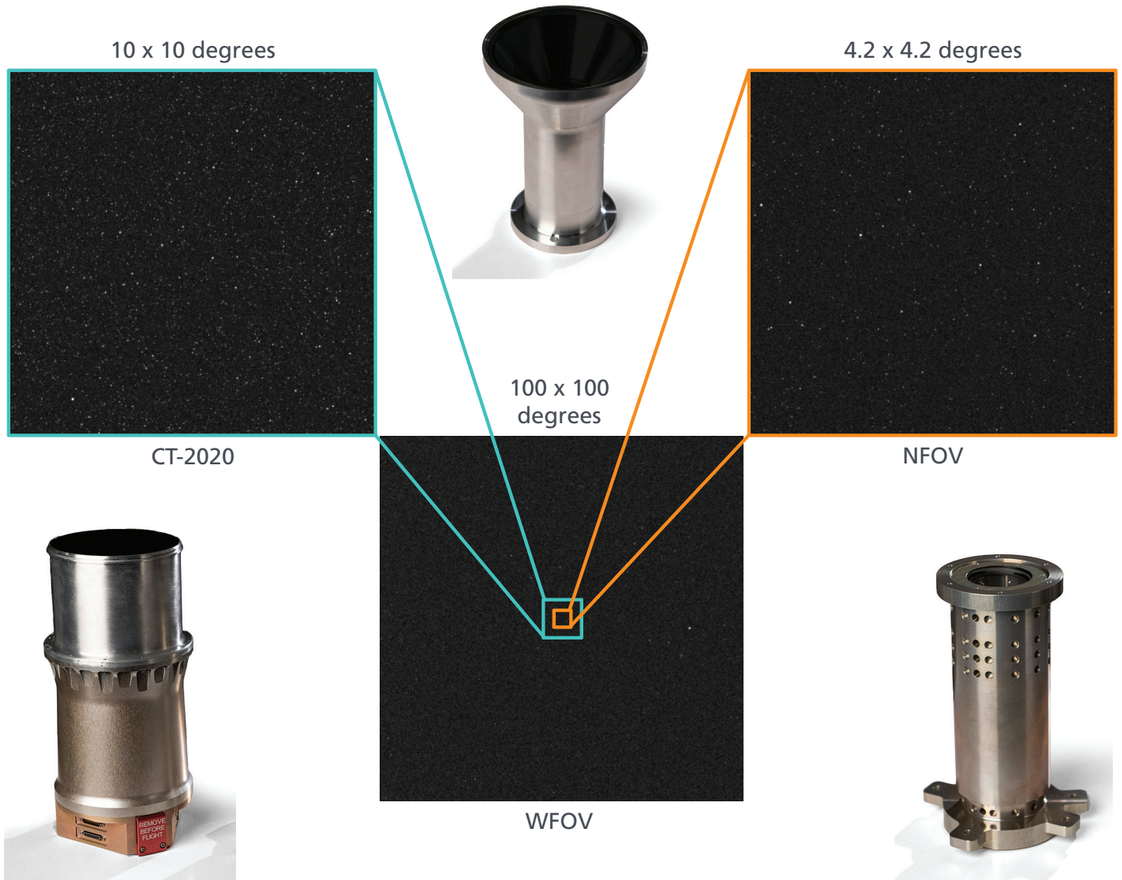
Space Camera Performance Comparison



CT-2020 provides star tracking and space domain awareness. WFOV provides the largest area coverage for local space awareness. NFOV is optimized for highest sensitivity to support space object detection.

For more information please contact:
Erin Coulter I erin.coulter@baesystems.us
www.baesystems.com/en-us/product/star-trackers

BAE SYSTEMS

Space Camera Product Line

BAE Systems has a versatile product line tailored for advanced space observation and surveillance needs. These innovative solutions empower missions with unparalleled flexibility, combining pinpoint accuracy with expansive surveillance capabilities to meet the evolving demands of space exploration and observation.

Overview

BAE Systems builds upon the highly accurate CT-2020 star tracker, which simultaneously provides star identification, quaternions, and full-frame video, to offer solutions for space observation missions. By incorporating lens assembly variants with CT-2020 electronics, we expand CT-2020 mission applicability to Space Domain Awareness (SDA), lunar observation and traffic management.

Product Line Features

- **Fully Domestic:** Designed and manufactured entirely within the U.S.
- **Integrated Assembly:** Optics assembly, electronics unit, and processing software in 5.8" diameter x 12" tall, 3.75 kg package for CT-2020; NFOV and WFOV integrated assemblies scale with sensitivity
- **Low Cost:** Cost-effective solution
- **Common Technology:** Utilizes a TRL 9 detector and electronics to support multiple missions.
- **ARM-Based Processor:** Includes a custom radiation-hardened ASIC integrated with an ARM processor, co-designed by BAE Systems and ON-SEMI
- **Fully Autonomous CT-2020 Operation:** Capable of autonomous quaternion output or higher fidelity blended operations using host commanded directed search
- **Cameras Designed for Space Observation:** Rad-hard 1k x 1k detector with global shutter for full-frame data readout and processing of visible spectrum
- **Dual Mode:** Simultaneously outputs full-frame imagery via a dedicated LVDS interface and star tracker telemetry, including quaternions, via RS422/1553
- **On-Orbit Configurability:** 1024 megabyte on-board storage supports data processing, storage, and re-calibration to improve performance as unit ages
- **Power Consumption:** Peak power <12W; average power <8W
- **Interfaces:** 1553, RS422 and LVDS
- **Lifetime:** 7 years LEO/18 years GEO; space rad-hard

Heritage

For decades, BAE Systems has delivered highly reliable performance star trackers to support civil, commercial and defense missions. With more than 60 trackers in LEO, GEO, and interplanetary flight, we leverage this heritage to expand CT-2020 functionality to new mission spaces with a commercial-competitive, affordable, domestic product line.

Optical Specifications

Narrow Field of View (NFOV):

- Mounting Options: Can be configured as body-fixed or gimbal-mounted, offering flexibility in deployment and operation
- Applications: Space domain awareness

Wide Field of View (WFOV):

- Optical Tube Assembly: Enables rapid scanning of a large volume with reduced detection sensitivity compared to NFOV systems
- Applications: Local space awareness and lunar space domain awareness

	NFOV	CT-2020	WFOV
Field of View (Square)	4.2° x 4.2°	10° x 10°	> 100° x 100°
Range to 1m Target @ SNR 6	9800 km	5100 km	670 km
<0.5°/ sec body rate inc. LSFE, HSFE, & NEA per star per axis			
TRL Schedule	Currently TRL 3 TRL 6: Q2 2025	Currently TRL 8 TRL 9: Q1 2025	Currently TRL 3 TRL 4: Q3 2025
Mission	Space Domain Awareness	Space Domain Awareness & Attitude (Quaternion) Output	Local space awareness, lunar observation & traffic management

Compliance:

- Government Standards: Designed to meet stringent standards
- Electrical Design: Compliant with MIL-STD-461G, with adjustments to RE102 and RS103 requirements
- SMC-S-016 Mission Assurance Profile: Compliance with this profile ensures reliability and mission success
- DoD 4650.06: Meets the Celestial Reference Frame Standard, demonstrating alignment with defense requirements

Single Unit CT-2020 Baseline Performance
1024 x 1024 STELLAR (CMOS) detector with Thermo-Electronic Cooler
CT-2020's embedded star catalog is compliant to DoD instruction 4650.06 and meets DoD Celestial Reference Frame traceability requirements
Robust algorithms developed from >50 years of experience
Hardware-in-the-loop mission modeling capability

Technical Specifications	
Environmental Characteristics	
Operating temperature range	-25/ +45
Storage temperature range (°C)	-34/ +71
Mechanical environment (in/out of plane)	Shock 1556 g
Reliability, Availability and Lifetime	
EEE parts class	IEEE INST-02 EEE parts with full traceability
Reliability (MIL-HDBK-217F method)	848 FIT (worst case temperature)
Electrical Interfaces	
Power supply (V)	22 to 34
Full frame image output at 10	High speed LVDS
Performance and Robustness	
Bias (worst case)	<10 arcsec
Thermo-elastic Error (worst case)	<0.04 arcsec/°C nominal performance temperature
Total attitude accuracy, 1σ, Includes LSFE, HSFE, and NEA	1.5 arcsec; <1.5 arcsec in directed search mode
Time from lost-in-space (typ)	2.0 s (<10 sec worst case)
Slew rate in Acquistion	5°/s
Slew rate in Tracking	8°/s
Acceleration	$3°/s^2$
Solar flare Acquisition/	Robust
Full Moon in the Field of View	No performance degradation
Baffle Sun Exclusion Angle	33°
Baffle Earth Exclusion Angle	25°