

Addressing the Challenges of High Voltage Lithium Ion Battery Validation and End of Line Testing

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- Simon Dunnett
- Three roles in HORIBA MIRA
 - Department Manager – Electrical Engineering
 - Quality Management Champion for Engineering
 - Lead for Battery Test Management Solution
- Over 20 years of engineering experience with Tier 1 suppliers and engineering consultancies
- Specialism in hybrid and electric vehicles with over 20 years of experience in the field

We are key part of HORIBA Automotive Test Systems (ATS)



Automotive Test Systems

HORIBA

- Est. 1945 by Dr Masao Horiba
- 7900+ staff worldwide
- Headquarters in Kyoto, Japan
- Locations in Europe, Americas, Japan, Asia

Semiconductor



Medical



Scientific



Process & Environmental



HORIBA MIRA: A global-leader in engineering, research and product testing, and a strategic location for transport R&D



**Vehicle Engineering
Consultancy**



**Test Engineering
Services**



Technology Park

Introducing HORIBA FuelCon

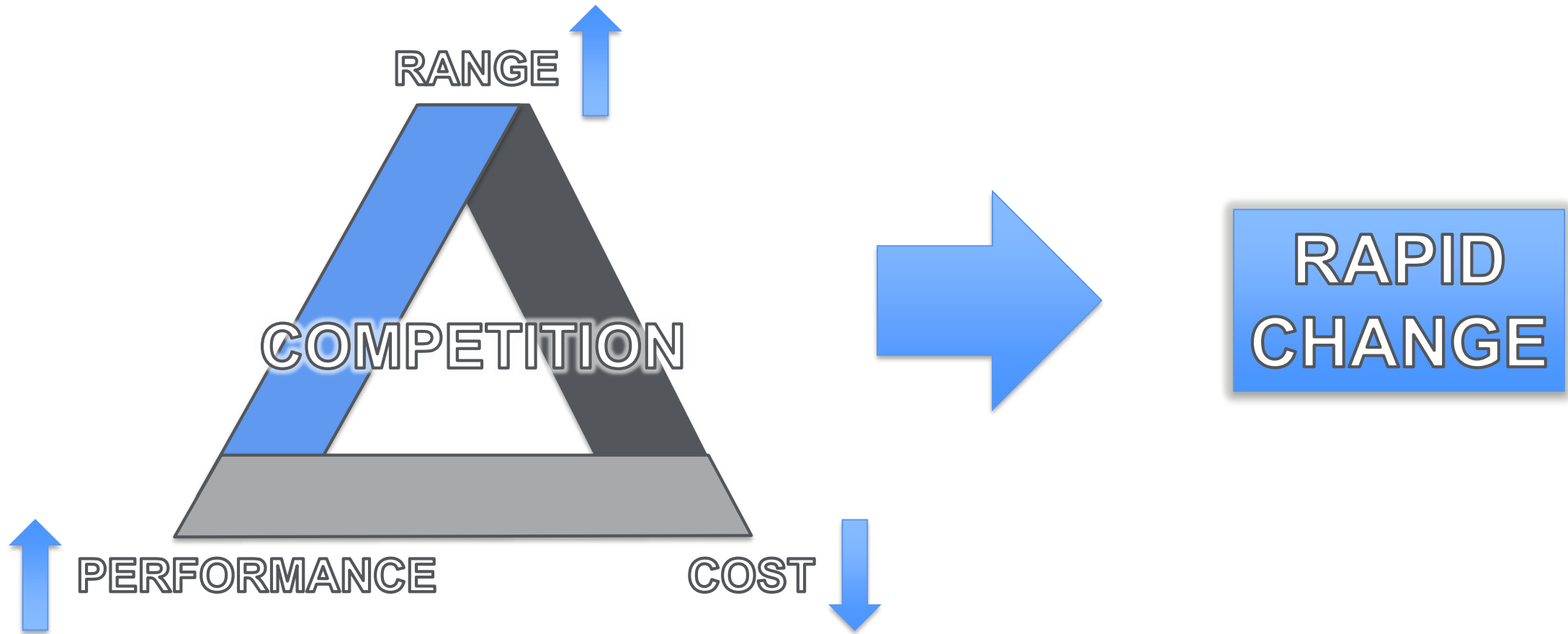


Background to the Market Challenges

Overall challenges

- Biggest change in the automotive industry since the horseless carriage
- Significant focus on battery systems due to the significant costs
- Race to release by vehicle manufacturers
- Ever increasing demands on range and performance
- Moving, evolving or missing legislation
- Facility capacity and capability issues

Change is the key challenge



Some global numbers – 5 Year prediction

- Number of vehicle platforms: 500
- Number of different vehicle models: ~1700
- Number of EV or HEV models: ~300
- Average battery design life: 3 years

Approximately **100** battery designs to validate every year!

Predicted production volume of **5 million** high voltage batteries in 2023

Where do our solutions sit?

End of Development Validation



Production Stages



End of Development Validation

End of Development Validation

Setting the Scene



Variety of programme size

Types of tests

Global testing market

Evolving legislation

End of Development Validation

What can be done about it?

Defined but agile programme management
processes

Scalable approach / facilities / capabilities

Change of test facilities from non-EV to EV

New types of facilities / capabilities

Invention of new types of test process

Different types of suppliers away from
automotive supplier base

Worldwide facilities

Build-up of internal facilities

Agile approach

Empowerment

Information flow

End of Development Validation

How is HORIBA MIRA addressing the issue?



- Dedicated electrification validation teams
- Single solution from the collective knowledge of battery engineering, component test and battery test specifics
- Cloud based information solution from HORIBA
- Facility and Capability solutions from HORIBA Group companies and partners



Battery Test Management Solution

Production Stages

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Production Stages

Setting the scene

- Fast paced evolution:
 - Products: New products every 3 years with mid-point updates
 - Components: Changes in cell chemistry forcing energy / power changes
 - Tests: New learning on how to test items with increased efficiency and efficacy
 - Limits: Tightening of limits for safety but widening of limits on power, voltage etc
 - Speed of production: As costs reduce, popularity increases, demand for speed increases
- Low possibility of rework: Often bonded / welded parts with little chance of repair but high cost of scrappage
- Updates to test processes and methodologies with increased learning

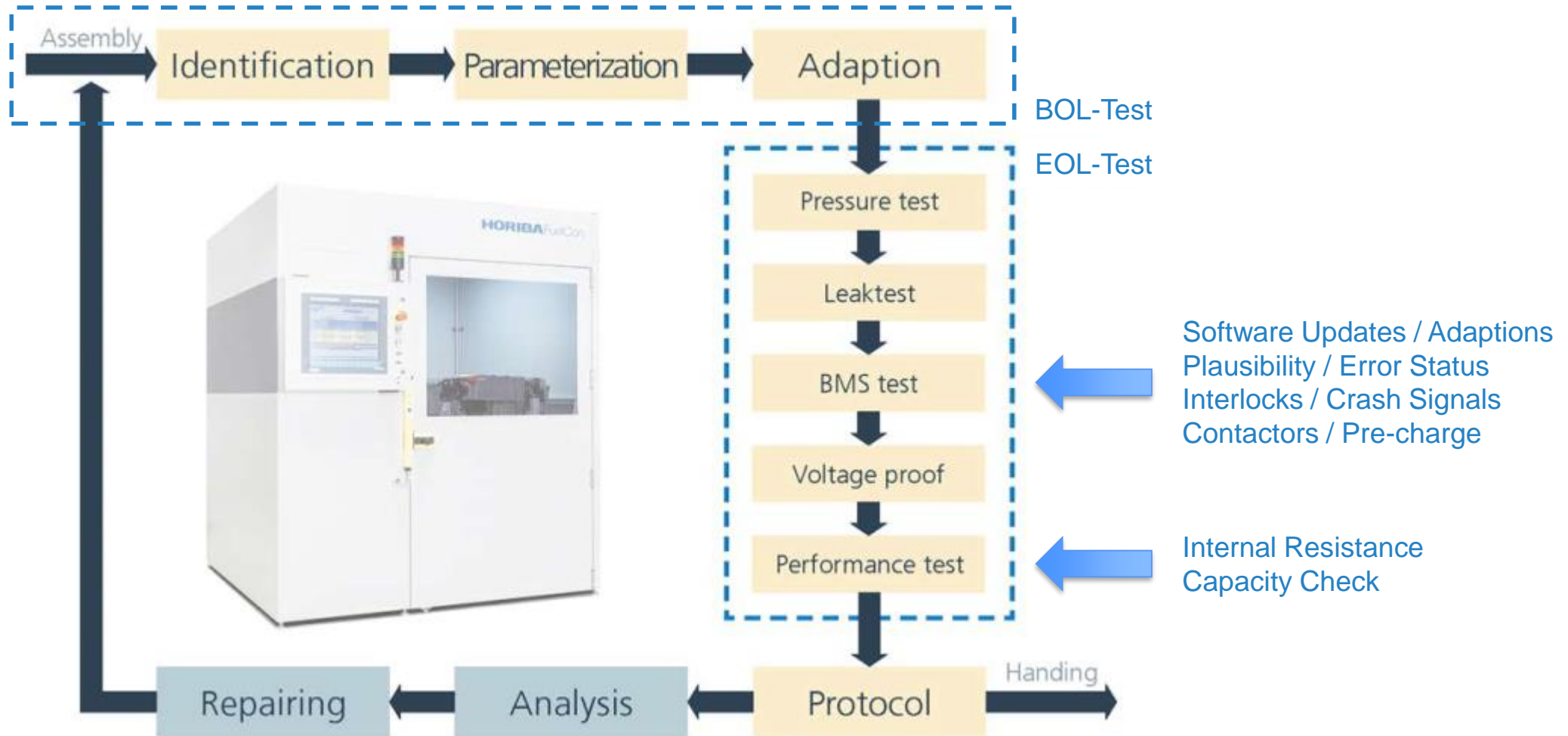
Production Stages

Approach to production testing

- Production approach is the same as any other production system
 - Prove at the earliest opportunity
 - Ensure stability of processes and yield
 - Speed through automation
 - Clear pass fail criteria and indication
- Solutions developed on 3 key fundamentals
 - Safety
 - Efficiency
 - Reliability

Production Stages

Typical Process



Production Stages

How is HORIBA FuelCon addressing the issue?



- Automated test and production processes with significant interaction capability
- Customisable and scalable solution to match the customers needs
- Realtime feedback, adjustment and control
- Multi-level user interface from 'Line Operative' to 'Specialist User'
- Training and Resident 'Super-Users' embedded in Customer premises
- 'Confidence is the basis'



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Key Take-away Messages



Key take-away messages

- With the evolving demands and technology in the automotive battery systems market, the validation and production testing must be agile to match the deadlines and changes
- Significant investment is needed to match the demands of growth in this area
- Agility, experience and expertise are key to battery validation challenges
- Safety, efficiency and reliability are fundamental pillars of end-of-line tests

Any Questions?

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