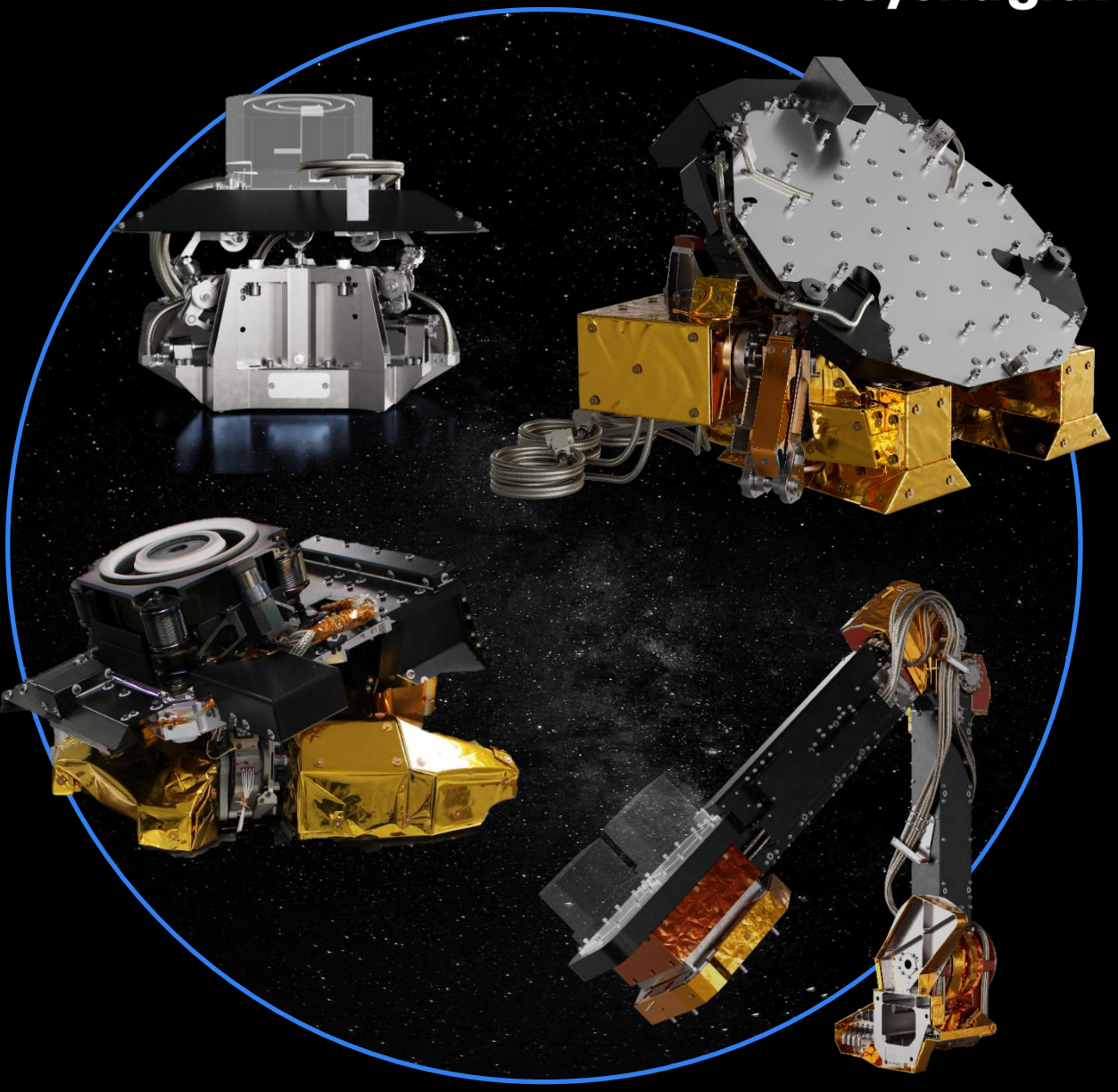
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APPMAX Family

Advanced Electric Propulsion Pointing Mechanism
2 Axis or 3 Axis

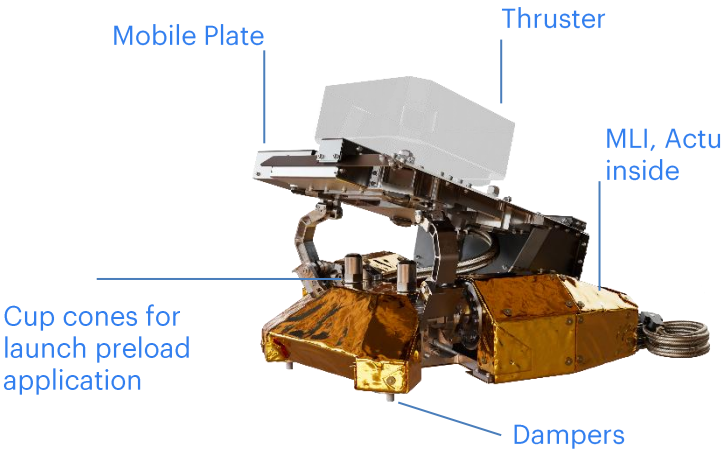
North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

The Beyond Gravity APPMAX Family is designed to provide low-cost standardized, modular and scalable 2-axis and 3-axis Pointing Mechanisms for Electric Propulsion. Accommodating a wide range of Thruster Types and Sizes.

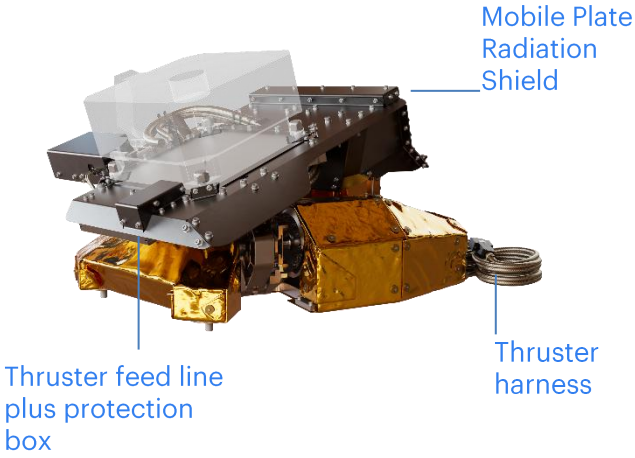
Contact: info.vienna.space@beyondgravity.com

APPMAX2 – Advanced Electric Propulsion Pointing Mechanism 2 Axis

Concept and Features



Deployed



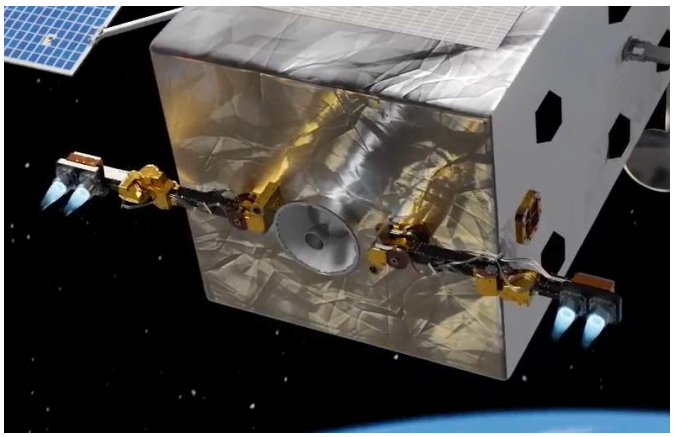
Stowed for Launch, no HDRM needed

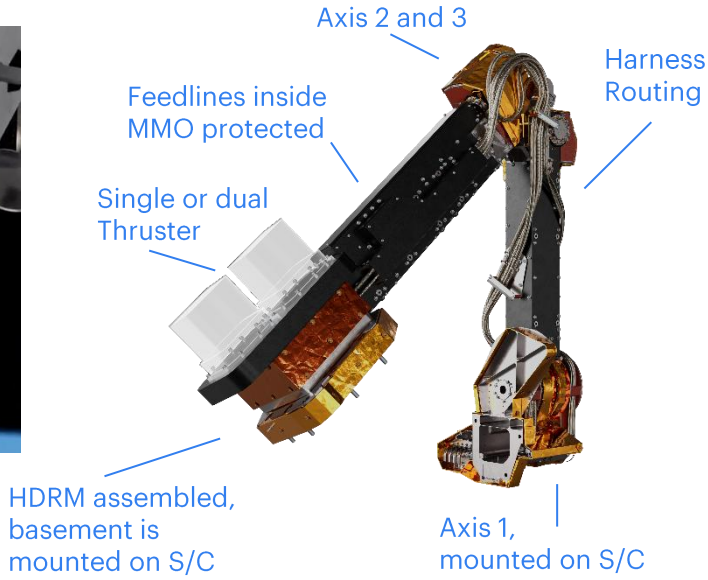
Thrusters	For different thruster sizes the mechanism can be scaled up or down. The APPMAX2-Baseline is compatible with Electric Propulsion Thrusters (up to 15kg) like PPS®5000, BHT-6000, RIT-2X, HT 5k, XR-5...
Kinematics	The mechanism is actuated by two independently controlled stepper motor actuators. Each actuator drives the movable plate via a connecting rod and operates between the launch position and the maximum deployment angle, with end-of-travel defined by mechanical hard stops. A cardan joint in combination with a flexible strut supports the third moving point. Position determination is based on motor step counting, with referencing provided either by the mechanical hard stops or by optional reference switches.
Pointing Range	The mechanism provides a 15° half cone as standard. The pointing range can be extended; adaptive design and delta qualification is needed.
Actuators	The Beyond Gravity LA15, a low-cost hybrid high detent torque stepper motor-based actuator, is used. Smaller actuators are used for downscaled APPMAX2-XS. Loads on actuators are only torsional.
Launch Locks	The actuators move the connecting rods slightly over the kinematic dead-center position of the crank drive. Their unpowered holding torque acts as a Launch Lock. The APPMAX2-H for higher mass Thrusters will be equipped with a flight proven HDRM, using a burn wire release actuator.
Tubing	Tubing is part of the mechanism and is designed in the form of a flexible helical routing on the fixed side of the mobile plate, protected by a micro meteorite shield.
Flow Controller	As standard, the flow controller is mounted on the spacecraft to meet thermal requirements.
Damping options	The baseline foresees damped mounting of the mechanism at the interface to the spacecraft. Depending on the thruster's allowable random vibration and shock loads, dampers may not be required or can be modified.
Harness	The Thruster Harness (generally Customer Furnished Item) is installed with the Thruster including connector. Harness routing shall be defined and verified by the mechanism supplier.
Switches and Positioning	Redundant reference switches are available as an option for position referencing.
No Zero-G device	No zero-G device is required, reducing Assembly Integration and Testing effort. (Not applicable to high-mass mechanisms.)
Thermal / Micrometeorite	The Actuators are equipped with heaters and MLI. Depending on the thermal analysis dedicated radiators, protective plates or MLI are mounted.

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APPMAX3 – Advanced Electric Propulsion Pointing Mechanism 3 Axis

Concept and Features





Thrusters	Single or Dual Electric Propulsion Thruster (T6, RIT 2X, PPS®5000, XR-5, BHT-600...).
Interface / Space Craft	Only the HDRM and the root bracket are mounted to the spacecraft.
Kinematics	Three stepper motor-based actuators move independently, without restriction from the launch position to the maximum operating angle limited by hard stops. The segments move individually via levers attached to the adjacent elements. Vespel bushings carry the main loads of each moveable element. The position of each element is defined by step counting and can be referenced via hard stops or reference switches (optional).
Pointing Range	The mechanism pointing range can be defined according to the specification. Up to 230° of angular range per axis is possible, depending on the launch configuration.
Actuators	The Beyond Gravity LA15, a low-cost hybrid high detent torque stepper motor-based actuator, is used. Loads on actuators are only torsional.
Hold Down Release Mechanism	The mobile plate is secured to the spacecraft during launch by a clamp-band-type HDRM. The HDRM can be reset an unlimited number of times and generates no release shock. Release is performed electromagnetically by neutralizing the holding force of a permanent magnet.
tubing	The tubing is integrated into the mechanism and protected by a micrometeoroid shield. Helical routing is provided at the rotational axes.
Flow Controller	The flow controller can be mounted close to the mobile plate and is equipped with radiators and / or MLI according to thermal analysis.
Damping options	The baseline configuration uses a rigid, direct mounting of the mechanism to the spacecraft interface. Depending on the thruster's allowable random vibration and shock loads, elastomeric dampers can be implemented.
Harness	The thruster harness (generally supplied as Customer Furnished Item) shall be installed with the thruster. Harness routing shall be defined and verified by the mechanism supplier.
Switches and Positioning	Redundant switches for position referencing are implemented.
Zero-G device	Zero-G device is part of scope.
Thermal / Micrometeorite	The Actuators are equipped with heaters and MLI. Depending on the thermal analysis, radiators and/or additional MLI are implemented where required. Protective plates are provided where applicable.

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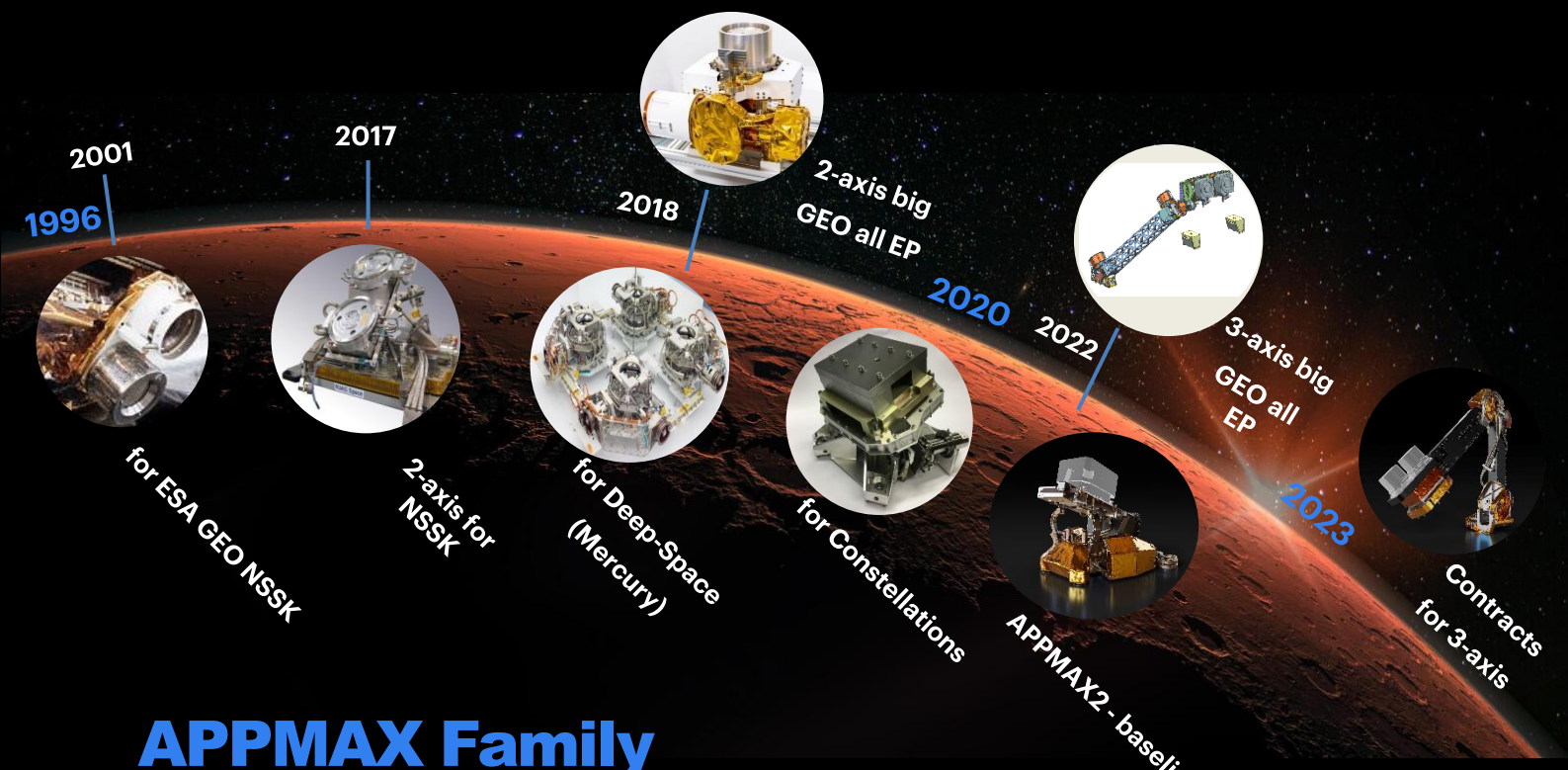
Beyond Gravity delivers qualified Pointing Mechanisms for Electric Propulsion Thrusters, which are increasingly used on commercial satellite platforms and scientific spacecraft due to their advantage in fuel mass efficiency for the spacecraft.
The Beyond Gravity Pointing Mechanisms support Electric Propulsion Thrusters in their nominal position during launch, by means of a dedicated Hold-Down and Release Mechanism if necessary and reduce the mechanical loads on the thrusters via dedicated damper elements.

Upon its release, the Thrusters can be tilted around two axis. This motion is facilitated by two actuators, which drive the platform either via a strut-linkage around a spherical joint or a crossgimbal type arrangement. A third axis can be realized with a robotic arm. This provides larger pointing and deployment range, e.g. for off-loading the momentum wheels needed for spacecraft stabilization.

Experience ... 120+ mechanisms

- 10+ different Mechanisms developed
- 10+ sizes/types of Thrusters (Hall Effect & Ion)
- 60 Models delivered
- 21 Flight Models in Orbit
- 65 Mechanisms in Production/Ordered
- 30+ Years of Development and Engineering

Electric Propulsion Pointing Mechanisms – Heritage



APPMAX Family



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APPMAX2-H

Advanced Electric Propulsion Pointing Mechanism 2 Axis for High-Mass Electric Propulsion Systems

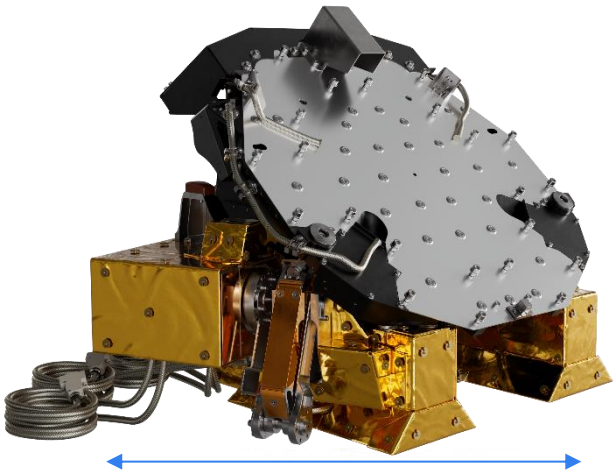
North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

Designed for thrusters above 15 kg, e. g. AEPS or HT20k , the APPMAX2-H is the preferred choice for high-mass spacecraft using electric propulsion for orbit transfer, escape trajectory or interplanetary missions.

Contact: info.vienna.space@beyondgravity.com

APPMAX2-H

Advanced Electric Propulsion Pointing Mechanism 2 Axis – Heavy

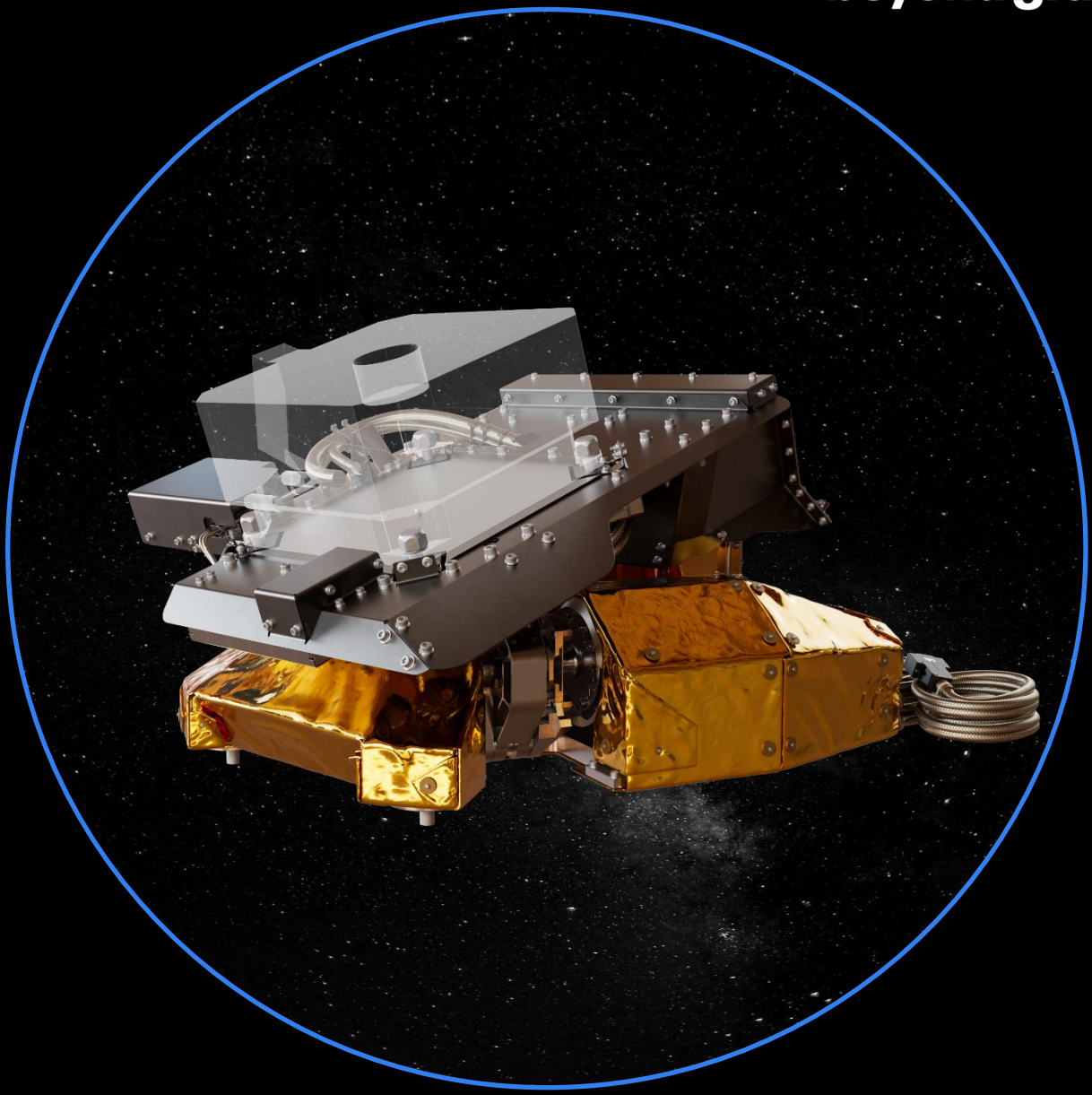




	APPMAX2-H
Motion Range	+/-26° and +/-5°, around vector perpendicular to spacecraft interface plane
Pointing Accuracy	better than 0.1°
Resistive Torque Capability	harness and tubing (routing by BGA)
Thruster Mass	55 kg
APPMAX2-H Mass	29.5 kg
Main Dimensions LxWxH (w/o thruster)	493 x 765 x497mm
S/C mechanism interface	377 x 357mm
Stiffness stowed	90 Hz
Stepper Motor Phase Resistance at 20°C	118 Ω
Actuators (separated from main load path)	SA15
HDRM	HDRM - TRL 9 2x burn wire Release Actuator
HDRM I/F	5.2 A +/-1 A firing duration 40-100 ms
Development Status	TRL 8 FMs delivered
Ground commissioning	Zero-g device is provided

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APPMAX2 baseline

Advanced Electric Propulsion Pointing Mechanism 2 Axis for Medium-Class Electric Propulsion Systems

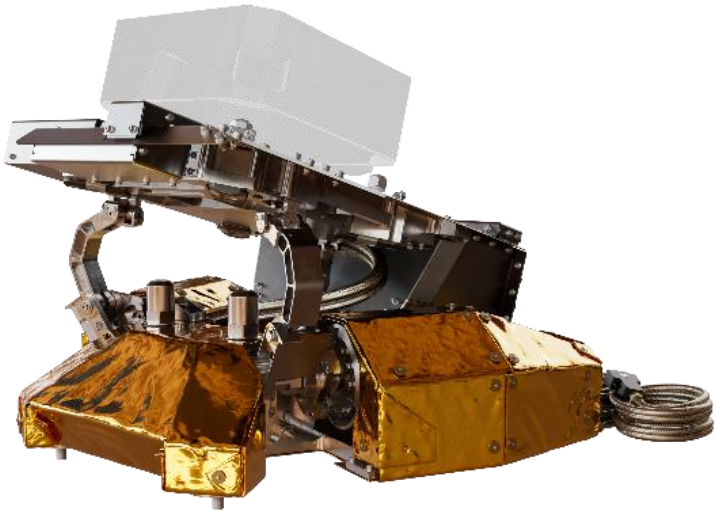
North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

Designed for thrusters up to 15 kg, the APPMAX2 is the benchmark electric propulsion pointing mechanism for spacecraft requiring precise pointing, proven reliability, and extensive flight heritage.

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APPMAX2-Baseline

Advanced Electric Propulsion Pointing Mechanism 2 Axis – Baseline

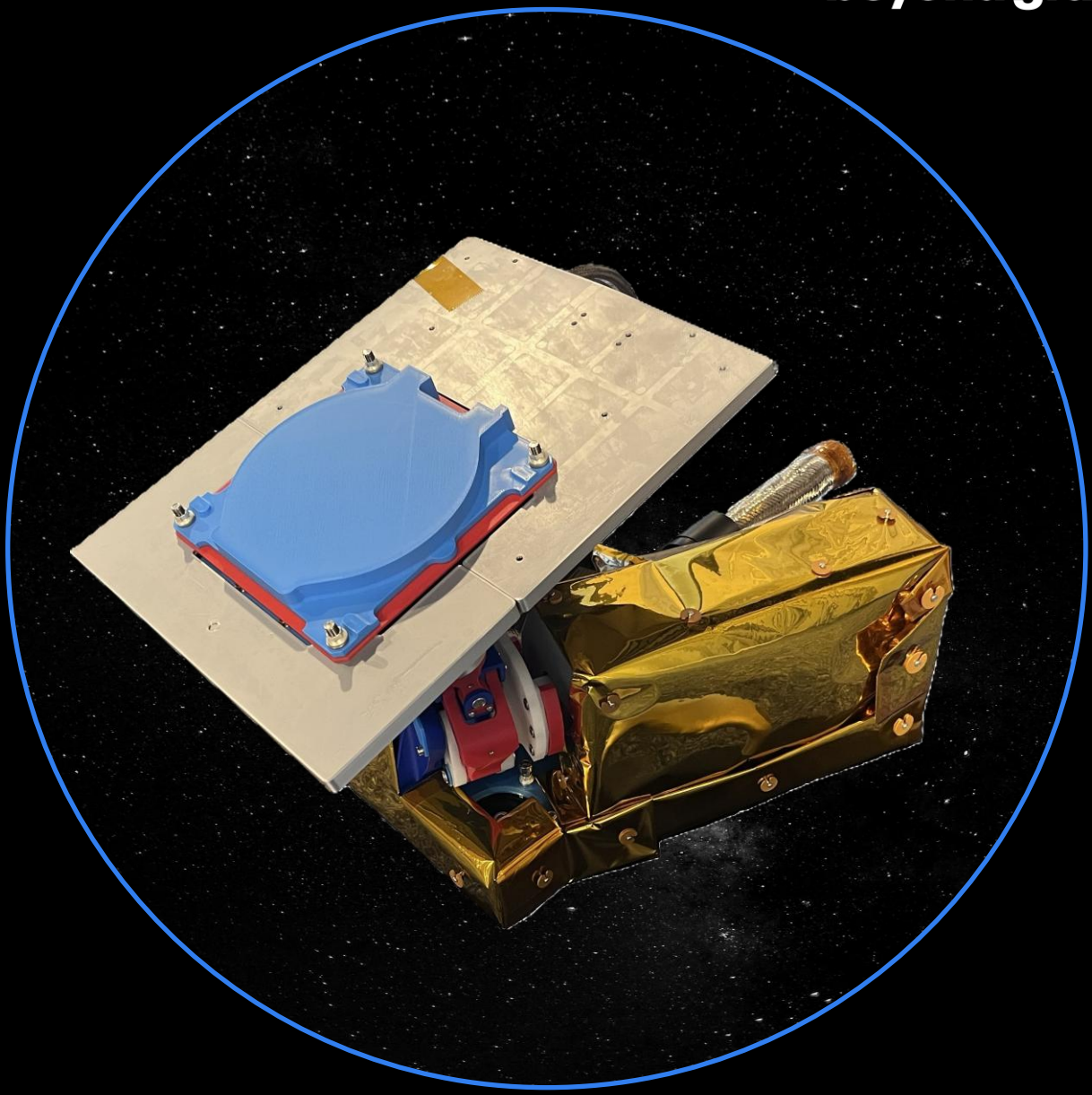


686 mm
APPMAX2-Baseline

	APPMAX2-Baseline
Motion Range	Standard 15° Half Cone, around vector perpendicular to S/C interface plane
Pointing Accuracy	better than 0.15°
Resistive Torque Capability	harness and tubing (routing by BGA)
Thruster Mass	8-15 kg e.g. PPS®5000, BHT-1500/6000 RIT 2X, XR-5
APPMAX2 Mass	~ 14 kg
Main Dimensions LxWxH (w/o thruster)	486x484x281mm
Stiffness stowed without damping as option	120 Hz
Stiffness stowed with damping as baseline	90 Hz
Stepper Motor Phase Resistance at 20°C	71 Ω
Actuator (separated from main load path)	LA15
HDRM	none (Launch Lock by Actuators)
HDRM I/F	N/A
Development Status	TRL8 with 4 customers, 22+ units delivered
Ground commissioning	No zero-g device needed

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APPMAX2-S

Advanced Electric Propulsion Pointing Mechanism 2 Axis for Compact Satellite Systems

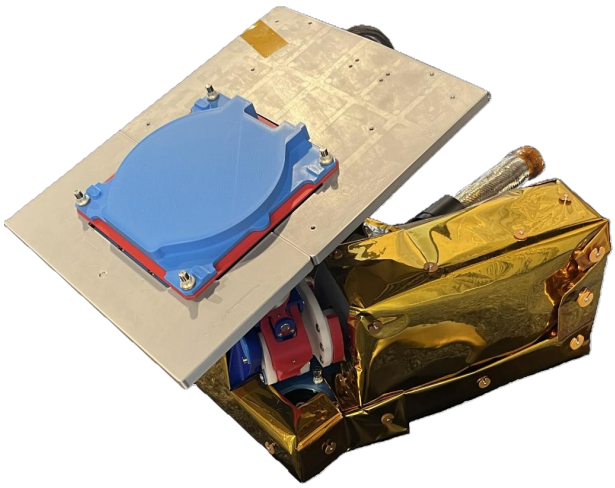
North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

Designed for thrusters up to 5 kg, the APPMAX2-S is the smart choice for compact spacecraft requiring lightweight, high-performance electric propulsion pointing with proven reliability on ECSS level.

Contact: info.vienna.space@beyondgravity.com

APPMAX2-S

Advanced Electric Propulsion Pointing Mechanism 2 Axis – Small



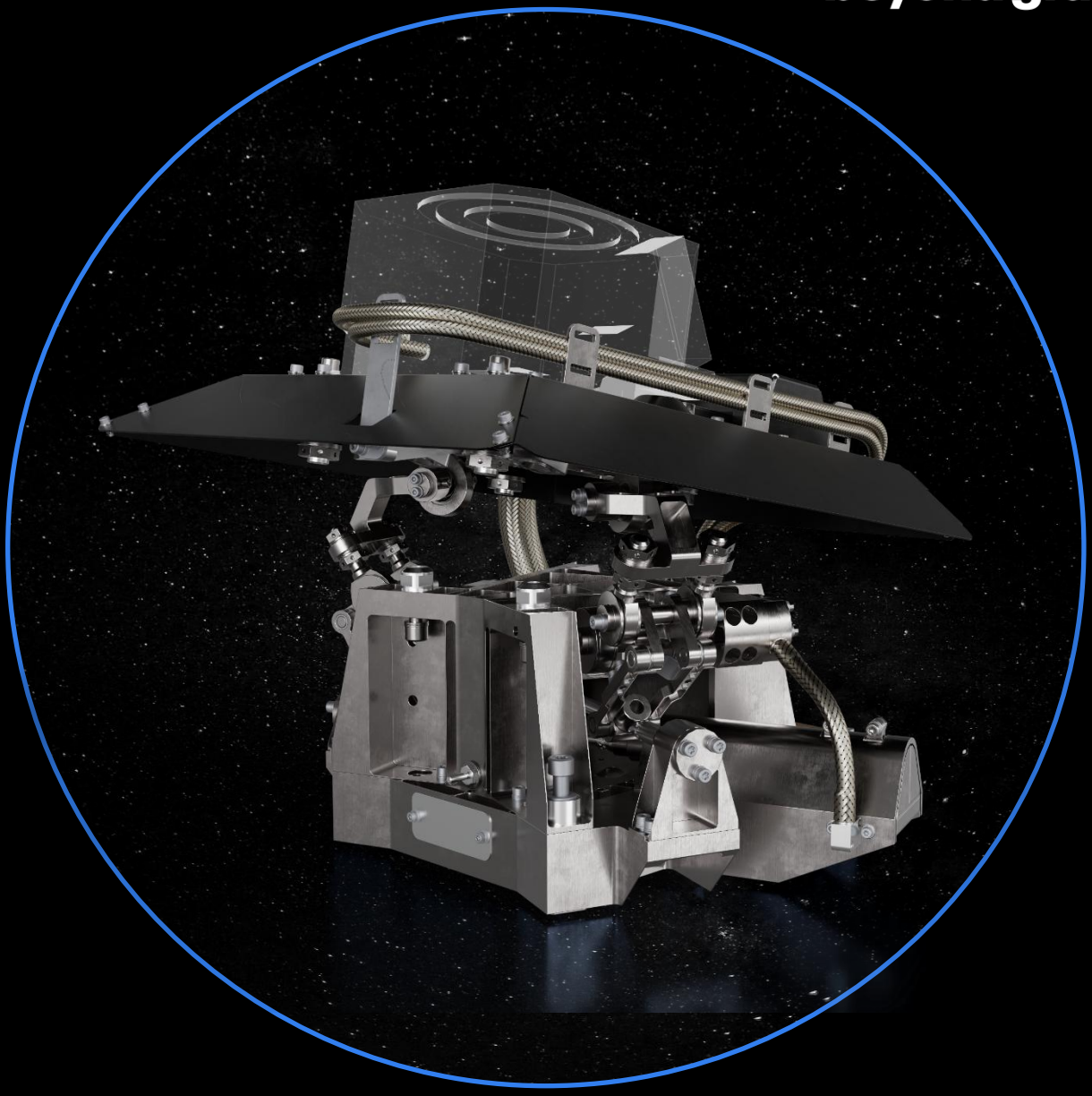
Movable 3D-print demo model

593 mm
APPMAX2-S

	APPMAX2-S
Motion Range	Standard 15° Half Cone, around vector perpendicular to S/C interface plane
Pointing Accuracy	better than 0,15°
Resistive Torque Capability	harness and tubing (routing by BGA)
Thruster Mass	Up to 5 kg e.g. PPS®1350 PPS®X00, BHT-600
APPMAX2-S Mass	10,5 kg
Main Dimensions LxWxH (w/o thruster)	370 x 450 x 244mm
Stiffness stowed without dampers	120 Hz
Stiffness stowed, with baseline dampers	90 Hz
Stepper Motor Phase Resistance at 20°C	71 Ω
Actuator (separated from main load path)	LA15
HDRM	none (Launch Lock by Actuators)
HDRM I/F	N/A
Development Status	Qualification on TRL6 in Q3 2027 internal funding
Ground commissioning	No zero-g device needed

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APPMAX2-XS

Advanced Electric Propulsion Pointing Mechanism 2 Axis for smaller Satellite Constellations

North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

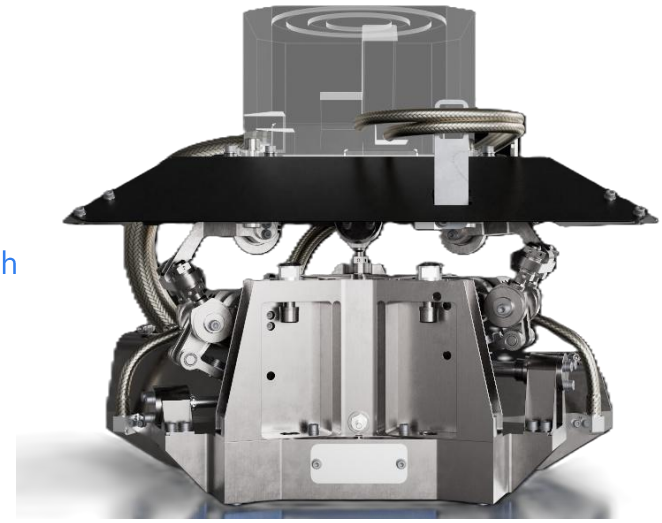
Designed for Small Sats and constellation platforms, the APPMAX2-XS brings high-end electric propulsion pointing technology to cost-sensitive missions without compromising performance or reliability.

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APPMAX2-XS

Advanced Electric Propulsion Pointing Mechanism 2 Axis – Small

Low-cost model with non redundant motors

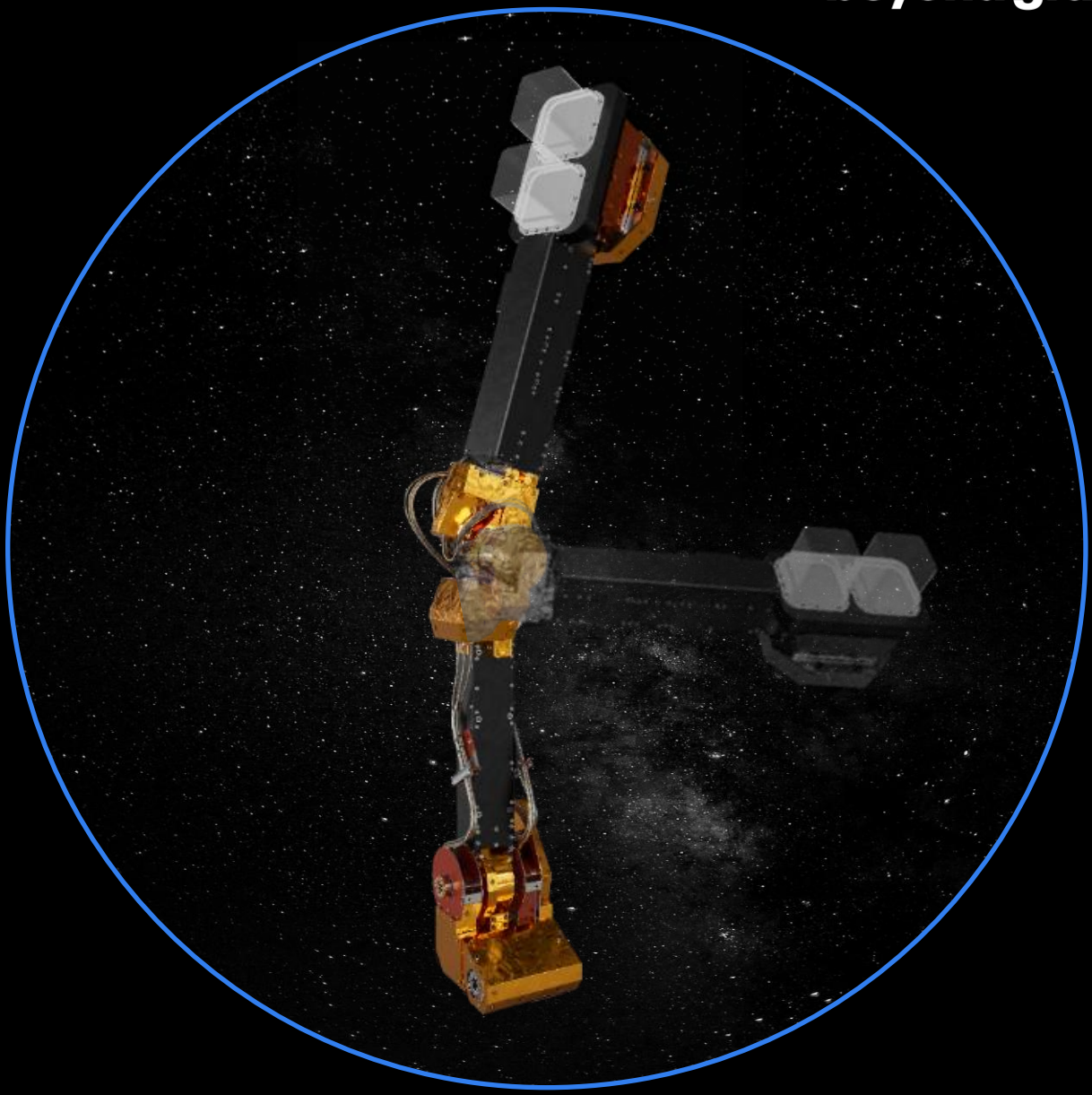


300 mm
APPMAX2-XS

	APPMAX2-XS
Motion Range	10° Half Cone, around vector perpendicular to S/C interface plane
Pointing Accuracy	better than +/- 0,05°
Resistive Torque Capability	harness and tubing (routing by BGA)
Thruster Mass	Up to 4,5 kg e.g. PPS®1350 PPS®X00, BHT-600
APPMAX2-XS Mass	~6,5 kg
Main Dimensions LxWxH (w/o thruster)	300 x 372 x 324 mm
Stiffness stowed without dampers	140 Hz
Stiffness stowed, with baseline dampers	110 Hz
Stepper Motor Phase Resistance at 20°C	71 Ω
Actuator (separated from main load path)	Stepper motor
HDRM	none (Launch Lock by Actuators)
HDRM I/F	N/A
Development Status	Qualification on TRL6 in Q1 2027 internal funding
Ground Commissioning	No zero-g device needed

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APPMAX3

Advanced Electric Propulsion Pointing Mechanism 3 Axis for large GEO-Satellites or Space Mobility

North/South respective East/West Station Keeping | Compensation of Center of Gravity Shift | Orbit Raising/Dropping | Momentum Wheel Off-Loading | Grave Yarding at S/C End of Life | Interplanetary Travel

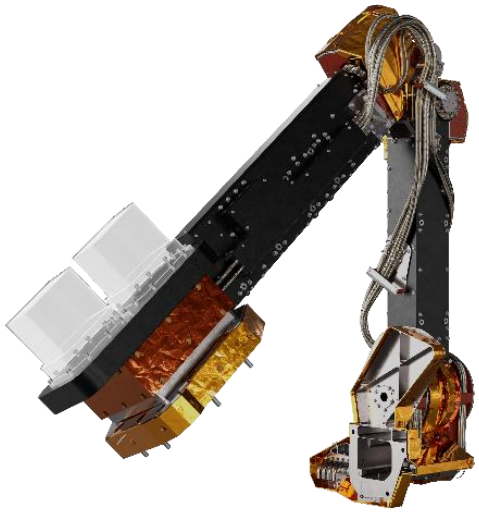
Designed for advanced electric propulsion systems requiring precise three-axis control, the APPMAX3 delivers outstanding maneuverability, accurate positioning, and reliable performance for the most demanding space missions.

Contact: info.vienna.space@beyondgravity.com

APPMAX3

Advanced Electric Propulsion Pointing Mechanism 3 Axis





	APPMAX3
Motion Range	Axis 1: 0° to 120° or 0° to 230° Axis 2: 0° to 120° Axis 3: 0° to 80°
Pointing Accuracy	up to 120°: +/-0.25° per axis up to 230°: +/-0.40° per axis
Resistive Torque Capability	harness and tubing MMOD protected (routing by BGA)
Thruster Mass	1x 12 kg (single Thruster) 2x 5 kg (dual Thruster) e.g. PPS®5000, XR-5, BHT600
APPMAX3 Mass	depends on design 30 - 45 kg
Main Dimensions LxWxH (w/o thruster)	depends on design selectable boom length up to 2m
Stiffness stowed	Depends on S/C boom configuration
Stepper Motor Phase Resistance at 20°C	71 Ω
Actuator (separated from main load path)	LA15
HDRM (on ground resettable)	Clamping mechanism, released by resettable electro/permanent magnetic holding device
HDRM I/F	8A at 26V ca. 200ms
Development Status	2 individual concepts contracted delivery start 2026
Ground Commissioning	Zero-g device will be provided

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