



TRIMCONTROLTM
SOLUTIONS
THE FUTURE OF TELLTALE



French Made



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Developed and improved for more than 15 years by Mer agitée, the E-Telltale® allow to make «electronic» the information normally only visual of the wool telltale. This system has been developed, tested and proven by Michel DESJOYEUX in the nautical world on a Vendée Globe or in a wind tunnel, and has shown its efficiency and durability.

The electronic penon (E-Telltale®) allows real-time monitoring of the aerodynamic performance of a wind turbine blade or a sail.

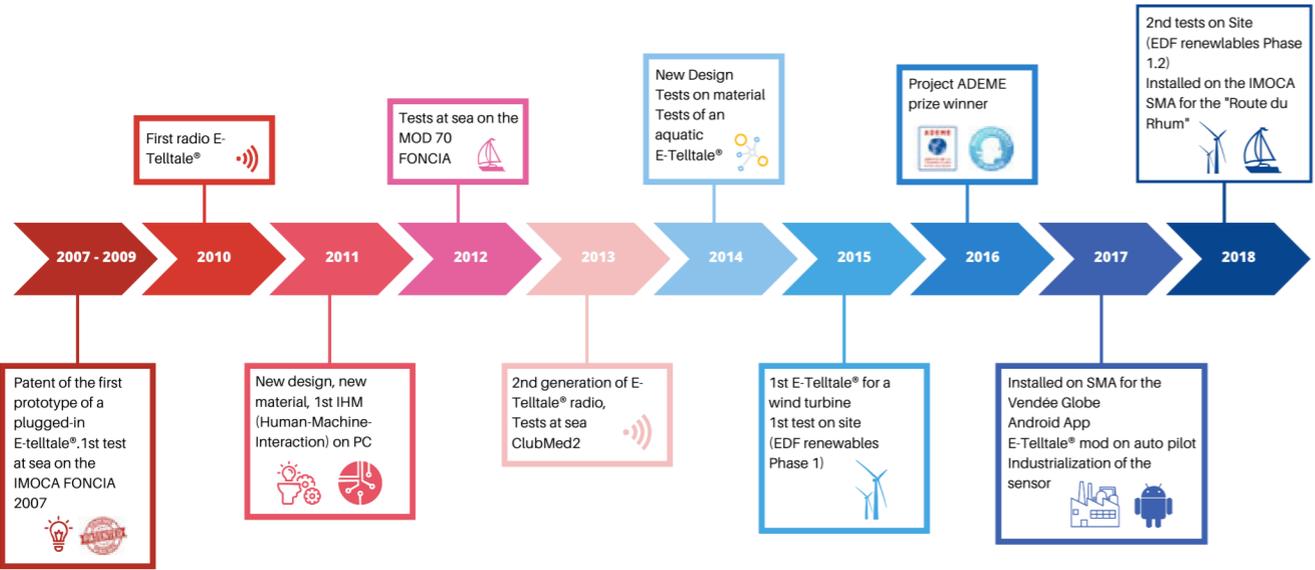
The E-Telltale® is a sensor that monitors in real time the state of the airflow (hooked/la minar or unhooked/turbulent) on an aerodynamic profile. It is a technology from offshore racing, which is very useful in the sailing merchant marine sector, the sport marine and in wind energy as well. Indeed, better tuning of the telltale allows you to optimize the performance of your wind turbine blade in order to take advantage of the wind's potential.



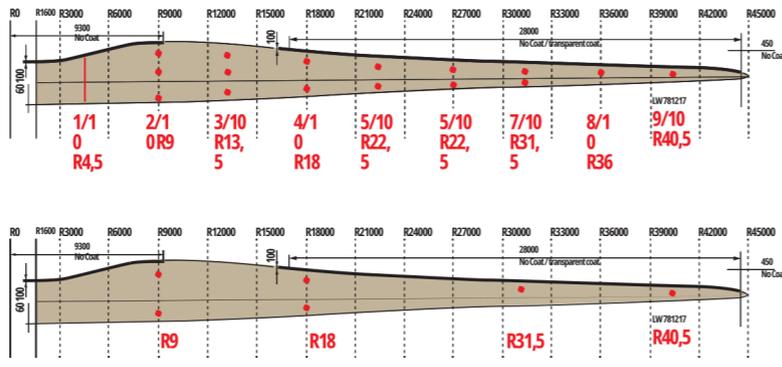

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DEVELOPMENT HISTORY

At **Trimcontrol™**, the E-Telltale® is not new: in fact, many versions of the telltale have been tested and improved in order to offer the product in its most functional and adapted version



Since then, the final version has already been submitted to a battery of tests on real wind turbine blades and in a wind tunnel



The graphic illustrates the Technology Readiness Level (TRL) progression from TRL 1 to TRL 9, culminating in Market Introduction. It features a series of images and logos representing key milestones and partners:

- TRL 1:** Initial prototype testing.
- TRL 2:** First radio E-Telltale®.
- TRL 3:** New design and material testing.
- TRL 4:** Tests on MOD 70 FONCIA.
- TRL 5:** 2nd generation of E-Telltale® radio.
- TRL 6:** New design tests on material.
- TRL 7:** 1st E-Telltale® for a wind turbine.
- TRL 8:** Project ADEME prize winner.
- TRL 9:** Installed on SMA for the Vendée Globe.
- Market Introduction:** Final product deployment.

Logos and images include: Trimcontrol, EDF renewables, Vendée Globe, nke, CSTB, SMA, IMOCA FONCIA, and various sensor and system components.



This project aims to develop a marketable version of the E-Telltale®

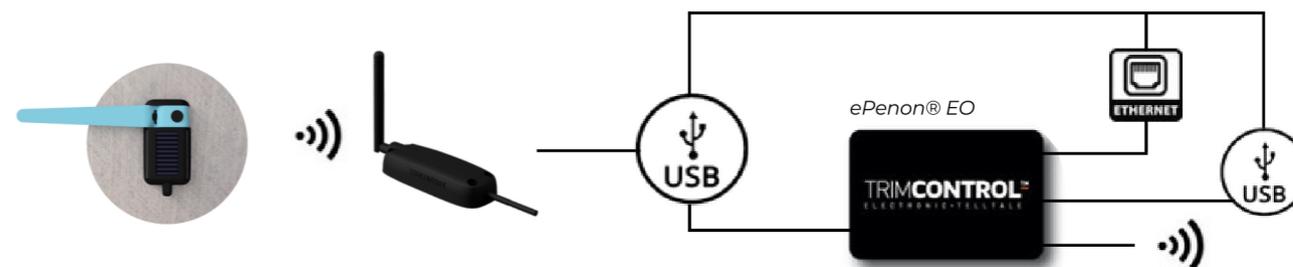
GENERAL PRESENTATION

The project participates in both the dynamics of Intelligent Objects and the Data Economy in order to provide operators and manufacturers of wind turbines with a solution that will enable them to improve the performance and optimize the maintenance costs of wind farms, which will ultimately contribute to the strengthening of the industry.

The project co-financed by ADEME within the framework of the Programme Investissements d'Avenir (PIA) was conducted by «Mer Agitée» in

partnership with the LHEEA lab (UMR6598), the CSTB of Nantes and EDF Renouvelables. This project aims to develop a marketable version of ePenon.

At the moment, based on our experience, we will generate a gain in electricity production of about 3 to 5% thanks to E-Telltale®. The stakes are therefore considerable with regard to the world wind power capacity of 433GW.

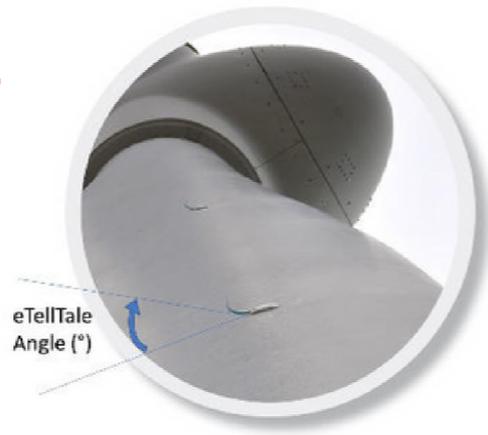


The E-Telltale® can be mounted on any type of existing wind turbine. With a worldwide installed capacity of 433 GW (141.7GW in Europe and 10.8 GW in France in 2016 - source: www.ecologique-solidaire.gouv.fr/eolien-terrestre) the equipment potential of the E-Telltale® is very important. An experimentation is conducted with EDF Renouvelables to test the E-Telltale® in real condi-

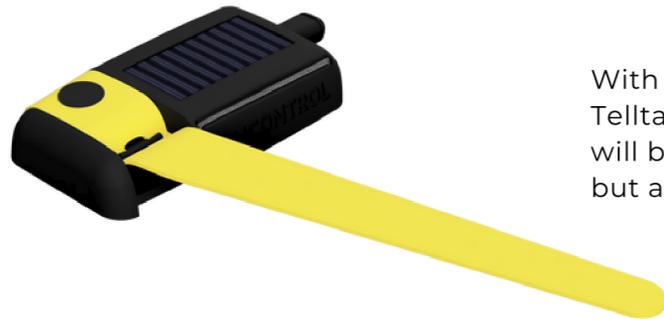
tions on a 3MW wind turbine. The objective of this partnership is to test the product in endurance and quantify the gains obtained in the context of an industrial use to prepare the connected blade.

THE TECHNIQUE

Wind turbines (offshore and onshore) must make the best use of the available wind to produce electricity. The adjustment of the angle of incidence of the blades allows to optimize their efficiency.



E-Telltale®



With a small size (8 x 4cm) and a weight of 50g, the E-Telltale® is connected to an electronic system that will be able to interpret its movements at 360 degrees but also its elongation in order to refine the data.

Receiver





Wind turbines (offshore and onshore) must make the best use of the available wind to produce electricity. The adjustment of the angle of incidence of the blades allows to optimize their efficiency. By placing our Telltale on an axis set in rotation so as to modify the angle of their tail following cycles.

Thus, it is possible to verify that they all have the same behavior (slopes) and the amplitude. It allows to calibrate the E-Telltale® in angle. Indeed, the minima correspond to the vertical position of the E-Telltale®, tongue (0° angle).

and the maxima to the horizontal position of E-Telltale® (20° angle). To date, only abacuses are used. This confront the incidence with the wind speed

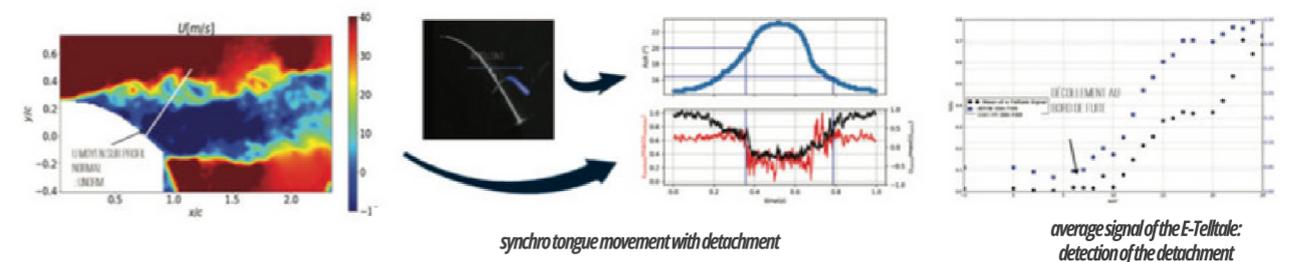
The wind speed is measured at a single point, which is not necessarily the best one for understanding the actual fluid flow along each blade

The anemometer is often placed at the back of the wind turbine mast, a position where the airflow can be disturbed by the movement of the blades themselves.

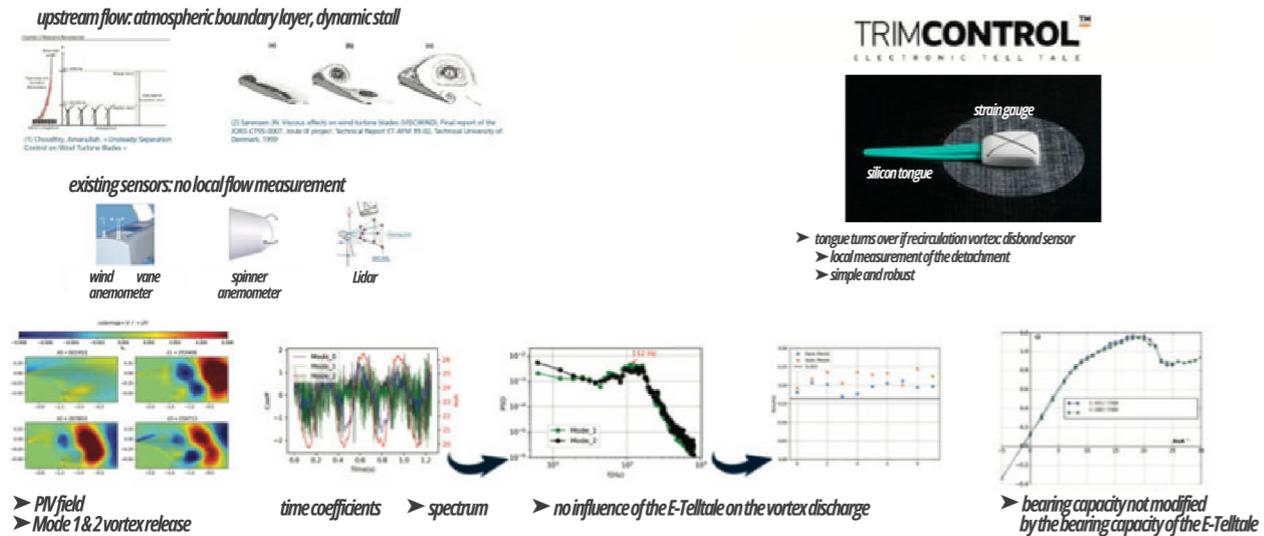
wind speed at the wind turbine, according to its relative position with respect to the mast.

At the wind farm level, another measurement technique consists in placing the anemometer at the top of a weather mast, and estimating the

The control of the blade position according to the measured speed is not done in real time, which suggests a potential for optimization.



These limits show what E-Telltale® technology can bring to the operation of wind turbines (offshore and onshore). Indeed, by positioning ePenon® directly on the blades, one obtains in several points an information of the real airflow along them, clearly more precise than that returned by a single anemometer, with a non optimal positioning.



This real time diagnosis of blade setting can then be used for several benefits:

- Diagnosis of the aerodynamic profile of the blades.
- Optimization of aerodynamic efficiency: by constantly checking that the angle of incidence of the blades is correctly set and correcting it if necessary, we maximize lift and increase performance.
- This function can be used for both start-up and operation.





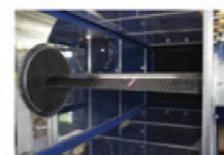
On the other hand, we have seen that E-Telltale® also allows advanced monitoring of wind turbine blades in order to guarantee the structural integrity of the blades and monitor their condition. This is all the more important as on some wind farms, serial defects of the blades are present and may worsen during the operation of these.

Wind tunnel tests have validated the principle and efficiency of the E-Telltale®. Productivity gains have been evaluated between 3 and 5%.

Detecting a defect on the blades is not expensive compared to the cost of a repair, which necessarily poses an immediate danger if carried out downstream.

The idea is to detect the presence of various defects on the wind turbine before they become dangerous for the blade. Replacing a blade is particularly costly.

LHEEA aerodynamic wind tunnel:



- NCA 1654-421 modified (C=93MM E=50mm)
- test sections 500x500x2400MM
- measurements, wakes, pressure, TRPV, aerial forces
- E-Telltale small scale

atmospheric wind tunnel NCA CSTB



- NCA 1654-421 modified (C=700MM E=200mm)
- 20M/S-1Re=880 000
- test sections 2X4X10M
- measurements, wakes, pressure
- E-Telltale full size

LABELLING & AWARD

FEBRUARY
2016

Labelling of the
e-telltale project by



SEPTEMBER
2016

The e-telltale project wins
the prize of Initiative PME
Energies renouvelables



NOVEMBER
2016

Trim Control is
nominated DAME AWARD
(METSTRADÉ 2016)



DECEMBER
2016

Trim Control
« The e-telltale of the future »
HIGH TECH AWARD



SEPTEMBER
2018

The e-telltale project is awarded one of the
TROPHEES INNOVATION OCEAN ®



LAUREAT

DATA SHEET

	ePenon EO
Dimensions	80mm x 40mm x 15mm
Weight	50g
Installation	Glued and/or flanged
Energy	Battery 980 mA with solar panel
Frequency	1Hz to 16Hz
Standby mode	Yes
TRIMCONTROL USB RECEIVER	
Dimensions	108mm x 44mm x 20mm + 10mm(antenna)
Weight	100g + weight of the cable
Connection	USB + Ethernet with TrimControl box
Operating voltage range	5V DC
Operating current	80mA - 12V DC
Energy consumption	0.96Watt
TRIMCONTROL CONNECTION BOX	
Dimensions	111mm x 75mm x 25mm
Weight	115g
Operating voltage range	9 to 36V DC
Energy consumption	1.2Watt
Power source	2 connection pins or USB
Connection	Serail (115 200Bauds) or USB or Ethernet by UDP



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