



Space Interferometry Mission

SIM

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Origins
Mission

Project Status for the Origins Subcommittee (OS)

Jim Marr
SIM Project Manager

2 December 2002



Space Interferometry Mission



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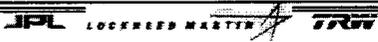
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- **Salient Features**
 - 3 parallel Michelson Stellar Interferometers
 - 10 meter baseline
 - Visible wavelength
 - Launch Vehicle: Space Shuttle or EELV
 - Earth-trailing solar orbit
 - 5 year mission life with 10 year goal
 - SIM is a JPL, Caltech, Lockheed Martin, TRW, and SIM Science Team partnership



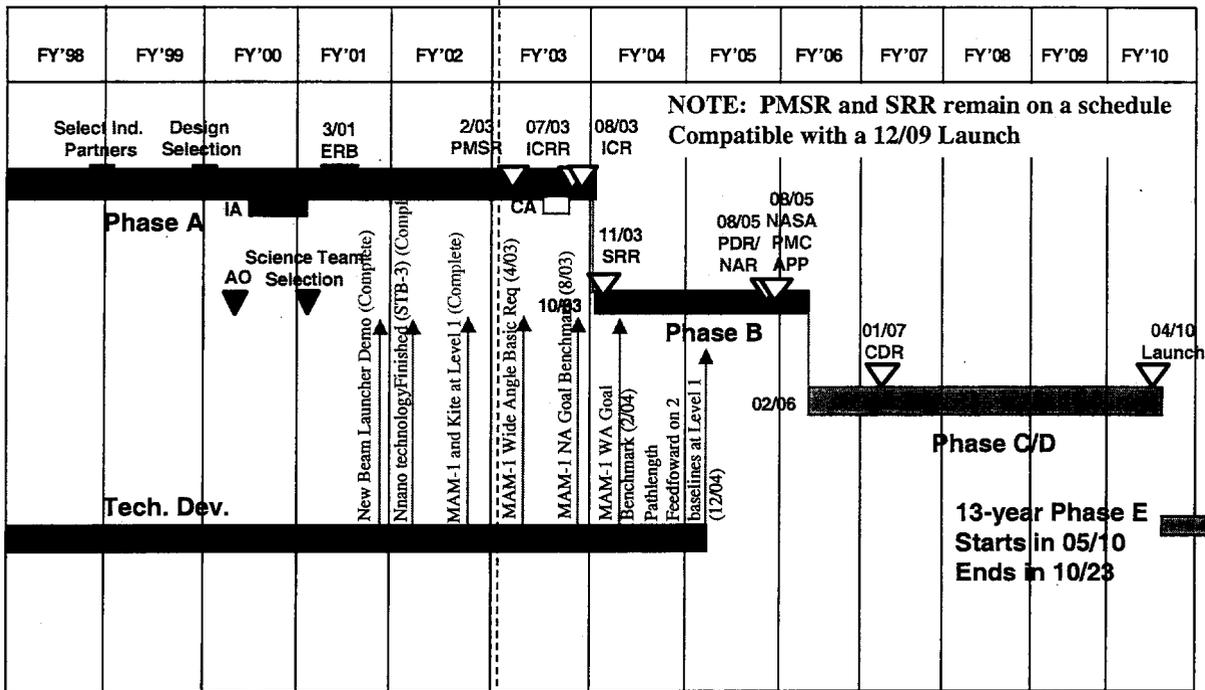
- **Science**
 - Perform a search for other planetary systems by surveying 2000 nearby stars for astrometric signatures of planetary companions
 - Survey a sample of 200 nearby stars for orbiting planets down to terrestrial-type masses
 - Improve best current catalog of star positions by >100x and extend to fainter stars to allow extension of stellar knowledge to include our entire galaxy
 - Study dynamics and evolution of stars and star clusters in our galaxy to understand how our galaxy was formed and how it will evolve.
 - Calibrate luminosities of important stars and cosmological distance indicators to improve our understanding of stellar processes and to measure precise distance in the distant universe





POP02 In-Guide Project Schedule

LRD 4/10



ATLO = Assy, Test & Launch Ops ERB = External Review Board PMSR = Preliminary Mission & Systems Review SRR = System Requirements Review
 CA = Confirmation Assessment IA = Independent Assessment NAR = Non Advocate Review CRR = Confirmation Readiness Review (JPL PMC)
 CDR = Critical Design Review I&T = Integration & Test PDR = Preliminary Design Review ICR = Initial Confirmation Review (Code S)
 CR = Confirmation Review (NASA PMC) NASA PMC = Programmatic Management Council (APP = Approved)

OS: SIM Project Status

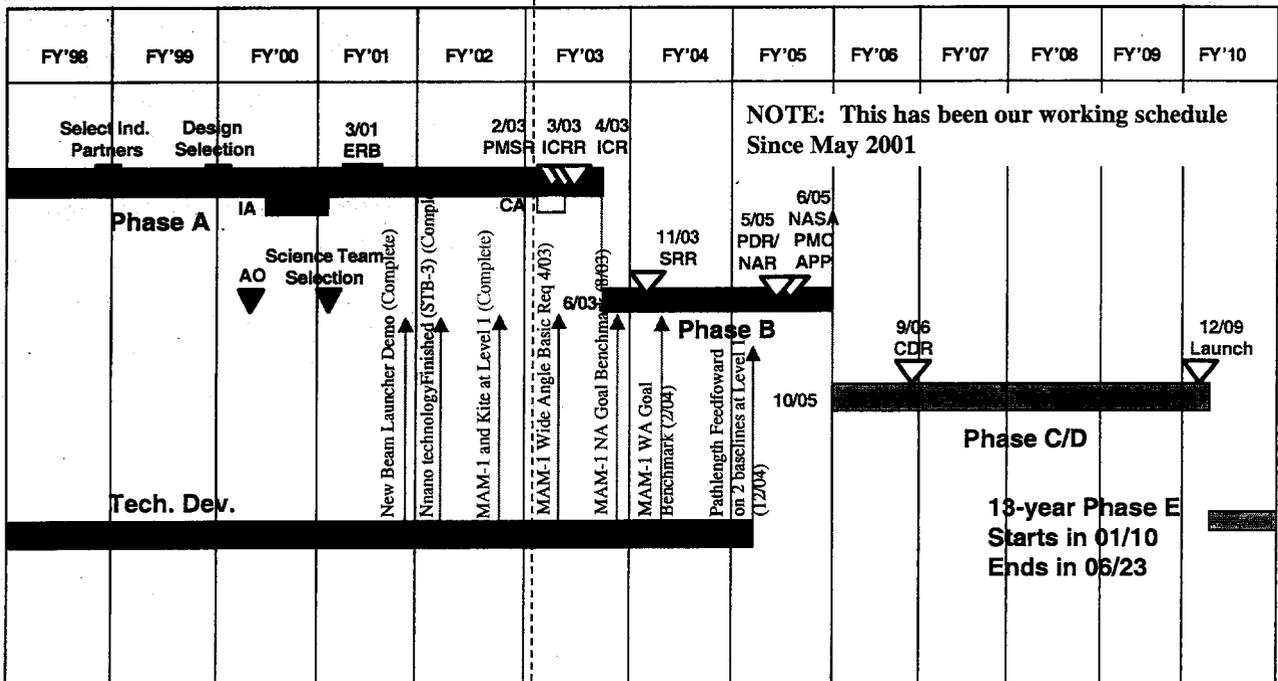


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POP02 Option 1 Project Schedule

LRD 12/09



ATLO = Assy, Test & Launch Ops ERB = External Review Board PMSR = Preliminary Mission & Systems Review SRR = System Requirements Review
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OS: SIM Project Status



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Technology Milestones



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- Gates into Phase B
 1. NextGen launcher performance at 100pm uncompensated cyclic error, 20pm/mK thermal sensitivity 8/01√
 2. Science star fringe tracking performance at 50dB (optical benches) 12/01√
 3. Kite performance at 50 pm narrow angle, 300 pm wide angle 9/02√
 4. MAM-1 performance at 150 pm, narrow angle 10/02√
- Gates into Phase C/D
 5. MAM-1 performance at 4000 pm, wide angle 4/03
 6. Benchmark MAM-1 performance, narrow angle 8/03
 7. Benchmark MAM-1 performance, wide angle 2/04
 8. Picometer knowledge transfer at 200 pm on PKT Testbed 12/04



MAM and Kite Technology Milestones



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- Milestone #3 (Kite):
 - “Demonstrate that multiple laser metrology gauges can be integrated to achieve a ‘metrology truss’ like the SIM external metrology system by achieving 300 pm wide angle and 50 pm narrow angle performance in the 6-Gauge experiment, a planar metrology truss consisting of 6 laser gauges. This level of performance meets both narrow angle and global astrometry Level 1 requirements of 3 micro-arcseconds and 30 micro-arcseconds respectively, and demonstrates, at the system level, that the external metrology will provide the performance required to meet the scientific Mission goals for the Broad Survey and the astrometric Grid. It also demonstrates SIM’s ability to meet the global astrometry minimum science requirements.”
- Milestone #4 (MAM):
 - “Demonstrate Micro-arcsecond Metrology (MAM-1) Testbed performance of 150 pm, over its narrow angle field of regard. This level of performance is consistent with the narrow angle astrometry Level 1 requirements of 3 micro-arcseconds. It demonstrates, at the system level, SIM’s ability to meet its Level 1 requirements for planet finding. This level of performance is required to perform the scientific Broad Survey.”



Kite & MAM Results Summary



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- Kite and MAM performance for current milestones is highlighted in yellow.
- Narrow Angle results approaching the "goal" level of performance.

Parameter	Science Measurement Capability	Current SIM Error Budget Req ^{mt}	Headquarters Milestone Value	Testbed Results
MAM:				
- Wide Angle "Basic"	30 uas	2,105 pm	4,000 pm	(Spring'03)
- Wide Angle "Goal"	4 uas	281 pm	"Benchmark"	(Spring'04)
- Narrow Angle "Basic"	3 uas	147 pm	150 pm	57 pm
- Narrow Angle "Goal"	1 uas	37 pm	"Benchmark"	(Fall'03)
Kite:				
- Wide Angle "Basic"	30 uas	835 pm	300 pm	248 pm
- Wide Angle "Goal"	4 uas	111 pm	none	
- Narrow Angle "Basic"	3 uas	49 pm	50 pm	27 pm
- Narrow Angle "Goal"	1 uas	12 pm	none	

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SIM Astrometric Performance

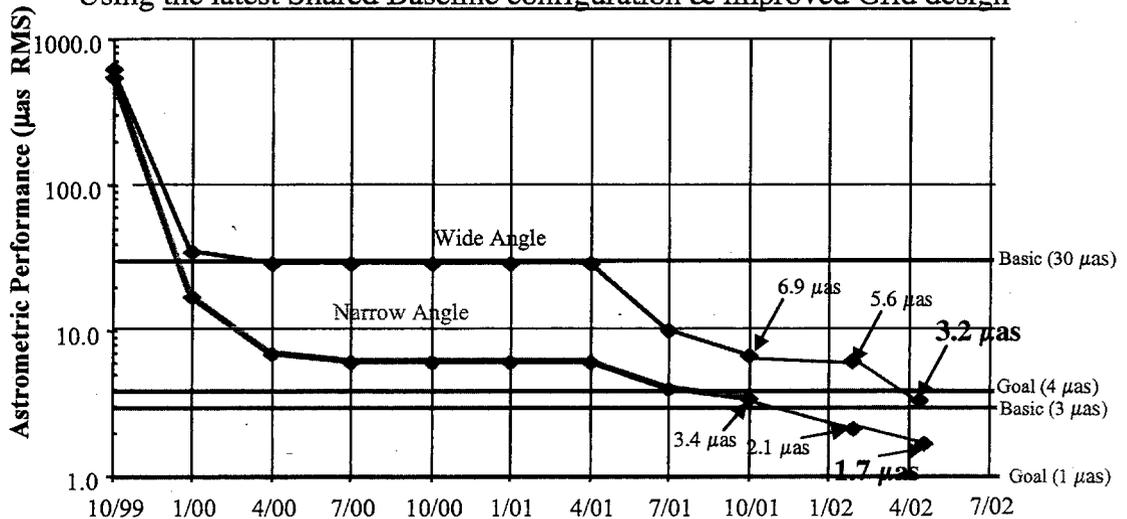
--Based on Feb 2002 component Technology Status



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- Calculated Wide Angle and Narrow Angle performance
 - Based on Feb 2002 component performance
 - Using the latest Shared Baseline configuration & improved Grid design



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- Predicted Wide Angle (Global Astrometric) performance better than Goal performance; Narrow Angle Astrometric performance within factor of 2 of Goal!



SIM Narrow Angle Performance

-- based on current MAM & Kite performance

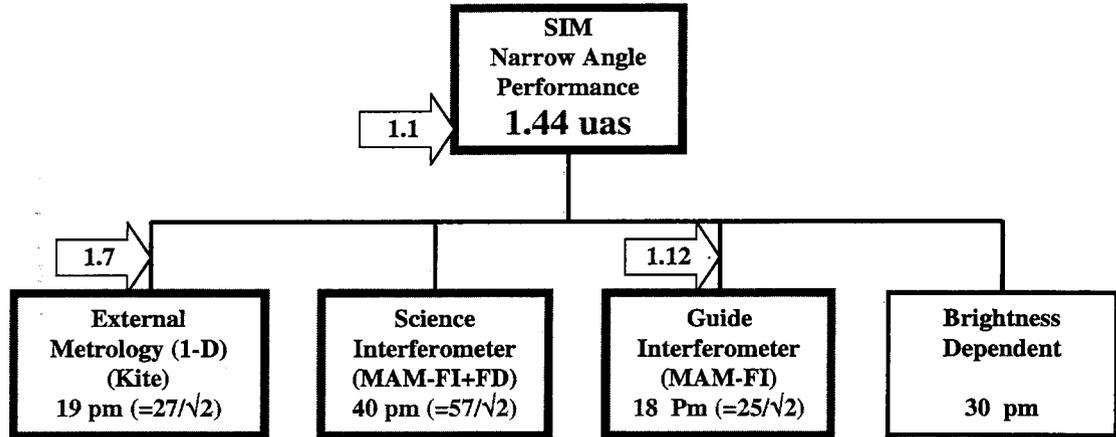


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- These results are consistent with the component-level error budget prediction of 1.7 uas.
- The testbed result numbers are divided by $\sqrt{2}$ to obtain equivalent flight numbers because:
 - The testbed numbers are the error in the difference between a target star and the mean of the reference stars,
 - While the flight error budget numbers have historically been specified as the error in the measurement of a single target.



SIM Wide Angle Performance

-- based on current MAM & Kite performance

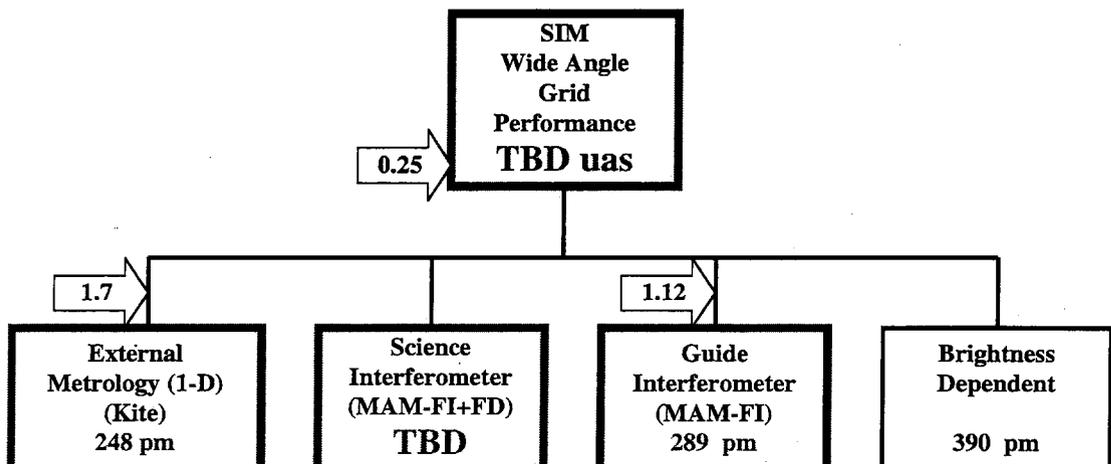


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- Awaiting the results of the April 2002 MAM Field Dependent testing to fill in the one remaining TBD in the performance buildup below.
- Testbed results and flight error budgets use the same number since chopping is not used in the Wide Angle mode.





Manager's Assessment



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- The SIM team continues to make outstanding technology progress
 - All four milestones required for Phase B entry are complete, with margin
 - Navigator Program Independent Review Team (NP IRT)'s assessment of the MAM and Kite Milestones:
 - "The unanimous conclusion of Navigator Program IRT members who weighed in on the subject is that SIM has met milestones #3 and #4. We congratulate you and your team on a very impressive accomplishment. The presentations at SIMTAC #27, at the splinter session on November 7, and at the Quarterly Review, did an excellent job of leading us through the rationale and results which demonstrate compliance with the stated requirements for the milestones. Congratulations! Regards, Vern Weyers"
- Technology completion (milestones for Phase C entry) remains our top priority
- We continue to work the details of the flight design in preparation for Preliminary Mission and System Review (PMSR) in February 2003
- SIM's Science Team is actively planning the needed preparatory science effort
- SIM will be ready to enter Phase B by CY 2003
 - When SIM enters Phase B will be determined by NASA OSS funding availability



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Backup Material



Project Organization & Personnel



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