

**Presentation by
The Coalition for Canadian Astronomy**

**To the
House of Commons
Standing Committee on Industry, Natural Resources, Science
and Technology**

by

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It is understandable if you do not make an automatic connection between scientific pursuits, in particular astronomy, and industrial policy. However, if you ask yourself a few key questions about the purpose of an industrial policy, the linkages become clear. For example, should an industrial policy foster greater knowledge and innovation in the workforce? Should it encourage research and development? Should it build international expertise in a defined field? Should it lead to Canadian industry developing niche markets for lucrative international contracts? And most of all, should it develop clear economic benefits to Canadians?

Our Long Range Plan for Astronomy and Astrophysics, or LRP, does all these things. We feel strongly, therefore, that science can, and should, be a major element of any industrial strategy.

Our presentation is divided into three parts. First, we provide an overview of the Coalition and our work. Second, we discuss our national plan for Canadian astronomy, which we feel serves as a model for a science-based industrial strategy. Third, we highlight the problems that we have encountered implementing that strategy and our recommendations for the Committee as it reviews Canada's industrial strategy and our competitive position in the global, knowledge-based economy of the 21st century.

The Coalition for Canadian Astronomy was formed in 2000 and is unprecedented in the Canadian science community. For the first time we have brought together representatives from the astronomical community, academia and industry to chart a course for scientific excellence in the field of astronomy. The Coalition has as its goal to secure the implementation of our Long Range Plan. You could say that the LRP is astronomy's industrial strategy for doing science.

In order for the LRP to succeed, all the stakeholders were needed to work towards its goals. On the academic side, the Association of Canadian Universities for Research in Astronomy, or ACURA, was formed at the very senior levels of university administration, bringing together 21 Canadian universities with astronomy departments.

We also sought a partnership with industry, since so many of our projects require highly specialized design, with price tags often into the hundreds of millions of dollars. Canadian firms that engaged in the Plan stood to benefit greatly from the projects identified therein.

And naturally, without the support of the astronomical community, there would be no Long Range Plan.

At the beginning of this decade (1999 to be precise), the Canadian astronomical community faced the challenge of responding to the internationalization of astronomy. The engineering scale and technological sophistication of next generation telescopes require the intellectual and financial resources of the world astronomy community to plan and construct them. As with any other science, astronomers faced a range of competing project priorities.

After lengthy debate and discussion within the community, we identified a set of priorities that would form the basis of the Plan. The LRP vision document was created by a Blue Ribbon Panel to chart a course for Canadian astronomy over this decade (2000-2009) and beyond. It calls for Canadian participation in the next generation of global astronomy projects, coupled with investments in technology development in Canada, the training of young Canadian scientists and engineers, and intellectual leadership in planning and operation of facilities by Canadian astronomers.

To succeed in astronomy, we felt we had to focus our efforts on specific projects and the support structures necessary to sustain them, rather than try to pursue every opportunity that arose. There are many projects we chose not to participate in. To ensure that the LRP was succeeding and the projects mentioned continued to be relevant, the community last November completed a Mid-Term Review. That review validated our efforts to date.

At this mid-way point for the LRP, the successes for each of our Coalition partners are clear.

First and foremost, our astronomers have achieved scientific excellence. Astronomy is now Canada's number one exported science; despite a per capita investment in astronomy that is eight times smaller than the USA, and five times smaller than European countries with similar GDPs to Canada. The priorities we identified in the LRP are providing Canadian astronomers with the opportunity to work on world-leading projects.

Second, enrollment in astronomy at Canadian universities is booming. The number of graduate students pursuing astronomy has doubled since the launch of the LRP. The number of Canada Research Chairs in astronomy has grown from 1 to 23 in the past 4 years. New astronomy departments have been created at several universities. These students now have access to those same projects just mentioned; thereby ensuring that the next generation of Canadian astronomers will be able to keep us at the forefront of this field.

Lastly, Canadian industry has reaped huge benefits, both direct and indirect. The Coalition estimates the direct economic return to Canada from its participation in past and future astronomy projects is at least two-to-one, with some estimates as high as eight-to-one.

Jobs have been created for Canadians through the construction and operation of astronomical facilities. Contracts have been awarded to Canadian companies for their design and construction. These contracts and work experience have in turn generated new knowledge and technological developments that produce spin-offs and market advantage for Canadian industry.

Consider just the following examples from the experience of AMEC, which supports a large cluster of associated companies that provided specialized goods and services. In the mid-1970s, Canada's \$38 million investment to become a partner in the Gemini twin eight-metre telescopes brought AMEC Dynamic Structures a \$44 million contract to build the domes for these telescopes. The structural design expertise generated through the involvement with this project and the earlier Canada-France-Hawaii telescope has now grossed over \$300 million.

Canada's participation in the LRP is delivering similar rewards for Canadian companies today. AMEC is about to secure a \$100 million contract to build the enclosure for the Thirty Metre Telescope (TMT).

In addition to AMEC's leadership in enclosure and telescope structures, the LRP has drawn companies into projects that have never been previously involved in astronomical work. These small and medium sized companies are spread across the country and have become engaged at the best time to leverage longer-term industrial benefits: the upfront design and research phase.

These include BreconRidge Manufacturing of Kanata, Ontario, which is developing optics for the Square Kilometre Array/Large Adaptive Array; Nanowave Technologies of Toronto is providing low noise amplifiers for Band 3 software development for the TMT; INO of Saint Foy, Quebec, is involved with conceptual design for extreme adaptive optics project; DiCos Technologies of Sherbrooke, Quebec, won a contract for laser technology work on the Atacama Large Millimetre Array (ALMA) project.

As a result of Canada's participation in these international projects, Canadian firms will also have the opportunity to pursue future contracts as they move into their next phase of development. The list of companies involved in applying new technologies and leveraging Canadian skills will only increase.

When working on projects, the Coalition uses a "smart procurement" model in which contractors are introduced to problems faced by the astronomical community and they in turn use their existing capabilities to find creative solutions. The knowledge gained in solving these problems leads to new business opportunities in sectors far removed from astronomy. For example, AMEC was able to parlay its experience building observatory enclosures and telescopes into becoming a world leader in, of all things, amusement park rides.

The Coalition relationship is truly extraordinary. We are aware of no other sector where academia, industry and government work so well together to ensure the success of a plan. It is this experience that we felt would be of most interest to the Committee.

This relationship is not only advancing Canada's scientific knowledge and international standing, but it is also doing so in a way that is delivering concrete benefits to our universities and our economy. Investments in astronomy are encouraging research and development, helping build a skilled workforce, and projecting an image to the world that Canada is serious about the pursuit of scientific leadership.

It is because of these successes that we feel our experience can serve as a model for a science-based industrial strategy.

At the heart of the LRP was a recognition that we simply could not succeed unless we focused our efforts. By uniting behind the Plan, Canada's astronomy stakeholders were all pursuing the same goals. This united front helped immeasurably in our efforts to secure government funding for the Plan.

That is the last issue we would like to address. We are very thankful to the Federal Government for its initial investment in our Plan. The initial phase of the LRP received \$68 million in Federal Government financial support, provided through the National Research Council and the Canada Foundation for Innovation. That funding helped get us to where we are today, with all the successes we have already outlined.

However, financial challenges remain.

By March 2005, our funding for some of the projects began running out. The Coalition made several trips to Ottawa to meet with senior bureaucrats and Members of Parliament, some of whom are here today, to remind them that our funding was due to expire, and that all we had accomplished risked being lost without continued support.

We presented decision makers with various detailed, multi-year funding requests. Ultimately, we did not receive any new funding in the 2005 Budget. We warned decision makers that without further funding – delivered immediately – Canada would be forced to withdraw from signed international commitments to projects that were already underway. Thankfully, we were finally able to secure the \$25 million (\$15 million from Industry Canada) needed to maintain our participation in the Thirty Metre Telescope, which ranks currently as the most pressing LRP priority. But since we did not receive multi-year funding, we will be back in the fall to lobby again.

Quite simply, we have a Plan to achieve scientific excellence, but lack the funding framework needed to implement it fully.

This experience raised some fundamental questions for us about the Government's investments in science. First and foremost, if the Government is not going to fund its top science, what are its scientific priorities? There is also the question of why the Government would make an initial investment in astronomy, let it build up to such a strong position, and then walk away? The initial funding allowed us to begin work on major international projects, but we are now scrambling to find resources to continue our participation. We cannot overstate what a blow it would be to Canada's international scientific reputation if we were forced to withdraw from signed international agreements.

Compounding the problem has been the lack of any mechanism within the Federal Government to fund scientific pursuits of the magnitude common today. These are what are often called "big science" projects, costing hundreds of millions of dollars, involving several international partners, and having lifespans of a decade or more. For example, there is no single agency that can fund them. When we do get funding, it is often short-term and piecemeal, forcing us to spend time and energy lobbying for dollars, rather than conducting research.

The National Science Advisor to the Prime Minister is currently circulating a discussion paper on exactly this topic, and the Coalition has submitted a response. Some of the recommendations made here are echoed in that response:

- The pursuit of scientific excellence, if carried out in a coherent and coordinated way, can be an engine for economic growth and industrial development.
- Canada's approach to science will help define its international investment "brand". If we are viewed as a country committed to scientific excellence, benefits will follow. An investment in Canadian science will be considered sound and worthwhile if such pursuits are supported by the Federal Government.
- Developing a Federal Government approach to the funding of "big science" is an excellent way to encourage further research and development in this country; our experience in astronomy has demonstrated that. Canadian companies have been winning contracts from a range of international sources as a result of our participation in world-leading astronomy research.
- Our efforts clearly demonstrate success in building a more highly skilled workforce in Canada, both through the opportunities created in our universities and the contracts being awarded to Canadian companies. Our workforce is developing even greater expertise in this field. Then there are the economic and technological spin-offs we mentioned earlier. Canadian taxpayers have been given a significant return for every dollar invested in astronomy and astrophysics.

Based on our experience, we would suggest that the Coalition for Canadian Astronomy can serve as a model for a science-based industrial strategy. We are confident that our Plan has laid the foundation for long-term success in the field of astronomy, with ongoing benefits for Canadian universities and industry.

We would like to thank the Committee for giving us the opportunity to share our experiences.