

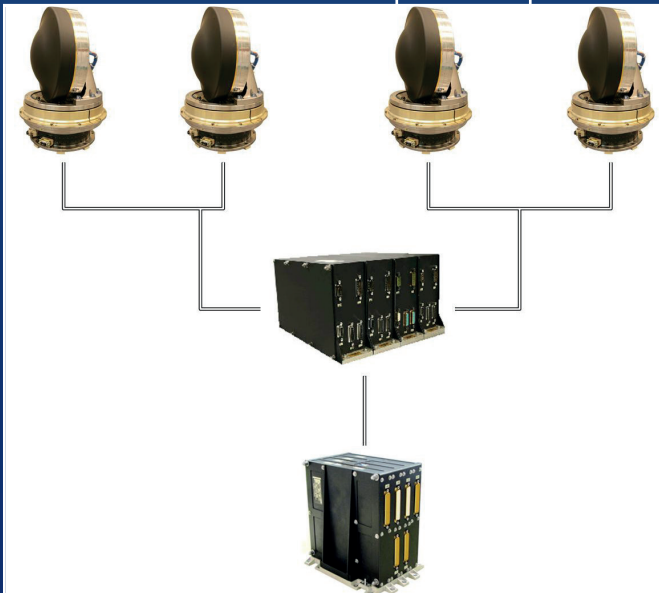
**DEFENCE AND SPACE**  
Spacecraft Equipment

# NEWTON CMG PACKAGE

When a CMG cluster  
becomes as easy as wheels



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In addition to a classic CMG cluster, the Newton package provides full CMG steering laws, increasing drastically the level of service and reducing the risk for customers. With the Newton package, use of a CMG cluster becomes as easy as a wheel cluster.

## KEY FEATURES

- CMG cluster commanded with 3D torque command (equivalent wheel array abstraction)
- Avoidance of CMG cluster singularities
- Integration of saturations on CMG commands
- MIL 1553 bus interface
- Availability of several products that help end-to-end validation (functional simulators, HW/SW simulators...)
- Compatible with all Airbus DS CMGs (15-45, 40-60 and 75-75) with the same TM/TC interface

## QUALIFIED FOR THE FOLLOWING

(data are for CMG 15-45)

- Thermal: mechanism -20 to +55°C, electronics -25 to +60°C
- Vibration: 20g sine, mechanism 10grms, electronics 15grms
- Shock: mechanism 800g, driver electronics 1600g over 2000Hz to 10kHz
- Radiation: Total Dose TID compatible with typical 10 years LEO, SEP tolerant, latch-up immune
- EMI/EMC: MIL-STD-461

## PERFORMANCES (data are for CMG 15-45)

- Max Momentum: 43 Nms on Y axis and 25Nms on X axis and Z axis at 4CMG
- Max Torque: 32 Nm on X axis, 28 Nm on Y axis and 16 Nm on Z axis at 4 CMG
- Lifetime: 10 years
- Gimbal maneuver: more than 2,400,000
- Angular momentum stability: <22 mNms at 4 CMG through a typical AOCS closed loop

## HERITAGE

- Airbus CMG products have cumulated over 1 million hours on orbit, without failure

## INTERFACES (data are for CMG 15-45)

- Mass: 81 kg (mechanism 4x16kg, drive electronics 3kg, processing unit 5kg)
- Volume: mechanism  $\varnothing$  270mm x h 350mm, drive electronics 310 x 300 x 150mm<sup>3</sup> (1 box for 4 CMG), processing unit 230 x 160 x 200mm<sup>3</sup>
- Power: <180 W
- Power bus: 22-37V
- TM/TC: MIL 1553B bus

## NEWTON CMG PACKAGE PRINCIPLE

### A CMG cluster controlled like wheels

The Newton package simplifies the use of CMG at spacecraft level. In addition to a classic CMG cluster, the Newton package provides full CMG steering laws, increasing drastically the level of service and reducing the risk for customers.

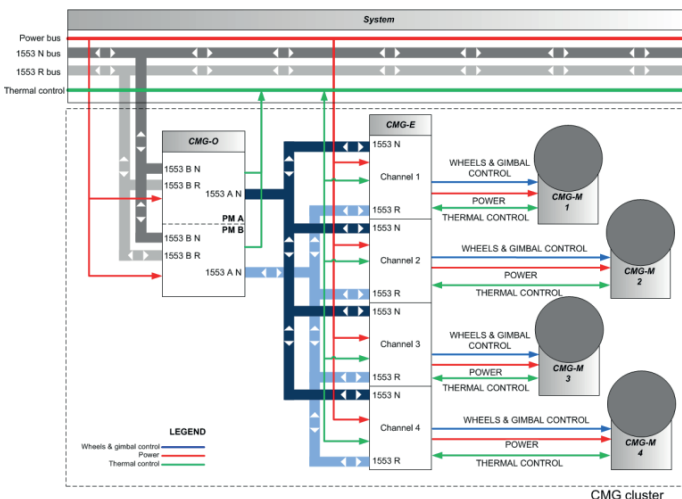
The Newton control laws manage the usual CMG clusters control issues (non-linearity of CMG control, singularity avoidance...)

### NEWTON architecture

The Newton assembly is composed of three different units: four mechanisms (CMG-M), their drive electronics (CMG-E) and the processing unit (CMG-O) that contains the steering laws.

All the electronics are connected to the main power bus and the thermal control is performed by the S/C.

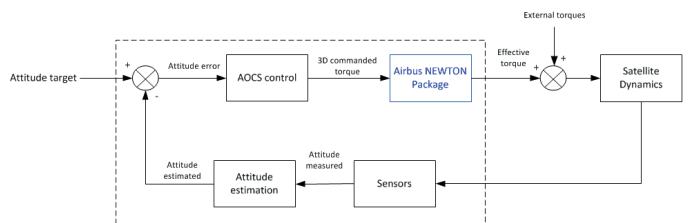
TM/TC transit from the S/C to Newton through a 1553 MIL bus.



### System integration simplified

Newton integration into AOCS closed loop is eased by an “autonomous torque box” concept. The mode logic includes initialization, nominal operations and contingency investigation. In Operational mode, the spacecraft only sends a periodic 3 dimensional torque command that is automatically translated into a CMG cluster command.

Newton also embeds FDIR logic that automatically protects CMG from its physical limitations regardless of the torque command.



### A product based on proven technologies

Both mechanisms and electronics have been designed for series production to minimize recurring costs.

We continue to innovate, bringing forward new hardware models and software features based on our existing flight proven solutions.