MISSION_01 // PROJECT_VECTOR

GNC_STABILITY_LEDGER

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2026-01-01

01 // EXECUTIVE_SUMMARY

Verification of 9-DOF sensor fusion stack. The system utilized a Complementary Filter ($\alpha = 0.75$) to achieve attitude stability.

02 // TECHNICAL_TRACEABILITY

The body-to-inertial rotation matrix was validated using the DCM orthogonality check:

$$R \cdot R^T = I$$

EXECUTIVE SUMMARY

Verification of 9-DOF sensor fusion stack using a Complementary Filter and body-to-inertial frame rotation via Direction Cosine Matrix (DCM).

Status: NOMINAL Drift Margin: $< 2.5\%$ per minute

TECHNICAL REQUIREMENTS

ID	REQUIREMENT	CRITERIA
GNC-01	Attitude Stability	$< 3\%$ Drift/min
GNC-02	Frame Transformation	Matrix Orthogonality $R \cdot R^T = I$

MATHEMATICAL VALIDATION

The state estimation utilizes a Complementary Filter to fuse gyroscope integration with accelerometer data:

$$\theta_{new} = \alpha(\theta_{old} + \omega\Delta t) + (1 - \alpha)\theta_{accel}$$

ANALYSIS & RESULTS

Testing confirmed that $\alpha = 0.75$ provided the optimal balance between high-frequency gyro response and low-frequency accelerometer stability.