



CASE STUDY /

Ansys + TWI + InnoTecUK

“By combining Ansys Granta and Ansys Maxwell tools, we were able to demonstrate that one week of virtual simulation was equivalent to 12 weeks of laboratory testing during the ATEX encoder project. This approach may lead to significant cost savings in future projects.”

Dr. James H. Kern

Senior Project Leader / Non-Destructive Testing, NIS, TWI

Replacing physical testing with virtual simulation using Ansys Maxwell, MDS and Granta Selector

For any application in an explosive environment, such as oil and gas or chemical plants, ATEX certification* is mandatory for all equipment to prevent explosions. Currently, there is no commercially available zero-torque encoder that's certified for ATEX, which is required for accurate distance measurements. In a collaborative research and development project with Ansys, TWI together with InnoTecUK's support, designed and developed an ATEX-compliant encoder to achieve accurate distance readings, safety, and life cycle requirements. InnoTecUK demonstrated the encoder on a submersible robot intended for in-service bottom plate thickness inspection of hazardous oil storage tanks.

/ Challenges

Three material selection challenges were overcome in the design of the ATEX Encoder. The first was **material selection for harsh environments** to protect the sensor. The second challenge was **meeting ATEX certification* for explosion protection**. The third challenge was **magnet selection to achieve measurement accuracy and flexibility during set-up** after sensor system assembly to meet in-service requirements. This involved a systematic down-selection against key material properties and environmental durability, cost and supply chain availability for core components.

/ Technology Used

- Ansys Granta Selector
- Ansys Maxwell
- Ansys MDS

/ Engineering Solution

Ansys Granta Selector was initially used to choose materials and validate off-the-shelf ATEX rated components by trading off on key performance and business parameters. The data in MaterialUniverse™ filled in missing suppliers' material information for durability in fluids, notably for the polymer-based jackets and cables.

Granta Selector then helped select the magnet and casing by trading off performance, price and criticality. Material grades, geometry and motion were then consolidated into a parametric study using Ansys Maxwell with simulation-ready data available in Ansys MDS. The simulated and experimental results of the magnet selection, design and operational scenarios were comparable, which validated the results.

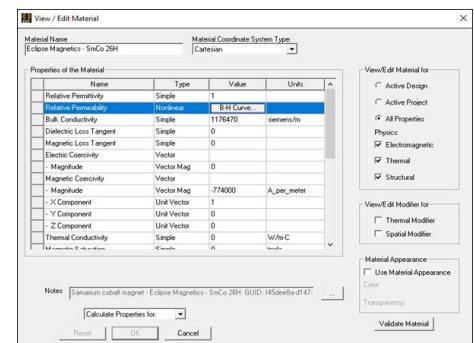
/ Benefits

By combining Granta Selector and MDS with Ansys Maxwell magnetic flux simulation, the team demonstrated:

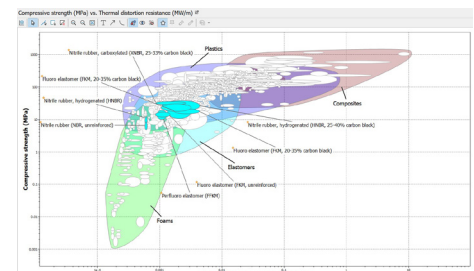
- One week of virtual simulation equaled 12 weeks of laboratory testing.
- A parametric study of design envelope by simulating various magnet grades, sizes, orientation lateral offsets, casing materials, and operational failure modes, required 5 days, saving an estimated 25 days of laboratory work with a physical setup.

The simulation approach can significantly reduce the time to market by replacing laboratory testing and simulation.

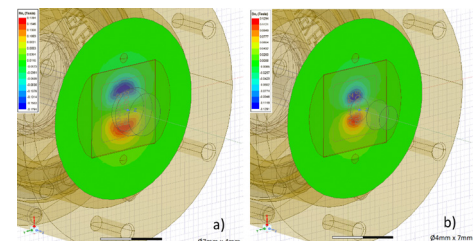
*ATEX certification: 2 EU directives describing the minimum safety requirements for workplaces and equipment used in explosive atmospheres.



MDS data for magnet selection in Ansys Electronics Desktop showing different material data properties.



Granta Selector, MaterialUniverse data showing relevant materials for the ATEX Encoder system.



Using Ansys Maxwell to compare magnet diameter and the effect of focusing field at the Hall probe array.

/ Company Description

TWI is a world leading research and technology organization. Over 700 staff give impartial technical support in welding, joining, material science, structural integrity, NDT, surfacing and packaging. Services include generic research, confidential R&D, technical information, technology transfer, training and qualification.



InnoTecUK is a dynamic and progressive research and innovation company specializing in the development and commercialization of high-quality and high-value technical robotic and automation solutions to address real-world market challenges in industries such as oil and gas, renewable energy, offshore, aerospace and rail, among others.

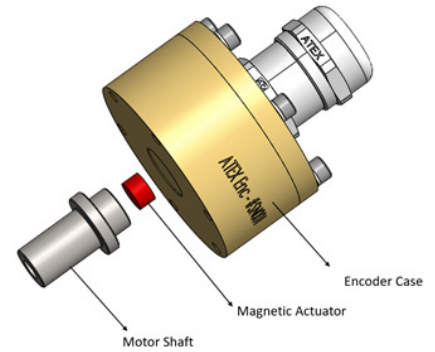


Partners InnoTecUK, TWI and Ansys are grateful for Innovate UK funding of the ATEX Encoder project, no. 105604.

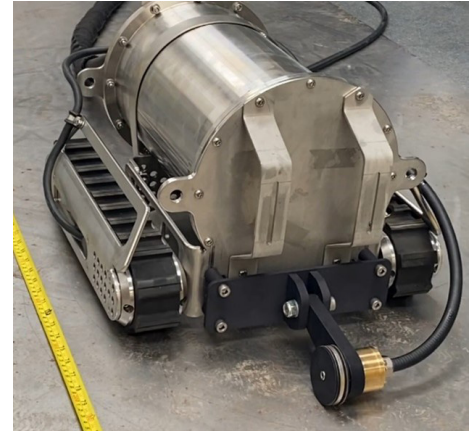
"Using Ansys simulation software has expedited both the prototyping and testing stages of the project, reducing the required length of the R&D project by at least half, and with that, significantly reducing the time to market and cost of developing the ATEX certified magnetic encoder."

Tadej Bregar

Project Manager / Robotic and Automation solutions, InnoTecUK



CAD drawing of the developed ATEX certified magnetic encoder.



ATEX certified magnetic encoder demonstrated, integrated with InnoTecUK's NDT tank inspection robot 'Nautilus' (encoder mounted at the front).

ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
U.S.A.
724.746.3304
ansysinfo@ansys.com

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

Visit www.ansys.com for more information.

Any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

© 2021 ANSYS, Inc. All Rights Reserved.