```
In [1]: runfile ('E://ComputerVision/als-cv/our_services.py')
Extracting VISUAL INSPECTION SERVICES...
Computing PAPI...
Computing ALS...
Computing RUNWAY LIGHTS...

Extracting RADIO INSPECTION SERVICES...
Computing ILS...
Computing VOR...

Extracting INFRAESTRUCTURE INSPECTION SERVICES...
Computing PCI...
Computing ETOD...

PROCESS DONE SUCCESFULLY.
```

CANARD DRONES

smart solutions for smart airports

What is
CANARD DRONES?

CANARD DRONES,
the most efficient, versatile and immediate drone-based solution for airport inspections.

SMART SOLUTIONS FOR SMART AIRPORTS.

CANARD

In a globalized world in which commercial aviation has become an essential and increasingly popular means of transportation, in a context in which environmental sustainability is crucial for the future of the planet, the airport sector faces several challenges in its maintenance and safety operations: immediacy, efficiency and operational agility.

Overcoming these challenges will depend on the commitment of companies, institutions, agencies and regulatory bodies in the international airport industry to innovation, the future and the environment. This is precisely where the solutions developed by CANARD DRONES come into play.

CANARD DRONES has developed a **comprehensive, technological solution** for the inspection of visual aids, radio aids and infrastructures at airports.

Through a single online platform, integrating a drone and an exclusive app, users can perform, with **24/7 availability**, a series of recurring inspections: **PAPI, ALS, Runway Lights, ILS, VOR, ETOD / Obstacles, and PCI**.

By having a **commercial off-the-shelf product** such as CANARD DRONES, users become completely autonomous, using the system for decision making with the **data and results obtained instantly**.

Why
choose our solutions?

FLEXIBILITY

DIGITALIZATION

SUSTAINABILITY

COMPLIANCE

PROFITABILITY

FLEXIBILITY

Those airports that acquire the CANARD DRONES solution have the ability to operate 24/7. That is, the availability to perform inspection and calibration operations, unlike traditional methods that need weeks or even months just to make adjustments, is IMMEDIATE.

In this way, the CANARD DRONES solution avoids any disruption in airport operations and all the problems that this entails (temporary closure of runways, dangerous maneuvers, etc.). With CANARD DRONES there is no need to close runways and, if desired, it is possible to operate at night, further reducing any risk.

CANARD DRONES, thanks to its exclusive software integrated with a drone, allows airports to have a complete report of the operation carried out IN REAL TIME.

DIGITALIZATION

CANARD DRONES has managed in recent years to develop its own software that, together with the simple integrated use of a commercial drone and a tablet, allows the realization, in record time, of airport infrastructure inspections as well as the calibration of navigation aids for civil and military airports.

In this sense, the digitalization of all these processes, together with the use and development of Artificial Intelligence, offers other advantages such as the digital collection and recording of data and parameters that help the execution of a predictive maintenance system, or simply having immediate availability to view videos of inspection operations in a single click.

SUSTAINABILITY

Sustainability is of great importance in the future of our society. The airport industry is increasingly aware of the need to reduce greenhouse gas emissions and other environmental impacts. In addition, the implementation of a sustainable management policy improves efficiency, profitability, image and reputation. Also, more and more countries and regulators are requiring airports to adopt sustainable measures outlined in the 2030 Agenda.

It is therefore essential that airports around the world implement sustainable measures to minimize their impact on the environment and promote responsible practices, as set out in the international social agenda.

In this sense, the sustainable solution offered by CANARD DRONES for visual, radio and infrastructure inspection of airports is the ideal alternative when it comes to SUSTAINABLE AND ENVIRONMENTALLY FRIENDLY OPERATIONS.
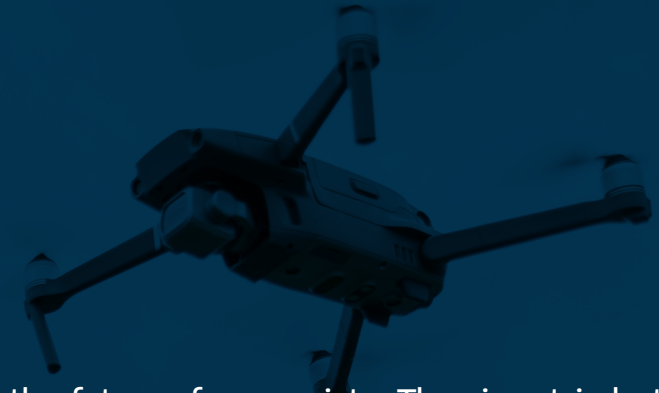
All CANARD DRONES solutions and procedures are developed and tested to comply with ICAO RECOMMENDATIONS AND SPECIFICATIONS shown in Doc. 8071, Doc. 9157, Annex 10 or Annex 14.

Some of these manuals already include mentions of RPAs (DRONES) as accepted means to perform certain inspection and maintenance activities, leaving the details of implementation to the Civil Aviation Authorities of each country.

Since its inception, CANARD DRONES has worked, side by side, with institutions and official bodies of different countries (authorities, operators, ministries, armies...).

We have collaborated, among others, with:

- **AENA** (main airport operator) / AESA (Civil Aviation Authority) - Spain.
- **ENAIRE:** Air navigation manager in Spain.
- **DGAC:** Direction Générale de l'Aviation Civil (DGAC) - France.
- **FAA:** Federal Aviation Administration (FAA) - United States.

Standards and certifications:

- **SPANISH MINISTRY OF DEFENSE.**
  In 2018, CANARD was declared a company of special interest by the Spanish Ministry of Defense.

- **ISO 9001:** CANARD became an ISO 9001 certified company in November 2018.

- **EUROPEAN UNION: SEAL OF EXCELLENCE - EU.** Awarded by the European Commission for R&D +i projects.

COMPLIANCE

PROFITABILITY

Opting for the CANARD DRONES technological and operational solution, either exclusively or in support of traditional airport inspection methods, is synonymous with profitability.

This profitability is obtained, for example, from the indirect savings that the operational benefits entailed for many airports not being forced to close a runway when carrying out the inspection and/or calibration operation, or having the 24/7 operational availability of the CANARD solution.

In some cases, there is also a direct cost saving taking into account that the average estimate of the positive ROI is from year 2 or 3 of the implementation of the solution.

(Learn about)

**Our
solutions**
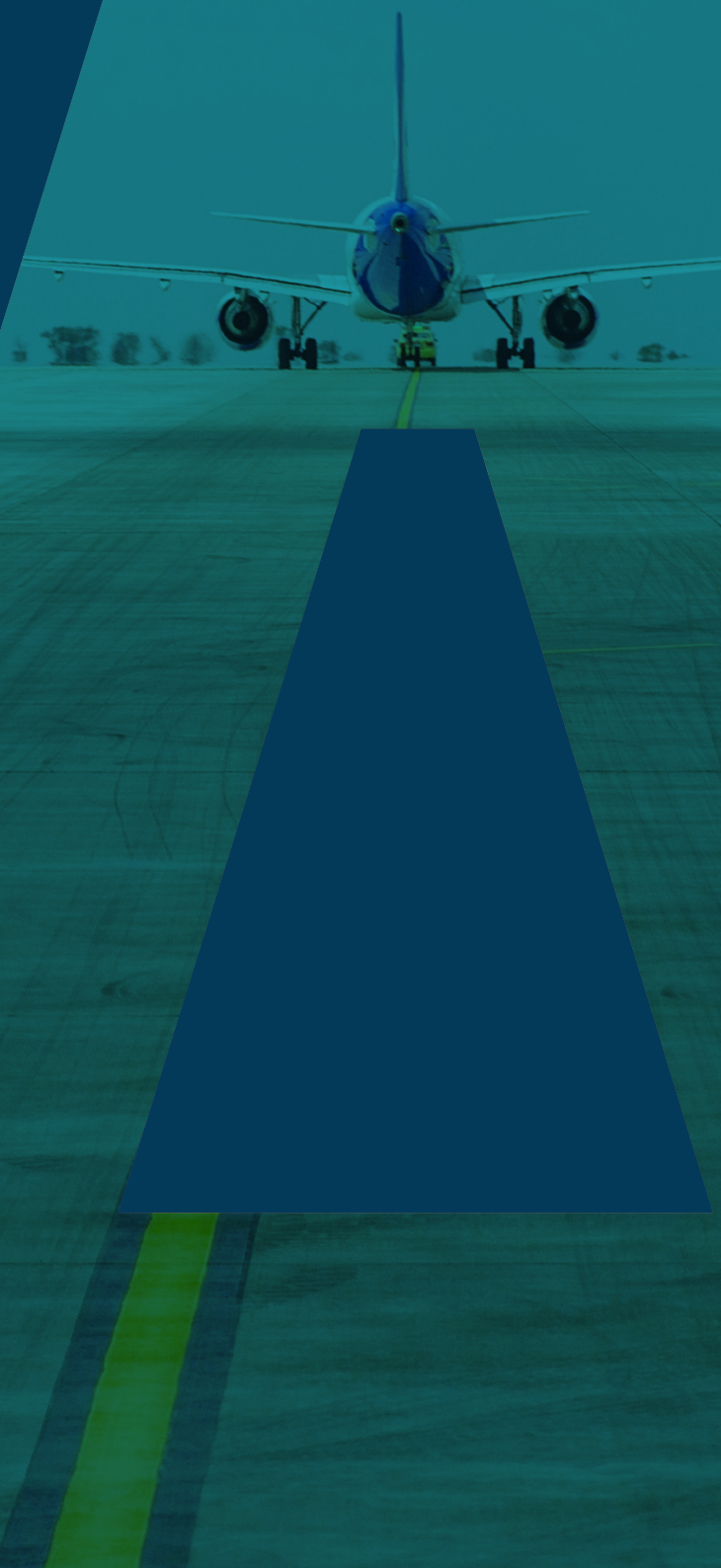
TECHNOLOGY

HARDWARE

Drone

The drone system from DJI, a leading drone manufacturer, can execute procedures autonomously, efficiently and safely thanks to precise positioning in RTK operations.

CANARD DRONES integrates its airport inspection solutions into two drone models:

The **M-300** offers visual (PAPI, ALS, Runway Lights) and infrastructure (ETOD, PCI) solutions as well as radio solutions (ILS, VOR) through the PNA-200 (Portable Navaids Analyzer) receiver device integrated in the drone itself.

The **Mavic 3 Enterprise** model is integrated with all its visual and infrastructure solutions. Its main advantage is its portability, as the drone, along with all its components (controller, battery, etc.), can be transported in a suitcase the size of hand luggage.

TECHNOLOGY

HARDWARE

PNA-200
(Portable Navaids Analyzer)

The PNA-200 has been developed by CANARD DRONES for the **inspection, maintenance and commissioning of ILS and VOR**, as specified by **ICAO** in Annex 10 and Doc. 8071.

Interface App

The main feature of the PNA-200 is that the interface has been developed through **an application that runs on a tablet with Android operating system**. By dispensing with the buttons and the display on the device itself, the weight is considerably reduced, as is the power consumption.

This also enhances **portability and flexibility**, as the receiver can be placed in one location while the user views data and configures the PNA-200 conveniently from a wireless tablet.

SDR Technology

SDR is a methodology of **digital processing of radio signals** versus analog hardware processing. By using digital signal processing, adding new functionality such as new types of radio aids, filters, processing or signal measurements is reduced to a matter of adding new software versions to the device, as would be done with a mobile application.

SLS 3D printing

The PNA-200 housing is manufactured using selective laser sintering (SLS) 3D printing technology. Unlike other 3D printing techniques and materials, this housing is **resistant to temperature changes, water, sunlight and chemical abrasion**.

TECHNOLOGY

SOFTWARE

Cloud Platform

The Cloud Platform enables **mission planning, asset management, data and report generation**. Thanks to a Database of airports, runways and systems, the CANARD platform automatically plans flights. All inspection results, reports, records and images can be accessed and reviewed **anywhere**.
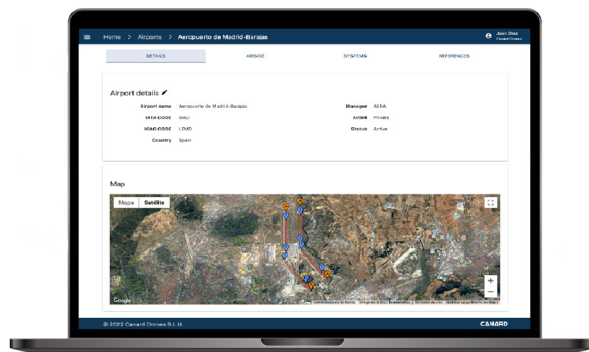
Calibration Tool App

Running on a tablet, the Calibration Tool App is an integrated, easy-to-use interface that allows the pilot to **automatically perform all tasks while displaying relevant real-time data for each type of inspection**. The application executes the **Operational Procedures** for each of the inspections.

Reports and Automatic Processing

Reports are automatically generated and stored in the Platform. For certain processing, **automatic analysis algorithms** (AI/ML) of the images obtained are used, thus assisting in the elaboration of data and reports.
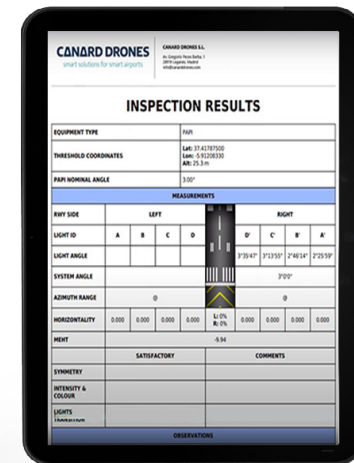
COMMERCIALIZATION

SOLUTION LICENSING

We offer a comprehensive solution tailor-made

The CANARD solution is a **ready-to-use product** for the inspection of aids to navigation and infrastructure at airports. Licenses for the use of the solution are **created according to the customer's needs**, and according to the type and number of inspections they wish to perform.

These licenses can be obtained **either for one of the inspection modules or for the entire portfolio**. All of them **can be combined and integrated** in the same hardware. Depending on the type of license, additional features are required, such as our ILS / VOR receiver, for radio aid inspections.

With the CANARD solution, **users are completely autonomous and can perform their inspections in a flexible way**. Users are trained and certified to use the tool and perform inspections on their own. CANARD will offer the necessary support during implementation and provide customer service for the duration of the contract. Maintenance and updating of the software is carried out remotely and periodically.

- *Licenses tailored to the client's needs.*

- *For one of the modules or for the entire portfolio.*

- *Combinable and integrable in the same hardware.*

COMMERCIALIZATION

IMPLEMENTATION

From start to finish

Training

CANARD offers users **comprehensive training in the use of the tool** and the application of the procedures.

The training consists of a 5-day program that provides the necessary knowledge to perform inspections using the solution. The program can be offered at the customer's premises or remotely (online):

- *Theory.*
- *Simulation.*
- *Practise.*
- *Solo flight.*

Support

Once training is completed, a dedicated team of experts provides remote assistance with **follow-up for 6 weeks** to ensure successful adoption of the solution.

CANARD accompanies its customer through the change management process and continues to provide support throughout the implementation of the solution:

- *Operations readiness support.*
- *Regular online meetings.*
- *Change management.*

Customer Service

CANARD's support to its customers continues after the implementation of the solution:

- *Response to queries.*
- *Software maintenance.*
- *Airport database.*

COMMERCIALIZATION

PROVISION OF SERVICES

We take care of everything

CANARD also provides **inspection and calibration services on an ad hoc basis**, when required by a customer.

The CANARD team is expert in the elaboration of risk assessments, the **handling of authorizations and in the definition and follow-up of coordination protocols** with airports and ATC.

What makes us different?

We offer a **comprehensive and closed service**, i.e., we take care of covering all the customer's needs, in all the stages of the operation until the final inspection report is obtained. We put at your disposal: a complete technical team; expert operators/pilots; management from the first moment with all airport areas and departments involved in these procedures; availability on site until the final inspection/revision report is obtained.

- *Risk assessments.*
- *Authorization management.*
- *Coordination with airfields.*

PORTFOLIO OF INSPECTIONS

CANARD DRONES is **the only company in the world** that offers a comprehensive portfolio of solutions that includes the inspection and calibration of:

- Visual Aids Module: **PAPI, ALS and Runway Lights**.
- Radio Aids Module: **ILS and VOR**.
- Infrastructure Module: **PCI and ETOD / Obstacles**.
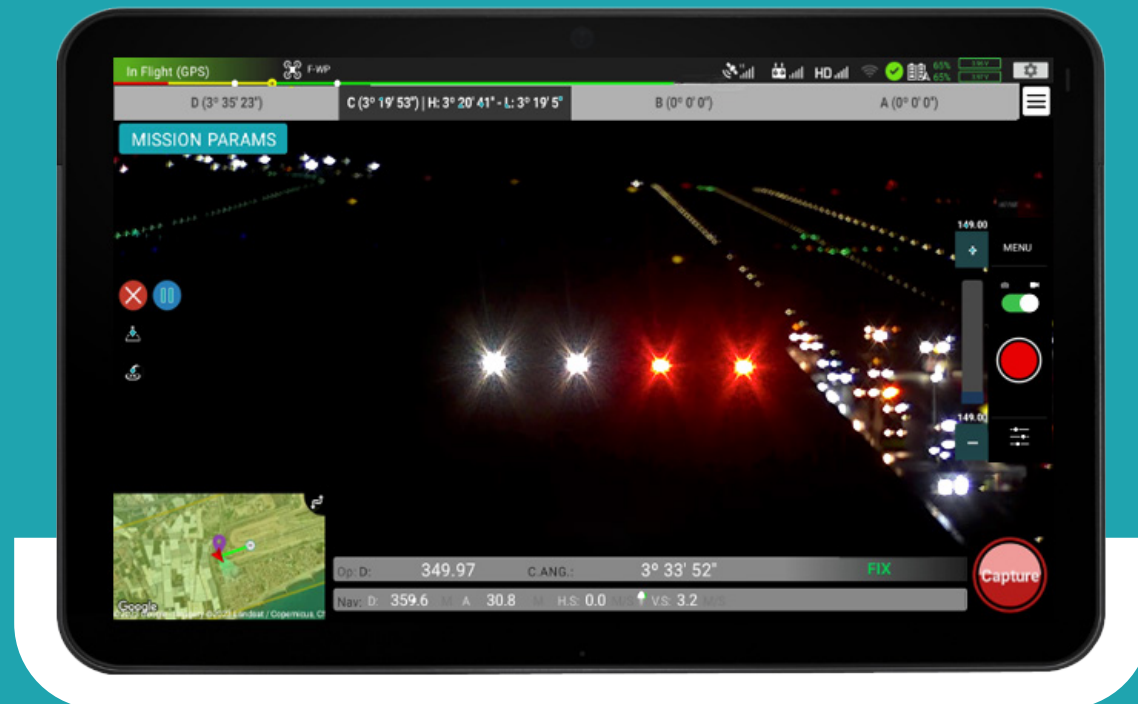
VISUAL AIDS

PAPI Calibration

CANARD Solution for PAPI replaces the flights inspections with manned aircraft for commisioning inspection and calibration.

The operation is done in a few minutes and can be carried out during a day or nighttime, which allows a more flexible scheduling.

Inspection with CANARD solution guarantees a more precise method thanks to custom software, specific procedures and RPAs with precise GNSS.

Measurements performed:

- PAPI Installation Horizontality
- Transition Angles For Each PAPI Unit
- PAPI System Angle

- MEHT
- Angular Coverage
- Symmetry
- Relative Brightness

VISUAL AIDS

ALS Calibration

CANARD Solution allows a quick and precise inspection of ALS (Approach Lighting Systems) and provides key information: check that all lights are operational; Verification of the correct alignment of all lights; Relative brightness and color.

This solution is more accurate than flight checks, it is faster and more reliable than ground checks, which are less precise and not always feasible for certain installations.

Checks performed:

- Lights On/Off
- Lights Alignment

- Angular Coverage
- Relative Brightness

VISUAL AIDS

Runway & Taxiway Lights

CANARD Solution for inspection of Runway and Taxiway lights quickly detects malfunctions such as lights off, misalignment and other issues.

CANARD Solution performs these inspections autonomously and systematically, allowing the user to identify any fault with lights and generate reports. This solution enables daily ground checks, and it is particularly necessary at the moment of doing the required flight checks for commissioning and new installments.

Checks performed:

- Lights On/Off
- Relative Brightness

Watch **how our smart solutions for visual inspections at airports work:**

RADIO AIDS

ILS Inspection

By flying further away from the antennas and higher, the ground inspections with CANARD solution have greater correlation with flight checks than handheld or vehicle mounted methods. This translates into quicker, more insightful and repeatable ground checks, which is especially relevant for GP. As a result, and according to ICAO, the period between flight checks can be extended, which results in cost savings.

The performance and accuracies required by ICAO Doc 8071 are achieved with our proprietary onboard ILS/VOR receiver. With a weight of less than 900gr, it provides all necessary ILS parameters (DDM, SDM, frequencies, modulation levels, etc.) required to perform the different checks and measurements.

Checks and measurements performed:

- LOC/GP Displacement sensitivity
- LOC/GP Width
- LOC/GP Alarms
- LOC/GP Clearance

- LOC/GP Structure
- LOC Course alignment
- GP Angle
- Identification

RADIO AIDS

VOR Inspection

In a similar way as for ILS, CANARD Solution allows for enhanced ground checks of CVOR/DVOR. By performing autonomous orbits and radials, the system can obtain accurate VOR measurements further away and higher than other ground-based methods. It is specially useful in areas with difficult access and for commissioning of new facilities.

The performance and accuracies required by ICAO Doc 8071 are achieved with our proprietary onboard ILS/VOR recevier. With a weight of less than 900gr, it provides all necessary VOR parameters (modulation levels, frequencies, bearing, etc.) required to perform the different checks and measurements.
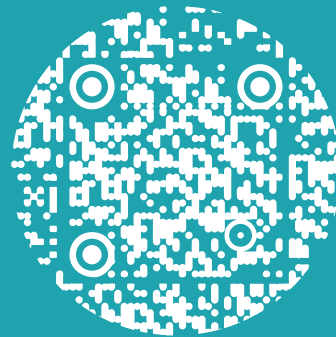
Checks and measurements performed:

- Measured Bearing
- Bearing Error
- 30Hz Modulation depth & frequency
- 9960Hz Modulation depth & frequency

- Deviation
- Ratio
- Identification

Watch **how our smart solutions for radio inspections at airports work:**
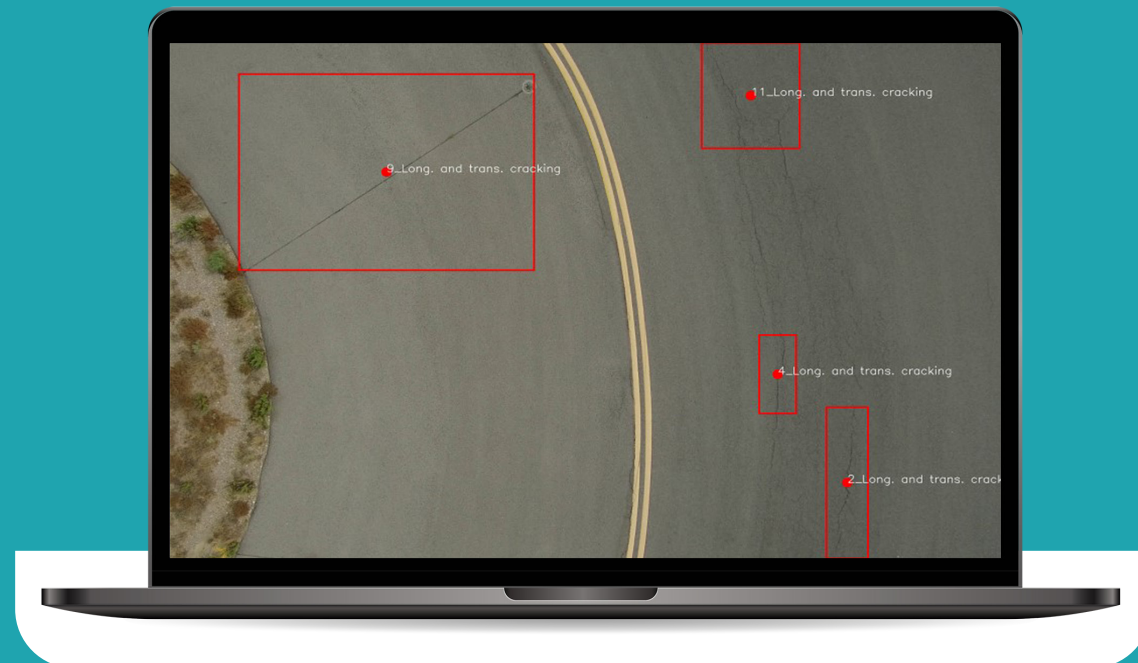
INFRASTRUCTURE

PCI Survey

The solution for PCI reduces the time required for an airside pavement survey from days to a couple of hours, minimizing the runway occupation. The images obtained by the drone are processed by Machine Learning algorithms to detect and classify defects, reducing the time required for reviewing the surveyed data.

Through CANARD's platform, the technician can review the images to correct and complete the list of distresses. The distresses are exported for the elaboration of the PCI reports using the airport's pavement management software.

Checks performed:

- Manually review and complete the identification of distresses
- Automatic detection and classification of distresses
- According to ASTM D5340 norm
- Export distresses to PCI management tools
- Rigid and flexible pavement

INFRASTRUCTURE

ETOD / Obstacles

CANARD Solution can be used to carry out topographic surveys and generate 3D models from aerial photos that allow the identification and characterization of obstacles and keep the terrain databases (ETOD) updated.

The accuracy of the models comply with ICAO requirements, making it especially useful for surveying areas 3 and 4 of airports.
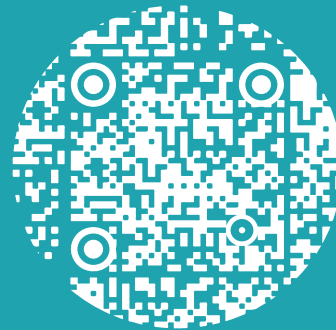
Checks that can be made:

- Point-cloud in .LAS/.LAZ or other formats
- DSM and DTM
- Orthophotograph
- CSV/Excel with identified obstacles
- Contour lines

CANARD

Watch **how our smart solutions for infrastructure inspections at airports work:**

About
the Company

CANARD

CANARD Drones is a company founded in Spain in 2015. It is led by professionals from the aviation and aeronautical sector with decades of experience managing engineering and aviation companies such as Airbus, Iberia or Indra.

CANARD is the leading company in the use of drone-based solutions for the inspection of airport infrastructure and calibration of navigational aids.

It is the only company in the world that offers a comprehensive solution portfolio that includes inspection and calibration of: visual aids, radio aids and infrastructure.

Our development team is composed of engineers **experts in Software, Telecommunications, Computer Vision and Aeronautics**. Our multidisciplinary teams combines knowledge several technologies such as cloud computing, machine learning, simulation, databases, mobile apps and more. This allows us to deliver state-of-the-art solutions to our clients.

International
presence

CANARD

Europe
Spain (15)
Greece (12)
France (3)
Belgium (2)
Italy
Switzerland
Luxembourg
Netherlands
Hungary
Finland
Sweden

Canada

USA

Panama

Nigeria

Oman

Indonesia

China

Papua New Guinea

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