

5G-encode

What is 5G-ENCODE?

A pioneering, £9 million project making the benefits of 5G a reality for UK manufacturers.

5G-ENCODE is the UK's largest trial of industrial 5G and one of the UK Government's biggest investments in 5G for manufacturing to date. Part of the Department for Digital, Culture, Media, and Sport's 5G Testbed and Trials Programme, it has been set up to establish sustainable business cases and value propositions for the application of 5G technology in manufacturing.

Creating 'right first time' and 'right every time' products with 5G

Using the power of 5G to improve efficiency and productivity in Liquid Resin Infusion

This case study outlines how 5G can improve efficiency and productivity in Liquid Resin Infusion (LRI) composite manufacturing to create products that are 'right first time', 'right every time'. 5G-ENCODE has successfully proved that through the application of 5G and other digital technology, businesses can lower the cost of labour by 25%, reduce cure cycle time by around 50%, and reduce the environmental impact by generating less scrap.

The Industry Challenge

Liquid resin infusion (LRI) is a process used by the aerospace, automotive, marine and many other industries to create composite components. These can range from boat hulls to full aircraft wings, such as on the Airbus A220. It offers higher rate and lower cost production compared to other methods used to make composites (such as prepreg moulding, which has higher material costs, and longer processing times). The technique however is highly dependent on the skill level of the operator and often requires multiple attempts to create the right process. This results in costly scrap components being produced when developing new parts.

About the use case

5G-ENCODE wanted to explore the use of 5G in the LRI process to help monitor the numerous complex variables that can affect the mechanical properties of the final composite. An in-oven infusion using a silicone bag was selected as the test for this use case. Dry fabric was placed into the silicone vacuum bag prior to being infused with liquid resin. Resin arrival sensors detected when the liquid resin reached certain points during the infusion process. Three in-bag sensors monitored the flow of liquid resin through the part while four in-line sensors tracked the liquid resin leaving the bag. Once the in-bag and in-line sensors all reported resin flowing, the resin infusion process was known to be complete and resin injection was automatically ceased by a control system. The oven cure process was then started with the sensors reporting temperature, degree of cure, and other important information as the part cured. Data from the sensors was visualised to users via cloud-based dashboards in real-time. All process data and control commands were sent over 5G.



Use case areas

Augmented/Virtual Reality (AR/VR) to support design, manufacturing and training

Monitoring and tracking of time sensitive assets

Wireless real-time in-process monitoring and analytics



Who is involved?

The 5G-ENCODE Project is a £9 million collaborative project aiming to develop clear business cases and value propositions for 5G applications in the manufacturing industry. The project is partially funded by the Department for Digital, Culture, Media and Sport (DCMS), of the UK government as part of their 5G Testbeds and Trials programme. The project, **led by Zeetta Networks Ltd**, is one of the UK Government's biggest investments in 5G manufacturing to date.

The key objective of the 5G-ENCODE project was to demonstrate the value of 5G on industrial use cases within the composites manufacturing industry – these use cases were **developed and run by the National Composites Centre**.

Testing the use case


5G-ENCODE created a use case to test the use of 5G within LRI, with the aim to prove that, using 5G, manufacturers can reduce both labour and data reporting costs while reducing overall manufacturing time. The use case had four main elements:

- A sensor array to capture data during the manufacturing process
- A control model which ingested the data and made decisions to control the process
- A feedback system which implemented these decisions in the real world
- A data visualisation system which displayed all process data to operators in real-time

The sensor array would send its process data over the network to the control model (and visualisation system), which was hosted on an edge compute platform. The control model then processed the data and returned control change decisions back over the network to the feedback system for implementation. The data visualisation system helped operators to have a clear picture of the entire process and allowed them to make data-driven decisions for optimising the manufacture of subsequent parts.

Phase 1: 4G baseline

This set-up was first tested on a private 4G network to establish a baseline understanding to compare with the 5G network. The testing demonstrated that all four elements of the use case worked effectively over the 4G network, with an operator able to use the visualisation dashboards to see what was happening in the process from anywhere based on the seven sensors deployed. The control system also worked as designed. It was predicted however that for larger parts (for example the production of an aircraft wing) where hundreds of sensors sending data in unison would be needed, the 4G network would likely become overloaded, resulting in delayed data delivery or data being lost in transit. This could lead to control system failures and potentially scrapped parts.





Phase 2: 5G test

In November 2021, the use case was upgraded to a bespoke 5G network, with subsequent testing proving that the use case enabled a 25% reduction in labour costs due to the automated control. Furthermore, the live dashboards gave engineers a clear view of the process and allowed them to reduce oven curing cycle time by around 50%, saving both oven energy costs and utilisation time. Finally, the use case enabled the automatic generation of a traceability report for each part manufactured. This report is used to verify a component's quality and assess the reasons for manufacturing issues. Creating the report typically requires around 8 hours of manual engineering time; this time and the associated costs have now been reduced. The ultra-reliable low latency, scalability, and edge compute of 5G enabled many of these benefits.



Get in touch

If you would like to learn more about 5G-ENCODE and how you could get involved.

visit our website

www.5g-encode.com

