AMRC
ADVANCED MANUFACTURING RESEARCH CENTRE

The University Of Sheffield.

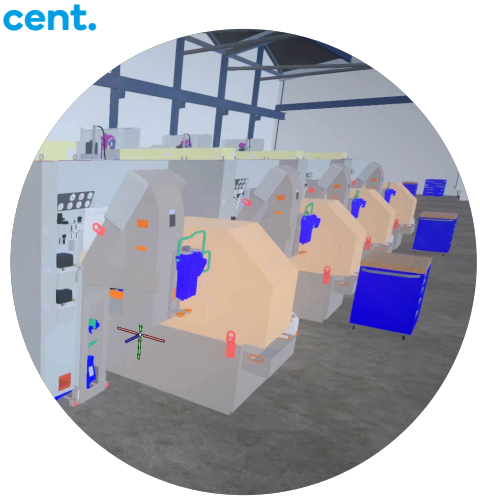
Manufacturing Intelligence
Case Study

Virtual simulation of new Boeing facility based in Sheffield

Off-line resource planning and optimisation becomes possible in the virtual world.

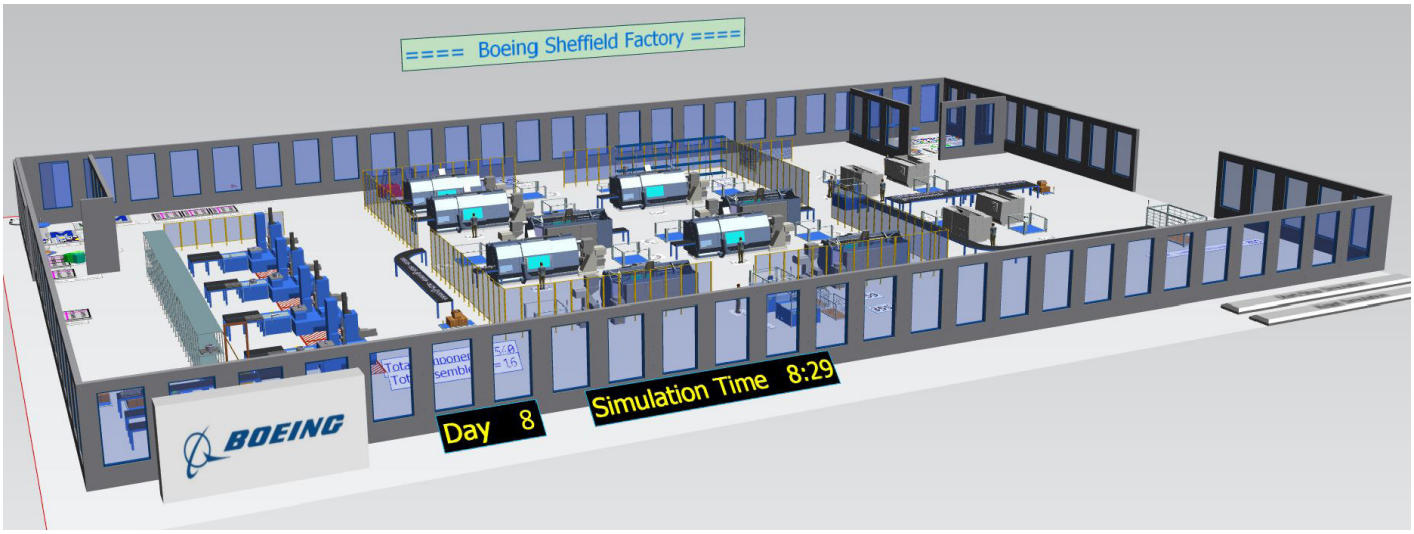
The University of Sheffield Advanced Manufacturing Research Centre (AMRC) has developed a virtual simulation model of the new Boeing Sheffield facility. The model will help to validate the opportunities Boeing has to increase productivity by up to 50 per cent.

As part of the Smart Factory research project, the AMRC are working on for Boeing, its Manufacturing Intelligence Group has worked closely with the Boeing team to create a virtual simulation model using Discrete Event Simulation (DES) techniques to examine the potential capabilities of their new factory and to validate opportunities for increasing productivity.



The key benefits of using simulation for factory floor planning are:

- Optimising factory flow to improve productivity
- Examine the impacts of uncertainties
- Validate new technology introduction



Boeing's first production facility in Europe simulated within a DES model.

A simulation model was created in Siemens Tecnomatix Plant Simulation, a discrete event simulation software package allowing events and what-if scenarios to be run without interrupting existing production systems or processes.

The software is used to produce layouts of factory floors and add in data for machines, processes, production targets and materials, allowing a simulation model to be created which mimicked production flow on the new workshop floor at Boeing Sheffield.

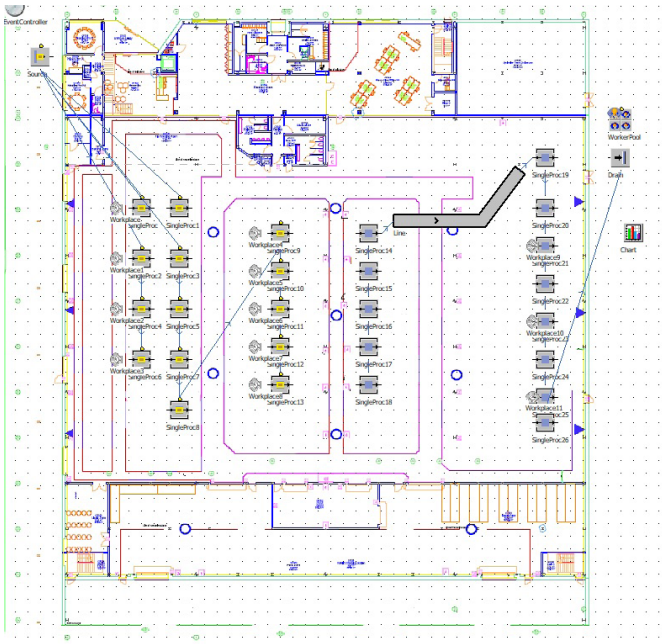
The virtual model and the factory simulation validated the impact of Boeing Sheffield's planned production processes and showed where they had spare production capacity, to assist with future optimisation of production schedules.

In the future, the digital model will provide new opportunities for Boeing to validate operational changes, technology introduction, identify opportunities to further increase through-put and introduce real-time factory monitoring.

Linking the virtual simulation model to Boeing's production data in real-time e.g. material delivery time, machine states, machine maintenance and process scheduling will provide continuing benefits such as:

- Improving the model's accuracy
- Real-time monitoring of factory production
- Apply optimisation to physical environment based on latest factory situation

Tim Underwood, Manufacturing Engineer for Boeing Research and Technology said: "Using DES has given Boeing a holistic view of the factory floor operations that will take place in Boeing Sheffield, before construction was even complete.



Factory flow simulation model in 2D.

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CATAPULT High Value Manufacturing
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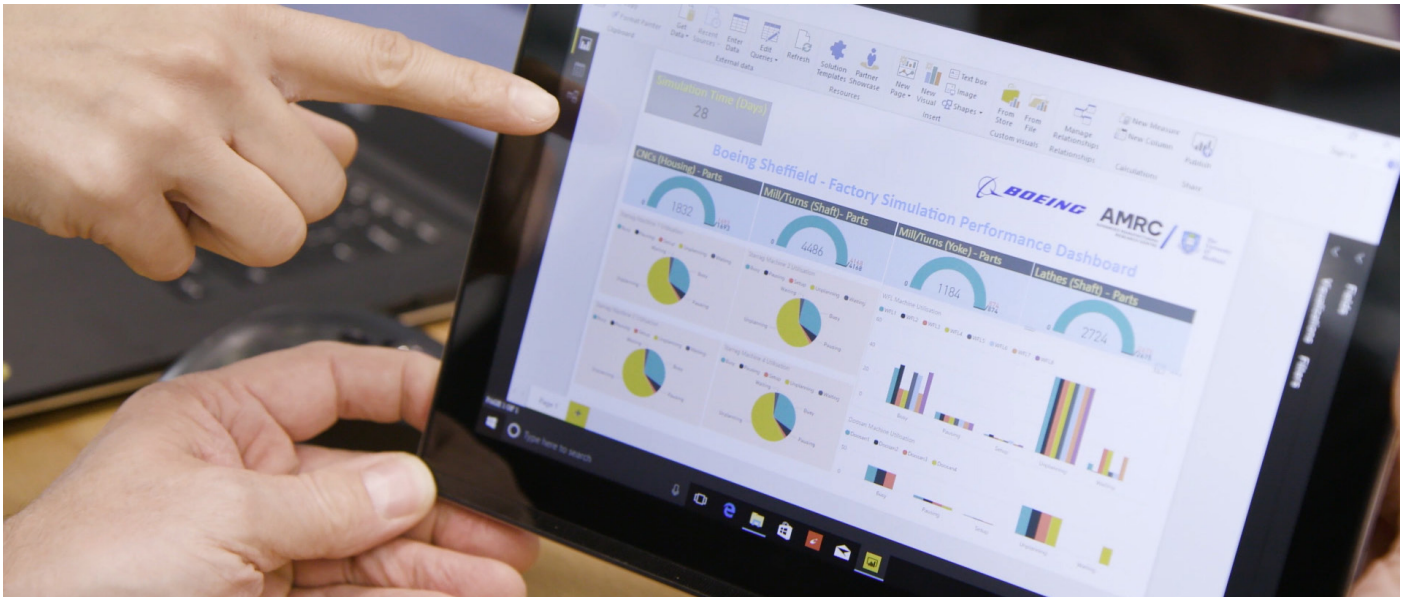
European Regional Development Fund



Dashboard system to monitor factory key performance indicators remotely.

"Going forward the technology will give us the ability to link the virtual simulation to the workshop floor to establish a digital twin for Boeing Sheffield." Gary Hilton, Boeing.

"Through the collaboration with the AMRC, we have been able to look at whether we had invested in the right number of machines for the workshop floor, to check we had the adequate workforce and resources availability to support operations and look at any bottle-necks in production to validate our targets against our intended operations."

Gary Hilton, Chief IT Engineer for Vertical Integration at Boeing, said: "Going forward the technology will give us the ability to link the virtual simulation to the workshop floor to establish a digital twin for Boeing Sheffield. This will enable us to discern in real-time how processes within the facility are operating and monitor the workshop floor for any issues that are occurring, or plan resources around future targets."

The AMRC is further developing its DES research to link to artificial intelligence (AI) solving complex real-world problems in shorter experimental time.

The methodology developed is suited to applications across many such as aerospace, automotive, defence and healthcare; where increases in productivity and reduced resource usage are critical to maintain productivity levels.

Technical Fellow and Head of Manufacturing Intelligence Group, Dr Ruby Hughes, said this also includes SMEs working in those sectors where low-risk validation and what-if analysis can be a major benefit: "With the expertise in house at the AMRC, the simulation model development time is fairly short, making this kind of technology accessible to any business who can access these capabilities through working with us."

For further information please contact Dr Ruby Hughes:

0114 215 8241 | r.hughes@amrc.co.uk | amrc.co.uk