TIDI CDR

Telescope Positioning System

Jon Harvey
TIDI Mechanical Engineer
(734) 764-6594
jdh@engin.umich.edu

TELESCOPE SUBSYSTEM

- **Position Detection**
  - Requirements
  - Configuration
  - Structural, Thermal, Radiation Design
  - Torque
- **Drive System**
  - Torque Margins

SPACE PHYSICS RESEARCH LABORATORY

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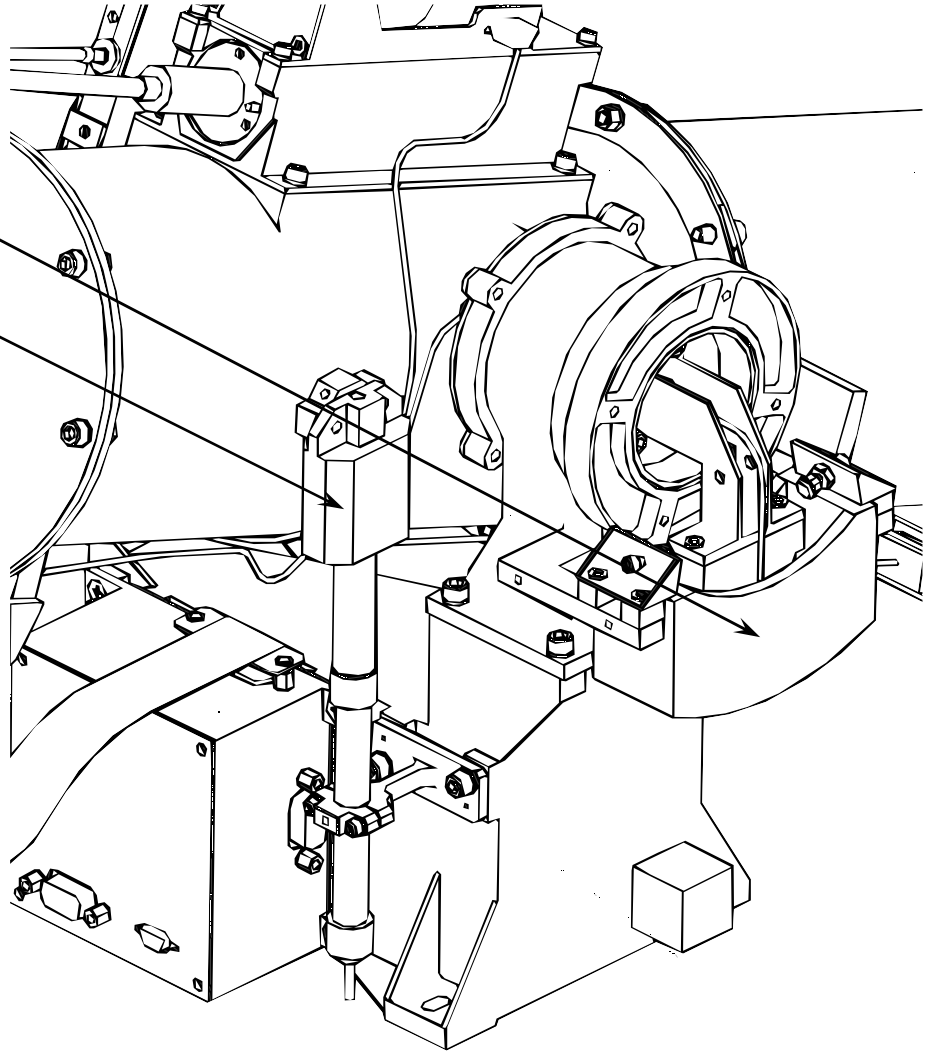
TELESCOPE MECHANISMS

- **BEI voice coil**
- **LVDT actuation mechanism**

- **Flight Assemblies delivered to APL - Aug 1998**

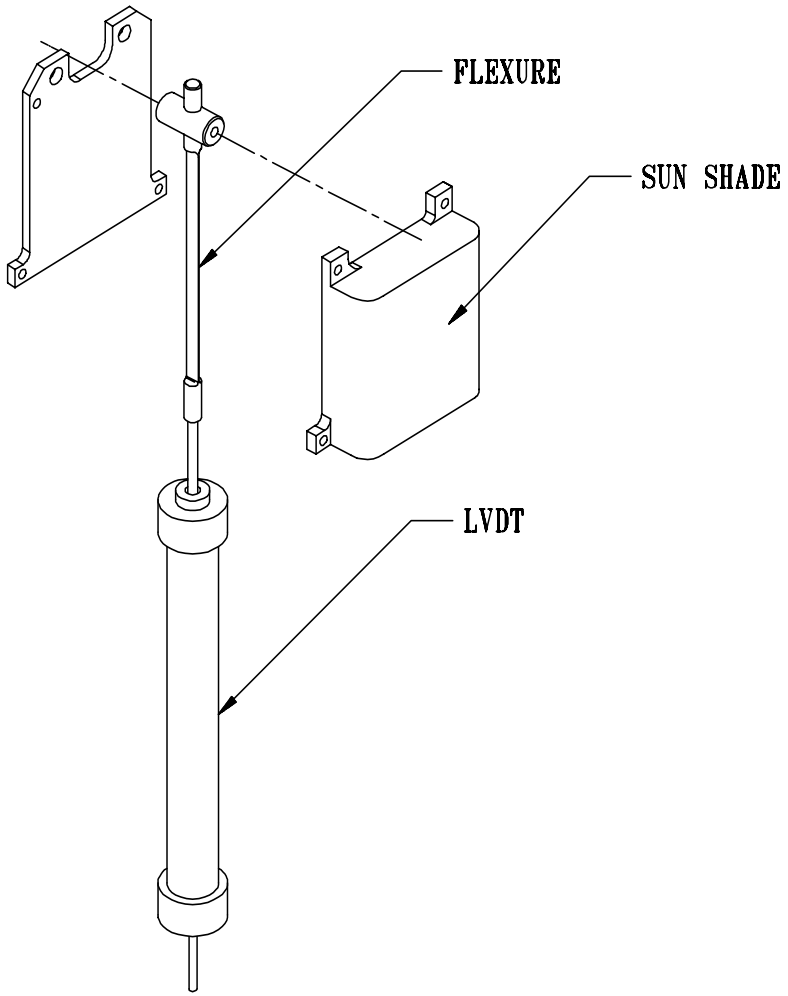


POSITION DETECTION SYSTEM

- **LVDT Mechanism Requirements**
  - **Convert rotary motion of telescope to a linear motion for the LVDT**
  - **Accuracy (Knowledge)** — **60 arcsec (LVDT and Mechanical)**
  - **Lifetime** — **1 million cycles (2 year life, baseline scan)**
  - **5 krad** — **0.03 in Tantalum to susceptible components in pre-amp**
  - **Low Torque** — **< 1.0 oz-in**
  - **Thermal Transients** — **Sun shade/ worst case @ terminator reduced position requirement**

POSITION DETECTION CONFIGURATION

- **Mechanical Configuration**
  - **Telescope interfaces**
    - **Flexure mount**
    - **Lvdt Mount**
    - **Upper Sun Shade Mount**
  - **Ti-6Al-4V Flexure/Link rod to match Tel. Pedestal CTE**
  - **Alum. sun shade to reduce thermal transient effects**
  - **Vespel SP-3 Bushings to prevent LVDT Core rubbing LVDT ID.**



POSITION DETECTION SYSTEM

- **Structural Design**
  - **Minimum thickness (0.007 - 0.010 in) and maximum length (1.80 in) to minimize stress in flex element**
  - **Fatigue life = 1million cycles (Baseline scan ± 5 deg, 2 year life)**

    Ti engineering flexure tested to 1 mil cycles (± 10 deg.)

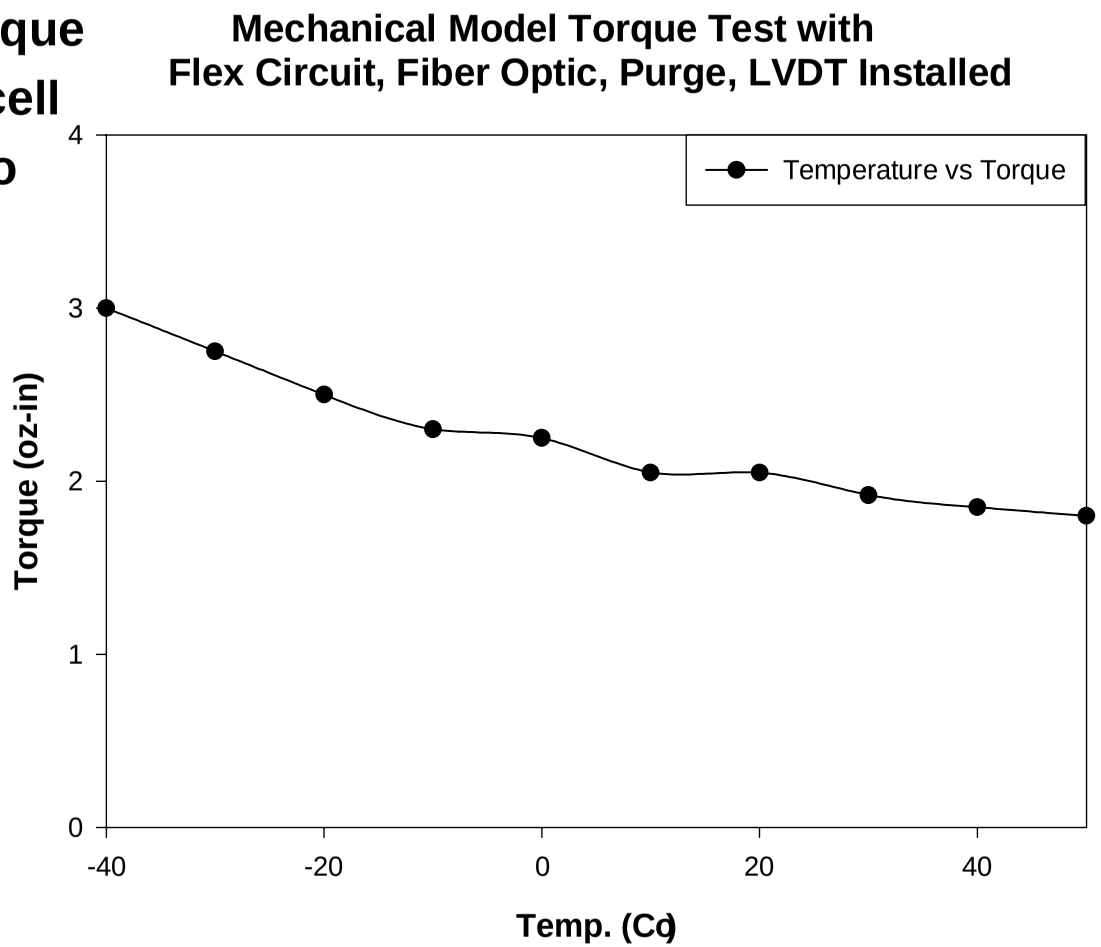
    40 flight like samples testing to 2 mil + cycles (± 10 deg)
  - **Surface treatment: 16 micro finish, Tiodize coating**

DRIVE SYSTEM

- **Rotary Voice Coil, BEI Model RA68-12-001**
  - **Rated Peak torque** — **170 in-oz**
  - **De-rated for TIDI to** — **50 in-oz**
  - **Stroke (motor max.)** — **± 11.0 deg.**
  - **Average power dissipation** — **0.058 watts (Baseline scan)**
  - **Max power dissipation** — **3.0 watts (continuos stall)**
  - **Materials changed to comply with 1% TML and 0.1% VCM**

TORQUE TEST RESULTS

- **Mechanical Model Torque Test Results**
  - **Combined drag torque**
  - **Ti 6Al-4V Bearing cell**
  - **Similar geometry to APL design.**



MECHANISMS SUMMARY

- **Mechanisms Summary**
  - **Life tests**
  - **Torque margin**
  - **Torque upsets**

MECHANISM	MFG	MFG LIFE TEST (CY)	2 YEAR LIFE* (CY)	RATED TORQ. (OZ-IN)	DRAG TORQ (OZ-IN)	ACCEL. TORQ. (OZ-IN)	MARGIN
TELESCOPE ACTUATOR	BEI	NA	650000	50.0**	5.0 max	45	10:1
FILTER WHEEL	LITTON	263865 M .	325000	5.9	0.36	5.54	16:1
SHUTTER	LITTON	263865 M .	<< Filter Wheel	5.9	0.36	5.54	16:1

* BASED ON THE BASELINE SCIENCE SCAN.
** DERATED FROM 170 oz-in.

TORQUE UPSETS

MANEUVER		FORCE (N)	TORQUE (N-M)
Filter Wheel 45^{o} (dt=0.143s)	0.0715 s 0.0715 s	0X+0Y+0Z	0X + 0.0426Y + 0Z 0X - 0.0426Y + 0Z
Filter Wheel 90^{o} (dt=0.202s)	0.101 s 0.101 s	0X+0Y+0Z	0X + 0.0426Y + 0Z 0X - 0.0426Y + 0Z
Filter Wheel 120^{o} (dt=0.247s)	0.124 s 0.124 s	0X+0Y+0Z	0X + 0.0426Y + 0Z 0X - 0.0426Y + 0Z
Filter Wheel 180^{o} (dt=0.286s)	0.143 s 0.143 s	0X+0Y+0Z	0X + 0.0426Y + 0Z 0X - 0.0426Y + 0Z
Telescopes 0.05^{0} Step (dt = 0.10 s)	0.05 s 0.05 s	0X+0Y+0Z	+0.0076* - 0.0076*
Telescopes 0.10^{0} Step (dt = 0.10 s)	0.05 s 0.05 s	0X+0Y+0Z	+0.0157* - 0.0157*
Telescopes 0.15^{o} Step (dt = 0.10 s)	0.05 s 0.05 s	0X+0Y+0Z	+0.0228* - 0.0228*
Telescopes 0.40^{o} Step (dt = 0.10 s)	0.05 s 0.05 s	0X+0Y+0Z	+0.0371* - 0.0371*
Telescopes 20.0^{o} Step (dt = 1.5 s) (Bearing scan)	0.75 s 0.75 s	0X+0Y+0Z	+0.0113* - 0.0113*

* Maximum torque with a 10% imbalance between any two telescopes. Direction vectors dependant on assignment of telescope location. No Z component of telescope torque.