SIM ERB Membership

- Dr. William Cochran, University of Texas, Austin
- Dr. William Danchi, NASA, GSFC
- Dr. Harold McAlister, Georgia State University
- Dr. William van Altena, Yale University
- Dr. E. Joseph Wampler, University of California, Santa Cruz (retired) (Chair)

The ERB unanimously endorsed the Report.

Major Conclusions

A. THE SHARED BASELINE CONCEPT CAN UNDERTAKE NEARLY ALL THE SCIENCE PROGRAMS FORESEEN IN THE NRC DECADAL REPORTS, IS TECHNICALLY FEASIBLE, AND FITS UNDER THE NASA-IMPOSED COST CAP.

B. THE SIM PROJECT STILL NEEDS THE DEMONSTRATION OF PICOMETER TECHNOLOGY.

The NRC Decadal reports justified high-accuracy space interferometry both for planet finding and mass measurements and for a host of other important astrophysical problems. While only the original SIM architecture (which is over cost) addresses ALL the science programs foreseen in the NRC Decadal reports, by dropping the requirement for imaging and nulling, the Shared-Baseline concept fits under the cost cap and can efficiently pursue all the other foreseen science programs.

- With a five-year mission and a 1μ arcsec, 1 σ single measurement error, SIM can detect planets at 10 pc with masses ≥ 3 $M_\oplus$ in orbits and periods comparable to the Earth's.
- Long-period planets will require Grid and Wide-Angle Astrometry.
- SIM is the only mission that can determine the masses of the planets. Without SIM, TPF becomes PF.
- The Shared-Baseline concept seems to retain most of the advantages of SIM-Classic, while reducing the complexity, increasing the inferred reliability, and resulting in a substantial cost savings to the project.
- We are not experts on the costing of space missions, and thus we must accept the costs presented to us at face value. We note that the various cost estimates given by experts are in agreement.
- As a demonstration of the required technology has not yet occurred, the technology is still not mature. A reduction of the achieved SIM narrow angle single measurement accuracy to the 3 μ arcsec will have little impact on wide-angle programs. But the reduced accuracy increases the lowest planetary mass detectable at 10 parsecs to about ≥ 10 $M_\oplus$ for orbits and periods comparable to the Earth's. The ERB feels that such a loss in measurement accuracy risks losing the terrestrial planets.
- If the SIM mirrors have only slightly degraded performance, the integration time required for a given magnitude object could be substantially increased.
- This would reduce the number of objects observable during the mission life.
- The throughput of the optical train must be sufficiently high to ensure that a tight system lock to appropriate guide stars is achieved.

Important Points Noted by the ERB

- While TPF will surely survey all 250 nearby stars for potential extra-solar planet candidates in the imaging mode, the results of that survey will be open to multiple interpretations due to the lack of planetary masses if SIM does not fly.
- The Shared-Baseline concept seems to retain most of the advantages of classic SIM, while reducing the complexity by almost a factor of two. **The ERB strongly endorses the Shared-Baseline option for SIM.**

Assessment of the JPL Effort

- Meeting the accuracy goal of SIM has not yet been demonstrated.
- However, the ERB believes that the SIM team is fully committed to a high-accuracy SIM satellite. And JPL has assembled an extraordinarily capable team to confront the extreme challenges of space interferometry.
- We commend the SIM project for their successful efforts to significantly reduce the complexity of the satellite.