DroneHome – ESA NAVISP Programme Summary

Resilient positioning in GNSS-degraded and denied environments

Overview

DroneHome, completed in early 2026 under the European Space Agency NAVISP programme, investigated resilient positioning approaches for operation in GNSS-degraded and denied environments.

The programme focused on integrating terrestrial ranging signals with onboard estimation to maintain bounded navigation performance under challenging conditions.

Validation activities were conducted across representative deployment scenarios to assess system behaviour, performance stability, and operational constraints.

Objectives

- Demonstrate resilient positioning capability in GNSS-degraded and GNSS-denied environments
- Integrate terrestrial ranging with onboard navigation estimation
- Characterise performance as a function of system geometry and deployment configuration
- Validate navigation performance under realistic operational conditions
- Establish a foundation for transition toward operational deployment

Technical Approach

The system architecture combines:

- **Terrestrial ranging signals** from distributed nodes
- **Onboard estimation algorithms** for position and clock state
- **Sensor fusion techniques** to maintain navigation continuity

Explicit modelling of clock bias and drift is incorporated within the estimation framework, enabling stable operation in the absence of GNSS reference signals.

System performance is governed by deployment geometry, beacon configuration, and measurement quality.

Validation and Performance

Validation demonstrated consistent and bounded navigation performance across operating regimes:

GNSS-supported (assisted):

cm-class reference convergence, with landing accuracy **< 20 cm**

GNSS-denied:

30-50 cm positioning accuracy within a validated bounded regime

Performance remained stable under representative deployment conditions, with behaviour determined by system geometry and beacon configuration.

Key Outcomes

- Demonstrated bounded navigation performance in GNSS-denied conditions
- Validated integration of terrestrial ranging with onboard estimation
- Quantified performance envelope across operating regimes
- Established deployment-dependent performance characteristics
- Defined a pathway toward operational system deployment

Next Steps

The programme established a foundation for further development and deployment of resilient positioning systems, including:

- Expanded validation across additional operational scenarios
- Integration into autonomous navigation workflows
- Application-specific deployment optimisation strategies
- Engagement with stakeholders to define requirements and use cases

Contact

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