UK perspective on Digital Manufacturing

Lord Prior of Brampton,
former Parliamentary Under Secretary of State
TOPIC ONE: IMPLEMENTATION

Moderator: Dr Steven Barr, Managing Director, Hennik Edge

Lars Nagel,
Managing Director, Industrial Data Space Association

Chris Biddle,
Global Business Development Manager, ATS Global

Christian Warden,
Head of Skills Development, MTC Advanced Manufacturing Training Centre

www.the-mtc.org/digital2017
Cyber security and data sovereignty

Lars Nagel,
Managing Director, Industrial Data Space Association
A NEW IDEA FOR SHARING DATA

INDUSTRIAL DATA SPACE

Digitalising Manufacturing Conference 2017 @ mtc, Coventry, 31.10.2017
Lars Nagel, Managing Director
WE HAVE A NEW IDEA
FOR SHARING DATA

Interoperability
Data Exchange
Sharing Economy
Data Centric Services

Data Ownership
Data Security
Data Value

DIGITAL SOVEREIGNTY
is the ability of a natural or legal person to exclusively and sovereignly decide concerning the usage of data as an economic asset.
OBSTACLES CONCERNING EXTENSIVE SHARING OF DATA

Today

57% worry about revealing valuable data and business secrets.

59% fear the loss of control over their data.

55% feel inconsistent processes and systems as a (very) big obstacle.

32% fear that platforms do not reach the critical mass, so that data exchange will be interesting.

Industrial Data Space Approach

More Data Security

Improvement of Sovereignty

Optimising Processes and Cost Structures

Join us!

© PwC-Study on "Industrial Data Space"
INDUSTRIAL DATA SPACE –
THIS IS OUR MISSION:

**MISSION STATEMENT**
The INDUSTRIAL DATA SPACE ASSOCIATION defines the basic conditions and governance for a reference architecture and interfaces with the objective of setting up an international standard.

**INTERNATIONAL STANDARDS**
The INDUSTRIAL DATA SPACE ASSOCIATION defines the basic conditions and governance for a reference architecture and interfaces with the objective of setting up an international standard.

**SECURE DATA EXCHANGE**
INDUSTRIAL DATA SPACE stands for secure data exchange between companies in which the data provider is always the owner of that data and still keeps control over the use of their data.

**USE CASES**
This standard is actively developed and updated on the basis of use cases.

**BUSINESS MODELS**
It forms the basis for a variety of certifiable software solutions, smart services and business models, the development of which is encouraged by the association.
# Architecture for Data and Data Services

An infrastructure for all industries and domains

<table>
<thead>
<tr>
<th>Architecture level</th>
<th>Automotive</th>
<th>Electronics and IT</th>
<th>Logistics</th>
<th>Retail and Food</th>
<th>Health</th>
<th>... (other Industries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart-Service-Scenarios</td>
<td>Service and product innovations</td>
<td>»Smart Data Services« (alerting, monitoring, data quality etc.)</td>
<td>INDUSTRIAL DATA SPACE</td>
<td>»Basic Data Services« (information fusion, mapping, aggregation etc.)</td>
<td>Internet of Things · broad band infrastructure · 5G</td>
<td>Real Time Area · sensors, actuators, devices</td>
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## ARCHITECTURE FOR DATA AND DATA SERVICES
AN INFRASTRUCTURE FOR ALL INDUSTRIES AND DOMAINS

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**Smart-Service-Scenarios**

- **Service and product innovations**
- **»Smart Data Services«** (alerting, monitoring, data quality etc.)
- **»Basic Data Services«** (information fusion, mapping, aggregation etc.)
A PEER TO PEER APPROACH
TO STANDARDISEDLY CONNECT PLATFORMS AND THINGS

It's all about sharing data!

OPEN CONTEXT DATA
- Traffic
- Weather

INDUSTRIAL DATA SPACE ASSOCIATION

VALUE CHAIN
- Production
- Consumer

FIELD VIEW (FACTORY)
- Actors
- Sensors
- Machines

PLANNING, EXECUTION, CONTROL (MULTI-SIDED PLATFORMS)
- IoT Clouds
- Marketplaces
- Broker

FIELD VIEW (FACTORY)

FIELD VIEW (FACTORY)

FIELD VIEW (FACTORY)
OK.

What's new?
OK.
WHAT'S NEW?

*Self determined control of data flows in a peer to peer approach:*

- **Endless Connectivity** – standard for data flows between all kinds of data endpoints
- **Comprehensive security functions** providing a maximum level of trust
- **Usage control and enforcement for data flows**
# Value Proposition

**Industrial Data Space contributes this:**

<table>
<thead>
<tr>
<th>1</th>
<th>Trust</th>
<th>Trust is the basis of the IDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Identity Management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• User-Certification</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>Security</th>
<th>Everything needs to be secure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Authentication &amp; Authorization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Usage Policies &amp; Usage Enforcement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Trustworthy Communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Security by Design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Techn. Certification</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>Ecosystem of Data</th>
<th>Being able to explain, find and understand data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Data Source Description</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Brokering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Vocabulary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>Standardized Connectivity</th>
<th>Connection of every data endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Integration of existing vocabularies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Using different data formats</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Connection of clouds and platforms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5</th>
<th>Value Adding Apps</th>
<th>Typical tasks can be solved easier with apps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Processing of Data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Remote Execution</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>6</th>
<th>Data Markets</th>
<th>Data is being traded as an asset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>• Clearing &amp; Billing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Domain specific Broker and Marketplaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Legal Aspects (Contract Templates, etc.)</td>
</tr>
</tbody>
</table>
REFERENCE ARCHITECTURE MODEL
INTERACTIONS OF COMPONENTS ON THE SYSTEM LAYER
DISTRIBUTED GOVERNANCE IN THE INDUSTRIAL DATA SPACE ECOSYSTEM

- Data Consumer
- Service Provider
- Broker Service Provider
- Data Provider
- Data Owner
- Software Provider
- App Provider
- App Store Provider
- Identity Provider
- Clearing House
- Vocabulary Provider

- Data flow
- Metadata flow
- Software flow
- Identification

- Certification mandatory
- Membership in the IDSA mandatory

- Depends on service provided
- Certification Authority

- Use IDS software
- Use data apps
REFERENCE ARCHITECTURE MODEL
REFERENCE ARCHITECTURE OF THE CONNECTOR

Operating System

Virtual Machine / Hardware

Application Container Management

Runtime

Execution

Custom Container
Data Service
Runtime
API

App Store Container
Data Service
Runtime
API

Execution Core Container
Execution Core
Runtime
Message Router
Message Bus

Configuration

Configuration Manager
Configuration model
Validator

Network Execution Configurator
Workflow Execution Configurator
...
Configurator Management

Runtime

Industrial Data Space

Layers
Perspectives
Business
Security
Certification
Functional
Governance
Process
Information
System

Connector Types

Base
Trusted
Internal
External
Developer, Mobile, Embedded, Custom, ...

www.industrialdataspace.org
Focus

- Connectors with different security profiles from base functionalities to highest security requirements
- i.e. remote integrity verification, secure data erasure, TPM 2.0, remote app execution, mutual authentication, ...
Connectors communicate with each other through an IDS protocol (IDSP)
- Secure Websockets over TLS
- Remote Attestation & Meta Data Exchange: Proof of trusted platform configuration
- Exchange of payload data with an associated usage policy
- Connection of backend protocols through protocol adapters. 200+ supported protocols (REST, MQTT, OPC-UA, AMPQ, ...)
Usage policies can be attached to data sources or data items.

Policies are signed by the source connector and can be verified by the target connector.

The policy set can be seen as a usage contract.

Different solutions: label-based usage control, distributed usage control, sticky policies, remote processing.

**Focus**

- Usage policies can be attached to data sources or data items.
- Policies are signed by the source connector and can be verified by the target connector.
- The policy set can be seen as a usage contract.
- Different solutions: label-based usage control, distributed usage control, sticky policies, remote processing.

**USAGE CONTROL - POLICIES**

- Custom Container
- Core Container
- Data Service
- Message Queue
- Connection Mgmt.
- Trusted Container Management Layer
- Data Flow Control
- Connection Mgmt.
- Message Queue
- Target App

**IDS Protocol**

- **Labels**
  - **personal AND raw** → **require(logging), delete_after(30 days)**

- **Constraints**
Policies for sticking to usage restrictions – concerning the data producer (compliance, legal regulations) and the data consumer (obligations from the data producer)

- Data may not leave the European legal area
- Data with the label "personal" must be anonymised
- Data producer to be informed at each usage of data set
- Data with the label "personal" may only be forwarded internally
- Data may be used max. 5 times and must be deleted after 14 days
- Deletion will be logged

Focus
MANAGEMENT OF DISTRIBUTED USAGE CONTROL

Focus

- Example from the automotive industry
- Sharing data between tier-1 supplier and OEM
- Usage control and execution mechanism
OUR USE CASES MAKE IT HAPPEN
INDUSTRIAL DATA SPACE IN ACTION

The use cases demonstrate the innovations based on Industrial Data Space

Potential core of an ecosystem by integrating further partners (also from different domains)

Each member of the association realizes a business driven use case

CHARACTERISTICS OF IDEAL USE CASES:

• Link data from several data sources
• Integrate various kinds of data (for example master data and status data in manufacturing)
• Combine various data goods (private and public data, »club goods«)
• Involve at least two companies
• Integrate more than two company architecture levels (for example »shop floor« and »office floor«)
• Basis for offering »smart services«
• Develop core components/basic services
OUR USE CASES MAKE IT HAPPEN

COLLABORATIVE SUPPLY CHAIN RISK MANAGEMENT

Short Description
- Phase 1: Event based transfer of affected Supply Chain data
- Phase 2: Event based transfer of material flow data

Benefits
- On demand Supply Chain Transparency
- Realtime Tracking and Tracing
- Proactive Supply Chain Risk Management

Main Technology/IDS Components
- Internal and external IDS connector
- Vocabulary
- Bosch Tracking & Tracing

Targets
- Set of rules
- Standardized data definitions
- Harmonized data model
- Proof of concept for the data transfer

Partners/Ecosystem
- Logistics Service Provider (tbd.)
- Tier-2 Supplier (tbd.)
OUR USE CASES MAKE IT HAPPEN

DYNAMIC TIMESLOT MANAGEMENT AND TRACKING IN THE SUPPLY CHAIN

- Time Slot Management, Dynamic Estimated Time of Arrival and Track & Trace
- Integrating all existing telematics systems
- Ensuring maximum connectivity to all logistics service providers
- Using GS1 EDI XML as common message standard
- Comprehensive status changes

Benefits
- Reducing traffic jams and out of stock situations
- Time slot management in realtime
- Better data quality for planning

DIGITAL LINKING OF A PRODUCTION LINE

- Semantic standards for the Machine 4.0 (RDF)
- Combining of production, replenishment, maintenance, quality management
- Exchanging data along the whole production line and supply chain
- Combining vocabularies
- Reference technology stack for a machine 4.0

Benefits
- Automatic matching of tool and order data
- Minimizing tooling time
- Correlation of machine and work piece
OUR USE CASES MAKE IT HAPPEN

INTELLIGENT STOCK INFORMATION

• Merging of procurement systems
• Automatic management of semantic description of steel quality criterias
• Machine interface for availability
• Transparency and fast response time to customers

Benefits
+ Reducing the connections to suppliers
+ Procurement in realtime
+ Better quality by reducing misinformation

BROKER BASED DESIGN OF SUPPLY CHAINS

• Small lot sizes make adhoc actions necessary
• Orchestration of all network partners (Logistic service providers) to fulfill orders
• Selforganised configuration of a transportation order
• Tender management

Benefits
+ Tailormade supply chains on demand
+ More transparency and options
OUR USE CASES MAKE IT HAPPEN

SMART CARE
PLATFORM FOR PROCESS- AND SERVICE-INTEGRATION

• End2End combination of connected devices between users, care services, family members and medical institutions
• Harmonization of various data protocols, transmission media, across vendors, users and institutions.
• Pre-requisite for implementing multi-local smart care services, e.g. in rural regions

+ Overcome babylonic variety of proprietary protocols
+ Elimination of barriers to mass-roll-out of smart care solutions
+ Data sovereignty

Benefits

PLATFORM INTEGRATION OF EQUIPMENT VIA OPC UA

• Integration of equipment via industrial standards like OPA UA
• Modular service based concept allows extension for semantic technologies or other protocols
• Support for horizontal integration across value chains
• Linking with platform and cloud services

+ OPC UA standard protocol integration
+ Platform connectivity via IDS secure channel

Benefits
MILESTONES REACHED
AND NEXT STEPS

ARCHITECTURE
Release of the reference architecture model 2.0 on Hannover Fair

STANDARD
Foundation of a working group at DIN to create a DIN specification for the IDS connector

INTERNATIONAL
Members all over the world, connecting with important initiatives, major European RTOs, intense engagement in European research activities

GO LIVE
Ecosystem potentially running, first products, enhancing global adoption
LIAISONS AND STRATEGIC ALLIANCES
OVERVIEW

Initiatives
- INDUSTRIE 4.0
- FIWARE
- DATA MARKET

Institutions
- BDI
- ZVEI
- DIN
- VDMA
- BDV
- OPC
- EARTO

Projects
- OpenAAS
- I4MS
- Fitman
- CBA Labs
- Virtual Fort Knox
- Smart Factory KL

Research Partners
- INDUSTRY
- TNO
- DigiCert
- POLITECNICO MILANO
- FORUM AI
- TECNIA
- iGovalia
- SINTEF
- Fraunhofer
Spreading our idea globally

Central hubs emphasize adoption

mtc is our partner in UK

Common targets:
- Bringing more adopters of IDS to our ecosystem and create a vital subcommunity
- Setting up new use cases
- Delivering new requirements
- Knowledge transfer
- Bringing IDS to national research calls
- Placing IDS on the EU roadmap
- Supporting international positioning
YOUR WAY THROUGH THE
INDUSTRIAL DATA SPACE ASSOCIATION

1. ACQUIRE BASIC KNOWLEDGE ON INDUSTRIAL DATA SPACE

- Just start reading and gaining knowledge on Industrial Data Space and the Association (whitepaper, presentations)

2. START CO-CREATING THE INDUSTRIAL DATA SPACE

- Send people to working groups
  - working group architecture
  - working group use cases & requirements
  - working group certification
  - taskforce exploitation and business modeling
  - taskforce legal framework

Engage on JIVE
- https://industrialdataspace.jiveon.com
  (apply for access via website or head office – members only)

Important Documents to be known:
- Reference Architecture
- Use Case Overview
- PwC Study on Data Sharing (German)

Sprint Releases
- Reference Use cases and documentation (image file + source code + docker container)

Try out reference use cases – test IDS on your devices:
- Sprint Releases

Start
Become a member
Find your role in the Industrial Data Space ecosystem and build services or products.

SET UP YOUR OWN USE CASE

Bring your use case on the IDSA use case map

Pitch your use case in the wg use cases & requirements

Use case process – if you are stuck, contact the head office. We guide you through the use case process.

Describe and communicate your use case

MAKE YOUR OWN INDUSTRIAL DATA SPACE BUSINESS CASE

Get inspiration from others use cases

Market conquest

ROLL-OUT INDUSTRIAL DATA SPACE IN MORE THAN ONE SCENARIO

Add your requirements to the functional overview, so that it can be considered in future architecture and sprint release and helps improving the Industrial Data Space:

https://idsspec.isst.fraunhofer.de/idsspec

Find your role in the Industrial Data Space ecosystem and build services or products

https://industrialdataspace.org
Connectivity and interoperability: Implementation of machine tool connectivity in global aerospace manufacturing. A case study based upon experiences at Rolls-Royce.

Chris Biddle,
Global Business Development Manager, ATS Global
Implementation of Machine Tool Connectivity in Global Aerospace Manufacturing

Christopher Biddle
Global Strategic Business Development Director
Digitalisation and Industry 4.0

1st
Mechanization, water power, steam power

2nd
Mass production, assembly line, electricity

3rd
Computer and automation

4th
Cyber Physical Systems
What is Industry 4.0?

- **Connection**: Deployment of infrastructure, cabling, IoT sensors, and shop floor IT
- **Acquisition**: Collecting Key Process Variable, Inspection and Operational Data
- **Contextualisation**: Tagging and transmitting data to give it meaning
- **Aggregation**: Associating related pieces of meaningful data together to form information
- **Visualisation**: Interrogating the associated data to bring insight into what has happened
- **Prediction**: Using trends, algorithms and statistical analyses to determine what is likely to happen next
- **Prescription**: Setting up rules as standard responses to predicted outcomes
- **Cognition**: System uses its own experience to plan for and respond to predicted outcomes – applied knowledge

Underlying Technologies:

- History and Experience
- Intervention
- 0100101001010

Increasing Value
First Generation Connectivity

- Individual, segregated plant floor networks
- Machine by machine configuration
- Separate software for each type of data

- Introduced Management of Shop Floor IT Devices for the first time
- Overcame perceived robustness and security issues

- Very costly to implement and maintain with limited data visibility
Second Generation Connectivity

- Individual, virtualised plant floor networks
- Machine by machine solutions

- Good delivery of high performance functionality for low-volume, single piece flow

- Individual testing of each solution

- Poor or zero skills in OEM to develop the required interfaces – limited understanding of Functional Design Specification

- Changing functionality in the MES caused multiple changes in OEM interface

Translator/Broker Model

Connection, Acquisition, Contextualisation, Aggregation and Visualisation
Third Generation Connectivity

- Standardised solution
  - OEM Independent
  - Changing functionality in the MES causes relatively few changes in the middleware

- Introduces latency, decreasing performance – originally designed for batch, now used as single piece

- High Burden of Configuration/Data Dictionary Management

- Stretches the capability of underlying SCADA software

Data Collector In A Box Model
Connection, Acquisition, Contextualisation, Aggregation, Visualisation and Prescription
Evolution of Capability

First Generation
- Connection
- Acquisition
- Contextualisation
- Aggregation
- Visualisation
- Prediction
- Prescription
- Cognition

Decreasing Cost, but also Decreasing Performance

Second Generation

Third Generation

Industry 4.0 Requires:
- Machine to machine, part to machine and tool and fixture to machine collaboration
- Enterprise and Manufacturing IT systems to machines communication
- Business continuity of individual manufacturing cell, production line and work center
- Communication among all OT/IT heterogeneous systems
“Industry 4.0” Implementation

Industry 4.0 Requires:

- Machine to machine, part to machine and tool and fixture to machine collaboration
- Enterprise and Manufacturing IT systems to machines communication
- Business continuity of individual manufacturing cell, production line and work center
- Communication among all OT/IT heterogeneous systems
Case Study 1: Automated Aerospace Assembly

Strategic Goals

- Productivity increase while lowering operative costs
- Flexible production – batch size one
- Rapid ramp-up and downscale of production systems
- Autonomous responsiveness to disruptive events and demand fluctuations
Case Study 2: Electronic Manufacturing Line

Strategic Goals

• Increase Operational Efficiency
• Reduce 80% defects in final product using real-time analytics
• Location awareness of the board and full traceability of consumables and products
• Improve lead-time through flexible routing
Smart Automation, Quality and IT Excellence Solutions
THANK YOU!
Christopher.biddle@ats-global.com
Skills and training – a digital competence framework

Christian Warden,
Head of Skills Development, MTC Advanced Manufacturing Training Centre

www.the-mtc.org/digital2017
Implementing Digital Skills
Creating Competence

Christian Warden
The changing landscape of manufacturing skills

Embracing the fourth industrial revolution
The changing landscape of manufacturing skills
Embracing the fourth industrial revolution

Competitive Capability is essential!
Are we ready to compete in an increasingly digitised world?
The AMTC leading the evolution
Embracing and implementing Digital skills

- Digital skills in manufacturing, what does it mean?
  - Automation and Robotics
  - Additive Manufacturing (3D Printing)
  - Advanced Manufacturing processes
  - Human-machine interaction
  - Artificial Intelligence

The AMTC:
- Advanced Engineering Apprenticeships
- Upskilling, Re-skilling, Multi-skilling existing employees
- Employer led, employer integration, future focused

Source: KPMG
BRIDGING THE VALLEY OF DEATH

The AMTC Apprenticeships, Training and Development
Business impact and genuine progression from Level 2 to Level 7
The AMTC Advanced Manufacturing Skills Solution

A forward facing programme, providing a pipeline of future proof talent
AMTC Apprenticeship Programmes and Skills Development – Advanced Manufacturing

A forward facing competency programme, providing a pipeline of future proof talent with digital skills integration

- Apprentices receive knowledge and skills in emerging technologies, including digital skills and Industry 4.0
- Learning takes place in and around many advanced projects with technology applied
- All apprentices essentially ‘over-trained’ when compared to current standards
- MTC programme highly attractive
- MTC create a pipeline of future-proof talent with known skills behaviours
- Embracing and leading new digital sectors
Digital Modular Construction – Level 2 to level 7

An end-to-end learning programme to enable a career path through the construction industry

Digital Architect  Digital Design Engineer  Digital Construction / BIM Technician  Automation Technician  Construction Manager  Modular Assembly Technician

Stage 0

RIBA (Royal Institute of British Architects) Plan of Work

Stage 7

Level 2 - Apprenticeship
Assembly Technician
AMTC and FE collaboration

Level 3 - Advanced Apprentice
Modular Assembly Technician
AMTC and FE collaboration

Level 4 - Higher Apprentice
Digital Construction Technician
AMTC and FE collaboration

Level 6 - Degree Apprentice
Digital Design Engineer
AMTC and HE collaboration

Level 7 - Masters Apprentice
Chartered
Digital Modular Construction

Initial analysis of current standards against digital modular construction

- Degree apprenticeship
- Design for Manufacture and Assembly
- Product lifecycle management
- 3D modelling / BOM
Digital Modular Construction

Initial analysis of current standards

- Higher Apprenticeship
- 4D and 5D modelling
- Augmented Reality
Digital Modular Construction

Initial analysis of current standards

- Advanced Apprenticeship
- Mechatronic integration, programming and maintenance
- Industrial robot integration, programming and maintenance

Diagram:

- Automation Technician
- Digital BIM Technician
- Digital Design Technician

Stages:

0. Strategic Definition
1. Preparation and Brief
2. Concept Design
3. Developed Design
4. Technical Design
5. Offsite Construction
6. Onsite Construction
7. Handover and Close Out
8. In Use
Digital Modular Construction
Initial analysis of current standards

- Advanced Apprenticeship
- Multi-skilled mechanical & electrical etc.
- Augmented Reality
MTC Additive Manufacturing: Map the skills

Map the responsibilities of all roles, including their tasks and associated knowledge, skills and behaviour

End-to-end AM process

Product conception

Applications Engineer
Requirements capture AM process matching

Material Engineer
Material selection, source powder material validation

Design / Sim. Engineer
Design for function, cost, manufacturing, inspection
Topography optimization

Design validation

Manufacturing Engineer
Design for manufacturing, optimise build, create production pack

Materials Engineer
Material selection, source powder material validation

Materials Technician
Handling, testing, storage of materials

Metrology Engineer
Design for inspection, inspection & testing method selection

Production Technician
Programming & operating of production equipment & post-processing

Quality Technician
Component inspection, Component validation

Product supplied to customer
MTC Additive Manufacturing: Define the apprenticeships
Steer / influence the creation of AM specific trailblazer apprenticeship standards for each job role (that match competency frameworks)
Apprenticeship Levy
The AMTC Solution

- An end-to-end solution - Recruitment to Retirement
- 16 -18 years old traditional apprentices
- 19+ adult apprenticeships
- Identification, registration and redeployment.
- Upskilling, multi-skilling and re-skilling
- Degree Apprenticeships
  - L6 BEng (Hons) – Product Design and Development
  - L7 MSc – Manufacture/Production Engineer
  - L7 MBA – Senior Leaders Masters Degree Apprenticeship

The AMTC are actively involved in:
- Trailblazer Apprenticeship Standards development
- End-point Assessment
The AMTC Apprenticeship Levy Solution
Modular Solution
The best way to predict the future, is to create it!
The AMTC are creating it!
Thank you