DIGITAL ENGINEERING
TECHNOLOGY & INNOVATION

DETI Case Study:
PoC5.4 Wireless Asset Tracking

Wireless asset tracking solution safeguards time-sensitive composite manufacture

As part of the Digital Engineering Technology & Innovation programme (DETI) collaboration with the 5G-Encode project, the National Composites Centre (NCC) have demonstrated a wireless 4G asset tracking solution. This system is setup to monitor the condition and location of time-sensitive composite materials to improve quality metrics of Automatic Fibre Placement (AFP) manufacturing processes and operations productivity.

The challenge

AFP uses a thermoplastic carbon fibre and resin material that must be kept frozen before use; this ensures the material retains its mechanical properties throughout the entire manufacturing process. If the material thaws, the ultimate quality of the component will be affected, and manufacturing becomes harder.

The key challenge was to ascertain whether an asset tracking system could capture how long the material had been out of the freezer, safeguarding against potential waste and rework. As well as feeding back this crucial information, the team aimed to collect material and tooling data throughout the entire manufacturing workflow and across the NCC workshop with RFID gateways in the freezer and thawing area, the AFP and Autoclave machines and throughout testing and inspection.

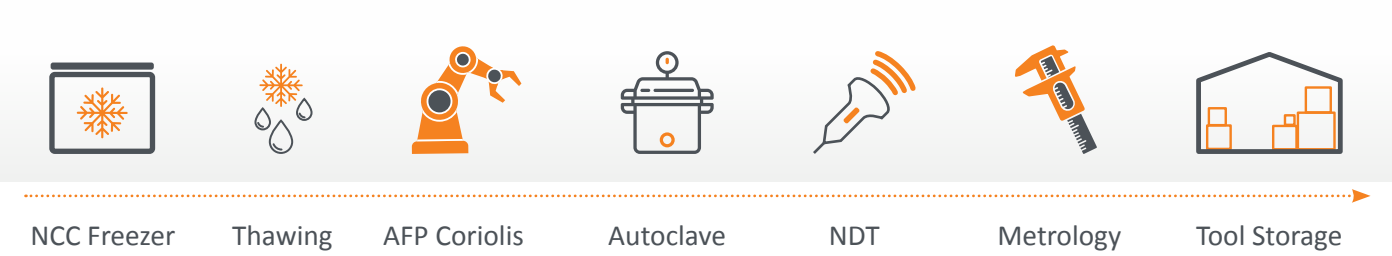

Figure 1 Location of RFID gateways

As the aerospace and renewable energy sectors look to AFP to engineer increasingly complex structures, proving successful asset tracking for this use case is a crucial step in high value composites manufacture. Applied across the entire production site, asset tracking can also enable organisations to interrogate productivity, equipment performance and safety while achieving the highest product standards.

What is Automatic Fibre Placement (AFP)?

AFP is a unique process where individual tapes are fed through a delivery system into a fibre placement head and placed directly onto a tool to create a preform. The separate layers of the preforms are consolidated on the fly, whilst several heating systems are used to tack one layer to the other.

How does Asset Tracking work?

An RFID tag is a network-connected device that can be portable or permanently attached. It uses radio waves to transmit signals that activate the tag. Once activated, the tag sends a wave back to the antenna, where it is translated into data using a piece of software, often with the accessible user interface.

Results

An initial solution was developed using a private 4G network within the NCC. RFID gateways were installed in seven locations that would follow the flow of material, component preforms, manufactured parts, and tooling around the workshop. As each asset was fitted with an RFID tag, by clicking into each asset through the interface, information on location and the time out of the freezer could be viewed. Each station was checked 50 times, and the data loss and bandwidth were measured.

Every RFID gateway worked as expected, except for the AFP, which ran at a slight delay due to the strength of the 4G signal. The correct RFID antennas picked up the assets, and the location was updated in the user interface with a valid timestamp associated. Time out of the freezer was also captured successfully, delivering on the project's key objective.

Next Steps

Having created the traceability of the materials and resulting products within the factory, the systems implemented will be extended to encapsulate external to the factory data sources. This will include capturing material and goods in information as well as product shipping to the customer, to create an end-to-end digital (Material source – product delivery) passport. An end-to-end digital passport provides a complete data picture of a physical asset showing it's journey from raw material to a manufactured product, providing actionable insights to improve quality, productivity, and sustainability across the board.

As tracking systems become more business-critical, increased reliability and data transfer speeds are imperative. An improved tracking system, upgrading to a 5G solution using the 5G private industrial test bed hosted at the NCC will also be investigated within the 5G-Encode programme. Phase two is set to commence at the end of 2021.

NATIONAL COMPOSITES CENTRE

Contact us

Organisations interested in learning more about DETI and accessing the industrial test beds can email **deti@nccuk.com**

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