

# Saving CO<sub>2</sub>, noise and money with skyguide CNS Drone measurements

Safety Forum 2022  
Safe Sustainability

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1. About Skyguide
2. Drone Measurement of CNS Equipment
3. Skyguide Measurement Software
4. Environmental Benefits
5. Financial Benefits
6. Future

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Skyguide provides air navigation services for Switzerland and adjacent parts of neighbouring countries.

With its 1600 employees at 14 locations in Switzerland, the company guides some 1.2 million\* civil and military flights a year safely and efficiently through Europe's most complex airspace.

\*pre-COVID figure



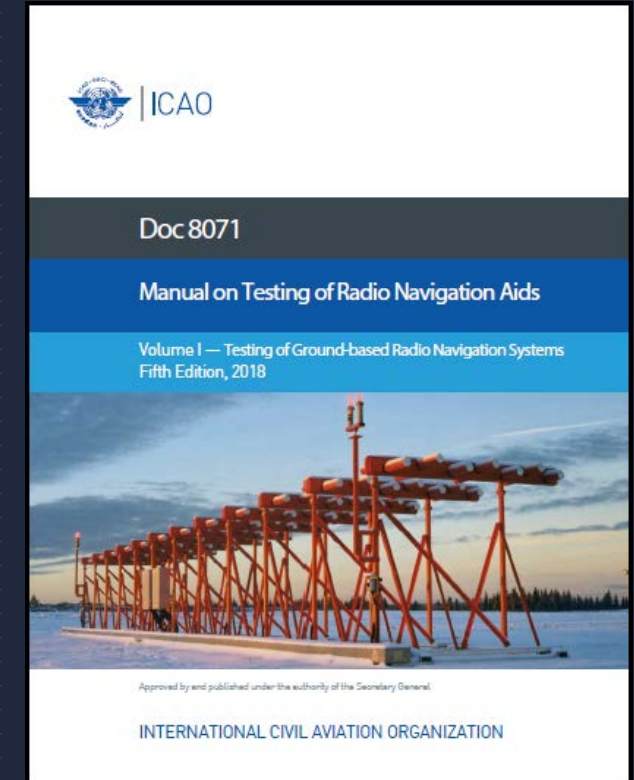
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## From ICAO Doc 8071 guidance material:

ILS ground measurements are (highly) recommended.

**Correlation** between ground and flight measurements is the main criterion for reducing the flight check frequency (and program)

The use of UAV is already mentioned since 2018



## ILS Ground Measurements Not Always Satisfactory

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Skyguide beyond horizons

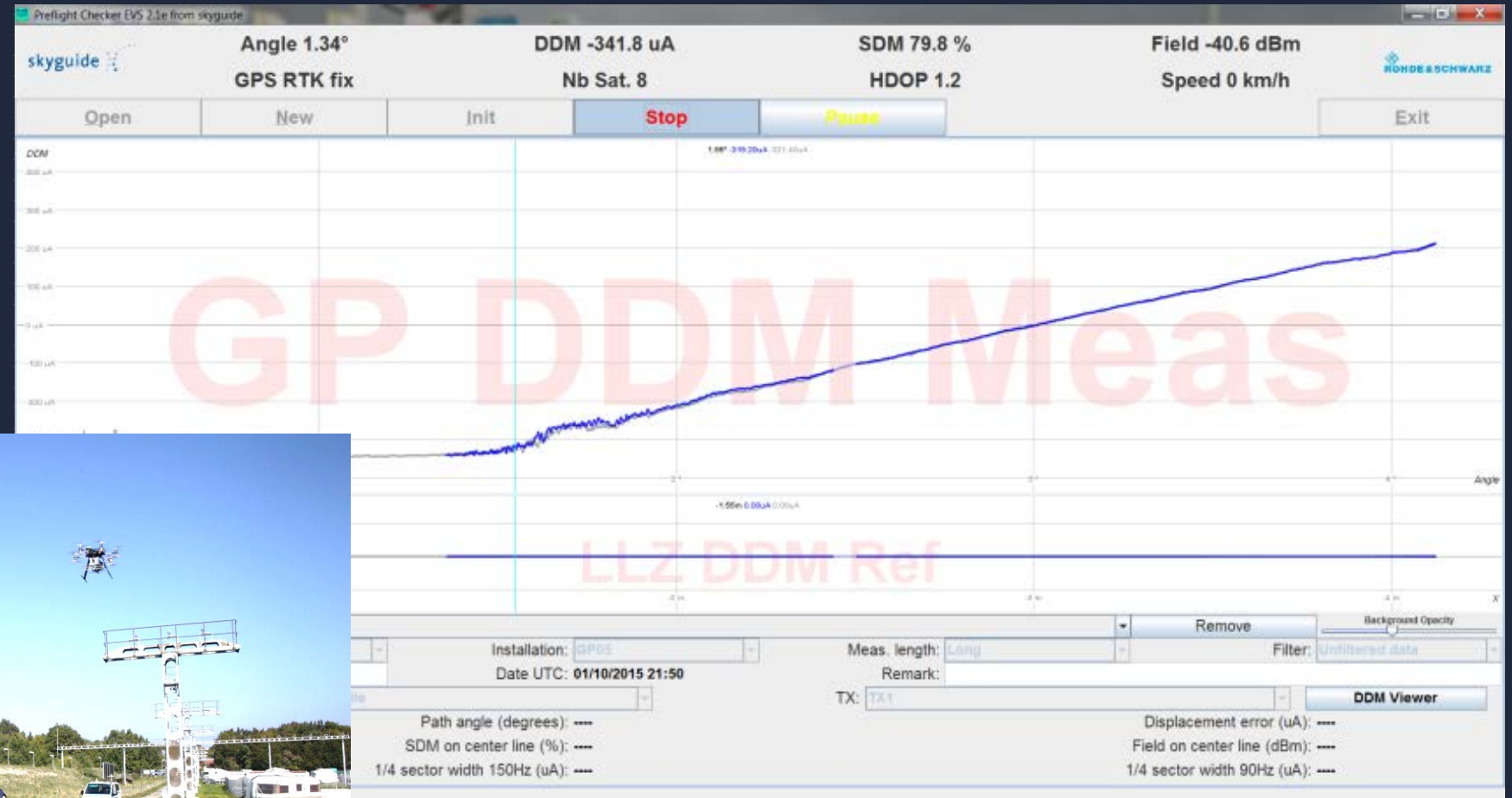
**Localizer**  
Good correlation

**Glide Path**  
Bad correlation  
(nearfield)



## Solution: "Ground Measurements" from the Air

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## The CNS Drone System

**Robust, powerful, fully automatic operation.**

**Successfully in operation for 4.5 years!**



**Excellent repeatability of measurements**



**Thanks to navigation repeatability (very precise flight)**

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<https://www.youtube.com/watch?v=ZfL0hth2CZ4>



A technician conducts the measurement in the Preflight Checker Software, typically with

- Vertical Profile (red)
- Mini approach (blue)
- LOC lateral orbit (optional)

A drone safety pilot monitors the drone as it fully automatically follows its pre-programmed path.



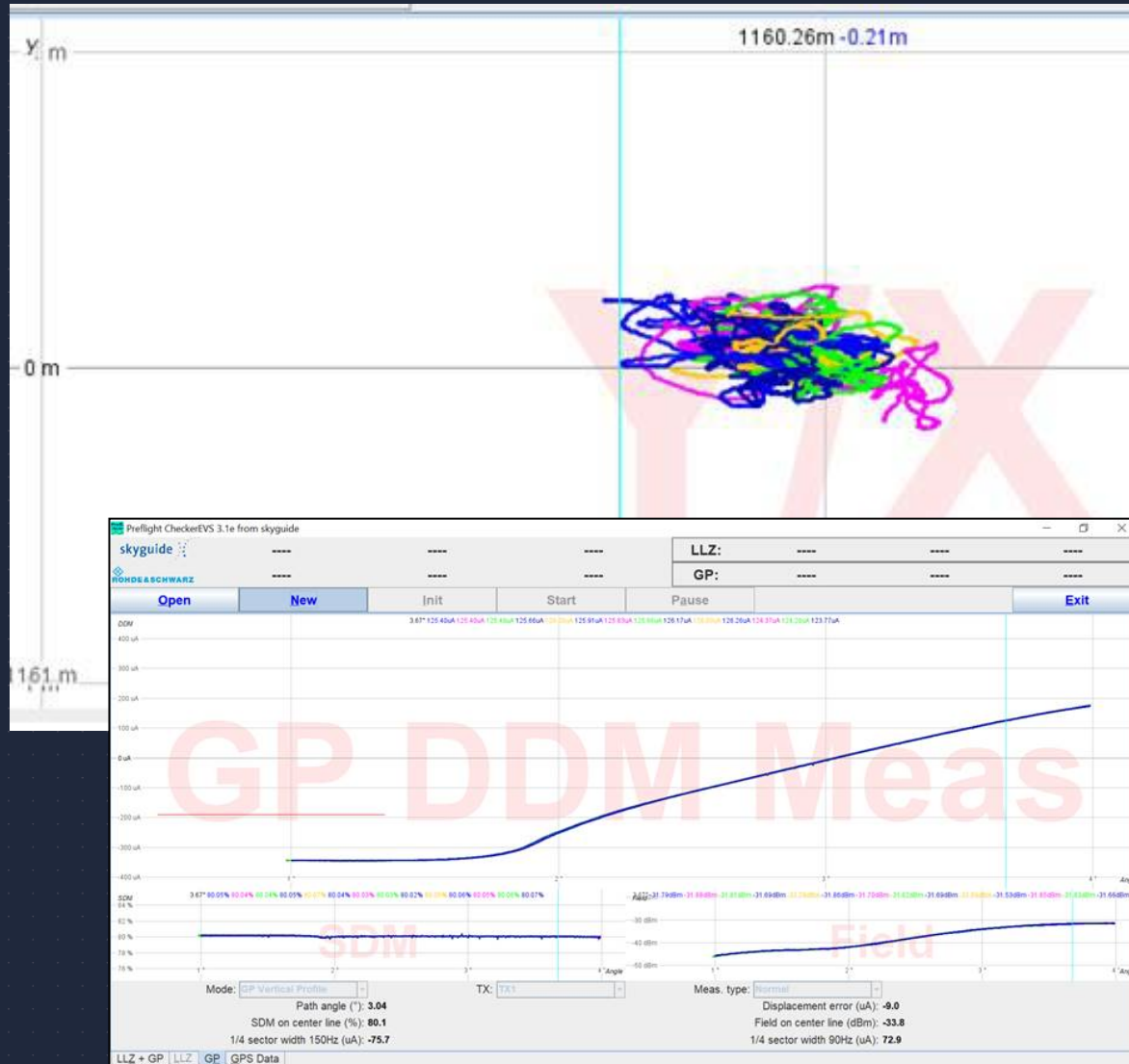
Our software provides instant (real-time) results that can be monitored and checked on ground.

The software allows instant analysis and tuning of the ILS.

The CNS drone can measure the glide path vertical profile, ILS mini approach and the localiser lateral orbit.

## What Did We Achieve?

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**Successfully in operation**  
for more than 4 years!

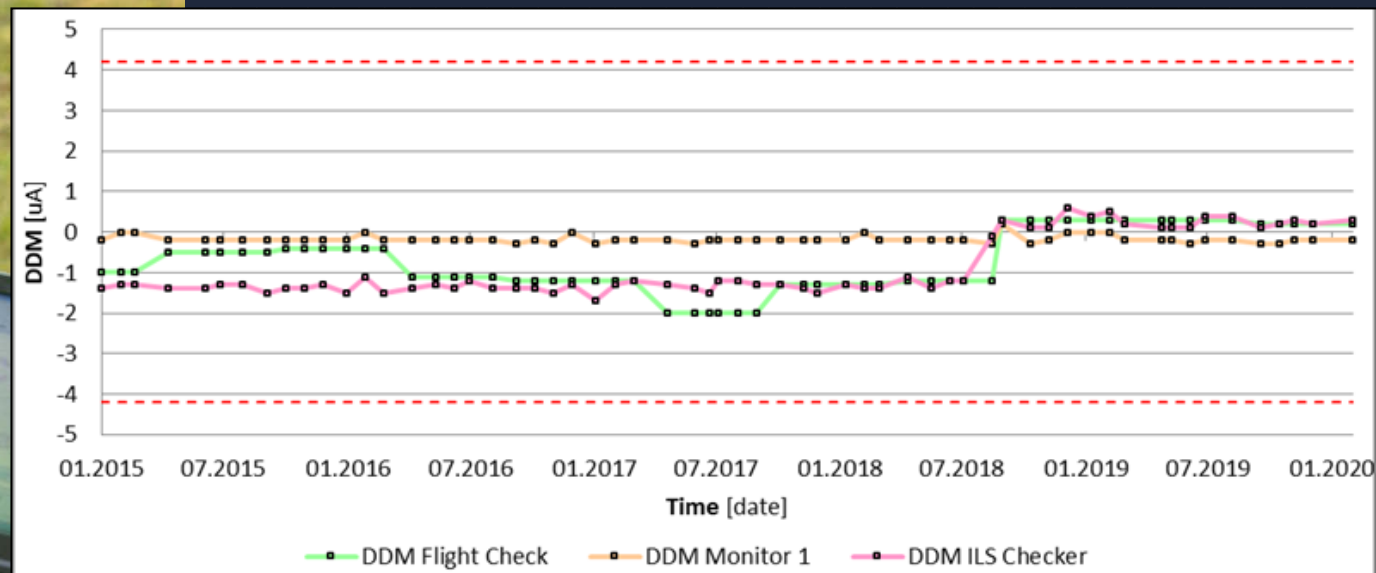
**Great repeatability** for both:

- vertical profiles
- mini approaches

What Did We Achieve?

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Excellent correlation  
with flight check

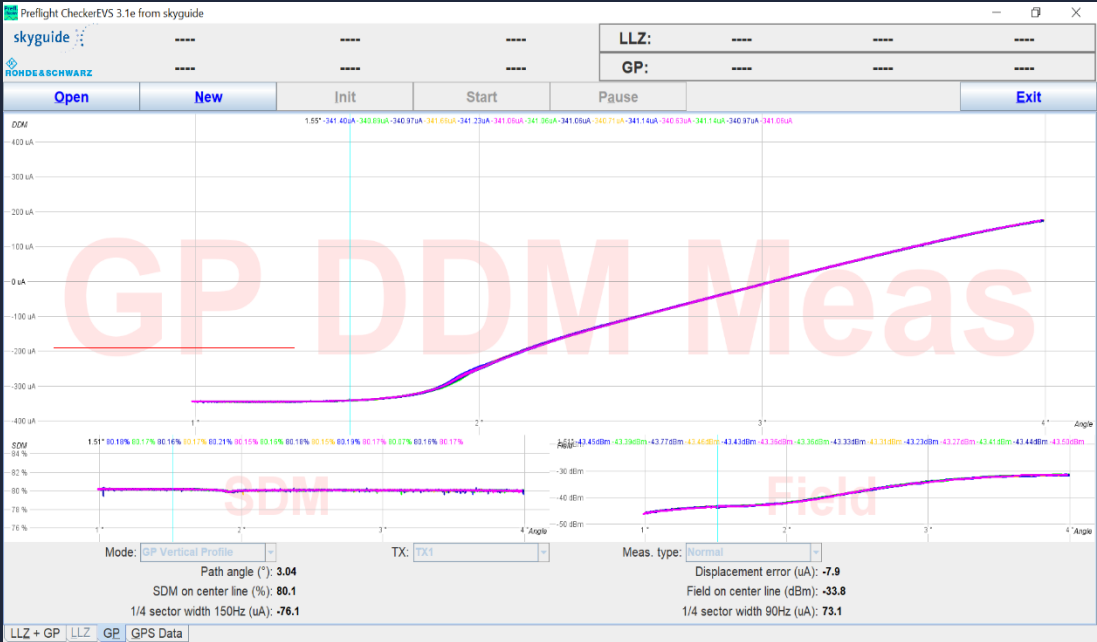


More accurate than flight check aircraft!

14 GP Vertical Profiles

Standard deviation:  
Smaller than 1  $\mu$ A  
Smaller than 3% of the ICAO limit

Excellent repeatability!



	ICAO-Limit		$\sigma$	uA	$\sigma$	%
DOWN measurements						
Axis	25.0	uA	0.9	uA	3	%
1/4 sector width 150 Hz	11.3	uA	0.3	uA	3	%
1/4 sector width 90 Hz	11.3	uA	0.2	uA	2	%



## Preventive maintenance

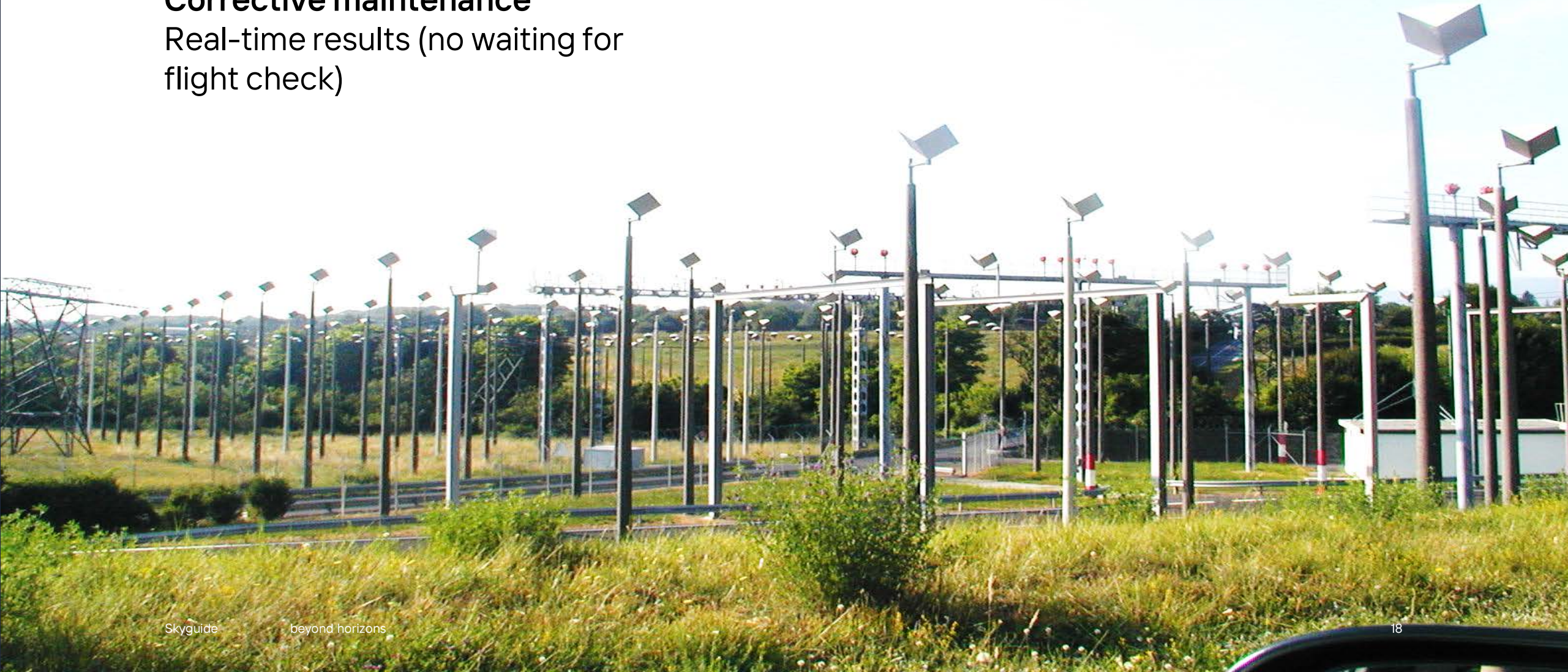
Faster, less flight checks, less downtime per measurement





## **Corrective maintenance**

Real-time results (no waiting for flight check)

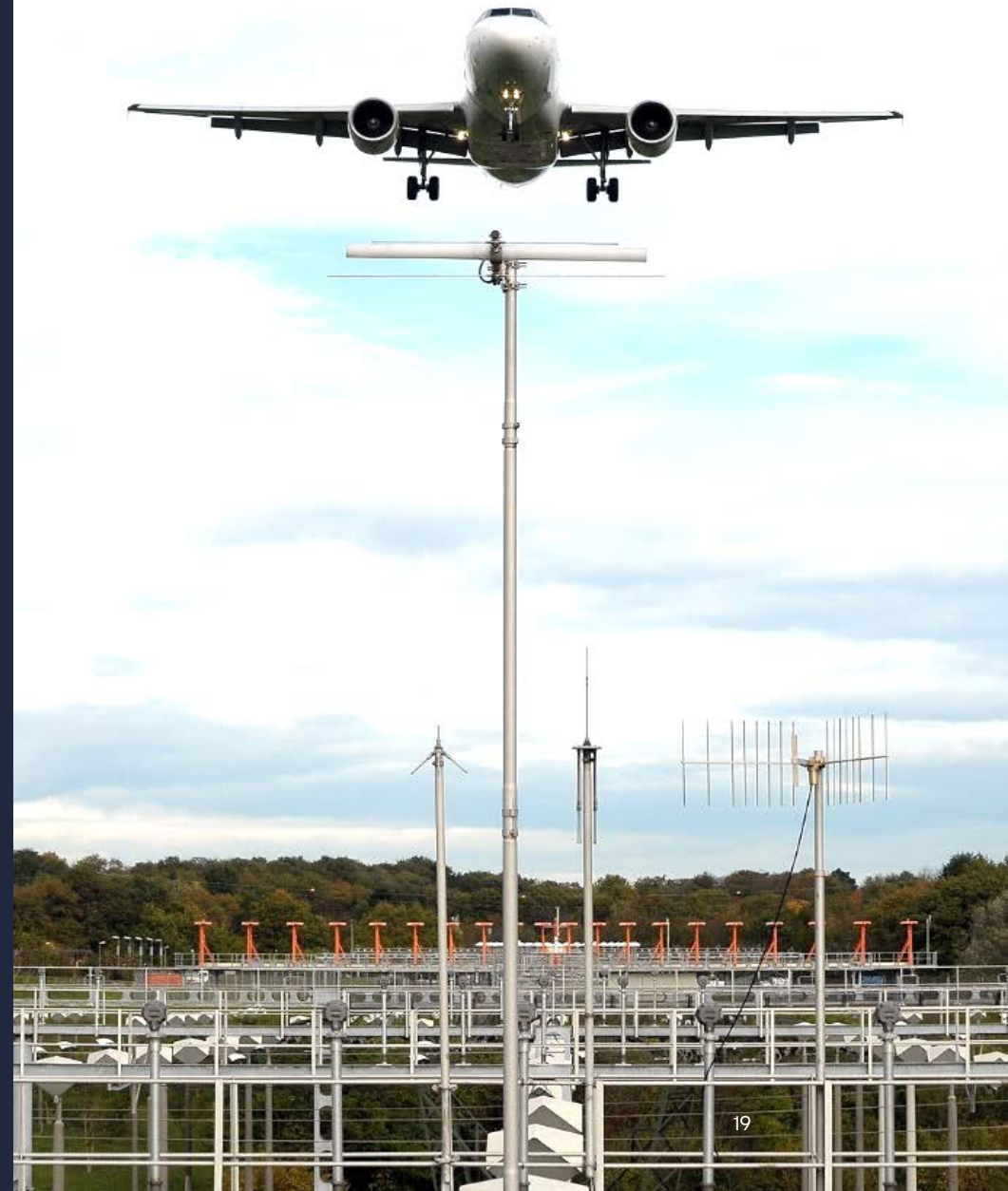


What Are The Benefits?

## Commissioning

Perfect tuning, and then  
just one single flight check

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Orbital and radial measurement flights for preventive and corrective maintenance as well as preparation for commissioning.





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## For Switzerland:

Current yearly savings:

- 50 % reduction of ILS flight checks hours (by a special equipped aircraft)
- > less operational disturbance for air traffic controllers
- > **increased safety**
- 541 MWh / year
- 137 tons of CO<sub>2</sub>
- 33 % noise during daytime
- 66 % noise during night-time

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## Flight checks are the main cost driver!

Our **initial savings** are > 50 %  
of the calibration flight cost:

This is an average recurrent  
saving of about EUR 22k  
per ILS per year!



Additionally there are equally reduced internal operating cost savings!



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Rolled out new service partnership with Intersoft Services at World ATM Congress 2022: CNS Drone Measurements as-a-service!

We will deliver more value by adding more CNS equipment measurement options.



The CNS Drone's capabilities are being extended to grow the gains even further:

- More energy-efficient:  
extended range / endurance
- Enable going into aircraft flight check measurements
- Beyond Line of Sight (BVLOS) flight capability
- Higher speed: save time and  
minimize airport disruption and noise





# Thanks for your attention

