8 meter is the lowest in a decade, and it is believed to be due to a lack of NSERC funds for some long-term users coupled with health issues for a contract observer. Plans are underway to investigate automating the 1.8-m telescope in the coming year.

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#### GEMINI (Contribution by Tim Davidge)

The past year has seen the continued development of new capabilities, and improvements to older instruments. On Gemini South, the commissioning of the multi-conjugate AO system (GEMS) continued throughout the semester, and a major milestone was a demonstration of the system's ability to deliver spatially uniform moderately high Strehl images over a 90 arcsec FOV. It is hoped that GEMS will be available for PI science in 2013.

The Gemini Planetary Imager (GPI) is undergoing integration and testing. The current schedule has the instrument being shipped to Gemini South in late 2012/early 2013. The GPI campaign science team contains a number of Canadian scientists.

A significant set-back was the fracturing of the main entrance optic for Flamingos 2, which is a cryogenic multi-object imaging spectrograph. The element failed near the end of instrument commissioning. The lens mounts in the instrument are being re-designed, and replacement optics have been ordered. The current schedule is for F2 to be back on sky in late 2012B, with PI science starting in 2013.

A long awaited development was the implementation of improved CCDs for GMOS on Gemini North. These detectors have much more uniform quantum efficiency across from the near-ultraviolet to near-infrared. These new devices are a bridge towards the deployment of CCDs with even more uniform quantum efficiency coverage. Plans are underway to upgrade the CCDs on the Gemini South GMOS.

One of the next generation instruments for Gemini is the Gemini High Resolution Optical Spectrograph (GHOS). A competition for design studies was held last year, and a Canadian team, based at DAO, was one of three successful applicants. The initial designs will be assessed later this year, and recommendations will be made for more detailed design efforts.

Gemini will host a science/users meeting in July 2012. This will be an opportunity for Canadian astronomers to play an active role in setting future priorities for Gemini. Pauline Barmby is in charge of the SOC.

Canadian interest in observing with the Gemini telescopes remains more-or-less consistent, although there has been a recent upswing in interest in Gemini South. On Gemini North, CanTAC typically receives ~15 proposals, with an oversubscription rate of between 2 and 3. Interest in Gemini South has historically been more subdued, with 15 proposals per semester and an oversubscription rate near unity. However, for the most recent semester the oversubscription rate jumped to ~2. It is anticipated that the implementation of new instruments on Gemini South will lead to oversubscription rates that are more in line with those seen on Gemini North.

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#### JCMT (Contribution by Tim Davidge)

SCUBA-2 has now been available for use on the sky for over six months. However, two significant issues for the JCMT are (1) the departure of the that Netherlands from the JCMT consortium at the end of March 2013 and (2) the cessation of Canadian funding in September 2014. A workshop dealing with the future of sub-mm astronomy in Canada was held in February 2012. There was unanimous agreement among attendees to maintain Canadian involvement in the JCMT through 2016 to allow for the completion of Legacy Projects. A study is now underway to identify the scientific role of the JCMT in the next decade.

The delivery of SCUBA-2 has rekindled Canadian interest in the JCMT. For much of the past few years, CanTAC typically received 15 JCMT proposals with an oversubscription rate between 1 and 2. However, 25 proposals were submitted for the most recent semester, and the oversubscription rate jumped to over 8:1.

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### Observatoire du Mont-Mégantic (Contribution by Robert Lamontagne)

The Observatoire du Mont-Mégantic (OMM) welcomes proposals for classical and queue-scheduled observing programs from any professional members of the Canadian astronomical community. Several instruments are available in classical observing mode: an IR Spectro-imager ( $R \sim 40-1500$ ), a wide-field IR camera (30 arcmin), a long slit optical spectrograph ( $R \sim 500-4000$ ), an FTS optical spectro-imager and a low noise wide-field optical Fabry-Perot EMCCD imager. The IR wide-field camera is also available for queue mode observations. Short scientific programs that cannot justify a long observing run over many nights are accepted in queue-mode. Proposals are limited to a maximum of four (4) hours of total integration time for priority targets. Queue-mode observations are obtained by graduate students from Université de Montréal and Université Laval.

For the period covering April 2011 to March 2012, the observatory received 48 observing proposals, 18 of which were for queue-mode. Seventy-two nights, or almost 20% of the available nights, were scheduled for queue-mode observations; the oversubscription rate was 1.4. The remaining nights were either scheduled for classical observations (288 nights), engineering (3 nights) or public viewing (6 half-nights in July and August). About 135 nights were clear or partially clear (at least 4 consecutive hours) and useful for scientific observations.

Examples of research based on OMM data obtained in queue- and classic-mode are available at <http://arxiv.org/abs/1205.0016> and <http://arxiv.org/abs/1205.0016> respectively.

Several upgrades are planned in the coming 12 to 18 months: the installation of a tip-tilt f/8 secondary, a new wide-field optical camera (45 arcmin), the replacement of the current IR detectors with ASIC devices and a new high-precision polarimeter.

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### \*\*\* Future Facilities \*\*\*

#### CCAT (Contribution by Mike Fich)

CCAT will be a 25 meter telescope optimized for work at 350 microns and sited in the Atacama area of Chile on a mountain overlooking the ALMA site. In the past year the eight Canadian universities,

acting on behalf of the Canadian astronomy community for the CCAT project, have decided to formally incorporate as "Canadian Atacama Telescope Consortium". This incorporation as a non-profit charitable corporation will happen in the next few months. Getting to this point has been a long and tedious process.

The CCAT project is now well into the final Engineering Design Phase (EDP), which will conclude with a Preliminary Design Review (PDR) in late June, 2013. Shortly after that the first construction contracts will be issued. The Canadian Consortium has issued a contract for the enclosure design as part of the EDP and work on this is progressing very well. It seems very unlikely that the enclosure will be the innovative calotte design that has been featured on most of the CCAT publicity materials in the past. Also, as a part of the EDP many of the Canadian institutions have participated in the call for the design of first light instrumentation for CCAT. These design projects are now ramping up to meet the PDR deadline.

It is expected that a request will be made to CFI in the next funding round (expected in early 2013) for the Canadian participation in this project.

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#### ngCFHT (Contribution by Pat Cote)

A concept study for the Next-Generation CFHT (ngCFHT) has been underway since January 2011. This study examines the feasibility of upgrading the existing CFHT to a 10m-class spectroscopic facility that is equipped with a dedicated, wide field (~1.5 square-degree), multi-object (N~3000) spectrograph (with resolutions ranging from R~1500 - 20000). Both the scientific capabilities of the facility, and its technical design, are being examined. It is expected that the final concept report will be submitted to the CFHT SAC and Board for their consideration, by November 2012. This report will also be made available to the CASCA community.

A total of ten science working groups consisting of more 50 leading astronomers from ten countries (Canada, France and Hawaii, as well as Australia, Brasil, China, India, Japan, South Korea, Taiwan, and the USA) are actively developing the science case for the facility, which includes topics as diverse as exoplanets, the ISM, stellar astrophysics, the Milky Way and Galactic Archaeology, the Local Group, nearby galaxies and clusters, galaxy evolution, QSOs and AGNs, the IGM, and cosmology and dark energy. Technical issues that are being considered include pier design and load capacity, the telescope optical design and fabrication, enclosures and ring support, thermal management, fibre injection methods, spectrograph design, survey strategies and facility operation models.

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#### TMT (Contribution by Tim Davidge)

The Thirty Meter Telescope is a collaboration involving Canada, CalTech, the University of California, Japan, China, and India. The first-light instrument suite consists of a wide-field optical spectrograph (WFOS), a near-infrared imaging spectrograph (IRIS) that will be fed by a multi-conjugate AO system (NFIRAOS), and a multi-object IR spectrograph (IRMS), based on MOSFIRE at Keck (this instrument saw first light earlier this year). During the past year design work continued on the instruments, telescope structure, telescope optics, and the observatory building. Construction on Mauna Kea is slated to commence in 2014, and 'first science' is scheduled for the end of this decade. A major effort during the past year was the preparation of a partnership proposal between the TMT and the NSF. The

proposal was submitted to NSF in April 2012, and a decision is expected later this year.

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## SKA

The SKA is an array of antennae that will deliver coverage from 70 MHz to 10 GHz, with an angular resolution lower than 0.1 arcsec. As the name implies, the effective aperture is one square kilometer. In May 2012 it was decided that the array would be located at two sites. Canada formally joined the project in March 2012

### **TIME DEMAND ON CANADIAN FACILITIES (*Contribution prepared by K. Venn & D. Crabtree*)**

A comparison of Canadian demand on Canadian (and where available non-Canadian) facilities shows that the oversubscription rates historically ranges from 1 to 2 uniformly (JCMT, CFHT, Gemini-N and S), although this past year has seen a boost in JCMT due to the long awaited arrival of Scuba-2.

These results are ordered by their Canadian demand for 2012:

Telescope	Semester	# Proposals	Subscription
ALMA	2012	3 / 112 (Canadian/total)	~10
JCMT	2012B	25	8.1
	2012A	19	5.6
	2011B	5	1.0
	2011A	11	1.5
	2010B	9	1.2
CFHT	2012B	31	1.8
	2012A	29	1.7
	2011B	25	1.6
	2011A	33	2.3
	2010B	24	1.8
Gemini-S	2012B	29	1.9
	2012A	9	0.8
	2011B	10	0.9
	2011A	21	1.2
	2010B	13	1.3
Gemni-N	2012B	36	1.6
	2012A	20	1.3
	2011B	24	1.1
	2011A	27	1.5
	2010B	22	1.5

Another useful way to examine Canadian demand on astronomical facilities (Canadian and non-Canadian facilities) is to examine Canadian publications and the facilities used in those. These numbers are not yet updated, and include only references from 2005-2009 at present. Dennis Crabtree is working on a script to extract this information for 2010-2011 from online publication sources.

These are sorted by total number of Canadian first authored papers (2005-2009):

*AIPP is an index to estimate the average impact per paper - the ratio of the number of citations that paper has to the median journal paper of the same year.*

Facility	# Canadian 1st papers	Total papers	% Canadian 1st	AIPP Canadian 1st	AIPP Total
HST	83	3355	2.5	2	2.3
CFHT	74	436	17	2.4	3.6
JCMT	46	350	13.1	2.1	3.4
VLT	44	2133	2.1	1.9	2.8
Gemini	43	578	7.4	2.7	2.8
Keck	22	1270	1.7	3.1	2.8
Magellan	15	404	3.7	2.1	3.3
Mayall	13	375	3.5	2.6	2.9
AAT	2	300	0.7	6	2.5

The information in the next table are sorted by total number of papers that included a Canadian co-author (2005-2009). It is interesting to see that Canadian impact (as measured by the AIPP) seems to indicate that non-Canadian facilities have the largest impacts (AAT, Keck, Mayall). This may reflect a higher standard for accepted proposals at these facilities that are headed by lead investigators who are not located in partner institutions/countries.

Facility	# Any Canadian papers	Total papers	% Any Canadian	AIPP Any Canadian	AIPP Total
HST	430	3355	12.8	2.5	2.3
CFHT	279	436	64	3.3	3.6
VLT	166	2133	7.8	3.2	2.8
JCMT	164	350	46.9	2.2	3.4
Keck	133	1270	10.5	4.6	2.8
Gemini	128	578	22.1	3.1	2.8
Mayall	65	375	17.3	3.8	2.9

Magellan	60	404	14.9	2.3	3.3
<i>UKIRT</i>	44	315	14	2.3	2.6
<i>Subaru</i>	32	426	7.5	3	2.6
AAT	18	300	6	6.2	2.5