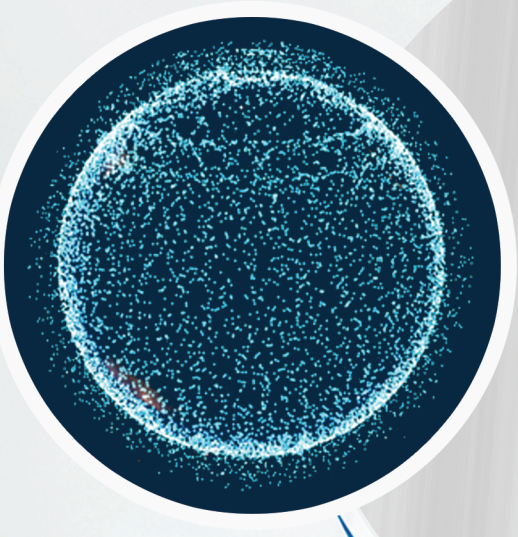
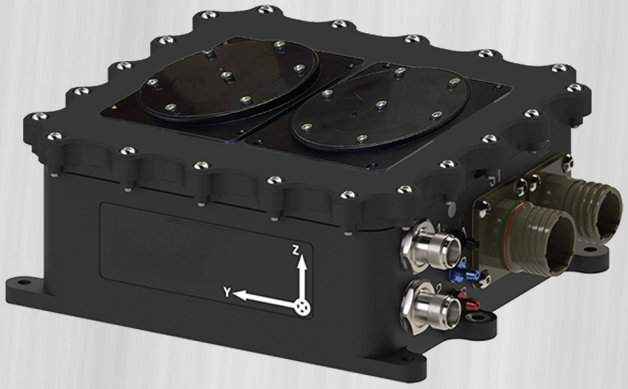




GNSS-Independent Integrated Navigation System With INS

AeroNav

AeroNav is a GNSS-independent Integrated Navigation System with INS, developed on the Pixhawk PX4 platform, designed to provide continuous navigation for on-the-move platforms. It integrates inertial measurements with positioning data from GNSS and AeroPos to determine the on-the-move platform's position, velocity and orientation, enabling reliable navigation even when conventional GNSS signals are unavailable or disrupted or spoofed. The system integrates an Inertial Measurement Unit (IMU), magnetometer, barometer and airspeed sensor with GNSS and an alternative positioning source, AeroPos. By combining inertial measurements with available positioning information, AeroNav maintains a continuous navigation solution and limits the accumulation of inertial drift during extended positioning interruptions.

GNSS-Independent Navigation:

Maintains navigation capability without relying on conventional GNSS positioning.

RF Interference Resistance:

Supports navigation in environments where conventional GNSS signals are disrupted, blocked or unavailable

Global Coverage:

Designed to provide positioning capability across geographically distributed operating areas.

Integrated Navigation System With INS:

Combines multiple inertial sensors and positioning sources to provide continuous navigation information

■ AeroNav combines information from its sensors and positioning sources through three main processes:

Sensing:

The IMU measures acceleration and angular velocity.
The magnetometer, barometer and airspeed sensor provide additional heading, altitude and airspeed information.

Navigation Estimation:

The navigation filter combines inertial measurements and available positioning information to estimate the on-the-move platform's position and velocity continuously.

Position Correction:

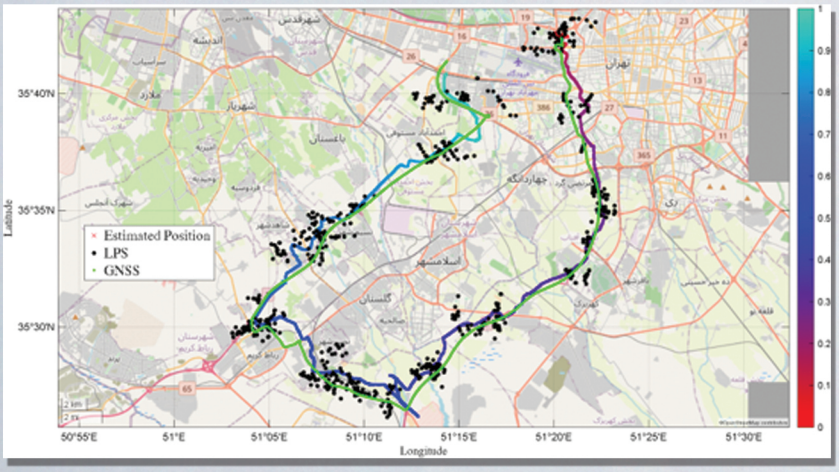
GNSS measurements are used when available.
When GNSS positioning is unavailable, AeroPos positioning provide an alternative source of position corrections.

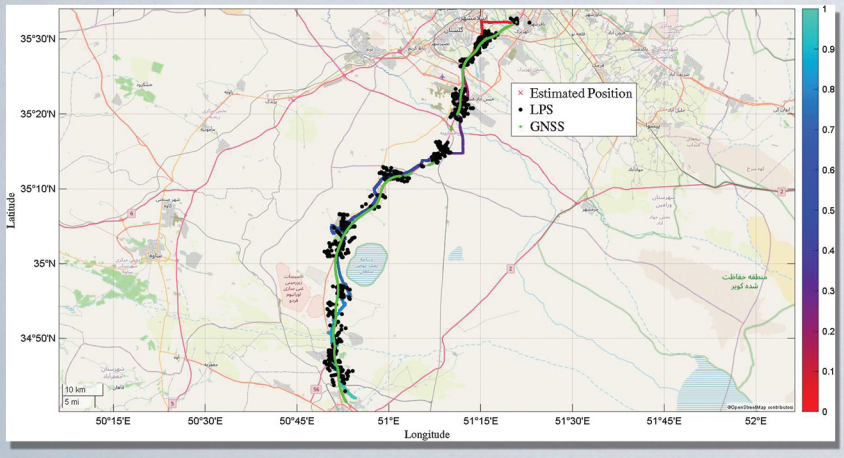
Global AeroPos

globalaeropos.com

Test and Validation Results

AeroNav was tested over an one-hour route without using GNSS data for navigation. During the test, the system relied on inertial measurements and AeroPos positioning fixes received at two-second intervals.
The estimated navigation trajectory was compared with the reference route recorded by GNSS. The results demonstrated the system's ability to maintain navigation throughout the test, with periodic AeroPos corrections limiting accumulated inertial drift.





AeroNav is designed for on-the-move platforms requiring continuous and reliable navigation, particularly in operating environments where GNSS signals are blocked, spoofed or unavailable

Autonomous Navigation:

Provides continuous navigation solutions, including position, velocity and orientation, to support autonomous operation and guidance systems.

Integrated Navigation:

Combines inertial measurements with external positioning sources to provide a unified navigation solution for host platforms.

GNSS-Denied Navigation:

Maintains navigation capability when conventional GNSS signals are unavailable or disrupted, using inertial measurements and alternative positioning corrections.

Navigation Redundancy and Verification:

Provides an alternative navigation source alongside conventional GNSS-based systems, supporting navigation continuity and cross-checking of positioning information.

Average Navigation Errors

Operating Condition	Position X Error	Position Y Error	Vertical Position Error
GNSS Available	2.4 m	2.5 m	4.5 m
GNSS Unavailable, AeroPos Every 2 seconds	1,100 m	700 m	20 m

Operating Condition	Velocity X Error	Velocity Y Error	Vertical Velocity Error
GNSS Available	0.26 m/s	0.27 m/s	0.17 m/s
GNSS Unavailable, AeroPos Every 2 seconds	4 m/s	4.5 m/s	0.4 m/s

Results represent average errors measured during the one-hour test. GNSS-denied results correspond to AeroPos positioning corrections at five-minute intervals.

Global AeroPos

globalaeropos.com