The Future of The Gemini Observatory (An Individual Perspective)

Timothy C. Beers
Department of Physics & Astronomy
Michigan State University

Outline

- What is the current role of the Gemini Observatory ?
- How is the landscape of ground-based astronomical observing changing ?
- What will be the scientific drivers ?
- What new capabilities should be explored ?
- How do we get from here to there ?

The Current Role of The Gemini Observatory

- The Gemini Observatory telescopes provide a broad user base with capabilities for (primarily) PI-driven science that demands:
  - Excellent delivered image quality in the optical and IR
  - Multiplexed moderate-resolution spectroscopy in the optical (and soon, again) in the near-IR
  - Excellent mid-IR optical and spectroscopic performance
  - A mature and capable AO system
  - A well-developed, sophisticated queue system
  - Access to targets over the entire N/S sky

Current Role (cont)

- The Gemini Observatory maintains a structure that encourages development and deployment of “visiting instruments” for specific niche science applications
  - TEXES: **Texas Echelon Cross Echelle Spectrograph**
- The Gemini Observatory is exploring operational modes which encourage “large campaign” science
  - The NICI: **Near-Infrared Coronagraphic Imager** campaign for planet discovery

How is the Landscape for Ground-Based Observing Changing ?

Changes in the Landscape (cont)

- In the not-so-distant past, “data” and the ability to gather MORE data than others was the currency of the realm
  - Those that had it **prospered**
  - Those that did not **struggled (or got clever)**
- Today, the “democratization” of astronomical data by surveys, space-based programs, etc.
  - Has **diminished** the value of raw data, per-se
  - Has **increased** the value of well-constructed and well-calibrated datasets

Changes in the Landscape (cont)

- The power is in the collaboration
- SDSS is a prime example
  - **Seven** public data releases
  - Generated over **2000 articles** in refereed journals
  - Approaching **100,000** citations
  - Year after year, **highest impact** observatory
  - Over **100 PhD Theses** based on SDSS data, many more when public data counted

Changes in the Landscape (cont)

For just one year (2006), as reported by Madrid & Macchetto (2009)

TABLE 1

HIGH-IMPACT OBSERVATORIES

Rank	Facility	Citations	Participation
1	SDSS	1892	14.3%
2	Swift	1523	11.5%
3	HST	1078	8.2%
4	ESO	813	6.1%
5	Keck	572	4.3%
6	CFHT	521	3.9%
7	Spitzer	469	3.5%
8	Chandra	381	2.9%
9	Boomerang	376	2.8%
10	HESS	297	2.2%

N.B. – Gemini (13), Subaru (14), NOAO (15)

Changes in the Landscape (cont)

- Today's 8m-class telescopes primarily carry out observations that fall into two classes:
  - **(Class-1)** Follow-up detailed studies (imaging and spectroscopy) of sources demonstrated to be of interest from previous observations
    - phenomena "known", instruments "known"
  - **(Class-2)** Discovery science enabled by the combination of (usually, large numbers of) photons gathered by instruments with unique capabilities
    - phenomena "unknown" or "new", instruments "new"

Changes in the Landscape (cont)

Two Facts Appear Certain:

- The explosion of ever-larger and ever-richer datasets will accelerate
  - Increasing the desire for **Class-1** science follow-up observations
- New-generation, 20m to 30m-class telescopes
  - Moving **Class-2** science off the world's 8m-class telescopes

What Will Be the Scientific Drivers ?

- We cannot know (for certain)
- We can only guess (with a high failure rate)

- We can base future development plans on the assumption that ***flexibility and capabilities*** of a long-term instrumentation suite will be essential

- Class-2 instruments for newly discovered phenomena will take sufficiently long to develop, and be sufficiently expensive
  - **They will be thought of as Class-1 follow-up instruments by the time they are ready**

What New Capabilities Must be Explored ?

- The most “scientifically successful” 8m telescopes will be those that are

best prepared, and most closely-coupled

to providing Class-1 follow-up of present, and especially, near-future surveys

- While development of Class-2 capabilities should continue, this aspect should be balanced against impact on Class-1 objectives

What New Capabilities Must be Explored ? (cont)

- Emphasis should be placed on establishing of a suite of instrumentation that is:
  - Affordable (on a “per-capita” basis, e.g. $/astronomer)
  - Capable of widest variety of Class-1 follow-up science
  - Rapidly developed and upgradable with new detectors
  - Planned for acquisition of Class-1 follow-up data of greatest interest to the broad user community
  - In the “out years,” consider specialization to specific areas driven by time on sky, not new instruments

How to Get From Here to There ?

- Recognize that we (both Gemini and Subaru) have reached the mid-life stage (which all telescopes do), and plan for the transition from Class-2 to Class-1 science

- Seek partnerships in the process, so as to **reduce redundancy** of "niche" instruments, while **increasing redundancy** of workhorse instruments as user demand warrants
  - Sometimes **new is better**
  - Sometimes **more is better**

How to Get From Here to There ?

- Review budgetary procedures, so that these transitions are managed, rather than stumbled into by default
- Work toward increasing user-base understanding of the power and promise of community-owned, rich datasets
- Develop and deploy new means of exploring these datasets, enabling multiple uses over time
- This conference, and especially what follows, provides an excellent beginning