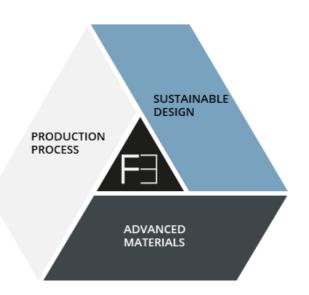
FORWARD ENGINEERING

COMPANY INTRODUCTION 2022 IACMI SUMMER MEETING

June 29th, 2022 | Adam Halsband – Managing Director, Forward Engineering North America, LLC



YOUR PARTNER FOR AUTOMOTIVE. COMPOSITE. SOLUTIONS.



Industry Leading Design & Engineering Partner for Sustainable Products and Economical Lightweight Solutions

- "Material & Production Based Engineering" From concept to series production
- Accelerate product development with standardized development processes
- Increase confidence in performance & costs forecasts
- Reduce validation costs & time with target-oriented FEA
- Enable well-founded decisions & empower our customer with unique material know-how
- Offer independent & flexible service in a strong composite network in Germany and globally





OUR HISTORY

2008 FORMATION Roding Automobile



2011 LAUNCH OF ENGINEERING

SERVICE













2016 FORWARD ENGINEERING FORMATION

Munich Robert Maier, Georg Kaesmeier



2018 FORWARD ENGINEERING JAPAN FORMATION Nagoya





2020 FORWARD ENGINEERING NORTH AMERICA FORMATION

Detroit Adam Halsband

of first CFRP concept car at IAA

2009



2012 WORLD PREMIER of Roding Roadster at Geneva Motor Show



PRODUCTION BASED ENGINEERING + SIMULATION DRIVEN DESIGN

APPLICATION DESIGN

MATERIAL & PROCESS



Continuous fiber, NCF, woven fabric, braiding, textile products



UD-Tape, Towpregs, Organo sheet, Prepreg



LFT/SMC



Sandwich



Adhesive, Inserts and mechanical fasteners



Lightweight metals



3D printing



Multi-material BiW



CFRP Monocoque



Closures / body panels



Battery enclosure

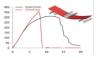


Structural Thermoplastics/ Hybrid overmolding



Leaf spring, pressure vessels, others..

SIMULATION (CAE) ANALYSIS



Material characterization & Material card calibration



Optimization (Topology, Thickness, Geometry, Layup)



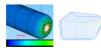
Stiffness / NVH



Strength / durability



Crash/Impact

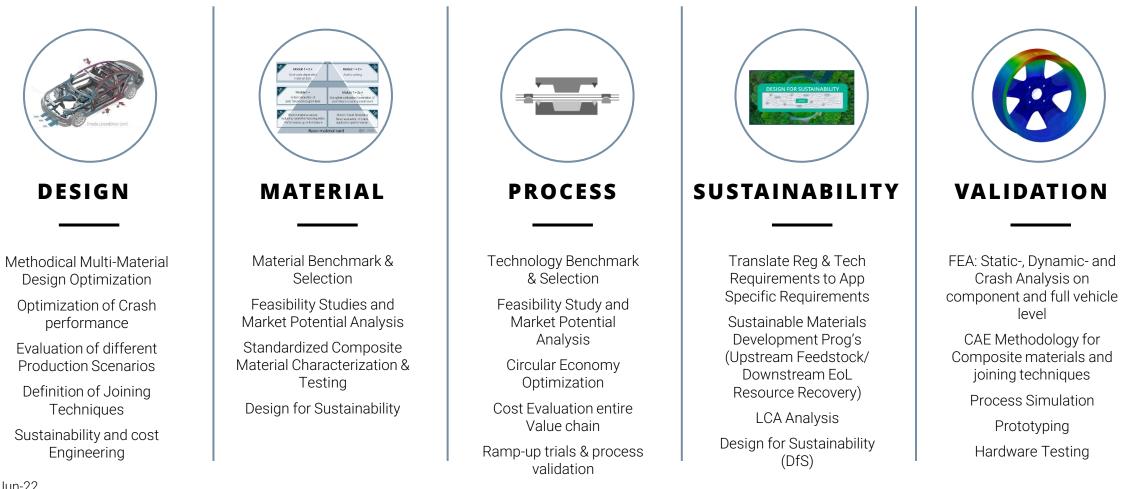


Process simulation

Software: Hypermesh, Optistruct, Ls-Dyna, Radioss, Abaqus, Pam-crash, CPD, Simlab, Moldex3D, Pam RTM, CADWind

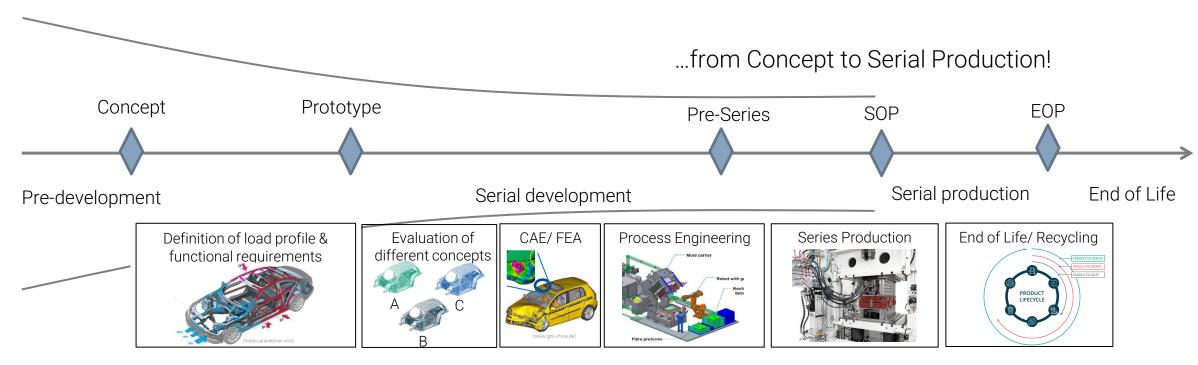


ENGINEERING AND CONSULTING SERVICES FOR YOUR SUCCESS





HOLISTIC AND INTEGRATED CUSTOMER APPROACH



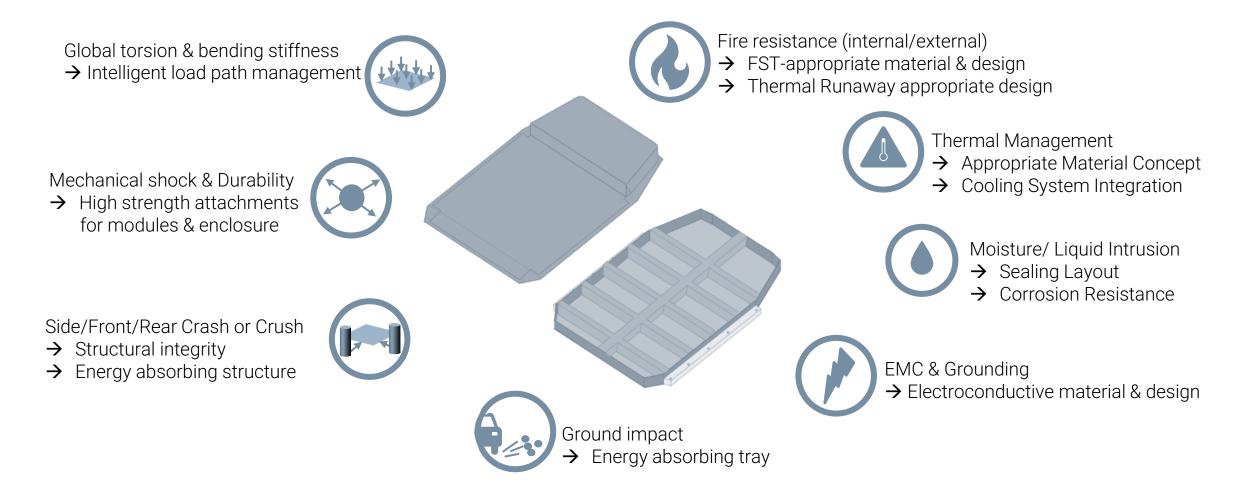
WORKING TOGETHER WITH LEADING STAKEHOLDERS ALONG VALUE CHAIN

FORWARD ENGINEERING						OEM/	TIER1	OEM/ TIER1/ EOL PARTNERS		
	Conceptual Design	Prototype Development	Prototyping Material Characterization	Testing & Validation	Serial Development	Pre-Series Production	Homo- logation	Ramp-Up Serial Production	Quality Management & Economy of Scales	End of Life Process Ramp-Up

FORWARD ENGINEERING USP: TRANSLATING SYSTEM LEVEL REQUIREMENTS TO MATERIAL LEVEL



MAIN REQUIREMENTS FOR HIGH VOLTAGE BATTERY ENCLOSURE





MAIN REQUIREMENTS FOR HIGH VOLTAGE BATTERY ENCLOSURE

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- FE Translates Global Regulatory and Technical Requirements to derive most relevant set of design requirements for a given application
- FE's Database of Regulatory Requirements
 - Continuous update of global regulations for mechanical and functional safety
 - ECE
 - GB/T
 - NHTSA/MVSS
 - etc.
- Harmonize with OEM Technical Requirements
 - Integration of regulatory and OEM specific requirements
 - Identify key design criteria (i.e. boundary conditions)
 - Load case visualization



TRANSLATING SYSTEM REQUIREMENTS TO MATERIAL LEVEL

Example: High Voltage Battery Enclosure Thermal Runaway Material Screening Program



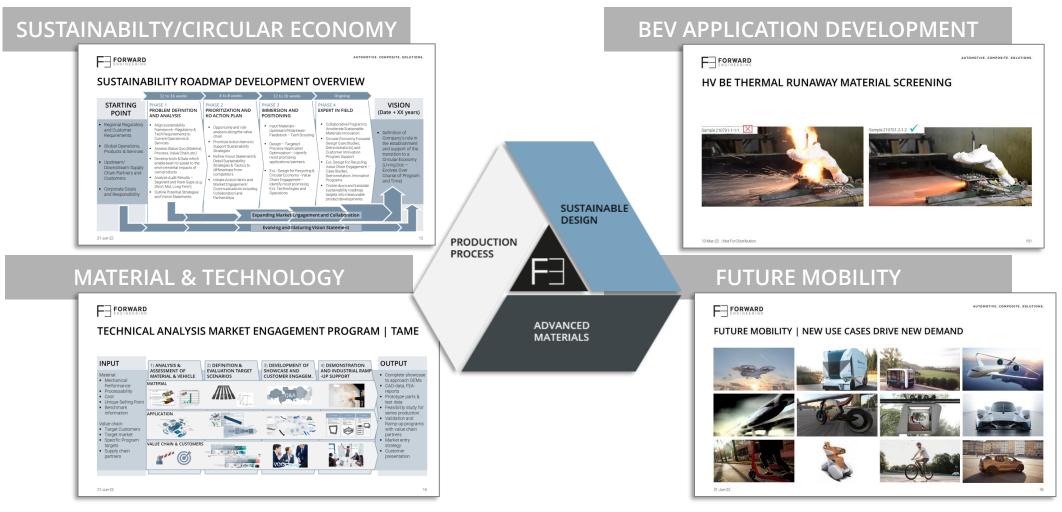




FEATURED FORWARD ENGINEERING SERVICES PACKAGES



FEATURED FORWARD ENGINEERING SERVICES PACKAGES





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