Gemini Science Committee

Meeting Resolutions

Meeting #10, April 1997

RESOLUTION 10.1:

The GSC congratulates the Project team for keeping the project on schedule during a difficult period and continuing its excellent leadership and management. We would like to recognize the OCS team for the excellent progress in developing the Observing Tool, which is critical for the efficient development and scheduling of observations with the Gemini telescopes.

RESOLUTION 10.2:

We feel that the participation of scientific representatives from all of the Gemini partners in the Gemini scientific oversight activities is essential. We are very concerned about the inability of representatives from Argentina, Brazil, and Chile to participate in the recent Project Science team and GSC meetings and suggest that the Project explore with the National Project Offices innovative ways to enable this participation.

RESOLUTION 10.3:

We welcome the significant UK contribution brought forward into 1997. This development is a key to the timely completion of the Gemini telescopes. We recognize that significant delay in any partner contributions will force the project to slow down, which will have a major impact scientifically because of increased project cost and a lessening of focus on the timely completion of the Gemini telescopes.

RESOLUTION 10.4:

Given the difficulties in obtaining SiC blanks for the Gemini secondary mirrors, we endorse the project approach of acquiring a light weight glass secondary for commissioning, but reiterate our goal to meet the scientific performance requirements at operational handover.

RESOLUTION 10.5:

The GSC endorses the Instrument Forum approach to implementing the On- going Instrumentation Program. The instrument development fund is a precious resource and we expect the Gemini Project, together with the National Project Offices and instrument teams, to implement in a cost-effective manner the approved on-going instrumentation program. The content of the on-going program and the top level performance requirements must be approved by the Gemini Project Scientist with the advice of the GSC.

RESOLUTION 10.6:

We are encouraged by the technical success of the GMOS CDR but are distressed by the very significant cost growth. The GSC feels that two GMOSs, one for Gemini-N and one for Gemini-S are a fundamental part of the Phase I instrumentation program. The GSC recommends that the Project maintains tight fiscal pressure on the GMOS team in order to minimize this cost growth, and with great reluctance we recommend that the additional resources suggested by the Instrument Forum are at the expense of the near-infrared upgrade to GMOS. In view of the scientific importance of the GMOS IFU's we encourage the GMOS team to consider how to retain the IFUs.

RESOLUTION 10.7:

The GSC notes with pleasure that the HROS conceptual design based on the performance specifications listed by the GSC at its last meeting appears to be technically feasible.

However this full-up Cassegrain HROS is judged by the UK Project Office and the IGPO to cost much more than the available $2.7M to complete. We recommend that the Project investigate very substantial simplification of the instrument, i.e., a single R=50K resolution, UV optimized, and with as few moving parts as possible, and report to the next OISWG and the Instrument Forum what can realistically be achieved within the available budget (i.e., what the UK Project Office will sign up to deliver for $2.7M), and assess the scientific viability of this simplified HROS. It is noted that a bench mounted spectrograph in the high stability lab with complementary high resolution capability (R= 120K-10^6) is a high priority in the proposed on-going instrumentation program.

RESOLUTION 10.8:

The GSC endorses the delay in implementation of the short red camera and the Wollaston prism as cost saving measures, with the understanding that the designs will be carried to the CDR level. The GSC recommends that the nominal `low' spectral resolution mode be adjusted down from 2000 to 1800 in order to provide complete spectral coverage in the cross-dispersed mode.

The NIRS IFU implementation should be kept relatively simple, since this is a new capability, with little experience concerning implementation or use. Performance guidelines for the IFU are as follows:

- Map a 2D area of image plane onto a single long slit with maximized fill factor.
- No additional blocking filters.
- Plate scales: 0.05 and 0.15 arcsec. One of these is required, with a goal of supplying both.
- Switching between IFU and long slit use, or between IFU plate scales should not require warming of the dewar.

RESOLUTION 10.9:

The GSC endorses the MIRI CoDR report and strongly supports the primary goal being superior imaging capability from 8 to 26μm, and that enhancements including spectroscopic capability should not compromise imaging performance, nor drive optical or mechanical design considerations.

RESOLUTION 10.10:

The GSC endorses the NOAO proposal for use of COB for commissioning of Gemini South, and the shared scientific use of Phoenix between NOAO and Gemini during scientific operations and recommends that Gemini proceed to negotiate an agreement with NOAO on this basis. The GSC remains enthusiastic about the possibility of shared use of a clone of NIRS between the SOAR telescope and Gemini South as a very cost effective means for providing a near IR spectroscopic capability at Gemini South.

RESOLUTION 10.11:

The GSC recommends the following revised Science Performance Requirements for GAOS:

Wavelength Coverage:

- 1-2.5μm baseline with requirement of changeable dichroic, allowing observations to 0.85μm. A goal is to extend observations to 5μm and not preclude use to 0.5μm.

Throughput and Emissivity:

- The deployment of AO will not lower the telescope throughput by >25% over the baseline wavelength range. With the changeable dichroic the same throughput specification is required for 0.85 - 1.0μm.
- The total emissivity of the telescope and AO system (without ADC) in K must be <19%, with a goal of this emissivity out to 5μm.

Flat Fielding:

- It is required that the flat field instability does not cause systematic effects larger than the photon noise over a 5x5 arcsec^2 region within a 1 hour integration in J through K. It is a goal to match this in L and M.

Strehl Ratio:

- A minimum on-axis strehl ratio delivered to the detector of the near-infrared imager of 0.4 in H during median seeing conditions for bright guide stars. The on-axis strehl must be met during any one hour of exposure within 45° of zenith when atmospheric conditions remain constant. The intent is that, when applied to a background-limited point source observed at a zenith angle of 45°, this strehl ratio will result in roughly a factor of 2 improvement in S/N ratio over what would be obtained with tip/tilt/focus compensation during the same integration time. This system is expected to deliver a commensurate performance at J.

Field of View:

- 2 arcmin diameter unvignetted field of view
- Conjugation of the DM to an optimal altitude is required

Sky Coverage:

- The intent is that sky coverage be maximized for the specified strehl ratios. The natural guide star AO system should be designed such that it can be upgraded to a laser guide star system and have a flexible control architecture, with the priority to increase the system's sky coverage at the above performance levels.

RESOLUTION 10.12:

The GSC is pleased that representatives of all the Gemini partners participated in the first Gemini Instrumentation Workshop held in Abingdon. The GSC congratulates the organizers for staging a very successful Workshop, and the editors for capturing the workshop discussions in their Report. We recommend (1) that this report be adopted as the basis for development of a proposed on-going instrumentation program for discussion at the Fall GSC meeting and (2) that additional workshops be held periodically as part of the continuing re-evaluation of the on-going instrumentation program.

The new components recommended for consideration in the on-going instrumentation program are:

- A&G polarization modulators for both optical and IR at both telescopes,
- a high stability lab spectrometer,
- a LGS/NGS AO capability for Gemini-S,
- a NIR Multi-object Spectroscopic capability for Gemini-N or S, and
- a NIR imager/coronagraph for Gemini-S.

Guidelines for the future instrumentation capabilities are given in Resolutions 10.13 - 10.17. These guidelines should be reviewed by the appropriate instrumentation SWG and the Project Scientist team prior to the next Instrumentation Forum and GSC meetings.

RESOLUTION 10.13:

Polarization measurements will require implementation of a polarization modulator in the A&G unit above the bottom port. The NIRI and NIRS are designed to incorporate Wollaston prism polarization analyzers; however, implementation of polarizing capability in GMOS and HROS requires further assessment.

Performance guidelines for polarization:

- Optical/IR polarization modulator plates in front of up-looking ISS port.
- Implementation must be remotely retractable and allow for unvignetted use of bottom port over the full 9 arcmin diameter (goal) science FOV
- Wavelength coverage: 0.3 - 1.2μm for GMOS, HROS and 1-5μm
- FOV: min of 1 arcmin. Extended FOV for OIWFS must be maintained
- Assessment of possible operating modes with GMOS and HROS
- A minimum of one modulator wheel with a goal of two that can be used in series
- Calibration capability

RESOLUTION 10.14:

The high stability lab in the pier provides a very stable environment for precision radial velocity measurements. A fibre-fed, stable bench-mounted optical spectrograph equipped with an absorption cell provides the greatest sensitivity currently for detection of low mass companion, and higher resolution modes would enable many studies in stellar physics.

Performance guidelines for pier spectrograph:

- Bench mounted in telescope pier; fibre fed from cass focal station
- Wavelength range: H&K lines to 1.1μm; simultaneous spectral coverage of at least 100 nm for 120K mode
- Resolution: 120K required, with goals of 300K, 500K, & 1000K
- Absorption cell for high stability wavelength reference
- Maintain throughput under poor seeing conditions
- Study to determine throughput capabilities to High Stability Lab

RESOLUTION 10.15:

The ability to obtain near diffraction-limited imaging capabilities at near-IR wavelengths, on both Gemini telescopes, through implementation of adaptive optics is of paramount

importance in effectively addressing key scientific issues over the whole range of science topics addressed by the Workshop.

Performance guidelines for CP AO system:

- Wavelength range: 1-2.5µm required, 0.7-5µm goal
- Operating Zenith angle range: 1 to 60 deg
- Switchable between NGS and LGS
- Strehl ratio performance requirements for NGS mode: the minimum requirement is to achieve Phase I strehl ratio performance, with a goal of achieving TBD strehl ratio at H under good conditions
- Strehl ratio performance requirements for LGS mode: TBD
- Preserve location of telescope focal plane, with the intent of allowing AO images to feed range of instruments?
- AOWFS and DM conjugated to opt alt or PM or both?

RESOLUTION 10.16:

The continued development of large format Near-IR Arrays provides an opportunity for three powerful new capabilities in the area of 1-2.5µm multi-object spectroscopy: advanced integral field spectroscopy, small field multi-slit spectroscopy for use with AO correction, and wide field multi-object spectroscopy over as much of the available f/16 FOV as possible.

Performance guidelines for multi-object near-infrared spectroscopy:

- Wavelength range: 1-2.5µm
- Array Format: min of 2kx2k, goal of 4k in at least one dimension
- Resolution: R~6000 requirement, and ~30K goal
- IFU with 0.05 arcsec pixels, FOV 5 arcsec (or as large as practical) minimum spectral coverage of ~1000 pixels
- Multi-slit with 0.05 arcsec pixels over a minimum 30 arcsec FOV. Flexibility in number, location, size, length of slitlets is highly desirable
- Multi-Object with 0.15 arcsec pixels over a minimum 5.5 arcmin FOV
- A goal is to combine two or more of the above modes in a single instrument
- Slit masks or other object selection devices should be changeable during an observing session without warming the spectrometer or significantly interrupting operations
- Mode changes should not require warming dewar
- NIR OIWFS for tip-tilt and fast-focus corrections

Study should determine optimum choice of spectral resolution for working between OH airglow lines.

RESOLUTION 10.17:

A small field near-IR imager with pixel scales and optics designed to exploit AO performance and tip-tilt corrected images with optimized near-IR coronagraphic imaging capability will address a very wide range of science topics.

Performance guidelines for IR imager:

- Wavelength range: 0.8-5μm
- Pixel scales: 0.01, 0.02, 0.05 arcsec
- Array format(s): 1kx1k with goal of 2kx2k
- Optimized coronagraphic mode
- Assume facility AO
- NIR OIWFS for tip-tilt and fast-focus corrections

Studies to evaluate coronagraphic performance and mask requirements and consider role of AOWFS within instrument.