

NFEC

Digital Manufacturing & Advanced Visualisation

Chris Freeman
AMRC with Boeing – Factory 2050



The AMRC – Factory 2050



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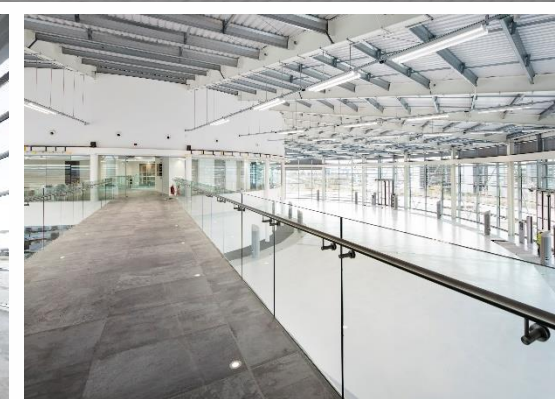
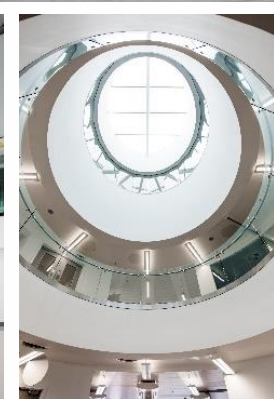
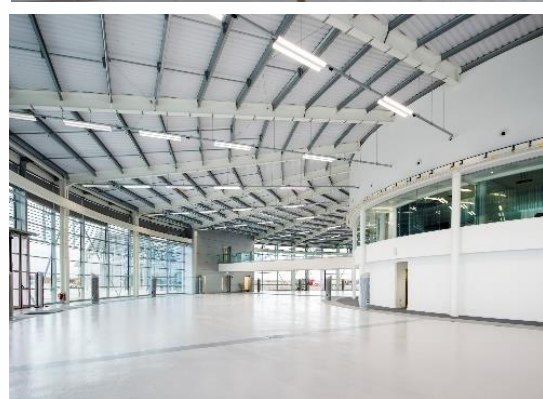


1. Existing AMRC Site
2. AMRC Expansion Site
3. AMRC Factory 2050 Site

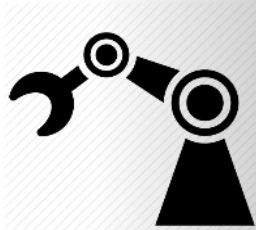
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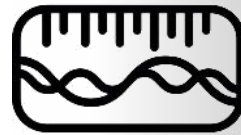


Factory 2050 - Capability Summary



Robotics and Automation

Robot accuracy
Robotic Machining, CMM
Robotic adhesive application
Reconfigurable Fixturing
Self-adapting machines
Human-robot collaboration
AGVs and part movement
Kinematics



Metrology & Verification

Laser trackers
Vision Systems
White Light Scanner
Low Cost Metrology
Measurement
Factory Scanning
Robot NDT
iGPS



Digitally Assisted Assembly (DAA)

Manual Assembly
Digital Work Instructions
Digital Twin
Augmented Reality
Optical Projection
Laser Projection
Wearable technologies
Intelligent Tools (DC)
Virtual Reality



Manufacturing Informatics

Integrated Sensors
Low-power wireless
Sensors Networks
Analytics
Ubisense part tracking
SCADA / WinCC
Control Systems
Programming

Factory 2050 DAA - Introduction



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SENSORS / EQUIPMENT / CELLS / BUILDING

STATE
LOCATION
ACCELERATION
ORIENTATION
TEMPERATURE
HUMIDITY
PRESSURE
VIBRATION
IMPACT
ACOUSTICS
+ ... ??

RFID

EMPLOYEES

DELIVERY OF INFORMATION

RIGHT INFORMATION
RIGHT TIME
RIGHT PLACE
RIGHT PERSON
RIGHT DEVICE
RIGHT FORMAT

WEARABLE
TABLET
PHONE
LAPTOP / PC

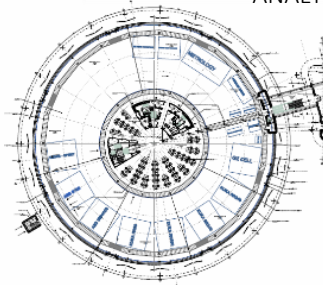
INTELLIGENT DECISIONS /
ANALYTICS FEEDBACK

LOW POWER BLUETOOTH /
WI-FI / RFID / FACTORY LAN

USER FEEDBACK /
VALIDATION

ALERTS /
JUST IN TIME INFORMATION /
WORK INSTRUCTIONS /
PROCESS / PROGRESS INFO

Factory Information BUS



FACTORY
PLANNING
MES / ERP

SUPPLY
CHAIN

CUSTOMERS /
ORDER
INTAKE

CLOUD /
LOCAL
CLOUD

STRUCTURED
DATA STORE /
WAREHOUSE

ANALYSIS

REPORTING

DASHBOARD

INTERNET /
WEB PORTAL

HISTORIC
DATA

LIVE
DATA

Factory 2050 DAA - Overview

- **What themes does Digitally Assisted Assembly cover?**

- User Training.
- Operator Work Instructions.
- Just in Time Information Delivery.
- Remote Support.



- **How is this delivered?**

- 3D Virtual Environments.
- Augmented Reality Overlays.
- Intuitive GUI's.

- **Through which medium?**

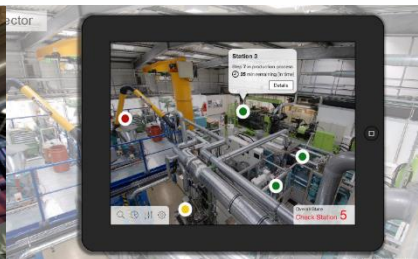
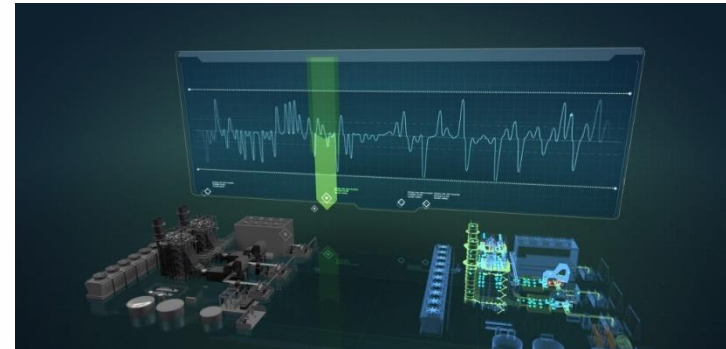
- Projection.
- Mobile Devices.
- Wearable Technology.



Factory 2050 DAA - Augmented Reality

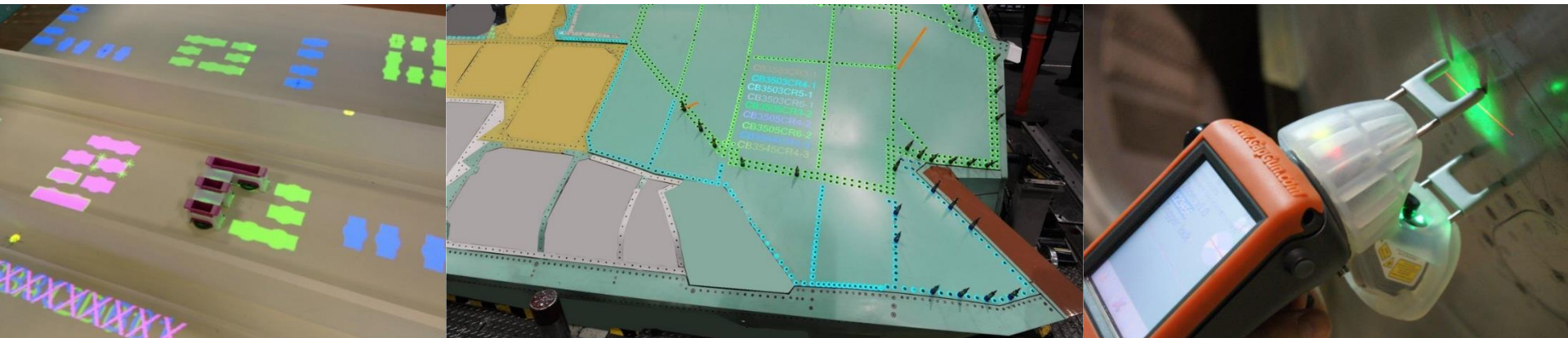
Current Aerospace AR drivers:

- **Digital twin / Digital Master.**
 - Facility planning
 - Process monitoring & control
 - Informatics visualisation
- **Paperless & LEAN environments.**
 - Procedural operator work instructions
 - Centralised / Remote support
 - Supervisory input / sign off / certification



Factory 2050 DAA - Augmented Reality

Optical Projection is a hardware/software system that uses standard boardroom projectors to display manufacturing information directly onto the 3D part:



Delta Sigma research states:

Direct build-time speed increases by factor 3.5 times. For a wide array of assembly tasks, a high quality AR system can provide an instantaneous 70% reduction in the costs of value-added work.

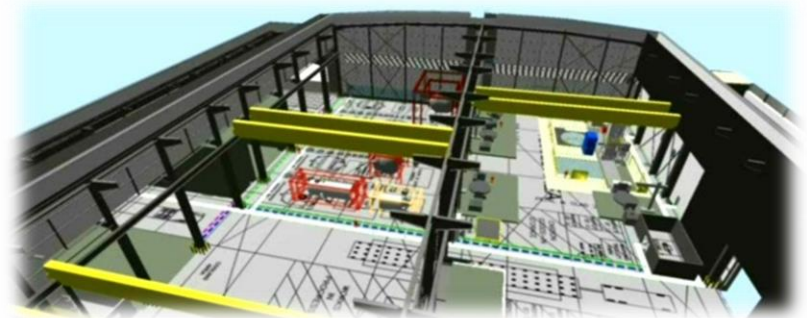
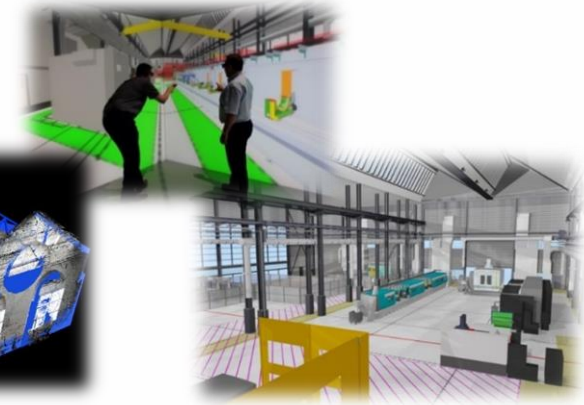
- Standard deviation is less than one third of doing the same task using traditional methods.
- Errors are reduced by 92%.

Factory 2050 DAA - Virtual Reality

Virtual Reality - Factory Layout

Advanced visualisation at the AMRC is currently being utilised for:

- Space & Layout Optimisation
- Installation planning
- Ingress and egress pathways
- Stage build models for contractors
- Routing planning
- Build verification
- Virtual Assembly
- Tolerancing
- Assembly training
- Sequencing
- Process Planning



A number of AMRC partners have already engaged with this technology and are realising the time and cost benefits of utilising the suite of visualisation tools. These partners include Rolls-Royce Aerospace, Rolls Royce Civil Nuclear, and BAE Systems.

Factory 2050 DAA - Augmented Reality

Mixed Reality devices quickly build up a digital representation of its surroundings enabling the deployment of full scale CAD within the physical environment.

- Visually experience models in real space.
- Better understand spatial challenges.
- Intuitively manipulate technical models.
- Create layouts without factory CAD.
- Informatics visualisation.



Factory 2050 DAA - Augmented Reality

Airbus have worked with their technology group partner Testia to develop and deploy an AR based mobile solution into an existing process. The application overlays virtual components onto the aircraft from any perspective. MiRA is currently used on the A380 and A350 XWB production lines to check the structural brackets that are used to hold systems such as wiring, pipework and hydraulics in place. It is designed to reduce the late discovery of damaged, wrongly positioned or missing brackets.



Booming Market



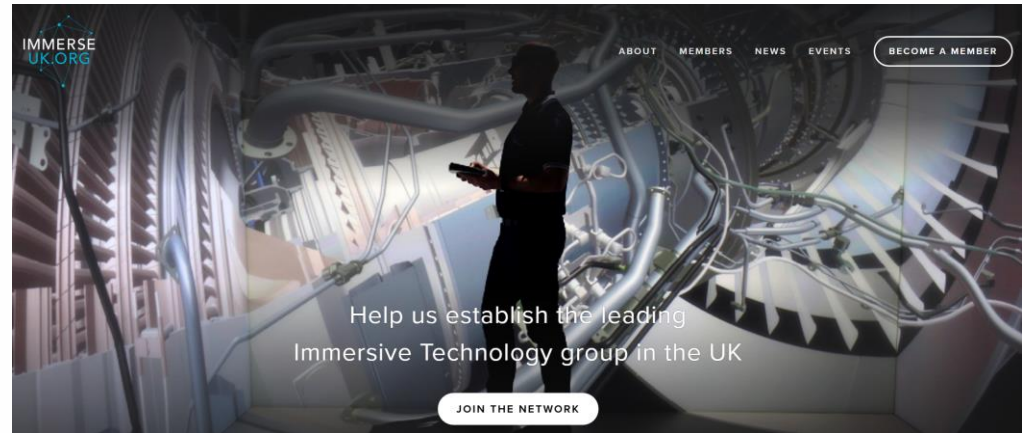
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APPLIED VISUALISATION

CREATING INDUSTRIAL VALUE

Exploring the opportunities and benefits that advanced visualisation can bring to your industry



AMRC

Integrated Manufacturing Group



The
University
Of
Sheffield.

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Thank you.

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