

Gemini: Long Range Plan Mid-Term Review

1. *Status in 2000*

The Gemini Observatory was still the Gemini Project in 2000 as Gemini was still in the construction phase. While Gemini had celebrated a successful, albeit artificially early, first light on Gemini North in mid-1999, regular operations were still more than a year away. The rush to an early first light had a deleterious effect on Gemini North's ramp up to normal operations.

In 2000, the Canadian time on Gemini (15% of each telescope) was regarded as significant but nowhere sufficient for the optical-IR community. (It is interesting to note that Gemini's mid-IR capabilities have attracted many proposals from the mm/submm community). The Canadian optical-IR community felt very strongly that the lack of 8-meter time threatened the viability of the community. The LRP recommended that the community "quickly obtain significant participation (40%) in the construction and operation of a new optical-IR, 8 meter telescope" to alleviate this situation. Around this time, Australia joined Gemini at the 5% level and the Canadian fraction of time then dropped to 14.28%. This exacerbated the need for additional Canadian 8-m time.

In 2000 the two Keck 10-m telescopes were working very well and producing a significant volume of high impact science. Two of the four VLT 8-m telescopes were operational with the last two to follow in 2001. The Subaru 8-m telescope was also coming online. Clearly, the competition between 8-m telescopes in the first decade of the 21st century was going to be very stiff!

In 2000, Gemini had yet to receive a working facility instrument as NIRI, the first instrument to be delivered, suffered from various problems. This forced Gemini to rely on visitor instruments in order to offer observing time to the community. The first successful instrument delivered to Gemini was the first GMOS, which was built jointly by Canada and the UK.

Gemini's instrumentation plan in 2000 called for several more facility instruments to be delivered by 2005-6. However, there was no instrumentation plan for post-2005.

The situation in 2000 at the time of the LRP can be summarized as follows. Canada had a smaller than desired share in the Gemini twin telescopes. The telescopes were limited in their effectiveness by a lack of facility instruments and "the competition" was either already operational or ramping up quickly. Through the LRP, the Canadian community clearly expressed their desire for more 8-m telescope time. This was expressed in terms of gaining access to a significant share of a new wide-field 8-m telescope and identifying Gemini as the highest priority for Canada's offshore facilities.

2. Developments Since 2000

Telescope Time

Chile is the host country for Gemini South and as a result receives 10% of the time on this telescope. Chile was also a “regular” partner contributing 5% of the capital and 5% of the operations budget for a 5% share of the time on each telescope. This meant that Chile ended up with 15% of the time on Gemini South and 5% of the time on Gemini North.

In late 2000, Chile decided that they had too much Gemini time and negotiated with the rest of the partnership to withdraw their 5% contribution to operations with this being picked up by the other members. In addition, they requested repayment of their 5% contribution to construction costs. In exchange Chile's 5% of telescope time would be distributed to the other members pro-rata on their contribution to Chile's buyout.

Canada agreed to purchase its share of Chile's time to bring us back to our nominal 15% share of Gemini time. The cost to Canada of the buyout of Chile's construction contributions was approximately \$1.4M US. WESTAR contributed \$0.38M US with **\$1.0M US coming from NRC LRP funds**. Canada's Gemini operations contributions increased as a result of the Chile buyout, which amounts to approximately **\$270K CA** annually depending upon the exchange rate. **This is also being covered by LRP funds through FY 2005.**

Instrumentation

In late 2002 Gemini initiated the “Aspen Process” to define the scientific requirements for instrumentation post-2005. This process was very much a bottoms up process with the scientists in the partner countries actively involved. The Gemini scientific community was challenged to define the “big” science questions for the period 2008-2012 and derive science requirements for the instrumentation needed to achieve major advancement towards the answers to these questions.

NRC-HIA hosted a Gemini pre-Aspen meeting in Montreal in May 2003. The meeting brought together approximately 25 scientists over two days to define the important science questions from a Canadian perspective and the types of instrumentation required to address these questions.

Gemini formed four science panels covering areas from the solar system to the high redshift Universe. Each of these panels had members from each of the Gemini partner countries and Canada was well represented. These panels started with input from the national pre-Aspen meetings and continued the process of defining the science questions and the necessary instrument requirements.

Gemini hosted the Aspen Workshop in June 2003 where approximately 90 scientists came together to discuss future goals. The Aspen workshop resulted in the development of the formal science case and a detailed plan for future Gemini instrumentation. The cost of the complete instrumentation package defined at Aspen exceeds the capital costs of the two

telescopes. The Gemini Science Committee reviewed the output from the Aspen meeting and prioritized the list of desired instrumentation. At its November 2003 meeting, the Gemini Board approved the recommendations of GSC.

The Aspen instrumentation plan is scientifically exciting. Gemini is taking a phased approach to the new instrumentation and is now starting design studies for an Extreme Adaptive Optics Coronagraph (ExAOC) and a High Resolution Near Infrared Spectrograph (HRNIRS). In addition, Gemini is beginning feasibility studies for a Wide Field Fiber Fed Optical Multi-object Spectrometer (WFMOS) and a Ground Layer Adaptive Optics System (GLAO).

It is worth noting that Gemini's leadership in high-resolution optical and infrared imaging and spectroscopy will uniquely qualify it to step in where the Hubble Space Telescope left off in the era where HST is not expected to be allowed to continue its mission past 2007.

The Aspen instrumentation plan is also expensive. The total cost is expected to be in the \$70M US range with **Canada's share being approximately \$14.7M CA spread over the period 2006 – 2011.**

Gemini Operations

The cost of Gemini operations has increased significantly over those in the original project plan. The LRP recommended that Gemini “be given the highest priority for ongoing operation and support of our international observatories”.

A total of \$6.4M in LRP funds have been/will be used to pay for increased Gemini contributions (includes O&M as well as instrumentation development) for FY 2003 to FY 2005. Gemini has proposed significant additions to budget that would see a 35% increase in the O&M budget in 2008 in order to better compete with other 8-m class telescopes.

This increased funding would pay for an increased scientific staff to support the high level of queue/service observing (95% of the time scheduled versus the planned for 50%) and to allow Gemini to deliver reduced data to PIs. Gemini is also proposing increases in the engineering and administrative/computing staff as well as operations money for network upgrades, enclosure painting, addition spares, and increased research funds for the scientific staff.

The competition is very intense, particularly with the VLT and Subaru, both of which were very well capitalized and have well-financed operations. In comparison, Gemini has suffered from a tight construction budget and is now forced to make up ground during normal operations. The proposed increase in Gemini operations would see Canada's contributions increase by \$1.25M CA by 2008.

3. Anticipated Status in 2010

Canada and the other Gemini partners have invested heavily in Gemini since the early 1990s and this investment is now producing forefront science. Gemini can not afford to stand still as other 8-m telescopes move ahead. The Gemini community has developed a compelling scientific vision which calls for ~ \$70M US in new instrumentation and the Gemini Observatory has proposed an ambitious ramp up in operational capability. **To meet this challenge, Canada's contributions to Gemini need to increase by a total of \$15.73M CA over the period 2006 – 2011.**

The LRP calls for an additional \$8M for Gemini/CFHT/JCMT operations in the period 2006-2010 and a further \$5M in the period 2011-2015. The increased Canadian contribution to Gemini alone over the period 2006 – 2010 amounts to almost \$16M, well above the amount noted in the LRP.

Canada will be in a very difficult situation if the other Gemini partners are able to identify the additional funds for Gemini's current plans and Canada is not. Canada may be faced with selling some of its Gemini time in order to allow Gemini to move ahead with its new instrumentation and operations initiative.

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