

**Working Group to Examine Funding
Support for the Long Range Plan for
Astronomy and Astrophysics**

Terms of Reference

December 2004

Preamble

The Working Group (WG) will present a report offering guidance on how to remove obstacles which impede the funding of the future elements of the Long Range Plan for Astronomy and Astrophysics (LRP). That report will be presented to key decision-makers, starting with the National Science Advisor and the heads of those bodies involved in astronomical research and funding in Canada, as well as to bureaucrats and politicians with varying degrees of knowledge about the LRP, its projects, and the funding challenges. Therefore, the WG's report will present its findings in as simple and systematic a manner as possible. It will assume that those reading the report will not be as familiar with the work that has already been done as are the members of the WG.

To ensure that all participants in the WG's review are comfortable with its goals and its scope, the terms of reference must also demonstrate that this project was entered into without any preconceived biases as to its findings. The analysis of the existing funding challenges has to be comprehensive and open-minded, even if assumptions have already been made as to where the problems lie.

The WG's work plan is divided into six phases. Those phases are then easily transferable into sections of the report. While some of the initial phases may seem redundant to members of the WG, they are necessary to clearly state the context for what follows. The phases, and the guiding questions that accompany them, also form the basis for meeting agendas and will help ensure a coherent, structured approach to the issues at hand. The six phases will:

1. clearly define the problem based on experience to date;
2. clearly state the funding needs for the future;
3. examine specific projects to put funding challenges into a practical context;
4. briefly examine funding models from elsewhere;
5. develop recommendations for future funding of the LRP;
6. prepare a report based on the above.

The Terms of Reference that follow detail how this can be accomplished. They present a simple and systematic plan for the review of funding challenges. While the Terms are detailed, the WG always has the ability to move deliberations in any direction it chooses. Some phases will obviously be very simple and quick to complete. However, by covering the aspects outlined above, the WG should not meet any resistance to its work and will still be able to make the recommendations it feels are necessary.

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Overview

Canada enjoys worldwide stature in astronomy. The Long Range Plan for Astronomy and Astrophysics (LRP) was launched in 1999 and provides a vision to maintain this world class status. The LRP identifies a range of projects, many internationally based and in the world facility class, that should be pursued by the Canadian astronomy community. Participation in these projects also generates interest and excitement in the public and pays substantial dividends through technological spin-offs for Canadian industry.

The 2004 Mid-Term Review (MTR) of the LRP by the Canadian Astronomical Society (CASCA) documents the considerable success thus far in meeting its goals, particularly Canada's participation in a number of major international projects. However, the review also notes that funding challenges remain for future Canadian success in meeting these goals. Canada's existing scientific funding system cannot respond individually to all elements in the projects being undertaken in the LRP.

This Working Group (WG) has been created to review the funding challenges of the LRP and to provide guidance on how to address them.

Funding Challenges

Major components of the LRP can be classified as "big science" projects. They involve international partners as well as multiple Canadian stakeholders. They cost into the hundreds of millions of dollars and have a development and operational lifespan of 10 years and 25 years, respectively. These are all major complicating factors for the existing federal research funding system. Canada does not currently have a system to deal with such projects.

The mid-term review identified a number of specific funding challenges to the successful completion of the next phase of the LRP:

- No single research agency or government-created funding body has the ability to fund or take primary responsibility for the LRP and its key projects. There are instead a variety of funding sources with a variety of mandates.
- Funding requests must be tailored to fit the requirements of the various agencies and bodies, not necessarily the goals of the LRP.
- Government allocations typically work on a five-year cycle, which is short compared to the 10 year planning and 25 year operational time scales of most LRP projects.

- Stability and predictability are key when working with international partners on major projects. A government agency can often provide those qualities, yet not all sources of funding may be available to that agency.

As a result, funding and project oversight processes are unintentionally cumbersome, disjointed and time-consuming.

Mandate

The LRP and the associated MTR set scientific priorities for astronomy and recommended how Canada should proceed to achieve those goals. Future funding requirements have also been identified, as have many of the challenges to securing that funding (as outlined above). The WG is tasked with examining those challenges and offering solutions to the funding needs of the LRP. In short, the WG will identify a way forward for astronomy funding to complement the goals defined in the LRP and the MTR.

The WG will use the funding challenges experienced in pursuing specific projects identified in the LRP as case studies to support this review.

The organizations included in the WG review are:

- the Canadian Space Agency (CSA);
- the Canada Foundation for Innovation (CFI);
- the National Research Council (NRC);
- and, the Natural Sciences and Engineering Research Council of Canada (NSERC).

Membership

The membership of the WG will be comprised of four permanent members from the astronomy community and at least five invited guests.

Permanent members will include:

- 1 representative from the Canadian Astronomical Society (CASCA);
- 1 representative from the Association of Canadian Universities for Research in Astronomy (ACURA);
- 1 representative from the Herzberg Institute of Astrophysics (HIA);
- and, 1 representative from industry.

Invited guests will include the Vice-Presidents of the following organizations:

- 1 representative from the Canadian Space Agency (CSA);
- 1 representative from the Canada Foundation for Innovation (CFI);
- 1 representative from the National Research Council (NRC);
- 1 representative from the Natural Sciences and Engineering Research Council of Canada (NSERC);

and,

- 1 representative from the Office of the National Science Advisor.

The WG may include other invited guests as it carries out its review.

The WG will be supported by a staff person who will coordinate meetings, prepare and circulate agendas, take notes, prepare draft reports and provide any other services the WG deems necessary.

Reporting

The permanent members of the WG will provide regular updates to their respective organizations on the activities of the group, as will the invited guests. Reports can be prepared at the completion of each phase, if the WG determines that is necessary. The final report of the WG will be presented to the Office of the National Science Advisor and the heads of the CSA, CFI, NRC and NSERC, but can be anticipated to also be reviewed by bureaucrats and politicians.

Governance and Meetings

The permanent members of the WG will select a Chair. The Chair will oversee the meetings of the WG and be the main point of contact between the WG and its staff support. The Chair will determine a meeting schedule with the permanent members of the committee and the invited guests. All permanent members and invited guests will receive notice of WG meetings. Meetings will be held by conference call unless otherwise required. If a permanent member or an invited guest is unable to attend a meeting, he or she may designate an alternate.

The WG will be governed by consensus. The WG will approve the Terms of Reference at its first meeting. The permanent members of the WG will prepare the final recommendations after consulting with all invited guests.

Work Plan and Time Line

A detailed work plan is attached as Annex 1. It outlines six phases of the project with guiding questions for each. The work plan results in a final report that will be accessible and understandable to a broad audience. A time line is attached as Annex 2.

Annex 1: Work Plan

The WG will conduct its review in six phases.

Phase 1: Using the Mid-Term Review (MTR) as a guide, the WG will examine the successes and failures of funding the LRP to date. The role and mandate of each scientific funding or operational agency will be examined within the context of the LRP, as will its strengths and weaknesses. The WG will be guided by the following questions:

- What examples exist of successful project funding?
- When has Canada's funding system failed the LRP?
- When funding has failed, how and why did this happen?
- Are some projects more adversely affected by Canada's existing funding system than others?
- Do some agencies and their policies work better than others for funding LRP projects? If so, how and why?

Phase 2: Stemming from the above review, the WG will clearly define the funding requirements and parameters for the remaining priorities of the LRP.

- How much funding is required to complete the next seven years of the LRP?
- When is that funding required?
- How must that funding be delivered?
- What obstacles have already arisen that are posing problems for future funding?
- Are there funding requirements that extend beyond the completion of the first ten years of the LRP?
- If funding stability and predictability cannot be provided, what are the implications?

Phase 3: The WG will examine three specific projects as case studies of the funding challenges for LRP projects, two of which are internationally based and one of which acts as a domestic support mechanism for the broader goals of the LRP. Each case study will design an ideal funding model that would work best for completion of the project in question. These projects were selected since they represent the most expensive international and domestic priorities. If funding solutions to these projects can be identified, those solutions should be applicable to all other projects.

International Projects: the *Square Kilometer Array (SKA)* studies will lead to the largest centimetre radio telescope ever built. Through the NRC-HIA, Canada is currently developing one of the leading designs for the array elements. International studies are also underway that will lead to the construction of the largest optical/infrared telescope in the world. The MTR identified the *Thirty Metre Telescope (TMT)* as Canada's best route to participation in such a project. These international project case studies will ask:

- What has been the experience thus far in soliciting funding for participation in these projects?
- What are the future funding requirements needed for long-term involvement in these projects?
- How is Canada's leadership role in these projects threatened within the current system?

Domestic Projects: the WG will examine Canada's efforts to develop a Tier 1 high performance computing capacity. The LRP identified such a capacity as one of the vital support elements needed in Canada for the LRP to reach its full potential. This case study will examine:

- What has been the experience thus far in soliciting funding for this project?
- What obstacles have arisen?
- What funding is needed to complete this project?

This phase will then compare the domestic and international experiences:

- Does Canada need one approach for funding domestic projects and another for international projects?
- How do the ideal funding models prepared for the case studies differ from the existing funding mechanisms?

Phase 4: The WG will explore other possible funding avenues and, if time permits and information can be obtained relatively easily, will examine how the world's other astronomy leaders are funding such projects.

- Are there other funding sources for the LRP that have not yet been identified?
- Are there other industrial strategies within Canada that could compare to the LRP and its funding requirements?
- What is the role of *provincial* governments in funding the *national* LRP?
- Does adding more potential funding sources improve the odds of success, or does it complicate things more?
- How is astronomy funded in the US and UK?
- How are countries currently trailing Canada in astronomy research trying to catch up?

Phase 5: Using the information gleaned from the first four phases of the review, the WG will prepare a series of recommendations that will address the funding challenges identified. The WG will also note any funding mechanisms that are working particularly well and will draw from the models prepared in the case studies. Lastly, the WG will include any lessons to be learned from other world leaders in astronomy. Questions to be examined include:

- Does Canada need a whole new funding apparatus, or can the mandates and procedures of the existing agencies be amended to facilitate the achievement of the goals of the LRP?
- In either case, is a formal structure and mandate needed to address national scientific plans such as the LRP?
- How would any unified funding arrangement be managed?
- What is the anticipated lifespan of any such arrangement?
- How does Canada create a secure, long-term funding arrangement for astronomy, subject to appropriate periodic review?

Phase 6: The recommendations stemming from the above will be circulated by the permanent members and the invited guests to a wider audience within the astronomical community and the related research agencies and funding bodies for feedback. The WG will consider this feedback before preparing a final report outlining its recommendations to the Office of the National Science Advisor and the heads of the CSA, CFI, NRC and NSERC. Those recommendations provide guidance to decision-makers on the future funding of the LRP.

Annex 2: Timeline

Timeline (Amended March 17, 2005)*

The tasks listed below for each month are to be completed by the end of the month indicated.

January

- WG permanent membership finalized.
- Invited guests identified by their respective organizations.

April

- First WG meeting and selection of a chair.
- Terms of reference reviewed and approved.

May

- Completion of Phases 1 & 2.

June

- Completion of Phases 3 & 4.

July

- Completion of Phase 5.
- Completion of the final WG report.
- Presentation of the WG report to the Office of the National Science Advisor.

August

- Meetings with key decision-makers to review the recommendations of the WG.