

Report of the “Gemini Assessment Point” Panel

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Primary Conclusion of the Panel

We strongly recommend the continued involvement of Canada in the Gemini Observatory partnership at the 15% level. Canadian astronomers are highly-dependent on access to 8–10m class telescopes and they will need such access for the next decade, at a minimum. Gemini’s frontier instrumentation and mature and efficient queue observing model make it the natural choice for the period covered by this assessment.

Context

Canada's participation in the Gemini Observatory provides Canadian astronomers with 15% of the available time on each of two 8m telescopes, providing access to both the northern and southern hemispheres of the sky. The development of astrophysics in the last few decades has relied heavily on frontier instrumentation and access to the 8–10m class optical and infrared telescopes to follow the cosmological imperative of studying forming galaxies at higher and higher redshift, the quest for large numbers of photons to provide the highest achievable signal-to-noise for spectroscopy and detection of outer solar system bodies, and the superb angular resolution needed to detect and study planetary systems around other stars. The Gemini Observatory represents Canada's only participation in operational 8–10m class optical astronomy facilities. Without access to 8–10m facilities, Canadian observational astronomers could no longer participate in the most topical and developing areas of the science. Furthermore, these facilities are critical to the readiness of Canadian astronomers to contribute and participate in the next generation facilities which will see first light no earlier than 2018.

Process

The Gemini Assessment Point process involved the preparation of reports on all aspects of Gemini's performance and impact for community consideration and response. All material made available to the panel was provided on the Gemini

Assessment Point community website for a month prior to the meeting of the Panel on Friday, October 4, 2009. Presentations to the panel were open to the community both by attendance in person at the Dominion Astrophysical Observatory in Victoria, BC and also by phone, video-conference and webcast.

Assessment

Canadian astronomers have been well served by their participation in the Gemini Observatory. Primarily as a result of the slippage in the delivery times of the first generation of instrumentation, the Gemini telescopes were only moderately productive in their early years – a pattern seen in the track record of most major international observatories. Various benchmarks, however, indicate that the scientific output of the Gemini telescopes is manifestly tracking the ‘growth curve’ historically displayed by other facilities, and the signs of its increasing influence and productivity are compelling. Gemini is now a major player in the sisterhood of 8–10 metre telescopes.

Within the Canadian community, the situation is particularly positive: relative to the broader international community, Canadian-led Gemini programs have produced greater-than-average publication and citation rates, both strong indicators that the research community is using the facilities imaginatively, to strategic advantage, and with consequently far-reaching scientific impact. Moreover, Canadians have been conspicuously interactive in striking international collaborations based upon Gemini research, and it is clear that the Canadian astronomical community’s scientific presence and influence have been materially advanced through our participation in the Gemini Observatory.

Gemini has played a key role in training highly-qualified personnel. In the last three years, the number of graduate student PhD theses which rely on Gemini data has grown significantly (20 since 2008) and it is likely that this number is a lower limit to the true value due to incomplete reporting from the community. A highly-successful co-op program for upper-year Canadian undergraduate students continues with term-long internships at the one of the two Gemini sites. The provision of travel support specifically for graduate students and postdoctoral researchers to travel to the observatories during their observing runs continues to be an important link in ensuring that they understand the conditions and real-life performance of modern astronomical facilities. Indeed, such visits are frequently more extended than the observing runs themselves and have the benefit of allowing the young researchers to develop close working relationships and collaborations with observatory personnel. Such

networking can be a decisive factor in the success and impact of young researcher's career.

Gemini has also engaged in well-publicized public outreach activities. Canadian initiatives, now being adopted by other partner countries, have seen high-school science students and amateur astronomers (in different years) compete for an hour of Gemini imaging time. Such competitions have always resulted in spectacular images and front-page coverage by the media.

Observing Time Share

Although the original partnership plan envisioned a 25% share of Gemini for Canada, funding restrictions eventually reduced this to 15%. Canada is therefore the third largest partner after the US (50%) and the UK (24%). Brazil, Argentina and Australia each have shares of less than 10%. The University of Hawaii and Chile each receive a 10% host allocation on Gemini-North and -South respectively. The Gemini Assessment Point presents an opportunity to re-evaluate Canada's share if some of the partners withdraw or re-negotiate their involvement. Canada must maintain its role in the Gemini partnership at this decision point to ensure access to an internationally-competitive research portfolio. A decrease in Canada's share of Gemini would directly weaken that research potential and hinder graduate training. Conversely, whilst the opportunity to increase Canada's share is certainly attractive from a scientific perspective, it is recognized that the commensurate increase in financial support is not easily achieved in the current budget. With Canada's recent withdrawal from JCMT, any additional funding for Gemini would likely come at the expense of funding Canada's existing share of the CFHT. CFHT has enormous support within the community, is consistently over-subscribed and has continued to produce cutting-edge science results. As a package, Gemini and CFHT both provide complementary, yet equally critical resources to the community. The over-subscription rates are often comparable, indicating a balanced involvement in both facilities. Therefore, based on current community demand, instrument and aperture need, and the limited funding pool, a continuation in Gemini at the 15% level appears to yield the appropriately balanced distribution of optical/infrared telescope resources.

The Gemini Agreement provides for no compensation for past investment in facilities construction or instrumentation for a partner who reduces their share.

Dividends of Canada's Participation in Gemini

There are two aspects of Canadian participation in Gemini that deserve particular note: 1) the creation of a highly-competent and highly-reliable laboratory and team for producing facility-class instruments, and 2) the profound influence of the development of the Gemini Science Archive at CADC on the ease of access to Gemini science data and to the subsequent externally-funded provision of non-Canadian astronomical science archives. We briefly remark on each of these achievements.

The construction of large-telescope instrumentation has historically been a source of consistent and highly-threatening cost-overruns and delivery-time delays. HIA's instrument group has established itself as the leader in realistic budgeting, planning, and execution and now has a worldwide reputation for these attributes as well as delivering complex instruments which perform to specification immediately upon delivery. A majority of the highest-demand and highest-impact science produced on Gemini has been achieved with HIA-built instruments. The integrity of the lab and team have resulted in their expertise being sought out for both future facility instrumentation and external partners.

The CADC's archive services have had a tremendous impact of the ability of Gemini scientists to access their data immediately and therefore hasten its reduction, publication, and impact. Primarily as a result of the demands of the Gemini Science Archive, the CADC has developed contract archives for missions and facilities outside Canada's borders. It is likely to maintain its pre-eminence in this area for the foreseeable future.

Future Gemini Instrumentation

The community expressed a strong interest in the being part of process by which future instrumentation is planned for Gemini. As Canada's sole access to 8-10 class facilities, it is critical that new instrumentation for Gemini be an excellent match for the needs of Canadian astronomers for the coming decade. The effectiveness and impact of imaging/spectroscopic programs involving two facilities was reported at the meeting and Canadian astronomers have used the Gemini/CFHT combination particularly effectively in this regard. Future Gemini instrumentation must reflect the compounding opportunities provided by access to such well-matched facilities. Furthermore, the importance of a funding level sufficient for development of competitive instrumentation on a few-year timescale cannot be understated.

Governance Issues

Despite this committee's strong support of continued involvement in Gemini, the assessment exercise has identified several issues that might impact full realization of the investment. Although these issues do not weaken the support for continued engagement, awareness and appropriate planning/action is critical for a functional research facility that services the community effectively. It is not the mandate of this report to provide an extensive assessment of internal governance, but the recommendation to continue in Gemini is contingent on a functional partnership. In this regard, perhaps the most important concern is the potential change in power balance in the partnership. The Canadian community has long recognized the importance of a governance role in its shared facilities – a model that has been very successful e.g. with the CFHT. Canada must be prepared to act to maintain its ability to actively participate in governance in the face of any partnership changes resulting from the assessment point. Although Canada is unlikely to become an equal share-holder in the partnership, there is a unanimous sentiment amongst Canadian astronomers to preserve community-driven planning.

Community Evolution and Synergy with Future Facilities

The Gemini telescopes have matured into high-performance research facilities equipped with state-of-the-art instrumentation of proven productivity and reliability; moreover, other promising instruments and technological advances are imminent. In particular, the highly-anticipated Multi-Conjugate Adaptive Optics system and the Gemini Planet Imager will both be transformational for the field. Similarly, the near-infrared, multi-object spectrograph FLAMINGOS-2 is likely to be extremely attractive to observers. A frequently stated comment heard by the GAP panel was that Canada is about to reap a huge dividend for its involvement in Gemini and this would be exactly the wrong time to reduce our share.

There are two particularly noteworthy aspects that bear on the continuing short- and mid-term promise for these facilities:

1. The infrared optimization of the telescopes (their lightweight design and structure, and the use of specialized low-emissivity coatings, combined with the natural qualities of the sites) means that they currently sit at a unique 'sweet spot' in the science that can be done. Gemini can foresee enjoying as much as a decade or so of frontier research before the launch of JWST into the near-zero background IR environment of space renders these ground-based telescopes less clearly competitive.

2. The multi-instrument queue scheduling protocols have matured and the Observatory is now achieving its goals of delivering the top-rated science programs, thanks to operational policies that are remarkably flexible and agile, both in their ability to accommodate changing conditions and in their adaptability in responding to calls for scientifically-important target-of-opportunity observations.

Given these signs of now-routine productivity and the important scientific beachheads being secured by these optimized facilities, we conclude that continued partnership within Gemini is very desirable. In the longer (post-JWST) term, the landscape will change in ways that will require close strategic attention, but that development is the best part of a decade away. In the meantime, Gemini has the opportunity to lead the world in the research areas which exploit its capabilities.