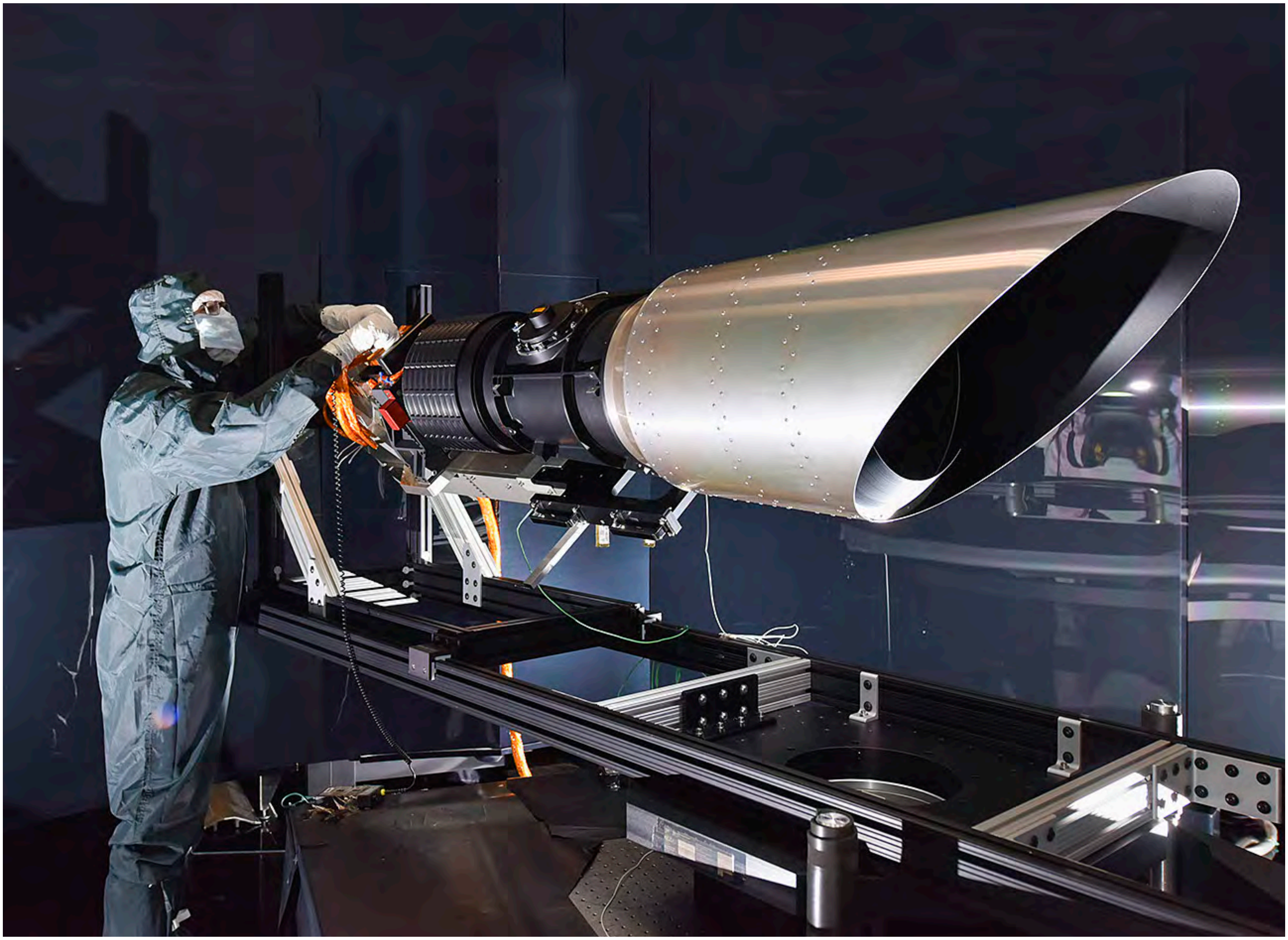
HIGH ACCURACY STAR TRACKER



GO BEYOND WITH BALL.®

Used in civil, commercial and defense satellite systems, Ball's High Accuracy Star Trackers (HAST) deliver the best performance in the industry, providing the highest reliability and most accurate star tracker available.

OVERVIEW

When your mission demands high resolution and high geo-location data, go with the Ball Aerospace HAST for extremely precise, real-time attitude control.

The HAST provides very accurate star measurements and is capable of tracking multiple stars moving 0 to 8 deg/sec, delivering best-in-class performance and accuracy unmatched in the industry.

A complete HAST system includes two Star Sensor Heads (SSH) and one Star Sensor Electronics Unit (SSEU), both of which employ redundant designs for ensured reliability. Shutters are included to protect the focal plane from direct solar radiation and to retain boresight stability. A typical unit also includes sun shades. Alignment cubes provide a method for positioning the SSHs on the vehicle or payload and are accurate to 10 arcsec and stable to 1 arcmin.

The HAST derives from our successful Aspect Camera built for NASA's Chandra X-Ray Observatory, which launched in 1999. Operating well beyond its 5-year lifetime, the Aspect Camera is the highest accuracy star tracker every flown, providing 0.04 arcsec of pointing knowledge.

Ball has more than 40 years of experience developing high-performance star trackers to support civil, commercial and defense missions. We design, fabricate and test our products in a dedicated facility in Boulder, CO. Our state-of-the-art stray light and Better Accuracy Test System facilities provide the highest performance star tracker testing available.

OPTIMIZED PERFORMANCE

Whatever your mission, we can customize our star trackers to your specifications.

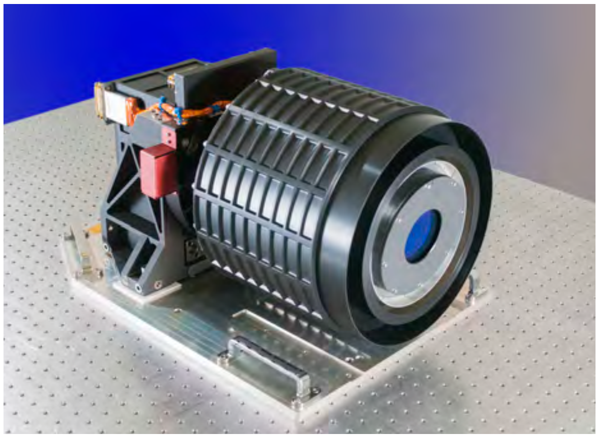
At lower angular rates, the integration time can be increased to increase signal. As a result, the number of stars available to track goes up and the processing throughput is relaxed, allowing up to 16 stars (8 per head) to be tracked. Under these tailored conditions, attitude estimates could be as small as a few tens of millisec of arc (0.03 arcsec). For higher angular rates, the integration time can be decreased to allow for optimum performance.

For high rate applications, HAST operation can be tailored to achieve per star random errors less than 0.50 arcsec at spacecraft body rates up to 8 deg per sec normal to the SSH boresight.

The data shown here are for agile LEO spacecraft.

SPECIFICATIONS

- Acquire and track rates and accelerations: ±8 deg/sec and accelerations between ±8 deg/sec^2
- Acquisition probability: ≥99% probability of at least one star per SSH for any boresight orientation, except when the Earth, moon, and sun are within the stray light keep-out zones
- Acquires stars in full field of view (FOV) search mode, or acquires stars as directed by the host
- Simultaneous tracks per FOV: 8 stars at a nominal internal sample rate of ≤60 Hz, and 4 stars at 100 Hz. Sensitivity and frame rate are host configurable to best match accuracy with the spacecraft dynamics
- Angular position estimation per star per frame: 0.18 arcsec, 1 σ angular position residual error per star per head for rate magnitudes between 0.07 and 1.00 deg/sec
- Star magnitude output is normalized to a G0V star
- Sensitivity: MI = 4.8 at a 100 Hz CCD frame rate. MI = 5.8 at a 60 Hz. MI = 6.5 at 40 Hz
- Instrument magnitude (MI) estimates: ΔMI = ±0.25, 1 σ
- FOV: 8.0 x 8.0 deg
- Power requirements: Entire system designed to use 28 V of spacecraft power, ranging from 22 to 36 VDC under steady-state conditions
- Debris & proton rejection: Rejects small debris and proton bombardment up to 10,000 protons/sec/cm^2
- Temperature range: SSH: -1 to 32 °C, Shutter: -26 to 27 °C, SSEU: -15 to 52 °C, Sunshade: -60 to 27 °C
- Performance characteristics (per star, per axis):
  - Random 0.110 arcsec 1 σ
  - Spatial 0.140 arcsec 1 σ



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