High Efficiency Preforming

Composites Large Scale Project (CLSP)

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HVM Catapult

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Cross Catapult Collaboration

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High Value Manufacturing

The University Of Sheffield.
Advanced Manufacturing Research Centre

BOEING

WMG
Innovative Solutions

NATIONAL COMPOSITES CENTRE

mtc
Manufacturing Technology Centre

Project Team

Composites Manufacturing Forum → **Project Team** ← **Industrial Advisory Board**

The University Of Sheffield.
Advanced Manufacturing Research Centre
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Hannah Tew and a team of 19.

mtc Manufacturing Technology Centre

Redland Sanders and Staff

WMG Innovative Solutions

Geraint Williams and Ken Kendall with a team of 5

NATIONAL COMPOSITES CENTRE

Chris Young and David Jewell with a team of 14

Project Aims

Aims:

Identify and develop high efficiency composite preforming processes suitable for automotive applications by 2019, and capture process data including:

- Cost
- Rate
- Repeatability
- Sustainability

Manufacturing Processes Requiring Preforming

Infusion

Automated Spray-up

Wet Pressing

Thermoplastic Overmoulding

Low Volume (<10000) | Mid Volume (10000 – 100000) | High Volume (>100000)

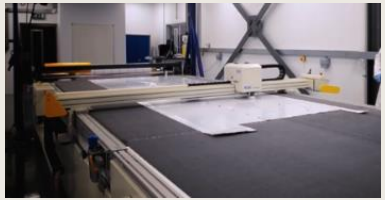
RTM

Thermoplastic RTM / HPRTM

HP-RTM (Benchmark Process)

Why Focus on Improving Preforming?

Materials → Preforming → Consolidation → Trimming and Finishing



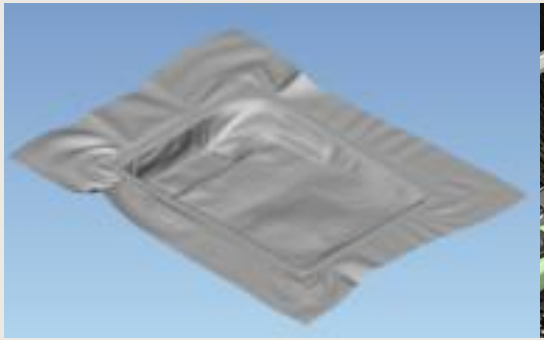
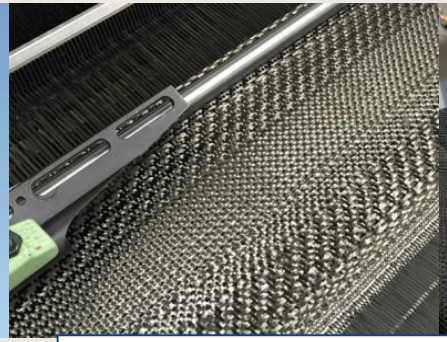
Indicative % of Overall Component Cost

55% | 22% | 18% | 3%

- Preforming is a significant contribution to manufacturing cost and cycle time
  - Rate challenge
  - Repeatability challenge – High reliance on post manufacturing inspection
  - Process scrap can be high

High Efficiency Preforming Targets

Preforming

% of Overall Component Cost

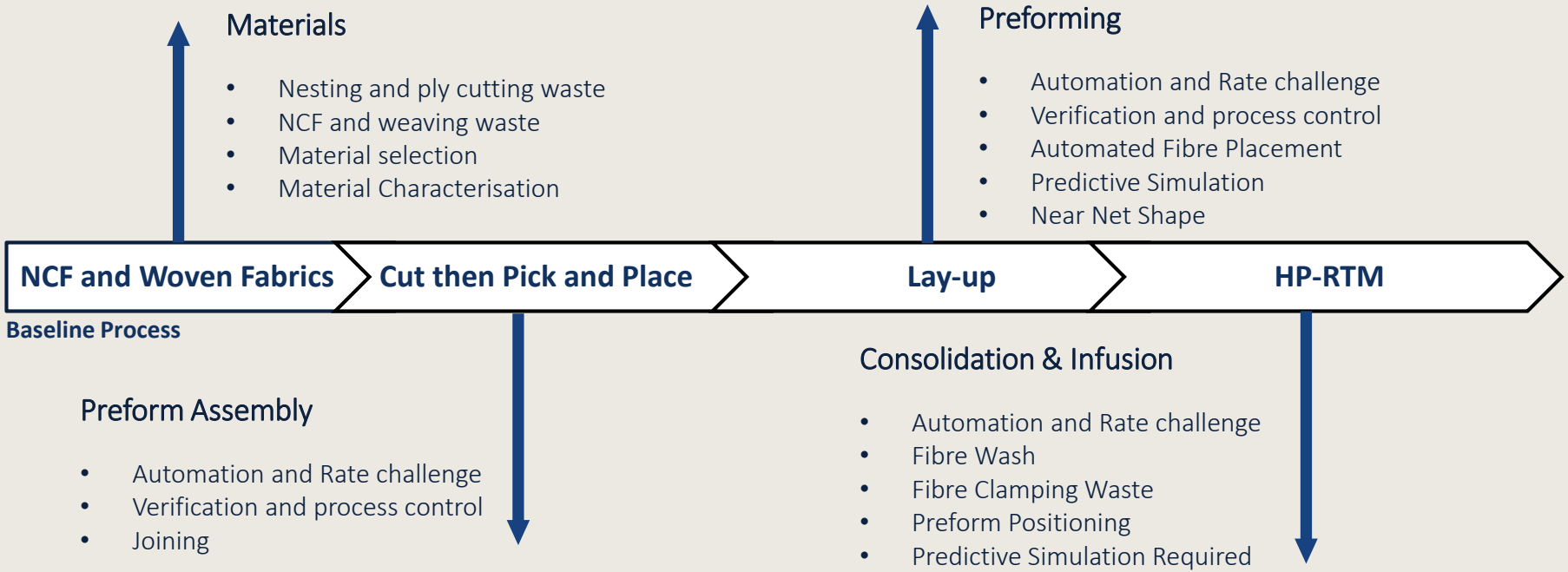
22%

Reduce process waste by **20%**
Reduce process time by **40%**
Reduce quality costs by **30%**
Identify Carbon footprint for preforming options in order to support life cycle analysis

High Efficiency Preforming Targets

Targeted Funding	UK (Affordable Composites)		Supported by HEP
Baseline 2017-19	**2020**	**2025**	
Production Cost of Finished Components	Reduce by 40%	Reduce by 75%	✓
Demonstrate Technologies for Recyclability	>80%	>95%	
Cycle (Takt) Time	90s TP 180s TS	60s TP 120s TS	✓
Reduction of Process Steps			✓
Material Cost Reduction (Includes Waste Reduction)	25%	50%	✓
Reduction in CFRP Embodied Energy		50%	

Process Improvement Opportunities



Required Supporting Activities:

- Costing, life cycle analysis, automation plan, inspection procedures as well as process monitoring and control.

Enabling Technologies

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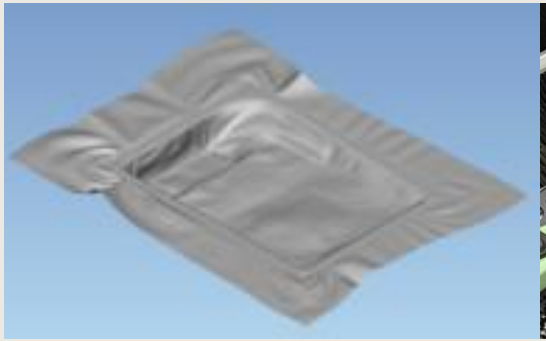
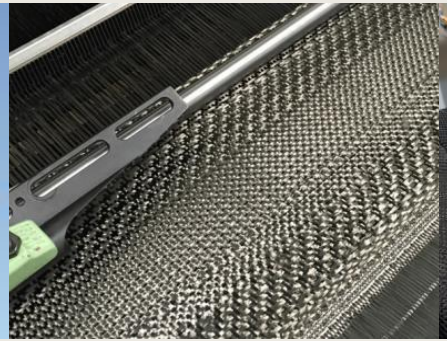
This project will investigate enabling preforming processes which appear to offer the most potential to meet cost, rate, repeatability and sustainability targets.

- **Pre-form Simulation and Stamping** - Warwick Manufacturing Group (**WMG**)
- **3D Woven materials simulation and manufacture** - Advanced Manufacturing Research Centre (**AMRC**)
- **Preform Joining and Near Net-shape Blanks** - National Composites Centre (**NCC**)
- **Non Destructive Evaluation, Cost Modelling and life cycle analysis** - Manufacturing Technology Centre (**MTC**)
- **Virtual Pilot Line** - Manufacturing Technology Centre (**MTC**)

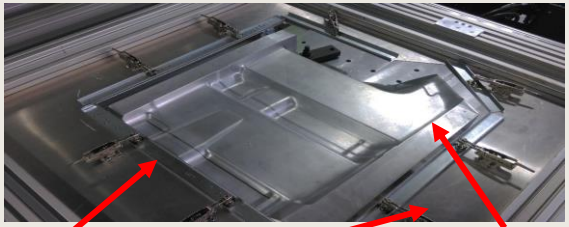
Stamped Preforms

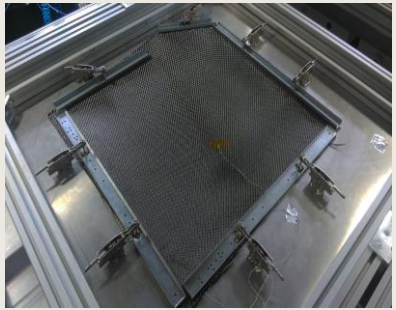
Key Benefits

- Significantly reduced process time – Increased **rate** and reduced **cost**

Current Work

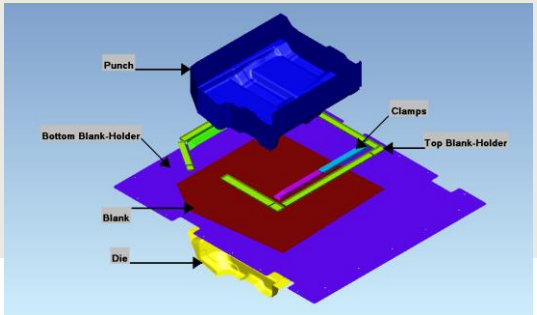
- Characterisation of stamp forming process
- Process simulation
- Permeability studies
- Process demonstration





Fabric reinforcement blank ready for forming

Forming Process Simulation Set-up



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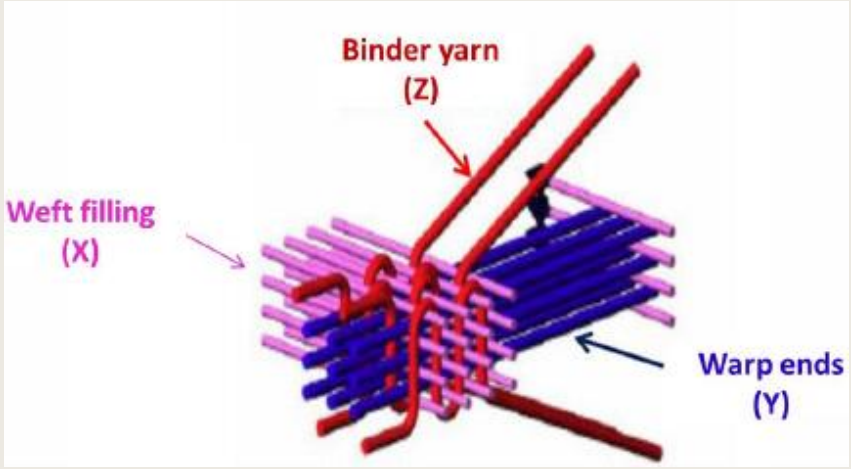
3D Woven Preforms

Key Benefits

- Reduced **waste**
- Reduced number of process steps – **Reduced cost**
- Tailored preform structure
- Reduced Defects – Improved **repeatability**

Current Work

- Manufacturing methodology for 3D woven preforms
- Process demonstration



Preform Joining

Key Benefits

- Joining sub-preforms
- Reduced process times – Increased **rate** and reduced **cost**
- Improved process robustness and **repeatability**

Current Work

- Characterisation of stitching and tufting processes
- Capability demonstration

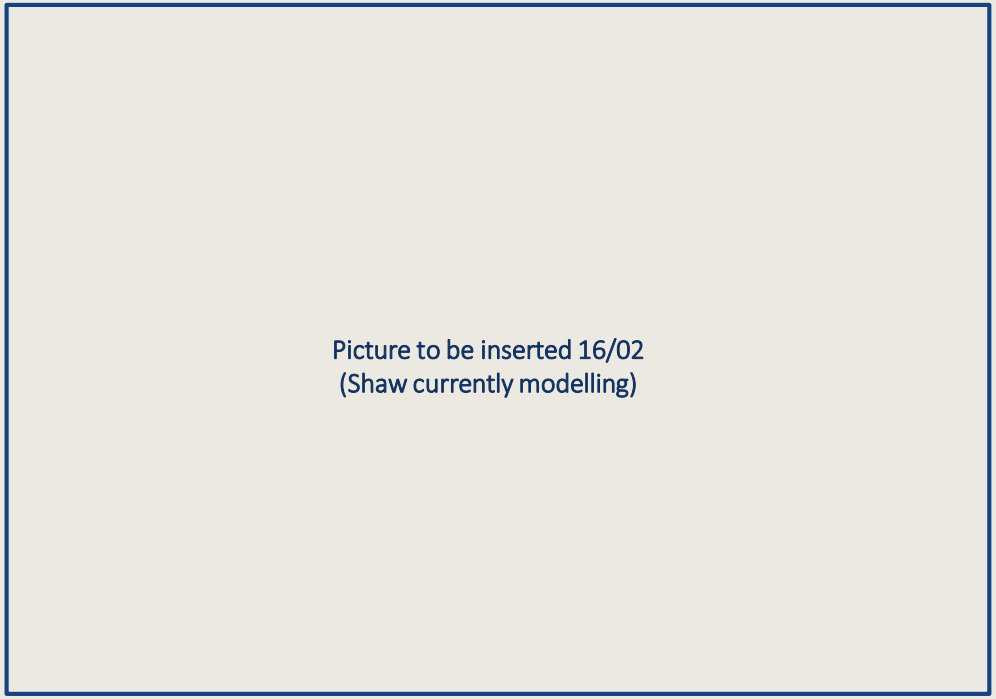
Near Net-Shape Blanks

Key Benefits

- Reduced **waste** and **cost**

Future Work

- Market Review
- Current Equipment Evaluation
- Potential Equipment Modification
- Blank Optimisation
- Part Characterisation



Development of Supporting Activities

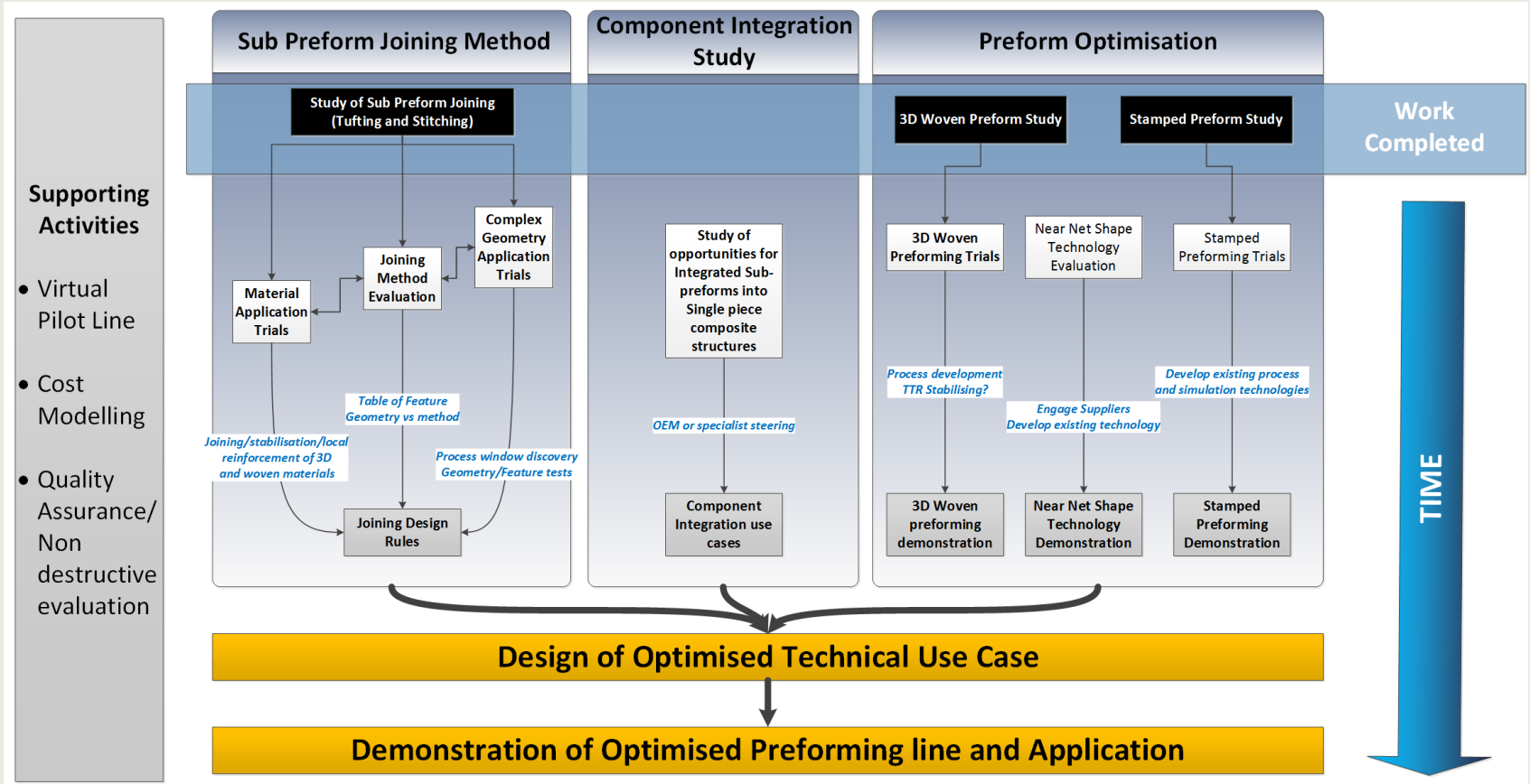
Key Benefits

- Reduced **cost**

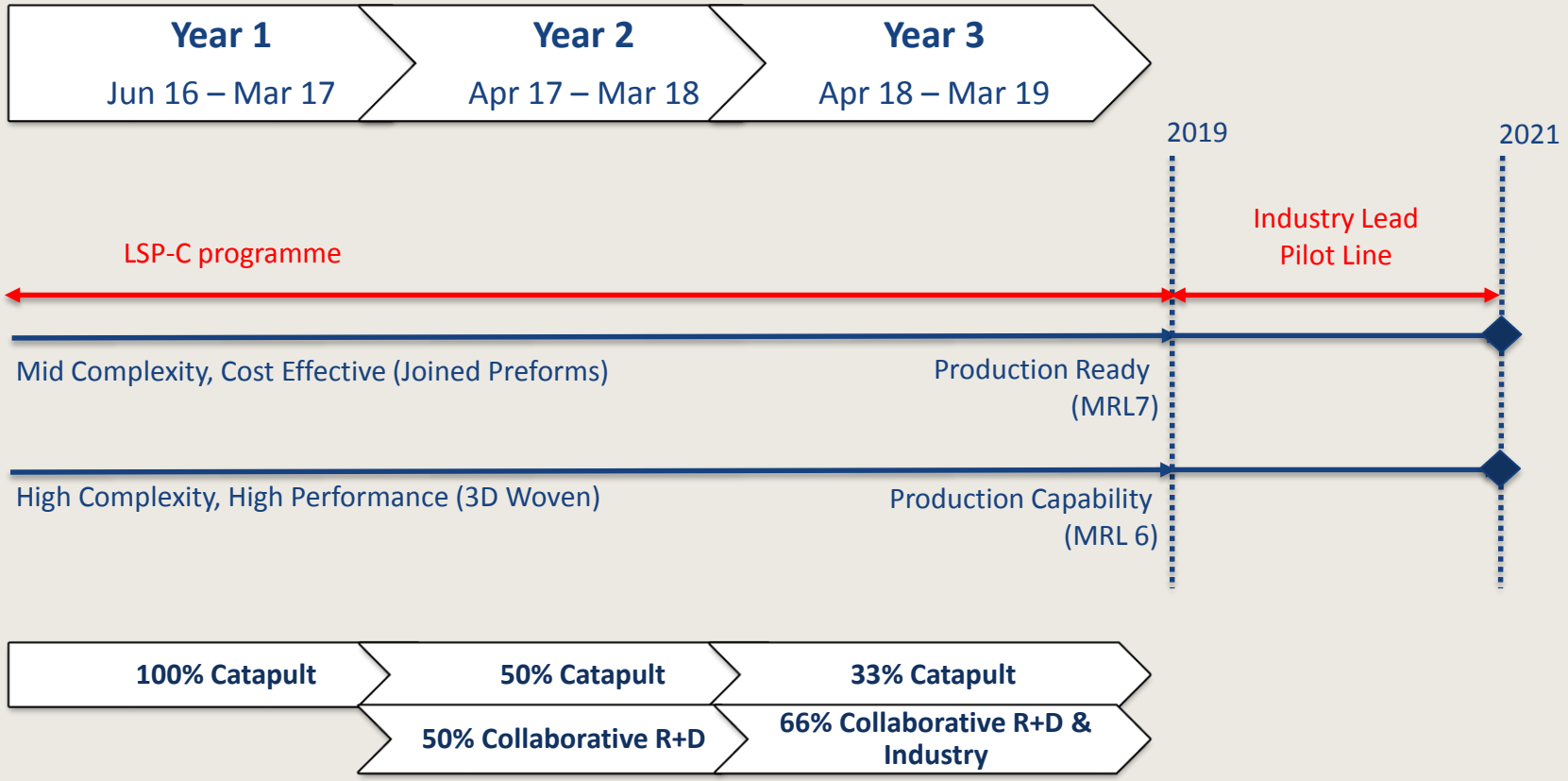
Current Work

- Virtual pilot line
- Automated visual inspection of plies
- Cost modelling
- Life Cycle analysis

Project Objectives and Key Tasks

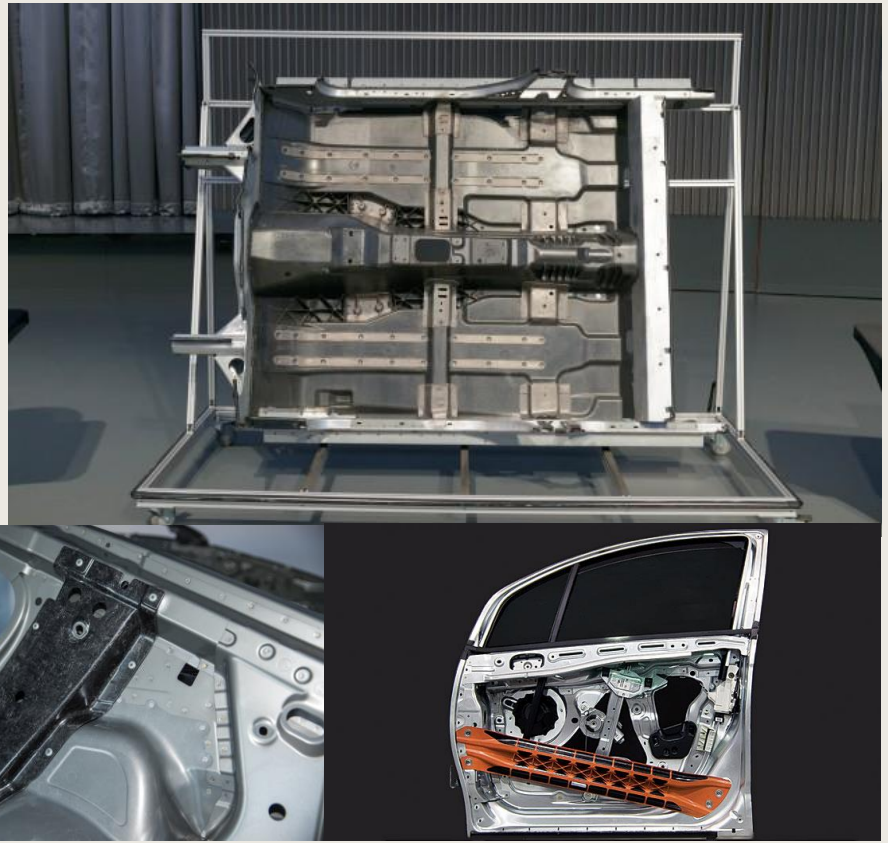


Proposed Programme Structure



Summary of Industry Benefits

- Candidate components identified – industry support required.
- Process demonstrated and optimised
- Factors critical to quality identified
- Manufacturing guidelines produced
- Qualified component cost at volume to build business case
- Generic plan for automation
- Qualified processes for quality control, monitoring and inspection.



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Thank you for listening

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