LRPIC input to the MRP MTR panel

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I. The LRPIC

The LRPIC was set up and given its mandate by the CASCA board, following the LRP 2010 recommendation. The terms of reference are laid out in the CASCA web page. The committee has kept track of the entire suite of LRP priorities and developments, working closely with CASCA, NRC, CSA, ACURA, and the coalition for astronomy. It has reported directly to the ACURA board annually, provided written reports to CASCA, and held lunchtime open sessions at the CASCA meetings. As was known at the time of LRP 2010, the situation then and since has been one of fiscal restraint, and changing circumstances among all our facility partners. The committee has operated with strong participation of other committee chairs, and representation from the other major players in a fragmented system.

LRPIC had a `baptism of fire' by having to report to the ACCA (Agency Committee for Canadian Astronomy), and deal with a public call to leave TMT and join the EELT, within weeks of its formation. The ACCA has not met since, but the occasion was useful in gathering and presenting the full extent and priorities of the LRP 2010. The LRPIC made a recommendation to stick with the TMT in light of community discussions and consideration of political realities, and delays in TMT. The LRPIC has been involved in helping the TMT funding effort, and continues to do so. One other priority issue was that of dedicating a major amount of CFHT time to enable partnership in Euclid, which at the time fitted the top priority for space astronomy in LRP 2010. The LRPIC made a statement on these priorities[1], that we believe still applies.

We consider that the decade will continue to be very challenging for achieving the LRP 2010 priorities, and note that new opportunities and difficulties have arisen, mostly unpredictably. This is a consequence of being a small partner in almost every major project. **For all these reasons, the existence of the LRPIC is valuable in being a body that keeps track of the LRP as a whole, and can offer guidance and help in strategic situations.**

The MTR may consider how the LRPIC charter or effectiveness could be improved. In particular the MTR should weigh on the following issues: 1) how and when the LRPIC should act on changing LRP priorities and how such changes should be agreed upon and implemented. At present, the committee's role is one of monitoring and advising. The name "implementation" leads to false expectations; 2) how much `power' the LRPIC should have, and in particular whether it should have lobbying responsibilities, or a clearer mandate with respect to ACURA and the Coalition.

II. LRP 2010

Major developments since the LRP 2010 are the emergence of a) the plan for CFHT upgrade (MSE), and b) the concept for a Canadian-led UV-blue imaging space telescope, CASTOR. These are potential major facilities for Canada. They lie some way off yet in planning, funding, and partnerships, but need support now to succeed.

MSE has now established a Project Office in Hawaii and is attracting the interests of international partners. The project is making encouraging progress with a development plan that potentially has a design and funded partners agreed by 2018. A scheduling challenge is potential delays by long-term Megacam and Spirou surveys. A solution in discussion is access to

[1] http://casca.ca/?page_id=2080

UKIRT, which could host observations after CFHT is taken down, nominally in 2020. The MTR will have to weigh on whether agreements and planning for such surveys be made in a way that will allow early termination if delays occur, so as not to obstruct the development of MSE. As outlined in their White Paper, since the LRP2010 MSE has reached a high level of maturity, and is now a serious contender as a high priority project for the community.

Since the LRP2010, widespread interest has developed in the CASTOR space telescope concept, with the realization that HST will not last forever and that no UV-blue facility with that resolution is in any other agency's plans. As outlined in its white paper, CASTOR has the unique potential to be a Canadian icon and major facility that the world will want to share, given its dark energy mission complementarity as well as the wealth of `legacy' science it would enable. CSA has shown encouraging interest in the proposal, but the reality is that the current CSA budget cannot support such a mission, even with major partners. The immediate need for CASTOR is the expected phase 0 study. We note that CSA's more costly and complex Radarsats have demonstrated the capability to lead a mission like CASTOR. CASTOR will require a boost to the CSA space-astronomy budget allocation that is far above what would be needed for any other mission on the table. For this to happen, a strong and unambiguous statement will be needed from the MTR in support of CASTOR.

Another space astronomy topic for the MTR is WFIRST, which has emerged as a potential dark energy partnership this year. The science return needs to be clear, together with what investment it entails: a nominal 5% share in WFIRST is $100m - in the same league as CASTOR and Canada's contribution to JWST. CSA's WFIRST studies are getting under way at the time of writing. A wildcard is the WISH space telescope, which was not listed in LRP2010 but has been raised in JCSA meetings several times. CSA has not yet pursued this, but the proposed participation is a complex mechanical filter holder whose design and cost need study. The science interest and return of WISH are also not well defined at present, and connection with dark energy is minor. The reality is that both from a budgetary and scientific (i.e. community interest) point of view a WISH partnership must be considered with both CASTOR and WFIRST.

CSA has performed a study on bolometer arrays for the LiteBIRD JAXA mission. To meet the needs of the diverse Canadian community, longer term partnerships in SPICA and Athena should also be pursued, but will depend on funding and performance in the shorter term.

On the ground, the SKA partnership and planning has evolved considerably and is a potential challenge for continued partnership, as outlined in the GAC white paper. CHIME has been funded and moving ahead. A proposal to fund Canadian participation in the construction of CCAT is currently under review by CFI. The result will be known during the MTR process.

Two of the LRP2010 priorities are no longer promising. The commendable and considerable effort to join Euclid as the top space priority was not successful and the desired partnership is no longer a possibility. Work on the arctic telescope has stopped and NRC is no longer supporting it, although significant work and testing has clarified its promise. However, given the number of unfulfilled ambitions in the LRP, the LRPIC recommends that this be given low priority. We also note the LSST situation and recognize that it represents community interests in wide field imaging and transients. It is not clear how the Canadian community may join the project directly, especially as a significant LRP priority. It is possible that Canada could effectively partner with LSST via our MSE and CASTOR projects, should we be in a position to negotiate those later in the current LRP term.

LRP 2010 contains an ambitious list of new projects. Given the fiscal realities of the decade, the MTR may want to consider a clear and possibly shorter list, whose overall focus is explained, and contains a good balance of access to wavelengths. **The MTR needs to consider what did not work over the past 5 years, and why**. In particular, the MTR should 1) consider how to pare down or clarify what are top and important `needs', and how they offer the best plan for

limited money. An obvious tradeoff is between the number of projects that can be undertaken and the level of involvement: should Canada lead a few projects, or try to assume a minor role in many?; 2) Consider proposing `plan-B' scenarios in case the top priorities cannot be achieved; 3) state clearly how we leave or close down old facilities when new ones appear. An example is JCMT partnership and public funding for its future should the CCAT initiative run into difficulties; 4) ensure that the community speaks with a single voice, and sign up to a plan that is best overall for Canada. The raising of the JCMT partnership in parliament this year, and the claimed interest to professional astronomy of the Madawaska Highlands Observatory only serve to confuse our major funding requests and create the perception of a divided community.

It is also essential that the LRP not be too rigid, since things will change in ways that cannot be predicted. Exoplanets have become very high profile scientific priority not reflected in LRP 2010. Canadians have a prominent role in that field now, and should have their ambitions reflected. Topics like dark energy have moved on, or become less compelling to some. This dichotomy appears strongly in the current WFIRST plan, which now seriously proposes to include a coronagraph and exoplanet science. This takes advantage of the topic popularity and interest in NASA at the moment, although it is not the ideal way to do the science in either topic.

The MTR needs to be very cautious in choosing its strong statements of priority. It also needs to be mindful of costs, value for money, tradeoffs with existing facilities, and likely schedules, knowing that delays are inevitable. CSA president Natynczyk was working to increase their budget significantly, by using independent studies of high RoI from their contracts. His sudden departure may represent new challenges, but it is important to work with CSA with well-considered astronomy projects set in this light.

Overpage: a simplified overview of the status of LRP initiatives in December 2014.

What	When	Who	New $C	Share	Funds	Notes
TMT	2013-2020	US, Japan, China, India	~$300M	~20%	2015 budget	ACURA , Univ Presidents lobby. Last chance for current plan
SKA	2016-2024	Consortium	~$60-100M	6-10%	Thru 2015…	to 2023 +$? SKA2 for 2030
CASTOR	2012-2020	CSA + XSA	$>=150m	33%?	CSA	Tech + science studies; partners, Phase 0 prepared
MSE	2014-2023?	~6 partners	$34m?	20%	Current +	Project office at CFHT. Partnerships in negotiation
CCAT	2013-	Consortium	$21-35M	15-25%	Current +	University funds, CFI?
CHIME	2013-	UBC, UT, McG	$10M	100%	CFI	DRAO site. Under way
SPICA	2013-2022	JAXA	$6-20M	?	? (CSA)	Hardware for upper price
WISH	>2017?	JAXA	$~20M?	?	(CSA)	Filter changer, **no CSA study**
Astro-H	2012-2015	JAXA	~$8M	5%	Current	Underway
WFIRST	2014 - ?	NASA + JAXA + ESA	~$30-100M?	<=5%?	(CSA)	Canadians on SDT. WFI & coronagraph concept studies
Athena	2028 launch	ESA et al	Long lead	?	CSA	Time to get involved?
JCMT	2014-16	UK, Asian cons	$0.1m/yr	few%	??	Initial 2 years
Balloon, Microsat	2012-2020	CSA, CNES	$10M	100%	Current	Continuing

Funds indicated all spread over several years – details differ.
Amounts secured or in present budgets. Space and Ground-based