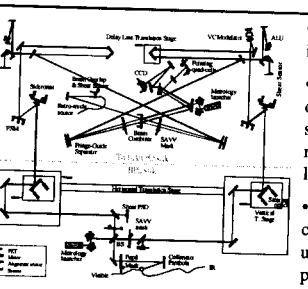
Optical Path Control in the MAM Testbed

Martin Regehr, Brad Hines, Buck Holmes,
Shake Akopyan, Xin An, Steve Azevedo, Charlie Bell, Eric Bloemhof, Joe Catanzarite, Brian Cox, Mike Deck, Sharon Dew, Glenn Eychaner, Renaud Goullioud, Yekta Gursel, Bob Irigoyen, Phil Irwin, Ron Kruid, Dennis Lapicz, Greg Neat, Xiaopei Pan, Sung Park, Martin Regehr, Raymond Savedra, Mike Shao, John Shaw, James Shea, Janice Shen, Jason Shupe, Jeff Yu, Feng Zhao and Robert Zimmer.

Jet Propulsion Laboratory, California Institute of Technology

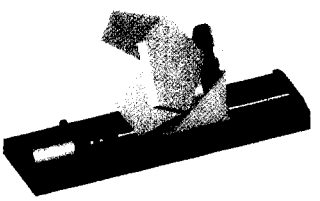
MAM Testbed



- Need to find fringes, track fringes, and modulate path length

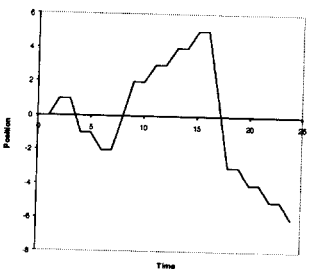
- Pseudo star and interferometer
- Measure difference between star light and metrology path lengths
- Delay line, voice coil, and FSM's used for optical path control in interferometer

Coarse Path Length Control



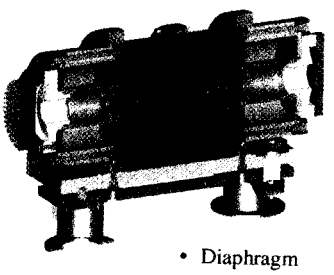
- 6.2" clear aperture corner cube
- Stepper-motor-driven translation stage with a linear encoder
- 1.5 mm/sec
- 1 μ backlash

Fringe-Finding Algorithm



- Search in alternating directions
- If no fringe, return to previous endpoint and continue

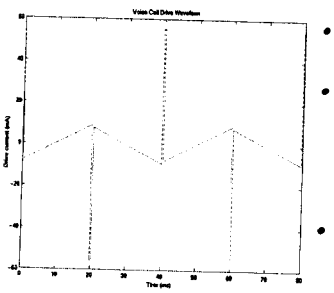
Voice Coil



- Momentum-compensated
- Permanent-magnet actuators

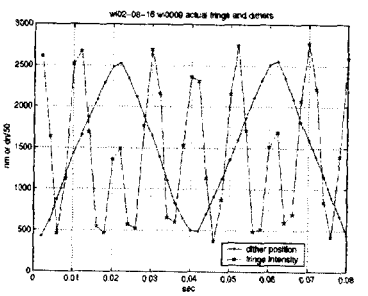
- Diaphragm flexures

Drive Waveform

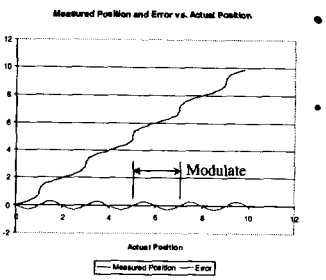


- Piecewise linear
- Counteract spring and damping forces in actuator
- Produce triangle-wave motion

Modulation and Fringe Intensity



Cyclic Error Suppression



- Measured position has periodic error
- Suppress by modulating actual position and averaging over one cycle

Real-Time Computer Control

- VME / VxWorks computer, interface cards
- Interface to delay line motor, voice coil (fine feedback), FSM's, CCD, and metrology system
- JPL control system toolkit ("RTC") provides periodic task scheduling, telemetry, and commanding

Summary

- Coarse, fine path length control provided by delay line, voice coil, and FSMs
- Provide fringe acquisition, fringe tracking, and path length modulation for fringe detection and for cyclic error suppression