

ARGO 2.0

MULTICAMERA STAR TRACKER



High performance
Robustness
Reliability
Flexibility
Low Cost

Fully qualified on ground

ARGO 2.0 is a novel star tracker architecture specifically conceived for the market of smallsat constellations, to provide a unique combination of performance and reliability, SWaP and cost competitiveness

Flexible configuration according to customer needs, from monocular to multicamera

Flexible camera accommodation in the platform

High accuracy also in monocular version

Intelligent real-time data fusion of data measurements of all cameras (multicamera)

Smart in-flight camera model calibration

Smart in-flight relative camera attitude calibration (multicamera)

Smart data processing to filter platform jitter

Output @ 5 Hz: attitude (quaternion), angular speed, angular acceleration

HIPPARCOS S.r.l. develops high accuracy attitude determination and control systems for SmallSats. Our product portfolio includes several architecture of multicamera star trackers, having flight heritage since 2021. HIPPARCOS is a spinoff company of EICAS AUTOMAZIONE S.p.a. and leverages on a 40 years' heritage in the field of attitude determination from star measurement, starting from the HIPPARCOS Mission. Discover our heritage in detail at www.hipparcos.space/heritage/



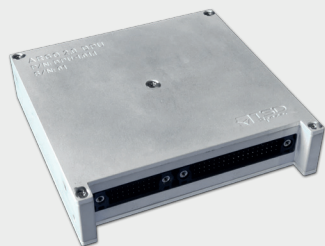
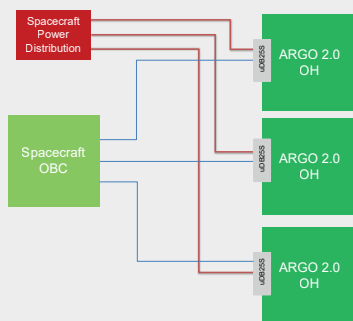
OUR SMART ARCHITECTURE



ARGO 2.0 is a Multicamera star tracker composed of:

- **Multiple Optical Heads (OH)** including pre-processing SW, Focal Plane Assembly (FPA), main electronics (with integrated PRE-processing capabilities) and custom designed radiation tolerant optics.

- **Data fusion software**, to be partially embedded in the Satellite Onboard Computer (OBC). Such a SW is able to perform the fusion of data coming from the optical heads, in order to get attitude and rate measurement and to perform the auto-calibration of both camera model and camera relative attitude.



Alternatively, a Data Processing Unit (DPU), running the Data Fusion software, can be provided for connecting up to 2 OH.

ARGO 2.0 will determine the attitude with respect to the Boresight Reference Frame (BRF) of one of the Optical Heads, to be rigidly mounted to the payload of which the attitude has to be measured. The other OH can be mounted as preferred by the user. ARGO 2.0 output includes:

- attitude of one OH, assumed as a reference (quaternion from fused raw data);
- angular speed;
- angular acceleration;
- OH's updated calibration models (all cameras);
- relative attitude of the other OHs with respect to the Reference one;

ARGO 2.0 for Constellations is developed under an ESA ARTES C&G Programme, with a co-funding of the Italian Space Agency.

OUR SMART AADS SOFTWARE

By using **the wide redundancy of the raw data provided by the OHs**, ARGO 2.0 implements smart data fusion algorithms able to determine in real time the S/C attitude, rate and acceleration and to perform in-flight calibration of each camera model and of camera relative attitude. In addition, a smart filtering process is included, able to provide the star tracker outputs filtered from platform jitter, aiming to contribute to reach high manoeuvrability and stability of your platform.

DATASHEET OPTICAL HEAD

Technical features

Detector	CMOS
FOV	$\pm 9^\circ$
Number of tracked stars	Up to 20 per OH
Update rate	5 Hz
Acquisition time from Lost in Space (up to $3^\circ/s$)	< 3 s

Accuracy - EOL - @ $1^\circ/s$

	1 OH (XY/Z)	2 OH (XYZ)
Low Frequency Error (3σ)	3 arcsec	3 arcsec
Noise Equivalent Angle (3σ)	2/21 arcsec	2 arcsec
Max tracking rate	$3^\circ/s$	$3^\circ/s$
Max Acceleration in tracking	$1^\circ/s$	$1^\circ/s$

Reliability

Failure Rate OH	278 FIT
EEE components class	Flight-proven industrial COTS-MIL
Lifetime	>5 years in LEO
TID	20 krad

Mechanical interface

Size (mm^3) – incl. baffle and mounting feet	61 x 79 x 104,3
Mass – including baffle (g)	320

Electrical interfaces

Power supply	5V Regulated
Power consumption	$< 1,5$ W

Data interfaces

Camera vs Spacecraft	Spacewire/#2 RS422
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Environmental features

Operational temperature	$-25^\circ C$ to $55^\circ C$
Storage temperature	$-40^\circ C$ to $70^\circ C$
Vibration levels (random)	21,31 g RMS

DPU

Reliability

Failure Rate OH	<1000 FIT
EEE components class	Flight-proven industrial COTS-MIL
Lifetime	>5 years in LEO
TID	15 krad

Mechanical interface

Size (mm^3)	95 X 93,75 X 22,2
Mass (g)	245

Electrical interfaces

Power supply	5V Regulated
Power consumption	3 W

Data interfaces

Vs Camera	Spacewire/#2 RS422
Vs Spacecraft	Spacewire/#2 RS422

Environmental features

Operational temperature	$-25^\circ C$ to $55^\circ C$
Storage temperature	$-35^\circ C$ to $65^\circ C$
Vibration levels (random)	17,38 g RMS