New Instrument Development Summary

The GSC and Gemini Board recommended new instrument development, derived from the Aspen Workshop, that can be split broadly into two categories. The highest scientific priority instruments are listed in the table below. Of these, the Extreme AO Coronagraph and High-Resolution NIR Spectrometer were approved at the level of pursing conceptual level design studies. The Wide Field Fiber-Fed Optical MOS, because of its expected cost/complexity, was recommended to be pursued as a feasibility study.

Highest Priority Instruments	
Instrument	**Science enabled**
• Extreme AO Coronagraph	• Direct detection of gas-giant planets • Protoplanetary disks
• Hi-Resolution NIR Spectrometer (with MCAO-fed MOS)	• Doppler detection of earth-mass planets • Star formation vs age, abundance, environment • Nature of circumstellar environments • Physical state/composition of ISM • Black Hole–SF connection in Milky Way
• Wide Field Fiber-Fed Optical MOS	• Dark energy • Dark matter on galactic scales • Galaxy genesis

In addition, the GSC recommended pursuing development along various fronts to support other science missions identified through the Aspen Workshop, albeit at a lower scientific ranking than the core package defined above. These other new capabilities are summarized in the table below. Among these new instruments, the GSC recommended that Gemini launch a feasibility study for a GLAO system in 2004. The science potential for this technology on Gemini is very exciting but additional detailed modeling is needed before a commitment can be made to pursue such a

system. Also recommended was a wide field IFU optical spectrograph, which is not expected to be as technologically challenging as the GLAO system. This, together with its lower scientific ranking, led to the decision to not pursue a study yet. Instead, it will remain among the list of options that might be pursued when all of the aforementioned design and feasibility studies are completed. Finally, the use of a tunable filter in the Gemini South Adaptive Optics Imager (currently under development at the Australian National University) is being investigated, as well as options for providing a high resolution mid-IR spectroscopy capability through the potential use of a visitor instrument on Gemini.

Other Opportunities	
Instrument	**Science enabled**
• GLAO System	• First light objects in the universe • Dark matter on galactic studies • Proper motion studies across the Local Group
• Tunable Filter with GSAOI	• First light objects in the universe
• IFU Optical Spec	• Formation of Hubble sequence • Stellar population studies beyond the Local Group
• High Resolution MIR Spectrometer	• Star formation & ISM studies

Together, this set of new capabilities for Gemini represents an aggressive program with far-reaching science applications. Again, a decision to build any of these instruments is pending resolution of future funding. In the mean time, Gemini is using existing funds to begin this development program, which will generate better costs, capabilities, science cases, etc. which will be used as part of the decision making process to commit to build various components of this program over the next 1-2 years.