

IAF ASTRODYNAMICS SYMPOSIUM (C1)  
Attitude Dynamics (2) (9)

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DARK UNIVERSE EUCLID MISSION: HIGHEST POINTING AND STABILITY AOCS,  
PERFORMANCE ACHIEVEMENT AND VERIFICATION**Abstract**

The properties of the Dark Energy and Dark Matter are the main objectives of the investigations in the Euclid medium class cosmology mission from ESA. Euclid will operate about 1.5 million km away from the Earth in a large Quasi-Halo orbit around the Sun-Earth Lagrangian point L2. The scientific observations mandate among other requirements, an attitude pointing stability better than 75 milli-arcsec (99.7% confidence level), to be obtained for periods of 700 seconds. Such level of stability is so demanding that it becomes the main driver of the AOCS design. Additionally, the AOCS must also guarantee a high pointing accuracy, and incorporate the agility necessary to maximise the sky coverage with a careful sequence of observations, including frequent small manoeuvres and internal changes in the telescope and instrument. A very specific and advanced design has been introduced, which incorporates dedicated state-of-the-art attitude sensors and actuators, used in different configurations customised for the necessary sequences of operation. Modes and submodes have been carefully organised for that purpose, and specifically mandate the operation of actuators (hydrazine thrusters, cold-gas micro-thrusters, Reaction Wheels, and Momentum Compensation Unit) in dedicated sequence and specific guidance profiles, such that dynamical disturbances introduced by any moving element in the satellite are minimised and properly compensated. Early fast prototyping, with later evolution of prototypes into auto-coding suitable models, has allowed an early verification of every configuration and sequence, with confirmation of the achievable performance, prior to the full OBSW implementation. At the same time, autocoding allows to guarantee that the final AOCS SW is fully aligned with the prototypes used for that early verification. The paper describes the AOCS design and the rationale for critical decisions, with emphasis on the specific combination and operation of actuators, the dedicated qualification necessary for that type of operation. The stages in the verification are described and justified, starting with the “informal” design environment up to the S/C FM,

and including the Functional Simulator(ESE), the complete OBSW Verification Facility (SVF) and the HW in the Loop test benches at AOCS (HILF) and avionics level (AVM). SENER Aeroespacial is overall responsible and prime contractor of the Euclid AOCS, with Airbus Defence and Space Netherlands as main partner, while more than 7 additional direct subcontractors are contributing to different components of the subsystem. Thales Alenia Space Italy is Euclid prime contractor and AOCS customer.