

CEDRAT TECHNOLOGIES (CTEC) has been involved in the IKKY Project granted by the French Aerospace Lab - ONERA. The project leader was Thales in Valence, France, and the project has been carried out in cooperation with CEA Tech List. During this project, CTEC has developed and tested a Magnetic Odometer prototype.

## BACKGROUND & INTRODUCTION

Magnetic sensors offer potential for contactless detection techniques. These magnetic sensing technologies are recurrently exploited by CTEC to provide innovative solutions, either as components or as complete systems:

- [Eddy Current Sensors](#) (ECP) products are used for high precision motion control on distance up to 3 mm. They are used in CTEC actuators or for making customised force & torque sensors.
- [Inductive Sensors](#) are used for distance measurements up to 100 mm and can be used as tyre wear sensors.
- Longer range electromagnetic detection systems, from 0.1m to 2m, have been shown feasible for localisation and for identification of objects via [SURGIMAG](#) and MUSIC projects.
- With the [ROXTAR](#) project, CTEC has developed an accurate Magnetic 6 Degrees of Freedom Alignment Localisation & Tracking (MALT) device with a detection range larger than 1 meter.

Using this background, CTEC developed an accurate Magnetic Odometer Sensor as part of the IKKY Odometer project.



*Prototype Sensor developed during the Project*

## IKKY ODOMETER OBJECTIVES

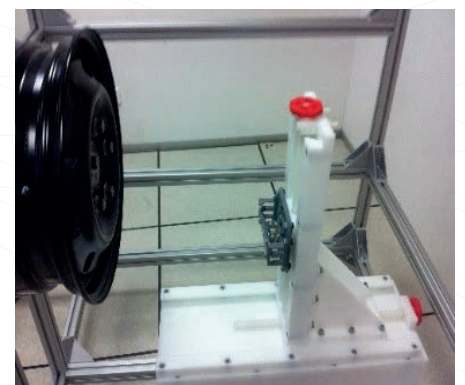
The trend in the avionics is to increase the aircraft autonomy during the Gate2Gate Operation. However current odometers are not accurate enough for this future new market and are invasive on the landing gear. The goal of the project has been to develop a technology to localize on the ground an aircraft thanks to a magnetic odometer solution. This technology would be implemented in addition to the current devices on the aircraft as the GPS and the Inertial Navigation System (INS). The sensor must be deployed on existing aircrafts and must be a contactless solution versus rotating parts.



*See our video*

## ODOMETER DEVELOPED BY CTEC

The CTEC Odometer sensor tracks the rotation of the wheel without contact. Therefore, no modification on existing parts is required to install it on the aircraft. The sensor is fitted with an AMR sensor to detect a variation of the magnetic field.



*Figure 1: Testings in Lab environment*

## SIMULATIONS AND TESTING IN LAB

After evaluating the configuration of the sensor with FEM, CTEC has tested the developed sensor in lab conditions. The proof of concept

has been performed with a wheel (see figure 1, on the left) to know the maximum distance between the sensor and the wheel for an appropriate detection.

On figure 2, the carrier sinusoid characterises the rotation of the wheel and the ripple signal comes from the detection of the holes in the wheel.

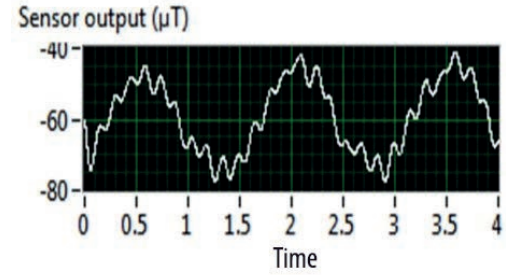


Figure 2: Signal given by the sensor in Lab environment

## TESTING ON A VEHICULE

The Magnetic Odometer has been tested on a vehicle (see figure 3) at Thales to compare the results after processing (done by CEA List) to an Inertial Navigation System. The raw data are given in figure 4, one colour for each component of the magnetic field.



Figure 3: Testing setup on a vehicle

## SUMP UP OF THE REACHED PERFORMANCES

SPECIFICATION	VALUE	UNIT
Sensor type	Contactless	
Detection distance of the steel wheel	>350	mm
Demonstrator housing dimensions (L.h.l)	175x180x75	mm
Refresh Rate	20	kHz
Scale Factor (Odometer distance)	0.2	%

These performances are very promising according to Thales and are closed to the best Odometers.

## KEYWORDS

Contactless sensor, detection, position, magnetic

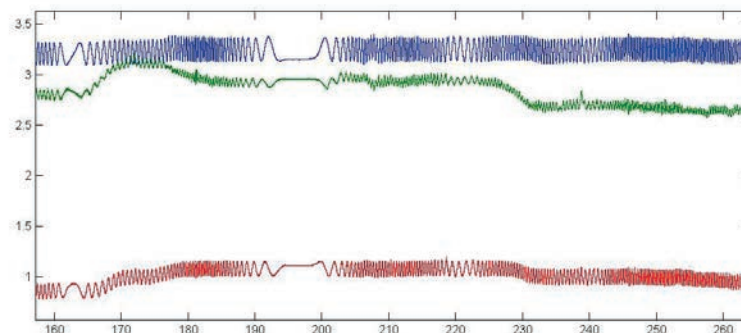


Figure 4 : Magnetic field 3 Dimensional components detected by CTEC sensor