Colibrex
Smart Drone Solutions

Drone Measurements

Drone-based NavAids Measurements

NavAidDrone-neo

Redefining Airborne NavAid Measurements
Next-Generation Airborne Measurement System for ILS, VOR/DME and PAPI

NavAidDrone-neo

Bridging Ground and Flight Inspections

The NavAidDrone-neo is a next-generation airborne measurement system developed for the commissioning, calibration, maintenance, and inspection of terrestrial navigation aids including ILS, VOR/DME and PAPI systems.
Designed specifically for high-precision signal-in-space measurements, the NavAidDrone-neo bridges the gap between conventional ground inspection and traditional flight inspection by bringing airborne measurements into routine CNS maintenance operations.
Unlike conventional ground-based methods, the NavAidDrone-neo performs measurements directly within the operational signal environment. Thanks to highly accurate trajectory control, RTK positioning, and stabilized flight profiles, the system captures the same key signal parameters used during flight inspection – with significantly greater flexibility and reduced operational constraints.
The NavAidDrone-neo supports also structured airborne measurement programs closely aligned with conventional flight inspection methodologies. Through direct correlation with flight inspection data, the system enables ANSPs to optimize flight check programs, extend inspection intervals, reduce operational costs, and minimize environmental impact.
The NavAidDrone-neo is the result of a strategic collaboration between Colibrex GmbH, specialists in drone-based RF measurement systems, and FCS Flight Calibration Services, internationally recognized experts in flight inspection services. The integrated receiver technology was developed in cooperation with Physikalisch-Technische Bundesanstalt (PTB), ensuring the highest levels of traceability, reproducibility, and measurement accuracy in accordance with ICAO recommendations.

NavAidDrone-neo in operation

The system isn´t just a concept but a mature and field-proven operational solution. Successfully deployed worldwide and validated over several years by DFS Deutsche Flugsicherung, the NavAidDrone-neo has become an integral part of modern navigation aid maintenance and inspection strategies.
As pioneer in drone-based navigation aid inspection, Colibrex not only provides advanced technology, but also supports ANSPs and operators in successfully integrating drone-based airborne measurements into their operational and regulatory environments.

Applications & Operational Objectives

The NavAidDrone-neo supports a wide range of airborne measurement and inspection applications for modern CNS maintenance and calibration.

Preventive & Corrective Maintenance
Early detection of signal degradation, advanced troubleshooting, and fault analysis caused by environmental changes, infrastructure modifications, or navigation aid performance issues.

Commissioning Support
Measurement support during installation, replacement, calibration, or repair of ILS, VOR, and DME systems.

Flight Inspection Optimization
Correlation with flight inspection data enabling reduced flight check programs and/or extended inspection intervals in accordance with ICAO Doc 8071.

Visual Aid Inspection
Inspection and measurement of PAPI systems in accordance with ICAO Doc 9157, potentially replacing conventional flight inspection methods

Core Technologies & System Highlights

Measurement Accuracy & Flight Inspection Correlation

The NavAidDrone-neo receiver technology has been specifically designed for high-precision airborne signal-in-space measurements from a moving drone platform. To ensure highly accurate DDM and SDM measurements, the system implements adaptive real-time signal processing with dynamic filtering. Beyond the capabilities of conventional ILS receivers, the NavAidDrone-neo performs high-bandwidth internal acquisition and recording of the complete transmission channel, enabling advanced in-channel separation of useful navigation signals and interference sources.

Measurement of VOR signals

The measurement system supports:

- Complete Localizer (LOC) and Glide Path (GP) parameter evaluation, including DDM, SDM, RF level, and course/clearance ratio
- Simultaneous analysis of course and clearance signals within a single measurement flight
- Advanced VOR and DVOR analysis, including individual SBO antenna evaluation in LSB and USB
- Optional DME measurements through an integrated lightweight transceiver module designed for high-accuracy DME distance error evaluation
- Remote receiver calibration

Engineered as a Fully Integrated Measurement System

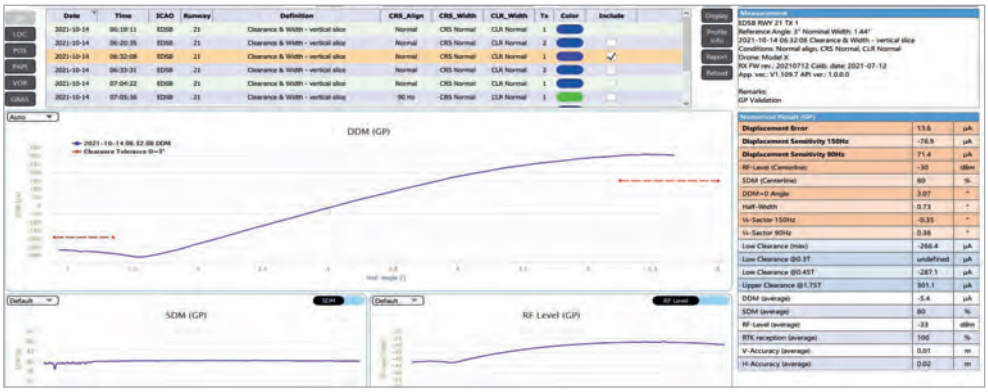
The NavAidDrone-neo goes far beyond the concept of a drone simply carrying a measurement receiver. It is a field-proven and fully integrated airborne measurement system specifically engineered for professional CNS inspection applications.

One of the most critical technical challenges — the precise synchronization between time reference, drone position, flight trajectory, and RF measurement data — has been successfully mastered and validated through extensive development and flight testing.

The integrated GNSS/RTK navigation architecture, including anti-jamming and anti-spoofing technologies, provides highly accurate real-time positioning with update rates up to 100 Hz, ensuring exceptional trajectory stability and measurement repeatability.

To optimize installed antenna performance and overall system behavior, Colibrex performed full numerical simulations of the airborne configuration, including the dedicated VHF/UHF measurement antennas. Particular attention was given to interference mitigation and platform-induced signal effects, including the selection of low-reflection propellers.

Dedicated communication links ensure robust system control, real-time telemetry, and live monitoring of key measurement parameters throughout the mission.



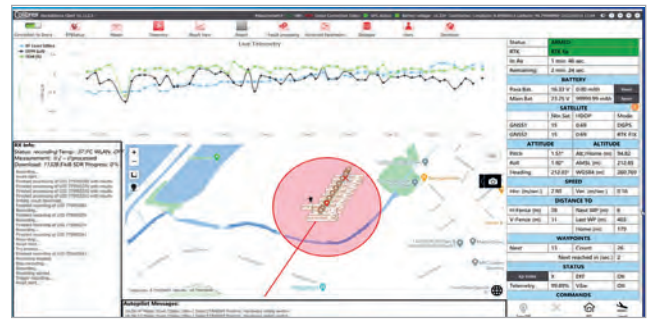
Example of GP measurement results

Unified Mission & Measurement Software Environment

A seamlessly integrated software environment manages the complete workflow — from airport data import and coordinate transformation to mission planning, automated flight execution, measurement processing, and report generation. The software allows operators to select predefined measurement profiles or create customized mission scenarios tailored to specific operational requirements.

This high level of integration significantly simplifies on-site operations, reduces preparation time, and accelerates the execution of complex measurement programs.

Particular attention was given to the usability and reporting structure, enabling flight inspection experts to work with familiar workflows and detailed measurement reports closely aligned with conventional flight inspection practices.



Overview software (live measurement, waypoints & telemetry)

Purpose-Designed & Scalable Drone Architecture

Unlike competing solutions based on commercial off-the-shelf drones, the NavAidDrone-neo uses a purpose-designed flying platform developed specifically for professional CNS inspection applications.

With full control over hardware, software, and supply chain, Colibrex ensures top-tier performance, operational safety, long-term sustainability, and continuous platform evolution.

Key features include:

- Robust and weather-resistant multicopter architecture configurable as X4 or X8
- Open-source autopilot enabling mission flexibility, full system control, and data confidentiality
- "Battery-agnostic" concept including batteries approved for transport on commercial aircraft
- Easily swappable payloads with modern interfacing for future applications

View of the NavAidDrone during night operation

- Compact transport design with removable arms, landing gear, and antennas
- Open interfaces for integration into UTM environments and future BVLOS operations

Future-Ready Platform for Expanding Applications

The NavAidDrone-neo has been designed as a flexible and expandable platform. Thanks to full in-house control of the drone architecture, payload integration, software, and interfacing, Colibrex can continuously develop and integrate new functionalities as operational needs and regulations evolve.

This scalable approach already enabled the integration of a lightweight DME transceiver module directly into the existing receiver payload, extending the system capabilities without requiring a separate platform.

All mission, measurement, processing, and reporting tools are developed in-house following the long-established software engineering standards of LS telcom. The software environment is continuously enhanced with new functionalities, reporting capabilities, and customer-specific features.

PAPI inspection software module

With the introduction of the PAPI inspection module, the NavAidDrone-neo expands beyond RF measurements into the field of visual aid inspection, paving the way for future applications related to airport lighting and visual approach aids.

Bridging Ground and Flight Inspection

Comparison of operational inspection capabilities for ILS, VOR/DME, and PAPI systems

ILS Capability Matrix

Parameter / Capability	Flight Inspection	Ground-Based Inspection	NavAidDrone
Glide Path Angle	✔	✖	✔
Glide Path Width	✔	✖	✔
Glide Path Clearance Below Path	✔	✖	✔
RDH (Reference Datum Height)	✔	✖	✔
Localizer Course Alignment	✔	⚠	✔
Localizer Course Width	✔	⚠	✔
Localizer Clearance Sector 1	✔	✔	✔
Localizer Clearance Sector 2	✔	✖	⚠
Signal Structure / Bends	✔	✖	✔
GP / Localizer Structure (Z1 / Centreline)	✔	✖	✔
GP / Localizer Structure (Z2 / Z3)	✔	✖	✔
Monitor & Alarm Verification	✔	✔	✔
Transmitter Switching	✔	✔	✔
Near-Field Behaviour	✖	✔	✔

VOR / DME Capability Matrix

Parameter	Flight Inspection	Ground-Based Inspection	NavAidDrone
VOR Bearing Accuracy	✔	⚠ Limited / local	✔
VOR Radial Alignment Accuracy	✔	⚠ Limited / local	✔
VOR Course Structure / Azimuth Behaviour	✔	✖	✔
VOR Multipath / Polarization Effects	⚠ Limited	✖	✔
DME Distance Measurement Error (Accuracy)	✔	✔	✔
DME Reply Efficiency / Reply Availability	✔	✔	⚠ Operational assessment
DME Coverage Evaluation	✔	⚠ Partial / local only	⚠ Partial
DME Near-field / Close-in RF Behaviour	✖	✔	✖

PAPI Inspection Capability Matrix

Parameter	Flight Inspection	Ground-Based Inspection	NavAidDrone
Transition Vertical Angles	✔	✔	✔
PAPI System Angle	✔	✔	✔
Relative Intensity	✔	✔	✔
Angular Coverage (±10°)	✔	⚠	✔
Symmetry Verification	✔	⚠	✔
MEHT Calculation	✔	⚠	✔
Obstacle / Coverage Verification	✔	✕	✔
Correlation with Glide Path Inspection	✔	✕	✔

✔ Fully supported ⚠ Partially supported / limited capability ✕ Generally not supported

Next-Level Drone Applications for Aviation

One Platform. One Supplier. Multiple Missions.

FDA

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