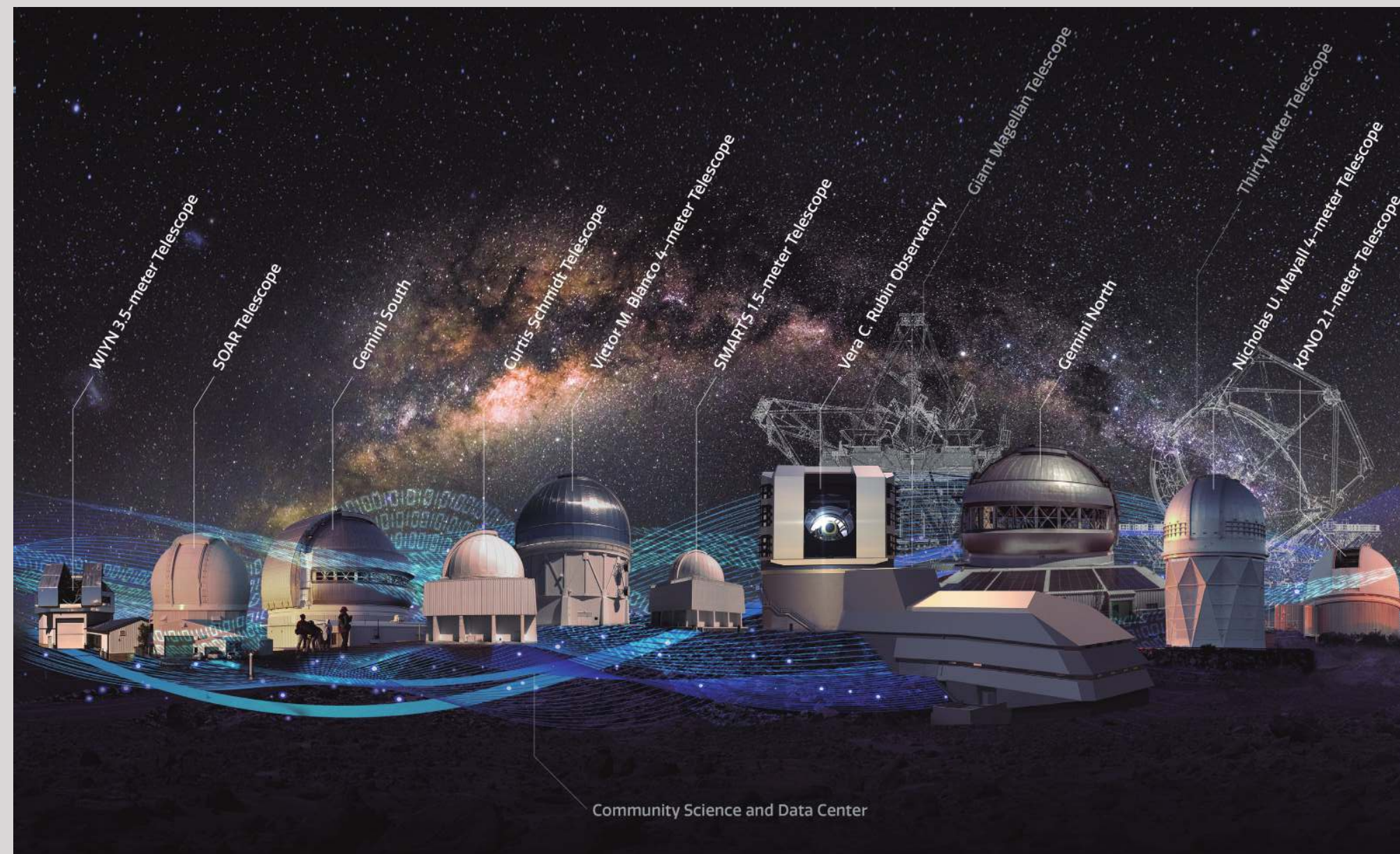




Abstract

Steady annual investment through the IDF contribution is a critical component to maintaining scientific competitiveness and capabilities of NSF's NOIRLab / Gemini Observatory. To remain competitive, the cost of upgrading core facilities (such as AO and telescopes A&G) and the cost of replacing our current suite of instrumentation and facilities far exceed the current level of IDF contribution. To fund our development program we are dependent on additional sources of income (recapitalization).

NOIRLab current and potential future system



IDF and other recapitalization sources

A steady annual investment through the IDF contribution is a critical component to maintaining Gemini's scientific competitiveness and capabilities.

- Partner contributions to the IDF are compensated with observing time for their user community.
- Contributions to the IDF are based on best efforts, with partners communicating their planned contributions upon approval of the Annual Budget each year.

Upgrading core facilities and replacing current instrumentation to maintain competitiveness requires funding beyond the current IDF contribution. **To support our development program, we rely on additional sources of income and contributions, including:**

- O&M funds support our instrument development program by providing funding for staff working on development.
- The Obsolescence Program, aimed at replacing outdated systems, is funded through the O&M Budget.
- Additional funds beyond our current CSA include supplemental NSF funding (such as the **GEMMA award**), partner funding (like the **GIRMOS Multi-object AO instrument**), and contributions from NSF and private institutions collaborating with Gemini (such as the planet finding instruments **MAROON-X** and **GPI-2**).

IDF recapitalization cost into Operations

The IDF and O&M are defined in the International Agreement. The IDF differs in nature from the O&M:

- The IDF is a voluntary 10% contribution from Gemini partners, primarily intended for external instrumentation contracts.
- Gemini has limitations on using IDF for staff or associated costs, with a focus on funding external contracts.
- Expenditures from the IDF are distributed considering partners' responsibilities and benefits.
- The current Gemini International Agreement is in effect until 2027, requiring ongoing international community engagement for instrument recapitalization.

Partners could increase the O&M fund to include the IDF, applying constraints to the portion intended for external instrumentation contracts.

It's worth noting that Gemini competitors, such as the European Southern Observatory and Keck Observatory, have different approaches. The former builds instruments through international treaties, while the latter utilizes a combination of limited Keck funding, NSF competed proposals, and pivot funding.

Instrumentation Recapitalization Use Cases



GMOS



GN Texas Installation (visiting instrument)

International Gemini Observatory

Gemini operates two 8-meter telescopes in Hawaii and Chile with optical and infrared instruments. It's the US astronomical community's flagship ground-based observatory.

The international agreement signed by the partner countries states, assigns the National Science Foundation as the executive agency. NOIRLab and AURA manage the observatory through a cooperative support agreement.

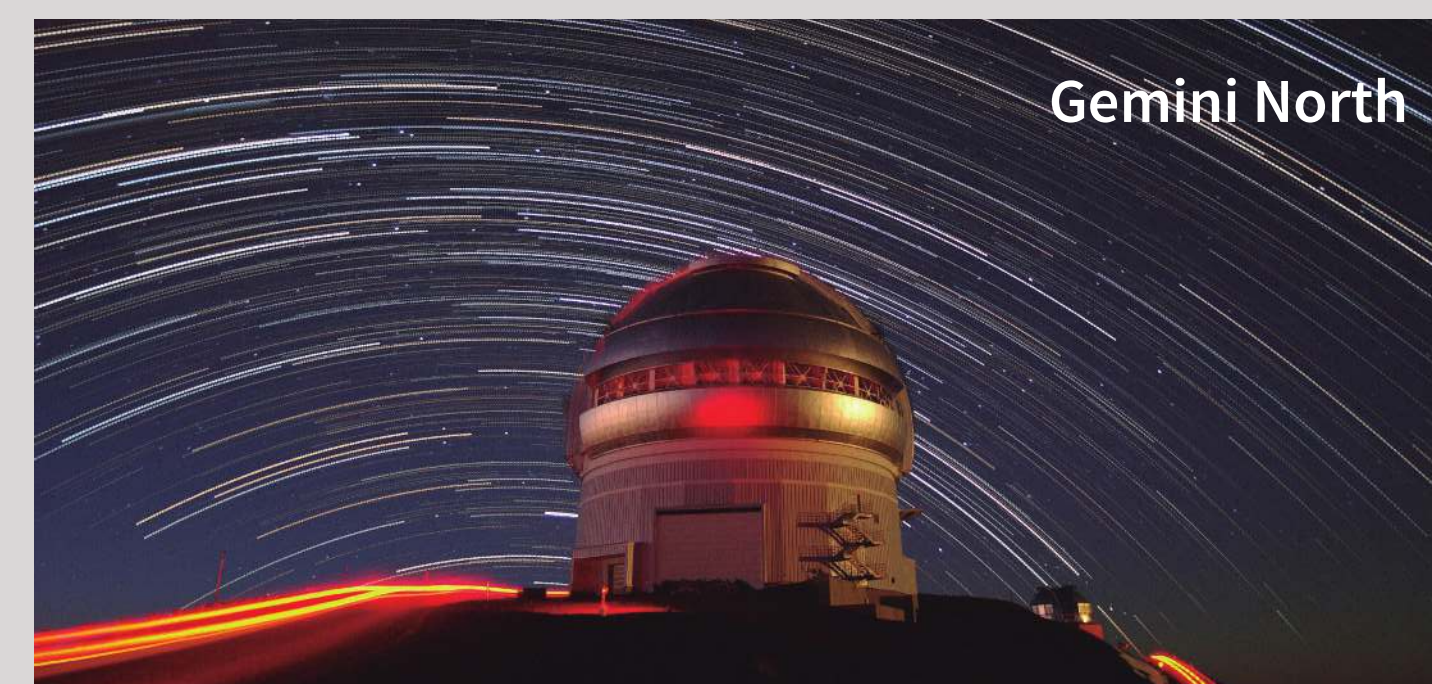
Gemini recapitalizes infrastructure, facilities, and instrumentation through the CSA, NSF Supplemental funding, and community-led projects.

Our main source for recapitalization is the IDF, which according to the International Agreement signed in December 2021, is intended **"to provide for instruments and their supporting systems to significantly augment, upgrade or replace those provided under this Agreement"**.

The IDF has replaced first-generation instruments and funded others such as infrared imager spectrograph Flamingos-2, Gemini Planet Imager, high resolution spectrograph GHOST, and the simultaneous 8-channel imager and spectrograph SCORPIO, while also supporting upgrades to workhorse instruments such as GNIRS, and GMOS.



Gemini South



Gemini North

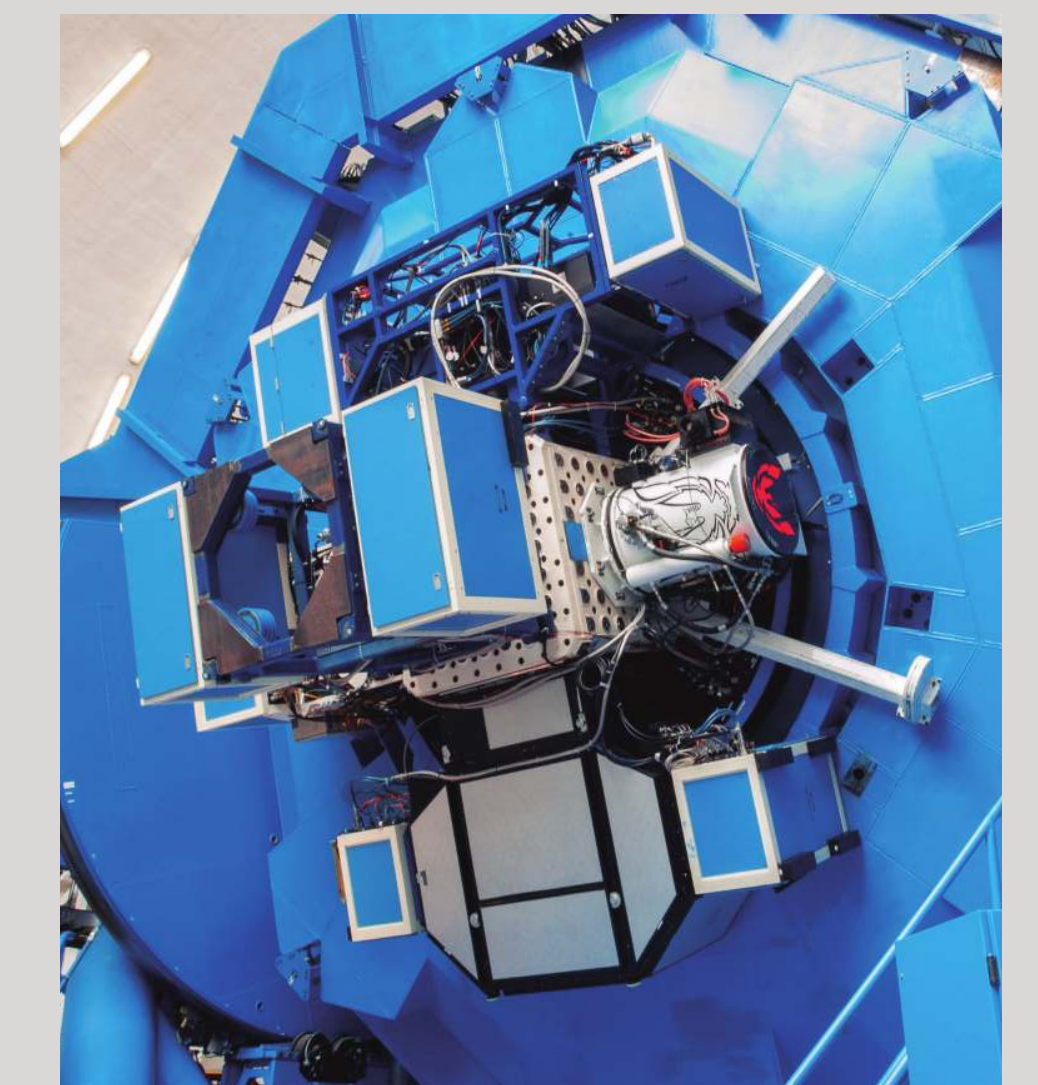
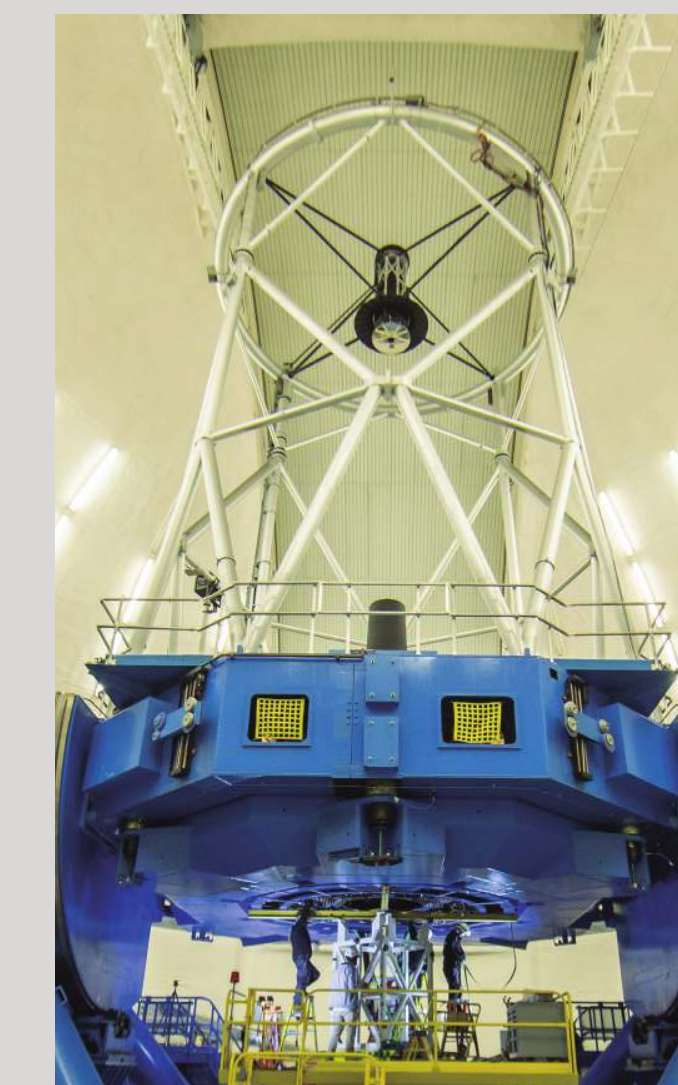
Appendix: Gemini Instruments

Both GS and GN 8.1m telescopes, are complemented by a suite of optical and IR instruments. Our operational mode offers to the user community 4 facility instruments plus a single adaptive optics (AO) system per telescope.

We keep our set of instrument capabilities competitive in 3 ways:

1. by replacing the least desirable instruments with new facility instrument,
2. by running an instrument upgrade program,
3. by supporting a visiting and community instrumentation program.

Our first generation instruments are more than 20 years old.



Left: Wide angle view of the Gemini South Telescope. The light truss structure and secondary mirror support are optimized for infrared observations. **Right:** The Instrument Support Structure (ISS) cube at the Cassegrain focus of Gemini North Telescope contains 5 ports, 1 for calibration sources, 1 for adaptive optics and 3 for instrumentation.