Optical and Infrared Astronomy Committee (OIRAC) Report to the CASCA Board, May, 2008

Submitted by M. Balogh on behalf of the OIRAC.

1 Recent OIRAC activities

Our last report to the board was submitted Dec 2007 and is available, with previous reports, on our web page at http://astro.uwaterloo.ca/OIRAC. A Skype teleconference was held on May 6, 2008, and the minutes are available on the restricted access area of the same webpage. Following is a report of OIRAC activities from Jan-May 2008.

1.1 Canadian participation in Gemini

OIRAC has been paying close attention to the changes occurring at Gemini, following the sudden decision of the UK to withdraw from participation, and their subsequent rejoining. In particular, it was brought to our attention that the UK is interested in selling some fraction of their time to other communities.

OIRAC recognizes that there is potentially a good opportunity here, either now or in the near future, for Canada to increase its participation in one of the best observational facilities in the world. In particular, with planned instrumentation there is likely to be tremendous Canadian demand for Gemini time in the future. Purchasing a larger share is excellent value for money because we have the opportunity to pay into operations without the proportional capital costs.

It is recognized that the current oversubscription rate for Canadian time on Gemini, especially Gemini-South, is not particularly high. The table below summarizes this for the past few semesters. However, OIRAC would like to note a few important caveats on these numbers.

- An interest in Gemini as a facility should not be confused with interest in the current suite of instrumentation. Specifically, Canadian requests for the mid-infrared instruments *Michelle* and *T-ReCs* have been minimal, partly because these instruments are not well suited to the scientific interests of the majority of the present Canadian community. This situation will very likely change drastically when instruments like *Flamingos-2*, *MCAO*, and the *GPI* become available. Therefore, a low oversubscription rate now does not alone warrant dismissing an investigation into how we might increase our time allocation in the future.

- Although it is difficult or impossible to quantify, OIRAC believes it is likely that having a small share of telescope time can itself lead to low oversubscription rates, especially in a queue system where the rank of a proposal nominally allocated time has a direct influence on whether or not it gets data. Proposals requesting more than about 15 hours of Gemini time are unlikely to get observed unless they are one of the very best in the country. This can serve as a disincentive for people to submit such proposals.

Instead, they focus on shorter proposals which are more likely to get completed. For example, a large programme may be split over several semesters, thus contributing to a low oversubscription rate in any given semester, despite representing a high demand overall.

- Proposals in Band-3 are unlikely to be completed (roughly 25–30% of Band 3 proposals are completed). Furthermore, those programmes which are successful in Band 3 are more likely to be short duration or poor-weather programmes, which could therefore be completed on a smaller telescope in a reasonable amount of time, given suitable instrumentation. It could be argued therefore that the community is really competing for time in Band 1 or Band 2, which is 60% of the available time. The oversubscription rate for this time is much healthier.

Given these points, OIRAC believes the Canadian community does have a strong interest in Gemini. Therefore, any opportunities existing now or during the renegotiation of our agreement, due to expire in 2012, should be fully explored.

Canadian demand on the Gemini Telescopes

Semester	Proposals	Total Oversubscription	Band 1 and 2 Oversubscription
Gemini North			
2008B	34	1.89	3.1
2008A	47	2.23	3.7
2007B	43	2.12	3.5
2007A	39	1.81	3.0
2006B	35	2.16	3.6
2006A	36	3.08	5.1
2005B	31	2.03	3.4
Gemini South			
2008B	16	1.28	2.1
2008A	13	0.92	1.5
2007B	20	1.90	3.2
2007A	13	1.21	2.0
2006B	22	1.45	2.4
2006A	18	2.12	3.5
2005B	16	1.12	1.9

1.2 Canadian participation in future Large Surveys

Canada has a strong, internationally recognized track record for leading large observational survey science. Recent examples are the CNOC and CFRS surveys in the 1990s, the more recent Gemini Deep-Deep and Red-Sequence Cluster Surveys, and of course the CFHT Legacy Survey. However, Canada currently has *no* direct involvement in any of the very large surveys

being planned for the next decade[1].

The Large Synoptic Survey Telescope (LSST) and Pan-Starrs projects are very ambitious, state-of-the art surveys that will not only provide tremendously important data themselves, but will also serve as the foundation for follow-up work using the TMT, ALMA, and JWST — facilities in which Canada is making a major investment.

We have noted that neither of these projects is necessarily closed to other potential partners. Below we give some preliminary information we have received on ways in which Canada might get involved. Whether either of these options is viable or of interest remains to be seen. It is our opinion and recommendation that if either opportunity is explored, we must also seriously consider funds for personnel, in addition to any joining costs. The data for these surveys will become public shortly after they are taken. If we are to fully reap the benefits of participating in such a collaboration, we need full-time research staff, postdocs and students, to devote their attention to the scientific analysis of the results.

1.2.1 LSST

Mike Hudson (Waterloo) has been contacted by Tony Tyson, Director of the LSST project. Details of the survey can be found at http://www.lsst.org, and OIRAC has posted a power-point presentation (provided by Tyson) on its own website. To summarize, LSST is a survey telescope with an 8.4-m primary mirror and 10 square degree field of view, expected to cover more than 20,000 square degrees in *ugrizy* filters, to a 5σ limit of AB=27.7. Each field will be revisited about 2000 times, in the *grizy* filters. The telescope will be located near Gemini South, at El Penon, and is expected to see first light in approximately 2015. Science teams are being formed now.

LSST plans to distribute data following the model of the Sloan Digital Sky Survey, releasing data in well-understood, correctly calibrated instalments, rather than in a steady stream. Thus, participation in this project would allow proprietary access to the data, in advance of the general public. An exception to this are the transient detections, expected to be about 10,000 per night, catalogues of which are released to the public immediately.

Tyson made it clear that LSST is primarily looking for contributions to the operating budget, estimated to be about $45 million per year and starting in 2015. The LSST consortium looks favourably upon participation from Canada, not only to bring a potential monetary contribution, but also to help raise the international stature of the project and to bring valued expertise. A rough estimate of the cost is achieved by comparing the expected number of involved Canadian PIs[2] (maybe 10–20) to the steady-state number in the project as a whole (1000-2000). This corresponds to a 1 per cent contribution, or $450k per year, but would allow full access to the data. LSST is also actively seeking international involvement from the European, Japanese, UK communities. LSST considers the possibility of having a data distribution centre physically located in Europe an attractive "bonus" of their participation.

[1]We are aware however that at least one group (PI: Hall) have submitted an NSERC SRO proposal to enable them to join SDSS-III.

[2]For the purpose of this calculation, a PI is a faculty-or-equivalent person interested in LSST-enabled science.

Although the LSST consortium is primarily interested in cash contributions, there may be other options worth negotiating. For example, both Pan-Starrs and LSST will produce so much data that efficient data mining is the only way to get to the science. LSST in particular is as much a computer science project as an astronomy project. At present, the LSST consortium already has detailed data distribution plans, and they are not explicitly looking for an external contribution. However, Canada has an outstanding data distribution and archiving institution in the CADC, which enjoys a strong international reputation. If CADC sees any opportunity here, it may be worth making a presentation to LSST. An update on CADC's current capabilities, resources, and growth rate has been obtained and is available from the OIRAC website.

We note that Canada also has a good reputation for instrumentation, and there are indications that it may not be too late to get involved in building parts of the instruments or a subsystem of the telescope itself. Again, we would encourage interested parties to explore these options, but this would require immediate action to get involved.

1.2.2 Pan-Starrs

The Panoramic Survey Telescope & Rapid Response System (http://pan-starrs.ifa.hawaii.edu/) is a wide-field imaging facility being developed at the University of Hawaii's Institute for Astronomy. The immediate goal of Pan-Starrs is to discover and characterize asteroids and comets, but it will also provide valuable data for many other kinds of scientific programs.

The prototype telescope, Pan-Starrs 1, is due to begin observations in Fall 2008, and operate for 3.5 years. A 1.8-m telescope with a 7 square degree field of view, it has the same optics design and camera design as anticipated for the full version of Pan-Starrs. The University of Hawaii has set up an international consortium (http://ps1sc.org/) comprised of astronomers from Germany, the USA, the United Kingdom and Taiwan to operate and analyze the data from the telescope. This is another survey for which the CADC could potentially provide a valuable contribution, and OIRAC understands that some discussions along these lines have already taken place.

However, here there may be an additional opportunity. OIRAC has learned that there have been discussions amongst the Pan-Starrs consortium about purchasing nights on the CFHT to perform $u-$band imaging in the wide survey fields[3]. This would involve 115 nights, spread over 3.5 years and starting as soon as possible, to cover 30,000 square degrees to a depth of AB=24. Originally part of the overall survey strategy, $u-$band coverage of the Pan-Starrs area was dropped due to its high cost. The main science driver is to improve photometric redshift estimates, necessary for most of the extragalactic applications of the survey. CFHT is recognized as the best facility in the world for wide-field $u-$band imaging. However, the expense of directly purchasing this time is still thought to be too high for many of the consortium members, and it is not clear at this time whether or not this proposal is actually going forward. In any case, especially given the Large Programme initiative at the CFHT, the timescale is likely too short to negotiate involvement in PS1, although further investigation may still be warranted.

[3]The medium-deep part of the PS1 survey is expected to be covered by GALEX (80 square degrees in ten areas, reaching AB=24.4 in the near- and far-UV), and optical $u-$band coverage may not be required here.

Pan-Starrs 4 is a very ambitious survey, involving four telescopes, each equivalent to the PS1 prototype. PS4 will cover 6,000 square degrees per night, surveying the entire sky visible from Hawaii to AB=24, three times during each lunar cycle. The timeline for this project seems poorly defined at present, but is certainly at least 3 years into the future and planning will likely progress rapidly following operation of PS1 in Fall 2008. The consortium membership and exact survey design parameters (including u coverage) remains uncertain at this point. The timescale and scope of this project are perhaps more attractive to Canadian interests, and we strongly recommend immediately exploring whether or not there are any opportunities for Canada to contribute.

The time is coming very soon when Canada has to carefully evaluate its involvement in CFHT. There are numerous possibilities and factors to be considered here. One such possibility may be to contribute some or all of Canadian dark time on the telescope to $u-$band coverage of Pan-Starrs fields (i.e. the whole sky visible from Hawaii), in exchange for participation in the consortium. Whether or not this would be attractive to either community is completely unknown at this stage, and in any event must be considered in light of the international agreement under which Canada is committed to CFHT.

OIRAC will continue to investigate the potential opportunities here. If sufficient interest is found within the community, we propose to convene two small teams – one to thoroughly investigate options with LSST, and the other with Pan-Starrs. They will report to OIRAC, which enables us to provide the Board with a balanced opinion of the value of any such opportunity, in light of our resources and other commitments.

1.3 Infrared Spectrum Management

OIRAC has continued to communicate with Ken Tapping about the need to specify quantitative constraints on the allocation of the infrared electromagnetic spectrum. On March 17, 2008, OIRAC provided a sample of sensitivity limits for near-infrared imaging and spectroscopic instrumentation, using the spectral power flux densities (SPFD) familiar to the radio astronomy community. These are dB units of flux per unit frequency for 2000s integrations. The numbers passed on to Ken are given below:

	Filter	wavelength (μm)	SPFD dB(W m^{-2}Hz^{-1})
Continuum Example (NIRI)	J	1.15–1.33	−325.5
	H	1.49–1.78	−320.4
	K	2.0–2.36	−323.6

Spectral R=5100 example (GNIRS)

Filter	wavelength (μm)	Resolution (nm)	SPFD dB(W $m^{-2}Hz^{-1}$)
J	1.15–1.331	0.245	−294.5
H	1.49–1.78	0.323	−297.6
K	2.0–2.36	0.431	−298.1
L	3.43–4.13	0.667	−285.4
M	4.55–4.79	0.941	−277.0

1.4 HIA Outreach Roadshow

OIRAC has received a report from David Loop on the country-wide outreach visits conducted by HIA. This report is available on our website.

1.5 OIRAC, the RAC, and a proposal for a CGBA:

In our June 2007 report we recommended that the CASCA board reconsider and redefine the mandate of its subcommittees OIRAC and RAC. In particular we made the recommendation that the Board consider the creation of a Committee for Ground Based Astronomy (CGBA), in full consultation with all CASCA committees. We are aware that there remains some resistance to this idea from some (but not all) RAC members. However, it remains our opinion that CASCA's committee structure be designed by CASCA such that it provides the best service to Canadian astronomy. The will of individuals on individual committees should of course be taken into account, but it is not clear to us that consensus at the committee level is necessary to move forward.

We note here that one of the most substantial parts of our present report, on participation in future large surveys, has impact on the entire astronomical community, regardless of wavelength expertise. Involvement of the CADC in this effort especially highlights this: data archiving and virtual observatory construction is specifically designed to transcend artificial wavelength boundaries. This is a good example of an opportunity that is best explored by a broader committee than either OIRAC or RAC alone.

We are aware that CASCA has established a subcommittee (Joncas and Hickson) to look into this issue, with the aim of developing recommendations. As of the time this report was written, OIRAC has still not been informed of any progress made by this subcommittee. OIRAC is looking forward to the meeting scheduled at the 2008 AGM, between the CASCA Board and the RAC and OIRAC chairs.

1.6 OIRAC webpages:

The Board recommended that the OIRAC webpage be hosted on the CASCA webserver, so that relocations of the website, following committee membership changes for example, are not required. We strongly agree with this; however, for a webpage to be useful the OIRAC chair must have free and ready access to it. In Jan 2008 Ros Hanes put in a request to have this investigated. We have had no further information on progress, but will continue to inquire about the status.

1.7 Clarification of OIRAC's role in the CGSC:

There was some confusion following our Dec 2007 report about how the CGSC was formed. The CGSC is meant to replace the CGSSC (the "Steering" was dropped as the new committee does not have any steering powers). The principal role of the CGSC is to review the GSC Agenda (either formal or informal) and provide advice to the GSC members in advance of the annual GSC meeting. It is not a CASCA committee; OIRAC was chosen to select the CGSC members just because it was deemed the most sensible collection of astronomers to do so.

2 Recommendations:

- OIRAC repeats its recommendation from June 2007 and Dec 2008, that CASCA define its mandate for OIRAC and the RAC, and consider forming a Committee for Ground Based Astronomy. OIRAC looks forward to the upcoming AGM for further discussion of this matter.
- We recommend that any opportunity to increase our share of Gemini, whether now or after 2012 when the current operating agreement expires, should be very seriously considered. Oversubscription statistics on queue-scheduled telescopes for which we have a minority participation may be misleading, and other indicators of Canadian interest in this important facility should be sought.

3 Membership

Name	Membership expires
Doug Welch	May 2008
Tim Davidge	May 2008
Michael Balogh (Chair)	May 2009
Pierre Bergeron	May 2009
John Hutchings	May 2010
Chris Willott	May 2010

Should CASCA decide to retain the current committee structure and not form a CGBA as we have recommended, then we need to find replacements for Doug Welch and Tim Davidge, who's terms of service have come to an end. Doug has expressed a wish not to be reappointed. However, Tim is willing to serve a second term and OIRAC looks upon this very favourably.

We therefore recommend reappointing Tim Davidge and adding a new member. In our opinion, this new member should be a person familiar with far-infrared or radio astronomy, as well as optical/near-infrared, to aid us in our goal of building bridges between the two artificially-divided communities.